

An illustration of a Black woman with short dark hair, wearing a gold hoop earring and a purple top, looking down at a sleeping baby she is holding. The baby has its mouth open and is being held by the woman's hands. The background is a soft yellow.

Saving Mothers: Caesarean Section Monograph 2013



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A MONOGRAPH ON CAESAREAN SECTION

**National Department of Health
South Africa
2013**



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National Committee on Confidential Enquiries into Maternal Deaths in South Africa

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CAESAREAN SECTION : GENERAL COMMENTS

J Moodley

Although rates of delivery by caesarean section (CS) show a wide variation globally ranging from 0.1 to 40%, a continuing rise in the trend over the last 30 years is a cause for concern¹. There is however, no consensus concerning the optimal CS delivery rate, but poor access to emergency CS can harm both mother and baby², while high rates of operative delivery may result in poor maternal and perinatal outcomes for the current or subsequent births. An ecological study found no association between CS delivery rates and maternal and neonatal mortality in medium and high income countries. However, for low income countries making CS delivery available for high risk pregnancies could contribute to improved maternal and mortality rates, whereas a system of care with CS rates < 10% would be unlikely to cover their needs³.

Women are more likely to have a caesarean delivery if they are in their first pregnancy, older, have previously delivered by CS, have a breech presentation, deliver preterm, have other complications of pregnancy or obesity⁴. These indications vary according to population characteristics and it appears that fetal distress, dystocia and previous CS are the 3 major specific indications for the rising rates of delivery by the abdominal route. There is little evidence from controlled trials on the risks and benefits of CS for these 3 above-mentioned specific indications, except for the Term Breech Trial, which evaluated vaginal delivery versus planned CS⁵.

There are however, ethical issues in setting up appropriate randomized trials for vaginal delivery versus CS for fetal distress and dystocia. Thus, more effort needs to be placed on having a comprehensive debate on ethical issues related to the role of doctors, preferences of patients and informed consent. Those supporting CS cite primarily observational rather than randomized trials and make 2 main points, viz. elective CS is increasingly safe for women and their babies and the rate of pelvic floor problems is much higher in women who have vaginal deliveries than those who have a CS delivery.

Other potential reasons for the shift in our thinking on CS are patient's preferences and the part doctors play in decision making. How women view their care in pregnancy and labour may have changed moving from a notion of demedicalisation in the 70s and 80s to an increased demand for the use of medical technology. Patient's preferences have an important role in informed decisions, but these preferences can only be expressed fairly in the context of the best evidence of risks and benefits, and doctors should not be expected to provide services that are of no clinical benefit and are potentially harmful.

What else can be done to overcome variations in Caesarean section rates?

Variations are most likely due to differences in thresholds for interventions at institutional and practitioner level⁶. One way is the continued surveillance of CS at hospital, regional and national level. A couple of approaches for surveillance have been recommended over the last few years and include the use of standard guidelines on intrapartum care for primigravida⁷. Comparisons of intervention rates in a 20-34 year old giving birth for the first time, without any obstetric or medical problems and with a well grown singleton fetus in a cephalic as controls for case mix between units has been used to show the impact of guidelines on intrapartum care⁷. The above approach has been extended to divide women into 10 population subgroups according to specific combinations of distinct characteristics, parity, multiple pregnancy, fetal presentation, type of onset of labour, gestation and previous CS delivery. This latter approach allows comparison of CS rates within comparable subgroups and allows maternity units to establish the contribution to the total CS rate made by each subgroup⁸. These approaches of auditing CS rates together with population based observational studies can provide robust evidence where randomized trials are unethical or not possible, can result in informed practice guidelines.

Evidence based CS techniques to support current practice is obviously needed to minimise harm to mothers. Recently, good quality studies have provided compelling evidence that prophylactic antibiotic administration should be administered prior to skin incision and that the use of blunt needles reduces glove perforation rates. Constantine et al (2008)⁹, performed a meta-analysis of 3 randomised controlled trials (RCTs) comparing antibiotic administration before skin incision versus after umbilical cord clamping. Cefazolin was used in the 3 RCTs (n = 749) analysed. Preoperative antibiotic administration resulted in a reduction of endometritis and total infectious morbidity in comparison to antibiotics given after cord clamping.

A RCT on the use of blunt needles in CS found significant reductions in total glove perforation rates (RR 0.66, 95% CI 0.49-0.89) with the use of blunt needles. The use of blunt tip needles should become a routine part of C/S technique.

Data on the traditional creation of a bladder flap and non-closure of the parietal peritoneum, methods of repairing the uterine incision are conflicting. An international trial (CORONIS) is currently ongoing and will address these issues¹⁰.

Continuing audits, observational studies producing robust evidence on indications for CS and RCTs on surgical techniques for abdominal deliveries should minimize harm to the mother and her infant.

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INFORMED CONSENT: LEGAL AND ETHICAL ASPECTS

J M Titus and N Khaole

Introduction

Informed consent is a process of communication and interaction between the health care provider and the woman, not just a signature. The obligation to obtain the informed consent of a woman before any medical/surgical intervention derives from respect for her fundamental human rights¹. Informed consent is also endorsed by the Health Professions Council of South Africa [HPCSA] and the South African Medical Association [SAMA] and failure to obtain written informed consent is viewed as substandard care.

Definition of informed consent for Caesarean Section (CS)

Informed consent is consent obtained freely, without threats or improper inducements or coercion, after appropriate disclosure to the patient of adequate and understandable information in a form and language understood by the patient on:

- a) the diagnostic assessment (physical examination, laboratory tests and tests of fetal wellbeing)
- b) the purpose, method, likely duration and expected benefit of CS;
- c) alternative modes of treatment and
- d) possible pain or discomfort, risks and side effects of CS.

While it may be difficult to implement the criteria for informed consent due to the patient's lack of formal education and or unequal power relationships, the healthcare provider is nevertheless obliged to fulfil the criteria for informed consent. It is only the patient who can decide if the benefits to her of a procedure are worth the risks and discomfort she may undergo. Even if other family members may feel that they should make the decision, it is the ethical obligation of the health care provider to ensure the woman's human right of self-determination is met by the process of communication that precedes any informed consent, provided she is competent to give such consent.

Legal considerations

Informed consent is a legal requirement for all surgical procedures. A patient has an absolute common law and Constitutional right to her bodily integrity and security². In addition, informed consent is referred to in both the National Health Act³ and the Children's Act⁴.

National Health Act

Every health care provider must inform the woman of the range of treatment options generally available to the her; the benefits, risks, costs and consequences generally associated with each option and the her right to refuse health services and explain the implications, risks and obligations of such refusal. The information should be provided in a language that the user understands and in a manner which takes into account the woman's level of literacy.

Children's Act

A child may consent to the performance of a surgical operation on her if she is over the age of 12 years; she is of sufficient maturity and has mental capacity to understand the benefits, risks, social and other implications of the surgical operation and she is duly assisted by her parents or guardian. If the child is unable to give consent, the parent/guardian may give such consent for surgical treatment and where treatment is necessary to preserve the life of the child or to save the child from serious or lasting injury or disability and the need for operation is so urgent that it cannot be deferred for the purpose of obtaining consent that would otherwise have been required, the hospital manager or a person acting on his/her behalf may consent to the surgical operation on the child. Where any of the *designated* persons unreasonably refuses to give consent, the Minister, a High court or a children's court may give consent and no parent/guardian may refuse to give consent or

assist the child, unless the parent/guardian can show that there is a medically accepted alternative choice to the surgical treatment concerned.

National Patients' Rights Charter

The Charter states the following relevant points which are pertinent to CS:-

1. Every citizen has the right to participate in decision-making on matters affecting one's own health
2. Everyone has the right to be given full and accurate information about the nature of one's illness, diagnostic procedures, the proposed treatment and the costs involved.
3. A person may refuse treatment and such refusal shall be verbal or in writing, provided that such refusal does not endanger the health of others.

Sudden unexpected maternal death: Advance directive/Living will

Once a pregnant woman has been declared dead, the life and well-being of her fetus becomes a matter of urgent consideration. Possible options are: immediate CS, continuation of efforts to maintain circulatory and respiratory functions of the woman to allow her fetus to mature or discontinuation of support for the woman's circulation and ventilation. Consideration should be given to the viability of the fetus, the probable health of the fetus, wishes expressed by the woman and the views of her partner or family members. Maintaining the pregnancy in order for the fetus to become more mature requires counselling to enable informed consent of the woman's partner and/or family member/s.

Caesarean Section for non-medical reasons/ Patient Request

CS is a surgical intervention with potential hazards for the mother and the baby and it uses more health care resources than normal delivery. Health care professionals [HCPs] have a professional duty to do nothing that may harm their patients as well as an ethical duty to society to allocate health care resources to procedures and treatments for which there is clear evidence of a net benefit to health. Health care professionals are not obligated to perform an intervention for which there is no medical advantage even though the woman may have given consent to such an intervention. Health care professionals have the responsibility to inform patients that available evidence suggests that normal vaginal delivery [NVD] for uncomplicated pregnancies is safer in the short and long term for both mother and baby, and that surgery on the uterus has implications for later pregnancies and deliveries. As hard evidence for a net benefit does not exist at present, performing elective CS in uncomplicated pregnancies for non-medical reasons is ethically not justified¹.

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3. ¹ Act 61/2003
4. ¹ Act 38/2005

ANAESTHESIA FOR CAESAREAN SECTION

Zane Farina and Chris Rout

Resources

Levels of Care and Referral

Before considering operative delivery the facility must meet all standards and requirements for operative and postoperative care (as defined by the DOH). On any given day if the facility's resources do not meet the required standards then the patients should be redirected to an appropriately resourced facility. More lives will be saved by timely referral than by attempting operative delivery with inadequate staffing and resources.

Personnel

There should be sufficient number of trained nursing and medical staff to provide comprehensive care in the preoperative, intraoperative and postoperative periods.

The Anaesthetist

The minimum standard of care is that there should be an appropriately trained and experienced doctor assigned to the sole task of providing anaesthesia and intraoperative monitoring of the mother during the procedure. The practice of a single-handed doctor providing anaesthesia, performing surgery and resuscitation does not meet the required standard of care and would be medico-legally indefensible in the event of complications. When only two doctors are available one should provide anaesthesia and the other surgery. *There is no place for the anaesthetist to abandon the mother in order to provide surgical assistance.*

Training and experience requirements

The basic competency to provide anaesthesia is successful completion of supervised internship training that includes practical experience of both general and spinal anaesthesia for obstetrics, as part of the two year programme. During training the intern should have demonstrated competency in both techniques and satisfied the assessor that he/she is capable of subsequently providing a safe anaesthetic when not directly supervised.

Before assuming a more independent anaesthetic role the post internship doctor should seek additional training by way of organized courses (such as ACLS, ATLS, APLS and difficult airway courses). Additionally, there should be a more experienced doctor (preferably with a Diploma in Anaesthesia or higher qualification) readily available to provide assistance, support and advice.

It must be remembered that the ability to perform a safe spinal anaesthetic requires familiarity with the skills necessary to provide general anaesthesia. In a situation where a hospital has no member of the medical staff capable of performing both regional and general anaesthesia then it is the responsibility of both the Chief Clinician and the CEO of the hospital to ensure that training requirements are met as a matter of urgency. Not doing so is a failure of clinical governance. Training should be available at the relevant regional academic unit.

Equipment

Should comply with National ESMOE guidelines for district and general hospitals, as a minimum (Table1).

Drugs

Table 2 shows the minimum requirements for intravenous drugs and spinal drugs in theatre. In addition 30mls Sodium Citrate 0.3Molar P.O. should be available for administration preoperatively within 20 minutes of commencement of anaesthesia. The drugs appropriate to cardiopulmonary resuscitation should be readily available in theatre.

Table 1 National ESMOE guidelines for District and Regional Hospital Equipment required for Caesarean Section

<p>Fixed equipment</p> <ul style="list-style-type: none"> • Anaesthesia machine with anti-hypoxia device • Reliable oxygen supply • Oxygen cylinder with flow-valve/meter and oxygen masks/tubing • Ventilator • Vaporisers for halothane and isoflurane • Integrated anaesthetic monitor (ECG, NIBP, SpO₂, capnography) • Tilting table with lateral arm supports • Anaesthetic wedge • Suction apparatus, suction tubing and Yankhauer nozzles • Defibrillator (charging and discharging, on electricity and on battery) and conducting gel • Forced air warmer 	<p>Equipment for intubation</p> <ul style="list-style-type: none"> • Laryngoscope handle with batteries • Laryngoscope blades (size 3 and 4) • Stylet/bougie/introducer • Magill's forceps • Cuffed endotracheal tubes (sizes 6.0, 6.5, 7.0, 7.5) • Syringe to inflate cuff • Strapping • Laryngeal mask airways (sizes 3 and 4), or equivalent supraglottic airway • Stethoscope to confirm intubation • Cricothyroidotomy set (scalpel handle and blade)
<p>Equipment for manual ventilation</p> <ul style="list-style-type: none"> • Manual resuscitation bag • Oropharyngeal airways size 2-4 • Face masks sizes 3-5 <p>Equipment for IV access and infusions</p> <ul style="list-style-type: none"> • IV cannulae sizes 14-20G • IV infusion sets (20-droppers and blood giving sets) • Sharps container • Balanced salt solutions 	<p>Other equipment</p> <ul style="list-style-type: none"> • Hb measurement capability • Thermometer • Sterile and non sterile gloves • Sterile syringes • 25 or 26G pencil-point spinal needles (90mm and 104mm) with introducers • Anaesthetic records • Resuscitation algorithm

Cool box facilities should be available to maintain the cold chain for drugs such as oxytocin and suxamethonium when needed in theatre; at all other times these drugs should be kept refrigerated.

Hospital Infrastructure

The hospital infrastructure needs to meet the guidelines laid out by the DOH for the appropriate level of care. In addition special note must be made of the following.

Pharmacy

Ideally should have the facility to prepare fresh batches of sodium citrate (0.3Molar). Alternatively this should be outsourced. Regular ordering of fluids and drugs should occur to ensure adequate sustainable supplies for service delivery.

Supply Chain Management

Ensure a regular supply of all disposables that are appropriate to CS such as Pencil Point needles. It is inappropriate for supply chain management to substitute inferior equipment on the grounds of cost alone.

Blood storage

It is a South African National Blood Transfusion Service (SANBTS) standard that a dedicated blood fridge containing blood for emergency use is available in every hospital where CS is performed. Checking of this fridge and its contents should be as per SANBTS protocol. The anaesthetist should check the contents of the emergency fridge before commencing anaesthesia. Guidelines to ensure replacement of used units should be closely followed.

Table 2: National ESMOE guidelines for District and Regional Hospital Drugs required for Caesarean Section

	Drug	How to dilute	Conc.	Dose	Dose 70kg pt
Drawn up for EVERY case	<i>Ephedrine or</i>	50mg diluted to 10ml	5mg/ml	5mg (1ml) bolus every 2-3 minutes	
	<i>Effortil</i>	10mg diluted to 10ml	1mg/ml	1mg (1ml) bolus every 2-3 minutes	
	<i>Phenylephrine</i>	10mg in 200ml bag of 0.9% Saline (Mix thoroughly)	50µg/ml	100µg (2ml) bolus every 1 minute	
	<i>Sodium-thiopentone or</i>	500mg diluted to 20ml	25mg/ml	2-4mg/kg	280mg (11ml)
	<i>Propofol</i>	200mg undiluted	10mg/ml	1-2mg/kg	140mg (14mls)
	<i>Suxamethonium / Succinylcholine</i>	100mg undiluted	50mg/ml	1.5mg/kg	100mg
	<i>Oxytocin (only draw up just before baby is delivered)</i>	5 IU undiluted	5 IU/ml	2.5 IU given slowly over 1 minute (Later: 20 IU in 1000ml Crystalloid over 6hrs in recovery)	
	<i>Atropine</i>	1mg diluted to 10 ml	0.1mg/ml	10-20µg/kg bolus	0.6 - 1.2mg
Have ready (not drawn up)	<i>Morphine</i>	10mg undiluted	5mg/ml	0.1mg/kg (5-10mg)	5-10mg
	<i>Adrenaline</i>	1mg in 200ml bag of 0.9% Saline (Mix thoroughly)	5µg/ml	Start with 10µg (2ml) bolus, double the dose every minute until response obtained	
	<i>Vecuronium or</i>	4mg mixed with 2ml water	2mg/ml	½ intubation dose = 0.04 mg/kg	2-4mg
	<i>Atracurium</i>	undiluted	10mg/ml	½ intubation dose = 0.25mg/kg	20mg
	<i>Glycopyrrolate</i>	0.4mg undiluted	0.2mg/ml	5-10µg/kg	0.4mg
	<i>Neostigmine</i>	2.5mg undiluted	2.5mg/ml	50µg/kg	2.5mg
Spinal	<i>Bupivacaine 0.5% + Dextrose 8%</i>	undiluted	5mg/ml	1.8ml (very short or obese patient: 1.6ml)	
	<i>Fentanyl</i>	undiluted	50µg/ml	add 0.2ml (10µg)	

Recovery facilities and staffing

The immediate postoperative phase is hazardous. It is not appropriate to transfer patients unrecovered from the theatre to the general ward. Where dedicated postoperative facilities do not exist the theatre team is responsible for ensuring full recovery from the effects of anaesthesia before transfer to the ward.

Postoperative facilities and staffing

Adequate nursing coverage must be available to perform the recommended frequency of post-operative observations for each CS performed. These are Vital signs (Blood Pressure, Heart Rate and Respiratory rate) and pad checks. The frequency of these observations should be:

*Half hourly for 2 hours,
Hourly for further 4 hours
2-hourly for further 6 hours
4-hourly for further 12 hours*

Also check Oxygen saturation, if less than 95% administer supplemental oxygen and notify medical staff.

Please note that blood loss should be observed to steadily decrease and stop. The need for frequent pad replacement or to change bed linen demands immediate medical attention.

Additional items:

Urinary output 2 hourly for 6 hours and 4 hourly for 18 hours.

Following spinal anaesthesia ensure that there is no residual muscle weakness and that there is normal sensation within 6 hours.

Post dural puncture headache should be treated initially with simple analgesics and adequate hydration. The medical staff should be notified of any headache that fails to resolve to simple measures. Epidural blood patches should be available at regional hospital level.

ICU or High Care facilities

Patients who require these facilities must be identified prior to their Caesarean Section and timeously transferred to hospitals that provide this care before their surgery. In the event of a patient needing transfer to such a facility after events in theatre the patient should be kept intubated and ventilated in theatre with full monitoring until such time as they can be transferred to an appropriate facility.

Nursery

Similarly babies who require specialized care should be identified prior to delivery and appropriate arrangements made with the paediatric services.

Pre-anaesthetic evaluation

Full Clinical Assessment

On admission a full history and examination should be conducted. This should be designed with possible requirement for caesarean section in mind, so that patients with particular anaesthesia needs are identified prior to any crisis. This will also prevent unnecessary delays in the event of an emergency caesarean section being required

History

In addition to a normal medical history this should review previous anaesthesia, complications and family history. A full medication history must be documented together with any allergies. A history of any events during pregnancy and labour that affect anaesthesia must be highlighted.

Check the partogram for features such as haematuria, vaginal bleeding or prolonged labour (particularly in the second stage) that may indicate an increased risk of anaesthetic complications.

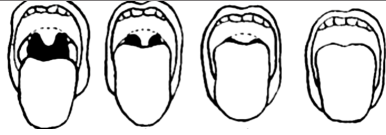

Examination

In addition to a full clinical examination focused assessment must be made of respiratory and cardiovascular systems and especially the patient's state of hydration. Any requirement for resuscitation fluids should be met before commencement of anaesthesia. In the event of overt bleeding, resuscitation should continue into the operating theatre.

Look for features of sepsis such as tachycardia, tachypnoea and fever. Pay particularly close attention to complications of pre eclampsia such as facial oedema, stridor, swollen or bitten tongue, right upper quadrant tenderness, and mental state.

Airway Assessment

This must be performed in all patients, not just those scheduled for general anaesthesia. Sudden cardiovascular collapse following spinal anaesthesia might demand immediate intubation and ventilation. Any difficulty with intubation should be anticipated beforehand and appropriate skills and resources made available. This may include transfer of the patient to a higher level of care.

<p>Warning Signs of a potentially difficult Airway</p> <ol style="list-style-type: none">1. Audible obstruction (stridor)2. Morbid obesity (BMI > 40, neck circumference > 50 cm), large breasts3. "Small mouth" Mallampatti score 3 or 4 Inter-incisor distance < 3 finger-breadths Poor dentition, missing or loose teeth Prominent maxillary incisors or overbite Large/swollen/bleeding tongue Airway masses/oedema4. Limited joint mobility Unable to protrude mandible (can't bite her upper lip) Thyro-mental distance less than 6 cm Unable to touch chin to chest Unable to fully extend neck (chin above occiput)	<div data-bbox="588 504 974 702"><p>1 2 3 4</p><p>Mallampatti Score</p></div> <div data-bbox="576 718 996 925"><p>"chin to chest" thyro-mental distance</p></div>
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Investigations

A healthy patient requires only a preoperative haemoglobin value. However, low risk deliveries cannot be predicted with certainty. Unanticipated complications of pregnancy and labour e.g. non-reassuring fetal heart patterns can occur and may require emergency operative delivery. At this point it is inappropriate to delay emergency care by belated requests for laboratory investigations. Therefore if it seems likely that additional investigations will be required it makes sense to do them as early as possible, even on admission. In this way results will be available when needed. In the event of an emergency such as abruptio placentae where surgery must proceed before results are available, send samples to the laboratory as early as possible and act on the results as soon as they are available.

For specific patients the following investigations are required for anaesthesia:

Pre eclampsia: Full blood count including platelets, urea, creatinine and electrolytes. Coagulation tests are required only when the platelet count is <75000 or the patient has unexpected bleeding.

Abruptio Placentae: Full blood count including platelets and coagulation tests (PTT, INR, D-dimers) These patients also require urea, creatinine and electrolytes.

HIV/AIDS: Although outcome data are lacking, the association of this disease with thrombocytopenia does not appear to cause any problem with regional anaesthesia. However if

the patient looks sick (sepsis, candidiasis, respiratory distress, dehydration etc.), a platelet count should be obtained. If the platelet count is low, or there is clinical evidence of bleeding then a full coagulation panel should be obtained. In the event of an obstetric indication for emergency caesarean section do not await results but proceed with general anaesthesia.

Course of obstetric care and labour

Events during pregnancy and labour can have implications for the anaesthetist. For example, hypertensive disease of pregnancy or intrauterine growth restriction may influence anaesthetic technique. Also, events during labour can give clues as to the likelihood of complications. It is incumbent upon the anaesthetist to be familiar with the obstetric history in order to pick up on these clues.

Indications for surgery

This is important for the anaesthetist in as far as it gives an indication of potential complications. For example in South Africa, prolonged delay in the second stage of labour has been associated with a disproportionate number of deaths due to complications of spinal anaesthesia. This may be attributed to maternal collapse from unrecognized hypovolaemia, ruptured uterus and severe postpartum haemorrhage. Where caesarean section is being performed for a non-reassuring fetal heart rate pattern, it is prudent to place the mother on her side, give intravenous fluid as resuscitation and to provide supplemental oxygen to the mother. The indication for caesarean section also provides a guide as to urgency and will influence the choice of method of anaesthesia to be used. For example in the case of non-reassuring fetal heart rate pattern it is important to know the type of pattern, again as a guide to urgency.

It is difficult to set an absolute time frame that is suitable for all maternity units and all circumstances. However, for audit purposes it is appropriate for each unit to individualise their time targets. For example in a level 3 obstetric unit with specialist anaesthetic cover a 15 minute time frame for delivery in the situation of abruption placenta with a viable baby should be achievable. Regular audit of cases not achieving this target will highlight operational deficiencies that can be overcome.

Urgency			
Category	Definition	Timing of Delivery	Targeted time for delivery
1	Immediate threat to maternal or fetal life	Emergent	15 minutes
2	No immediate threat to life	Urgent	45 minutes
3	Requires early delivery	Unscheduled	Within hours
4	At a time to suit the mother and health services	Elective	Normal working hours

Examples of each Category:

Category 1: Abruption placentae with viable baby, cord prolapse with fetal bradycardia

Category 2: Cord prolapse without fetal compromise.

Category 3: The eclamptic whose convulsions have been aborted, is maintaining a patent airway and requires transfer to a higher level of care.

Category 4: A patient with a previously scarred uterus at term

Preparation of Operating Theatre

At the start of every shift the doctor responsible for anaesthesia and the Sister in charge of theatre should ensure that all equipment, drugs, intravenous fluids, disposables and appropriately trained theatre staff are available. Also specific attention must be paid to guarantee a fully operational anaesthetic machine and monitors.

Machine check: See table 4

Most modern anaesthetic machines have integrated checklists parts of which are automated. Medical staff must ascertain which features are not automatically performed and ensure these are done manually. In the case of simpler anaesthesia machines without these features the entire checklist must be performed each day. Particular attention must be paid to wall and cylinder gas supplies to ensure that sufficient supplies of oxygen are available and connected correctly so that there is no possibility of delivering a hypoxic mixture to a patient. All machines must be fitted with an oxygen analyser that continuously monitors the inspired oxygen delivered to the patient. In the case of portable oxygen analyser the batteries must be checked and the instrument calibrated. Remember to perform the single hose test.

Ensure that the auxillary equipment is available and operational (Table 3).

Please note that a functional anaesthetic machine and set of auxillary equipment is an essential requirement even for spinal anaesthesia.

Check that all equipment as per table 1 is available and functional

Drugs

Check all the drugs are drawn up and/or ready as per table 2

Table 3: Auxillary Equipment

M: Masks, Magill's forceps A: Airways, Assistant L: LMA, Laryngoscope blades and handle E: ETT, Emergency drugs S: Stylet Strapping Defibrillator checked and available	AmbuBag: emergency ventilation device, valve working, bag and tubing attached Suction: dedicated anaes. suction. Achieves -30 to -50 cm H2O Scavenging
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WHO Surgical Check List

All hospitals performing surgery should be implementing a WHO surgical Check List procedure for all procedures.

Preparation of patient

Explanation and reassurance

Informed consent for anaesthesia must be obtained following full explanation of the procedures to the patient and this should be documented on the anaesthetic form (together with the indication for surgery). Ensure that salient details of the history and examination are recorded on the anaesthetic form as well as the details of any relevant investigations and the blood group of the patient. Document that sodium citrate has been given within 20 minutes of commencement of anaesthesia.

Position during transport

Patients should be transported to theatre on a trolley in the left lateral position; supplemental oxygen must be administered when necessary. Patients for elective caesarean section may walk to theatre if not contraindicated. Continue all important infusions (e.g. tocolytics) during transport.

Table 4 Anaesthetic Machine Check

<p>Starting Up</p> <ul style="list-style-type: none"> • Check last and next service date of machine • Turn on machine and monitors - NIBP, SpO₂, ECG • Calibrate O₂ analyser - FiO₂ 0.21 in room air, FiO₂ 0.90 with O₂ flush • Capnograph must show expired breath <p>Wall</p> <ul style="list-style-type: none"> • Check pipelines – colours/shapes, tug test <p>Machine</p> <ul style="list-style-type: none"> • O₂ cylinder > 50 kPa • Pipeline pressures 400-500 kPa • The rotameters should open easily, and the bobbins shouldn't stick • When FGF is occluded, the bobbins should bounce. (Repeat with each vaporiser open) <p>Anti Hypoxic Device</p> <ul style="list-style-type: none"> • Prevents hypoxic gas mix • The O₂ bobbin should rise when the N₂O is opened • The N₂O bobbin should fall when the O₂ is closed <p>O₂ Fail Device (single hose test)</p> <ul style="list-style-type: none"> • Disconnect wall O₂ • The O₂ fail alarm should sound • Open the O₂ cylinder: the alarm should go off, and the O₂ bobbin should rise. • Reattach O₂ line and repeat tug test • Close O₂ cylinder 	<p>Vaporisers</p> <ul style="list-style-type: none"> • Ensure O rings (on the back bar) intact • Ensure seated securely and locked • The vaporiser should be at least half full, with the correct agent • The dials must open easily and ONLY ONE dial should be able to open at a time <p>CO₂ Absorber</p> <ul style="list-style-type: none"> • Must be securely in place • <50% colour change indicating absorber saturation <p>Circuit</p> <ul style="list-style-type: none"> • No holes or cracks • Switch to BAG (or manual) mode • Check APL valve: close completely and press O₂ flush up to 40cm H₂O. Compress reservoir bag and the APL valve should open at 65cm H₂O • Attach test lung and 'bag': this allows one to check that the tubing has no obstruction and that the valves are working <p>Ventilator</p> <ul style="list-style-type: none"> • Switch onto VENTILATOR mode • FGF should be at minimum • Set ventilator and watch that tidal volume and respiratory rate that you have set is delivered. • Bellows should rise to the top of the casing (if not, increase FGF till bellows reach the top: this FGF is the quantity of the leak in the machine). • Acceptable leak is <200ml • Commonest leaks are the circuit, CO₂ absorber, vaporisers and bellows
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Antacid Prophylaxis

Sodium citrate must be used as per the drug guidelines, even if prokinetic agents such as metoclopramide have been used. The best time to administer the sodium citrate is arrival in theatre on the transport trolley before the patient moves on to the operating table. Particulate antacids, such as Mist. Mag. Trisilicate, should not be used.

Intravenous access

The anaesthetist must ensure that an intravenous cannula of at least 18 ga is in situ and freely running. Fluid resuscitation should be given if appropriate. When excessive bleeding is anticipated (such as when the indication is delay in the second stage of labour) at least two such lines should be inserted.

Procedure – General Anaesthesia (Table 5)

Never place a patient flat on her back on the operating table. The standard of care is to use an obstetric wedge under the patient's right buttock. The objective of this manoeuvre is to avoid aortocaval compression. If signs suggest aortocaval compression tilt can be further adjusted; a few patients may require tilt in the opposite direction.

Modified Rapid Sequence Induction (MRSI)

Mask and laryngeal mask anaesthesia for caesarean section cannot be condoned due to the high risk of the aspiration of gastric contents. MRSI consists of preoxygenation of the patient via the anaesthetic circuit and well-fitting mask for three minutes or 5 vital capacity breaths or until the expired oxygen concentration reads 80%. Thiopentone is the ideal agent, but where unavailable propofol or etomidate can be used. In either case a sleep dose is required (thiopentone 2-4mg/kg, propofol 1-2 mg/kg, etomidate 0.2-0.3 mg/kg) Remember that lower doses need to be used in patients who are hypovolaemic or critically ill. In these cases etomidate may be most suitable. Ketamine (1-2 mg/kg ivi) can be used safely as part of rapid sequence induction (i.e. with subsequent intubation), but remember that the side effects of ketamine (hypertension, hallucinations, delirium and increased secretions) will have to be managed. Although ketamine has a reputation for preserving airway reflexes this cannot be relied on to prevent aspiration of stomach contents.

Cricoid pressure is applied during injection of the induction agent, timing full recommended force with loss of consciousness. Once the patient is asleep Suxamethonium (1-1.5 mg/kg) is given intravenously. Full relaxation occurs after 60 seconds when laryngoscopy and intubation should be performed. A major cause of aspiration and difficulty with intubation is premature instrumentation of the patient's airway before full muscle relaxation. Fasciculation is a variable sign in obstetric patients, particularly following the use of magnesium sulphate, and intubation "by the clock" is recommended.

Post-induction checks

Ensure that the endotracheal tube is in the correct position by checking for an appropriate capnogram trace on manual ventilation, and listening to the chest in both axillae for good equal bilateral air entry (to exclude one lung ventilation). As a rough guide tube position will be 22 to 23 cm at the teeth is appropriate. The ventilator must be turned on, the appropriate tidal volume given, and visible bilateral chest expansion must be observed. The inspired oxygen must be adjusted at least 40% and inhalational agent turned on. The oxygen saturation trace must be observed and the post-intubation saturation recorded. Check the blood pressure and heart rate and record these values.

Maintenance

Inhalational agents should be restricted to 1 MAC before delivery. Nitrous oxide (up to 50%) may be used as an analgesic and to limit the amount of volatile agent used. Short acting muscle relaxants may be given if required to facilitate surgery. If using repeat doses of suxamethonium, glycopyrrolate 0.2 mg to 0.4 mg will limit bradycardia and secretions.

Delivery

Oxytocin is ideally administered with delivery of the anterior shoulder (cephalic presentation). Always check with the surgeon that there is no second baby before giving oxytocin. Excess doses of oxytocin do not enhance uterine contraction and can cause severe haemodynamic instability. Repeated small doses may be used to maintain uterine contractions. However ideally one bolus dose of 2.5 iu should be followed by continuous infusion of oxytocin at a rate equivalent to 20 iu in one litre over 8 hours. In theatre bolus fluid administration may complicate this calculation and a separate oxytocin infusion may be desirable.

Most centres would administer antibiotics for prophylaxis after delivery of the baby rather than pre-induction. However, this practice is much debated, with precious little evidence for either approach and local policy should be followed.

Table 5 Procedure for General Anaesthesia

<p>PREPARATION</p> <p>Full history and examination</p> <p>NB airway and assess difficulty of intubation</p> <p>NB signs of hypovolaemia - decide whether the patient requires resuscitation first</p> <p>Prepare the patient</p> <ul style="list-style-type: none"> • Premedication – sodium citrate 30ml orally, 0 - 30 minutes pre-operatively • Good IV access, with 500ml clear fluid given as preload • Urinary catheter <p>Prepare the theatre</p> <ul style="list-style-type: none"> • Full machine check, check vent. settings • Check equipment and monitoring (ECG, NIBP, SpO₂, capnograph) • Draw up essential drugs <p>TECHNIQUE</p> <p>Position the patient</p> <p>Wedge under right hip</p> <p>Head and shoulders on a pillow, “sniffing the morning air”</p> <p>Administration of general anaesthesia</p> <p>Measure NIBP now, and every 3 minutes</p> <p>Establish ECG and pulse oximetry</p> <p>Pre-oxygenate 100% FiO₂ for 3 minutes</p> <p>Start the suction, place Yankauer nearby</p> <ul style="list-style-type: none"> • Perform rapid-sequence induction with cricoid pressure, then perform laryngoscopy and intubation • Confirm correct placement of ETT by capnography, auscultation and clinical impression of chest moving equally • Ventilate, using at least 40% oxygen and not more than 1 MAC volatile • Use small doses of short-acting muscle relaxant if necessary <p>Failed intubation</p> <ul style="list-style-type: none"> • Call for help, and try to wake patient up • Maintain cricoid pressure and attempt mask ventilation 	<p><i>If successful mask ventilation:</i></p> <ol style="list-style-type: none"> i. Check head position, change to a different laryngoscope blade, assistant to externally manipulate the cricoid, and re-attempt intubation. ii. If still unsuccessful, decide whether to continue with mask ventilation OR with spontaneous ventilation OR attempt insertion of LMA OR awaken the patient <p><i>If unsuccessful mask ventilation:</i></p> <ol style="list-style-type: none"> i. One further intubation attempt OR attempted insertion of LMA ii. If still unsuccessful and unable to ventilate, and spontaneous ventilation has not resumed, perform an emergency cricothyroidotomy (or tracheostomy), and ventilate the patient. iii. Decide whether to continue with the procedure or wake the patient up <p>After delivery</p> <ul style="list-style-type: none"> • Confirm there is no second baby • Give 2.5 IU oxytocin IVI over 1 minute • Can increase volatile, and give multimodal analgesia – morphine 10mg, consider fentanyl 100µg, paracetamol, NSAID and infiltrating with local anaesthetic. <p>Once the surgery is completed</p> <ul style="list-style-type: none"> • Switch off the volatile, and give reversal if a non-depolarising muscle relaxant was given use nerve stimulator or see signs of spontaneous recovery first. • Extubate in theatre, awake and reversed <p>RECOVERY</p> <p>Monitoring</p> <ul style="list-style-type: none"> • Administer oxygen via 40% venturi mask • Monitor NIBP and SpO₂ • Ensure the patient is not bleeding • Ensure the patient is comfortable • Infuse 20 I.U. oxytocin in one litre of clear fluid over 8 hours (80 mls/hour) <p>Discharge to the ward</p>
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Routine monitoring and anaesthetic record

The time of starting anaesthesia, the time of the surgical incision, details of delivery and time of awakening from anaesthesia should be recorded. The method of uterine displacement should be noted.

Blood Pressure, Heart Rate, Saturation, expired CO₂ and inhalational agent concentrations should be recorded every 5 minutes as a minimum. Where instability occurs the frequency of record keeping, including the corrective steps taken, should be increased. Other monitoring to consider includes glucose readings in diabetic patients, urine output and temperature in prolonged cases, and nerve stimulator observations where repeated muscle relaxants are given.

Documentation is also expected of such features as the size of endotracheal tube used, its depth of insertion, the ease of laryngoscopy, the use of the obstetric wedge and a note of any complications or difficulties that arise. A subsequent doctor reading your record must have a clear idea of what to expect if the patient requires another anaesthetic.

The national obstetric bed-letter has an anaesthetic form specifically designed for caesarean section and all required details can be documented in an easy rapid manner. Copying of this form and its use in other cases is encouraged.

Failed intubation

Although an uncommon complication, this is the commonest cause of maternal mortality associated with general anaesthesia. The first step in avoiding this complication is careful preoperative evaluation and referral to a specialist centre for the anticipated difficult airway. However, unexpected failed intubation will still occur and the team should be drilled in the management of this complication. Never commence a general anaesthetic for caesarean section before considering the possibility of a failed intubation and rehearsing the steps you will take should this occur. The key to management of a failed intubation is early recognition of the problem and ensuring adequate oxygenation; it is *hypoxia* that kills the patient.

There are three essential rules:

1. Maintain cricoid pressure
2. Do not turn the patient on her side
3. Never give a second dose of muscle relaxant

The important management goals are to maintain a patent airway and manually ventilate the patient by mask. If this can be achieved there is time to plan another intubation attempt, if feasible, or await more experienced assistance or keep the patient asleep with an inhalational agent until the suxamethonium wears off (about ten minutes). The patient can then be allowed to wake up.

If it is ***absolutely*** essential to deliver the baby, this is possible with the patient breathing spontaneously. ***But*** the airway must be guaranteed and cricoid pressure must be maintained throughout the procedure. Even an experienced specialist anaesthetist and experienced anaesthetic nurse would be hard pressed to achieve this. In small hospitals with non specialist staff the best option would most frequently be to wake the patient and transfer her to a regional centre.

If from the outset, a patent airway and mask ventilation cannot be achieved death is inevitable without immediate action (figure 1). First place a laryngeal mask airway, releasing cricoid pressure at the last moment to allow correct placement and inflation of the cuff. If the patient still cannot be ventilated via the laryngeal mask, gain airway access by cricothyrotomy (needle or surgical depending on operator experience).

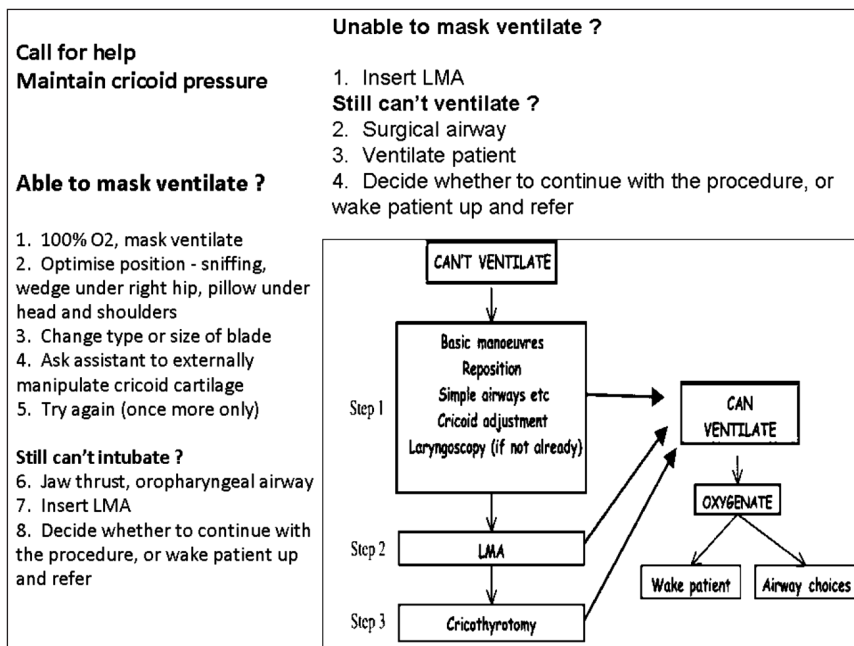


Figure 1: Flow Diagram of immediate management if patient airway and mask ventilation cannot be achieved

Emergence and extubation

Ensure that a patient has fully recovered from the effects of anaesthesia and is able to protect their own airway and adequately ventilate their lungs before extubation occurs. Any patient who has received a non depolarising muscle relaxant must receive neostigmine (2.5mg) and glycopyrrolate (0.4mg) to antagonise residual effects. This must be administered after signs of spontaneous recovery of muscle function (breathing efforts, any movement or swallowing) are observed or a second twitch has been observed on the train of four of the peripheral nerve stimulator. Reversal must be administered before the patient is awoken from anaesthesia.

Suxamethonium is a depolarising muscle relaxant, so administration of neostigmine is contraindicated. Spontaneous recovery from suxamethonium should be awaited and usually occurs over the course of 5 to 10 minutes from the last dose. Rarely patients lack the enzyme necessary for spontaneous reversal and recovery is delayed for sometimes several hours. All that has to be done in the interval is to keep the patient sedated, intubated and ventilated until recovery occurs. The minimum requirement is a high dependency area with mechanical ventilation. The patient should be kept in the theatre if such a facility does not exist. If necessary, expert advice should be sought from the regional anaesthetic centre.

Once reversal of muscle relaxation is assured then the volatile anaesthetic should be discontinued and the patient ventilated with 80% oxygen in air to normocarbica (end tidal CO₂ 4 - 5 kPa). Once the patient awakes and is capable of sustained eye opening and head lift for more than 20 seconds the endotracheal tube can safely be removed.

Visible secretions in the endotracheal tube should be aspirated using an appropriate size suction catheter. Before extubation the oropharynx should be cleared using a Yankauer suction nozzle.

Following extubation a clear airway and normal respiration should be confirmed by the use of a tightly fitting face mask and observing the capnogram. When adequate spontaneous respiration is assured the patient should be placed on her side on a trolley and transferred to recovery. If the recovery area is any distance from theatre, supplemental oxygen should be administered during transfer.

Procedure – Spinal Anaesthesia

The life-threatening complications of spinal anaesthesia for CS are profound hypotension and high motor nerve blockade. Both complications can present with rapid loss of consciousness and respiratory arrest. Before commencing spinal anaesthesia the practitioner must be confident in the ability to perform rapid tracheal intubation and general anaesthesia. Also, failure of the spinal anaesthetic to provide full blockade of the relevant sensory nerve roots will require conversion to general anaesthesia. Therefore it is essential that full machine and equipment checks are performed. There are specific contraindications to spinal anaesthesia:

1. Patient refusal
2. The patient who is actively bleeding, or is likely to bleed excessively (abruptio placentae, bleeding placenta praevia, morbidly adherent placenta, ruptured uterus, anticoagulant therapy, thrombocytopenia with a platelet count below 50000 – 75000/ μ L, or other significant abnormalities of coagulation)
3. The haemodynamically unstable patient, due to cardiac disease, hypovolaemia (inadequate resuscitation or associated with prolonged labour) or systemic sepsis.

Complications of spinal anaesthesia can occur rapidly in the pregnant patient and may be provoked by moving the patient. Therefore only perform spinal anaesthesia for Caesarean section in the operating theatre, with the patient on the operating table.

Check vital signs

Measure and record blood pressure heart rate and respiratory rate and check the last recorded temperature. The worrying signs are hypotension, tachycardia (above 100 bpm), tachypnoea and pyrexia, all of which can indicate serious systemic disease that can have a disastrous interaction with spinal anaesthesia. Individually a systolic pressure below 100mmHg can be normal, a heart rate above 100 can be normal during labour, as can a temperature of 38 degrees, and tachypnoea during a contraction. As a rough guide do not proceed with spinal anaesthesia when any of the vital signs are significantly abnormal (heart rate above 120, systolic pressure below 90 mmHg, a respiratory rate above 30 and a temperature above 38.5oC).

Table 6: Procedure for Spinal Anaesthesia

<p>PREPARATION</p> <p>Full history and examination</p> <ul style="list-style-type: none"> • NB contra-indications to spinal anaesthesia • NB signs of hypovolaemia - decide whether the patient requires resuscitation first <p>Prepare the patient</p> <ul style="list-style-type: none"> • Premedication – sodium citrate 30ml orally, 0 - 30 minutes pre-operatively • Good IV access, with 500ml clear fluid given as preload • Urinary catheter <p>Prepare the theatre</p> <ul style="list-style-type: none"> • Full machine check, check vent. settings • Check equipment and monitoring (ECG, NIBP, SpO₂, capnograph) • Draw up essential drugs <p>TECHNIQUE</p> <p>Administration of spinal</p> <ul style="list-style-type: none"> • Measure NIBP before starting, and set NIBP to read at 1 minute intervals • Monitor ECG and pulse oximetry • Provide O₂ via 40% facemask • Administer 500ml of Ringer's lactate (or similar) while performing the spinal • Position patient sitting, and inject 2-3ml of 1% lignocaine into the subcutaneous tissue over the L3/L4 (or lower) interspace • Use aseptic technique • Using a 25 or 26g pencil point needle, with an introducer needle, perform dural puncture • Inject hyperbaric, adrenaline-free bupivacaine 0,5% 1.8ml (=9mg) with 0,2ml (=10µg) fentanyl 	<p>Positioning after spinal injection</p> <ul style="list-style-type: none"> • Supine with wedge under right buttock • Head and shoulders raised on a pillow <p>Monitoring after spinal injection</p> <ul style="list-style-type: none"> • Remain with patient, in direct contact and communication with her • Measure NIBP every minute for at least 10 minutes, or until delivery (then every 2-3 minutes) • Expect the blood pressure to drop and treat hypotension aggressively with ephedrine/etilephrine or phenylephrine. • Actively monitor for signs of low cardiac output • Monitor level of block, watch out for high spinal anaesthetic <p>Failed spinal</p> <ul style="list-style-type: none"> • If no effects at 20 mins, repeat spinal. • If partial block, decide between: <ol style="list-style-type: none"> i. Conversion to GA ii. Local anaesthesia/ketamine iii. Delay surgery for spinal later • If repeat injection has no effect, convert to general anaesthesia. <p>After Delivery</p> <ul style="list-style-type: none"> • Confirm there is no second baby • Give 2.5 IU oxytocin IVI over 1 minute <p>RECOVERY</p> <p>Monitoring</p> <ul style="list-style-type: none"> • Administer O₂ via 40% venturi mask • Monitor NIBP and SpO₂ • Ensure that the patient is not bleeding • Make sure that the patient is adequately analgesed • Infuse 20U oxytocin in one litre of clear fluid over 8 hours (80 mls/hour) <p>Discharge from recovery room</p> <ul style="list-style-type: none"> • When block height has decreased by 2 segments, and vital signs are normal
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Check intravenous line and emergency drugs

An intravenous cannula of at least 18G should be used. The intravenous line must be checked before commencing anaesthesia to ensure that it is freely running into a vein and that fluid can be administered rapidly if necessary. Prepare ephedrine (50 mg diluted to 10 mL in a syringe) and phenylephrine (10 mg into a 200 mL infusion bag of 0.9% saline). Check that drugs required for possible general anaesthesia are immediately available.

Patient Position

Spinal Anaesthesia may be performed in the sitting or lateral positions. Whichever position is used, it must be ensured that the patient is never left lying flat on her back. In order to maximise the size of the lumbar spinal interspaces, the patient must have a flexed lumbar spine. This can be achieved by the patient adopting the “foetal position” if lying on her side or placing the patient’s feet on a stool, gently resting her forearms on her knees and flexing her neck if seated. In either case it is important that the patient relax her shoulders to avoid tensing her back. An oxygen mask may

interfere with flexing of the neck; if this happens consider removing the oxygen mask, turning it upside-down or administering oxygen via nasal cannulae.

Aseptic technique

The standard of aseptic care for spinal anaesthesia is facemask, full surgical scrub, sterile gown and gloves. Chlorhexidine in alcohol solution ("Hibitane") should be used for skin preparation of the back. A sufficiently large area should be prepared to allow examination of the back, including palpation of the posterior superior iliac crests, without risk of contamination.

Preparation of spinal trolley

With nursing assistance, prepare a trolley covered with a sterile green towel. Equipment required will be a kidney dish (to hold the skin antiseptic), a sponge holder and swabs or sponges, a 5 mL syringe, a 2.5 - 3 mL syringe, an 18G and 25G needle (for skin infiltration), and a sterile disposable pencil-point spinal needle (25 - 27G) with introducer. Ensure that none of the sterile equipment is contaminated with hibitane as this has been associated with severe neurological damage. Required drugs should be drawn before needle insertion. Lignocaine 1% 3-4mL should be drawn for skin infiltration and hyperbaric bupivacaine 0.5% drawn for the spinal. It is common practice to add a small dose of fentanyl (10 - 15 *micrograms*) to the bupivacaine.

Identification of the L3-4 interspace

A line passing between the posterior superior iliac crests would normally pass through the lower edge of the L3 vertebra. The L3-4 interspace should be found immediately below. This can be identified by placing the index fingers on both iliac crests and allowing the thumbs to meet in the midline of the back at the same level. Gentle pressure at this point should identify the L3-4 interspace. If a posterior spinous process is palpated, the L3-4 interspace is immediately below. The importance of this identification is that the lower limit of the spinal cord is normally at the level of L2 in an adult. ***Needle insertion above this line runs the risk of spinal cord damage.*** Any interspace at or below the L3-4 interspace is acceptable.

Injection of local anaesthetic

Infiltrate the skin and subcutaneous tissues in the midline overlying the central point of the chosen interspace with lignocaine 1%.

Needle insertion

Using a 25, 26, or 27 gauge pencil-point spinal needle, first insert the short introducing needle, keeping to the midline, perpendicular to the skin in both planes, until it is gripped firmly by the posterior spinal ligament. ***(Larger gauge sharp tipped needles (e.g. 22g Quincke) may be used to facilitate a difficult spinal but should not be the routine. Where doctors are using these needles to compensate for lack of skill, training should be obtained to facilitate the use of pencil-point needles.)*** Insertion of the introducer into the spinal canal is unlikely, but can occur with thin patients. Gently advance the spinal needle through the introducer until the tip is in the spinal canal. Quite often a loss of resistance to insertion or a slight "popping" sensation can be felt. This does not always occur so test for position by withdrawing the trocar at intervals and watching for c.s.f. return in the transparent hub of the needle. The spinal canal is located within 5 - 6 cm from the skin in the majority of cases. If the tip of the needle hits bone, withdraw both introducer and needle as a unit and repeat the insertion, with the introducer pointing in a slightly cephalad direction.

Inject hyperbaric bupivacaine 0.5% 1.8 to 2 mL (9-10mg), with fentanyl 10 - 15µg, ensuring that the tip of the needle remains within the c.s.f. by gently aspirating small amounts at intervals during the injection.

Withdraw the spinal needle together with its introducer as a unit and place a small dressing over the injection site.

Intravenous fluid administration

It is common practice to commence rapid intravenous fluid administration (Ringer's lactate or similar) either with commencement of the spinal procedure ('preloading') or upon injection of the

spinal anaesthetic (“co-loading”). This is done to reduce the severity of subsequent post-spinal hypotension. Whilst it might reduce the incidence and severity of post-spinal hypotension to a small degree, it cannot be relied upon to prevent hypotension in all cases. Note that this is not done to correct any preoperative hypovolaemia – this should have been done before the patient comes to theatre.

Reposition the patient

Gently reposition the patient into the supine **wedged** position. The use of the obstetric wedge is the standard of care. Alternative methods such as tilting the table to the left or the right or the use of an old 5 litre dialysis bag can be used, but usually introduce additional problems. With table tilt it is too easy not to tilt the patient adequately or if tilt is adequate the patient fears falling off the table. The 5 litre bag may be too round if fully inflated and too flat if inadequately inflated (in this regard a one litre bag is completely inadequate).

The importance of correct wedging is that it is the most reliable method to prevent dangerous hypotension due to aorto-caval compression.

Monitoring and recording of blood pressure and heart rate

Commence blood pressure measurements at **1 minute intervals**. Pay close attention to the patient as well as the blood pressure and heart rate. Hypotension can occur rapidly and requires prompt treatment. In normotensive patients maintain the systolic blood pressure above 100 mmHg. For hypertensive patients, do not allow the systolic blood pressure to decrease to below 80% of the preoperative value.

Use of vasopressors

Should hypotension occur, treat immediately with either phenylephrine (50µg) or ephedrine (5mg) **at 1 minute intervals** until the blood pressure has returned to more than 100 mmHg or greater than 80% of baseline. Repeated doses of phenylephrine cause slowing of the heart rate and subsequently bradycardia; if slowing occurs, change to ephedrine. Pay close attention to the patient’s conscious level and any complaints of nausea, which is a symptom of hypotension. Automatic non-invasive blood pressure machines may have difficulty detecting rapid changes in blood pressure and may take a long time to re-establish the systolic pressure. If this occurs, or if the patient complains of nausea give a bolus of vasopressor. **NB: Any symptoms suggesting hypotension, such as faintness, blurred vision, nausea or vomiting should be promptly treated with a vasopressor without a prolonged wait for a non invasive blood pressure reading.**

Establishing height of block

You **must** test the height of the sensory block using light touch or cold before allowing surgery to commence.

A block height of at least T6 is required before commencing Caesarean section. Slow development of a high enough sensory level can be hastened by tilting the patient head-down and allowing the hyperbaric bupivacaine to ascend within the spinal canal. Do not leave the patient in this position; readjust the theatre table as soon as the desired block height is achieved. ***Never use the head-down position in the management of hypotension following spinal anaesthesia.***

High Motor Block: Identification and Management

High motor blockade (i.e. local anaesthetic blockade of motor nerves necessary for breathing) is rare. Warning symptoms include the patient complaining of shortness of breath (although this is not very specific) and numbness of the fingers. Signs include “pill rolling” of the patient’s thumbs across her fingers as the sensory level rises into the cervical dermatomes, “floppy” movements of the patient’s arms as they become weak, and the inability to speak above a whisper. Sometimes the onset is so rapid that the first sign is respiratory paralysis.

Treatment must be immediate:

1. Administer oxygen via the anaesthetic machine circuit and an anaesthetic mask
2. Prepare for immediate intubation

3. Observe the patient and the anaesthetic circuit bag:
If there is an inadequate tidal volume, gently assist ventilation and warn the patient what is happening and that you will need to give a general anaesthetic.
4. Apply cricoid pressure and proceed with rapid sequence intubation.
The most suitable induction agent under these circumstances is etomidate 0.2 – 0.3 mg/kg.

Hypotension should be treated as above.

In the situation of rapid onset hypotension and loss of consciousness, proceed with emergency intubation and ventilation without the use of an anaesthetic induction agent. If the patient appears to regain consciousness increments of an induction agent can be given at that time. The most important considerations are to protect the airway, oxygenate the patient and maintain perfusion (blood pressure).

Failed spinal block

Failed spinal block is one where the patient feels pain during the procedure. Failed block presents in three ways:

1. complete failure with no sensory level detected
2. partial failure where the block height is below T6
3. the block is apparently adequate, but the patient subsequently feels pain during the procedure.

In the first two instances the spinal can be repeated, but sufficient time must be allowed to elapse before repeating the spinal. If the caesarean section is an emergency then use of general anaesthesia is indicated. If the indication for surgery is not an emergency but urgent enough to require proceeding within hours wait 20 minutes before repeating the block.

In the situation of a patient perceiving pain during the procedure proceed as follows:

1. Reassure the patient that you will help them
2. If pain occurs before delivery, the chances of successfully tiding the patient over the entire procedure are minimal. General anaesthesia should be promptly provided in this circumstance after explanation to the patient.
3. Later in the procedure, where the sensory block is receding, or the effects of peritoneal retraction may be contributing to the pain, it is possible to assist the patient through the painful period without general anaesthesia and it is worth trying this.
 - a. Administer nitrous oxide either via a Venturi mask or the anaesthetic circuit, aiming for a 50/50 nitrous oxide mix
 - b. Ask the patient if she is still in pain. If so, administer 50 mcg of fentanyl intravenously. After three to five minutes reassess for pain. If she is still in pain ask her if she wants to go to sleep. If so commence general anaesthesia. If the patient chooses to continue give further aliquots of fentanyl and continue reassurance.
 - c. Ketamine can be used, but only as an analgesic. It should not be used as a “sedative”, when it is in effect used as a general anaesthetic with an unprotected airway.

Please note that the problem here is pain. The use of sedatives or low doses of anaesthetic agents is inappropriate. The key to management is maintaining contact with the patient and jointly determining the best course of action. If general anaesthesia becomes necessary it must be a full obstetric anaesthetic with induction, suxamethonium and intubation to protect the airway.

Delivery

As for general anaesthesia

Management of Recovery Room (Both General and Spinal Patients)

Although theatre turnover is assisted by early transfer to the recovery room remember that each patient transfer event is associated with a risk of instability. At the end of the procedure in theatre fully assess that the patient is breathing and that vital signs are stable and that there is no bleeding. Only then may the patient be transferred from the operating table onto the trolley and then to the recovery room. In facilities that do not have a dedicated recovery room, the patient must be fully

recovered in theatre. This must be to the same standard as if a recovery room was available. Only then may a patient be transferred back to the general ward

Patient Monitoring and Oxytocin management

Monitoring of vital signs (Blood pressure, Pulse rate and Respiration and pulse oximetry) should be recorded at 5 minute intervals for at least 15 minutes. Any on-going hypotension must be managed by the anaesthetist and surgeon.

Ensure that the oxytocin infusion is never stopped during the first eight hours of the postoperative period. Baseline infusion rate and concentration administered should be 20 i.u. per litre of Ringer's Lactate over eight hours. If the uterus is not well contracted and the oxytocin rate needs to be increased the use of separate administration sets for intravenous maintenance fluid and the oxytocin should be considered.

Discharge criteria

Patients should not be discharged from theatre to the ward until they have recovered sufficiently. The vital signs should have returned to near normal values. It should be at least 20 minutes since the last intervention such as vasopressor administration.

All patients must be checked to ensure that the uterus is well contracted, that there is no abnormal bleeding and that the postoperative oxytocin infusion is running. Adequate analgesia must be ensured before discharge from recovery, and post-operative analgesia prescribed for the ward.

Post-operative nausea and vomiting must be controlled

General anaesthesia patients must have recovered fully from the effects of the anaesthetic and muscle relaxant. They must be capable of a sustained head lift for at least five seconds, and an adequate cough.

Spinal anaesthesia patients must have had a documented reduction in block height of at least two segments and have a stable cardiovascular system.

Postoperative visit

Ideally all patients should be visited after surgery. Where this is not possible anaesthetists should still visit high risk patients. At this visit any patient concerns should be addressed and signs and symptoms of complications such as Post Dural Puncture Headache (PDPH) looked for. A review to ensure that the minimum observations outlined under "Postoperative facilities and staffing" should be performed. Where anaesthetists cannot perform regular post-operative visits a clear mechanism by which the obstetric care team can obtain an anaesthetic opinion on post-operative patients should exist.

Abbreviations Used in this Chapter

ACLS/ATLS/APLS:	Advanced Cardiac/Trauma/Paediatric Life Support training courses
CEO:	Chief Executive Officer (of a Health Facility)
CO ₂ :	Carbon dioxide
DOH:	Department of Health
ECG:	Electrocardiogram
ESMOE:	Essential Steps in Managing Obstetric Emergencies
Hb:	Haemoglobin Measurement
INR:	International Normalised Ratio
IU:	international units
Kg:	kilogram
kPa:	kilopascals
mins:	Minutes
mg:	Milligrams
mls:	millilitres
µg:	micrograms
NIBP:	Non Invasive Blood Pressure Machine or Measurement
N ₂ O:	Nitrous Oxide
O ₂ :	Oxygen
PDPH:	Post Dural Puncture Headache
P.O.:	Per Os – by mouth
PTT:	Partial Thromboplastin Time,
SANBTS:	South African National Blood Transfusion Service
SpO ₂ :	Oxygen Saturation of the patient on the Pulse Oximeter

ANTIBIOTIC PROPHYLAXIS FOR CAESAREAN SECTIONS

Zweli Mbambisa and G Justus Hofmeyr

Introduction

Pregnancy related sepsis is the 4th leading cause of maternal death and severe morbidity in South Africa, accounting for 5.6% of all maternal deaths in the 2005-2007 report of The Confidential Enquiries into Maternal Deaths in South Africa¹. Assessors indicated that 57.4% of these deaths were clearly avoidable. Caesarean Sections (CS) were performed in 45.8% of these maternal deaths.

The 5th Millennium Development Goal aims at improving Maternal Health by reducing the Maternal Mortality Rate by 75% by 2015. Pregnancy Related Sepsis is one of the areas where there can be a quick and significant reduction in maternal deaths if managed correctly².

Caesarean section is the most important risk factor for puerperal infection³ which is 5-20 times more common than after vaginal birth. The risk is highest for women undergoing emergency CS in labour.

Other risk factors that have been identified in women undergoing CS are: prolonged and/or obstructed labour; prolonged rupture of membranes; multiple vaginal examinations; immuno-compromised women; manual removal of the placenta; wiping the uterine cavity; the socioeconomic status of the woman; the number of prenatal visits; internal fetal monitoring; urinary tract infection; anaemia; blood loss; high body mass index; diabetes mellitus; general anaesthesia; development of subcutaneous hematoma; the skill of the operator; the operative technique and presence of bacterial vaginosis.

Women with preterm rupture of membranes <34 weeks are at increased risk of chorioamnionitis either as a result of a pre-existing amniotic fluid infection which caused the rupture of membranes or as a result of ascending infection once the protective barrier has been breached. Chorioamnionitis may subsequently lead to puerperal sepsis after delivery. This is supported by the results of the Oracle 1 randomised trial which demonstrated as one of their secondary outcome measures that significantly fewer women required antibiotics for septic morbidity if they received either Erythromycin or Co-Amoxycylavulanic acid or both before delivery⁴.

The most common source of organisms responsible for post-caesarean section sepsis is the genital tract. Infections are commonly caused by multiple organisms.

Evidence of effectiveness of antibiotic prophylaxis

A recently updated systematic review of 86 studies involving over 13,000 women, found that both for emergency and for elective CS, antibiotic prophylaxis reduced the risk of postoperative pyrexia, (average risk ratio (RR) 0.45; 95% confidence interval (CI) 0.39 to 0.51, 50 studies, 8141 women), wound infection (average RR 0.39; 95% CI 0.32 to 0.48, 77 studies, 11,961 women), endometritis (RR 0.38; 95% CI 0.34 to 0.42, 79 studies, 12,142 women) and serious maternal infectious complications (RR 0.31; 95% CI 0.19 to 0.48, 31 studies, 5047 women)⁵.

The quality of the studies was variable, and reporting of adverse effects, particularly for the baby was poor. The development of drug resistance was not assessed.

The effectiveness was similar whether the CS was elective or non-elective, and whether the antibiotic was given before or after umbilical cord clamping.

The findings of this systematic review justify a policy of recommending prophylactic antibiotics to all women undergoing CS.

Possible adverse effects of prophylactic antibiotics include side-effects (gastro-intestinal, skin rashes, kidney or liver damage) and anaphylaxis⁶. Public health adverse effects include development of resistant strains of organisms.

Caesarean section technique

Vaginal cleansing with povidone iodone solution prior to caesarean section significantly reduces the risk of postoperative endometritis⁷.

Joel Cohen based methods are associated with less postoperative fever than the Pfannansteil technique⁸, as is non-closure of the peritoneum⁹.

Manual removal of the placenta is associated with increased postoperative endometritis compared with removal by cord traction¹⁰. Routinely wiping the uterine cavity with a swab has also been associated with an increased risk of febrile morbidity.

Randomized trials have to date found no benefit for subcutaneous wound drainage in reducing the risk of wound infection or endometritis¹¹.

Recent evidence indicates that wound infiltration with local analgesic reduces the risk of wound infection.

HIV Status

The 2005-2007 NCCEMD report suggests that women who are HIV infected are at greater risk of infection and of maternal death. Of the women with a known HIV status in this report, 70% were HIV positive. Although no evidence is available from randomized trials, general principles suggest that women who are HIV infected may benefit from a longer course of antibiotics.

Choice of antibiotic regimen.

Systematic review of randomized trials found no differences between penicillins and cephalosporins regarding short-term infective morbidity for the mother¹².

A multiple dose regimen for prophylaxis appears to offer no added benefit over a single dose regimen. Systemic and lavage routes of administration appear to have no difference in effect.

Commonly used regimens are as follows

SINGLE DOSE : AMPICILLIN 2 g i.v. or CEFZOLIN 1g i.v.

MULTIPLE DOSE : AMPICILLIN 2g i.v. 6 hourly x 3days
GENTAMYCIN 240mg daily x 3 days
METRONIDAZOLE 500mg 8 hourly x 3 days

OR

CEFZOLIN 1g i.v. 8 hourly x 3 days
METRONIDAZOLE 500mg 8 hourly x 3 days

Although there is no good evidence from randomized trials, a multiple dose regimen is commonly used with Prolonged Rupture of membranes; prolonged and or obstructed labour; immuno-compromised women (due to HIV); and intraoperative complications considered to increase the risk of infection.

For women on adequate antibiotic treatment for other reasons, there is no need to give additional preoperative antibiotics.

Timing of prophylactic antibiotics

In general, it is recommended that prophylactic antibiotics for preventing surgical sepsis should be given before the skin incision. However, in the case of CS, there is concern regarding the unnecessary transplacental administration of antibiotics to the baby. Theoretical disadvantages for the baby include sensitisation to antibiotics, masking of infection, and fungal infection. One meta-analysis has found that prophylactic antibiotics given before cord clamping reduced maternal infection without measurable adverse effects on the baby¹³. However, there is also the possibility of developmental effects on the baby, particularly if preterm. In the childhood follow up of the oracle II trial of antibiotics for preterm labour, children exposed to prenatal antibiotics had double the rate of cerebral palsy as those whose mothers received placebo¹⁴. Other possible adverse effects are a change in bowel flora and an effect on the baby's developing immune system¹⁵.

The decision regarding timing comes down to the relative weight attached by the clinician and the woman to better infection prophylaxis with early antibiotics versus possible adverse effects on the baby.

SUMMARY

1. CAESAREAN SECTION IS ONE OF THE MAJOR RISK FACTORS FOR DEVELOPMENT OF PREGNANCY RELATED SEPSIS.
2. INFECTIVE MORBIDITY MAY BE REDUCED BY PRE-OPERATIVE VAGINAL CLEANSING; JOEL COHEN BASED OPERATIVE TECHNIQUES; PLACENTAL DELIVERY BY CORD TRACTION, NOT MANUAL REMOVAL.

ADMINISTRATION OF PROPHYLACTIC ANTIBIOTICS SIGNIFICANTLY REDUCES THE INCIDENCE OF MATERNAL POST-OPERATIVE ENDOMETRITIS BOTH FOR ELECTIVE AND FOR NON-ELECTIVE CAESAREAN SECTION.

3. SINGLE DOSE PENICILLINS AND CEPHALOSPORINS ARE SIMILARLY EFFECTIVE
4. WOMEN WITH PROLONGED RUPTURE OF MEMBRANES, PROLONGED AND OR OBSTRUCTED LABOUR, MULTIPLE VAGINAL EXAMINATIONS AND IMMUNO-COMPROMISED WOMEN (HIV) MAY RECEIVE A MULTIPLE DOSE ANTIBIOTIC REGIMEN.
5. POSSIBLE ADVERSE EFFECTS FOR THE BABY MAY BE AVOIDED BY ADMINISTERING THE ANTIBIOTICS AFTER CLAMPING THE UMBILICAL CORD

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CAESAREAN SECTION: SURGICAL TECHNIQUE

M G Schoon and J Seabe

The technique of performing caesarean section (CS) consists of a number of steps. These steps may vary under different circumstances. It is however imperative to standardise the procedure as much as possible in order to reduce costs and improve surgical skills.

Preparation for Caesarean Section

Ensuring written informed consent and carrying out appropriate pre-operative preparations for the CS *remains the responsibility of the surgeon*. Informed consent is applicable for all cases and should highlight the procedure, cost and consequences and potential complications. Consent for procedures should always be obtained in a written format and the *surgeon* should reflect in the clinical notes the extent of discussions with the patient. (See chapter 2)

General pre-operative measures

Obtain a full clinical history

- Clarify the indication and urgency for surgery
- Perform a physical examination that includes baseline blood pressure (BP), pulse and respiratory rates and assessment of the airway
- Discuss the merits of the decision with the patient and obtain written consent for the procedure

Ensure that a baseline haemoglobin (Hb) level is available (within the previous 4 weeks)

- The appropriate Hb level should be determined on a case to case basis. In a healthy woman a level of 8 g/dL is acceptable as a minimum figure, but care should be taken to ensure the availability of blood if needed during the operation. (Chapter 3)

There is no need to measure urea and electrolytes, and platelet counts in healthy women. This is, however, recommended under the following circumstances

- A recent platelet count (< 6 hours) should be available for patients with pre-eclampsia/eclampsia/HELLP syndrome.
- A platelet count should be available in HIV infected women
- Urea and electrolytes are indicated in women with pre-eclampsia, diabetes and cardiac disease

Elective caesarean section

Elective surgery is scheduled on an elective routine list and such patients should have been evaluated by the anaesthetist. These women are not in labour and must have a sound indication for CS. Elective CS are performed at 39 weeks gestation.

- The patient should be nil per mouth for 6-8 hours prior to the procedure
- Acid aspiration prophylaxis regimen for elective procedures are cimetidine 200 mg orally 12 hours and 2 hours pre-operatively, metoclopramide 10 mg orally 2 hours pre-operatively and sodium citrate 0.3M 30 mL per os not more than 30 minutes before anaesthesia
- Empty the urinary bladder prior to surgery. If the procedure is being carried out under spinal anaesthesia, insert an indwelling urinary catheter

Emergency caesarean section

At the time of decision for an emergency C/S, the following steps should be taken:

- Acid aspiration prophylaxis regimen give cimetidine in 200 mL slowly IV, metoclopramide 10 mg IV, and sodium citrate 0.3M 30 mL not more than 30 minutes before anaesthesia
- Avoid using magnesium trisilicate, even if sodium citrate is unavailable
- Assess fetal wellbeing and carry out intrapartum fetal resuscitation if required

- o Stop Oxytocin if being used for induction/augmentation of labour
- o Place the mother in the Left lateral position
- o Give the mother oxygen
- o Set up an IV line with a litre of Ringers Lactate or equivalent.
- o Give tocolysis, to inhibit uterine activity
- Insert a urinary catheter to empty the bladder

Intrapartum fetal resuscitation should be considered if a CS is scheduled because of fetal distress

Just prior to surgery:

- The indication for CS should always be reviewed just before starting the operation. This is especially true if there has been a delay in getting the mother into theatre. Do a vaginal examination in theatre.
- Clean abdomen with chlorhexidine soap/solution
- Give prophylactic antibiotics intravenously (See chapter 4)

Women given prophylactic antibiotics are much less likely to have infection of their uterus and wound (see chapter 4)

Abdominal incision

There is a choice of 2 incisions to make on the abdomen: transverse or midline. The transverse incision is more comfortable for the patient and carries a lower risk of complications¹ while the midline incision is easier to perform by inexperienced staff.

Transverse incision

The incision described by Joel-Cohen is a rapid, safe option with less risk than other techniques described. Repeat transverse incisions may be difficult due to fibrous tissue. Fibrosis can lead to poor exposure and difficult delivery of the baby. Repeat transverse incisions should therefore only be performed by experienced operators.

- Make a transverse skin incision 2-3 cm below a line joining the anterior superior iliac spines. The incision should be about 15 cm in length². Once the skin is incised, only cut the fat in the midline.
- With the index fingers bluntly tear the fat and superficial fascia to the lateral edges of the incision.
- Incise the rectus sheath transversely by making two cuts either side of the midline with a scalpel. This incision is then extended on both sides by blunt dissection (a scalpel could be used, but is more likely to cause bleeding laterally).

A Joel-Cohen incision is the preferred method of abdominal access for caesarean sections

Midline incision

It is better to do a midline incision under the following circumstances³:

- o When pathology is likely to demand considerable exposure (e.g. in the presence of large fibroids or possible uterine rupture.
- o When a vertical incision of the uterus may be required (e.g. transverse lie with ruptured membranes)
- o When there are two or more previous midline incisions
- o If the procedure is performed by an inexperienced operator without assistance
- The skin incision extends in the midline from 2 cm below the umbilicus to about 2 cm above the pubic symphysis (It is usually not necessary to extend the incision into the pubic hair bearing area.)

- After cutting through the skin, cut through the rectus sheath across the same length. An initial incision is made through the sheath with a scalpel, and extended up/down with a scissors- (the entire sheath could also be cut with the scalpel)
- Directly below the rectus sheath are the rectus muscles. The two muscles are separated by blunt dissection. In the absence of previous surgery, this is done by placing your two index fingers between the muscles and pull firmly up and down. If the muscles are stuck together (often after previous surgery), it can be separated by bluntly pushing the scissors between them. The underlying peritoneum should be visible in the newly created gap.
- The peritoneum is opened by lifting the peritoneum with two artery forceps as high as possible to avoid injury to the bladder. Ensure that there is no bowel clamped before making the incision with a scissors. The opening could be extended by bluntly pulling the fingers up and down.
- By looking at the peritoneum from inside you can identify the bladder- light shines through peritoneum, but not bladder.

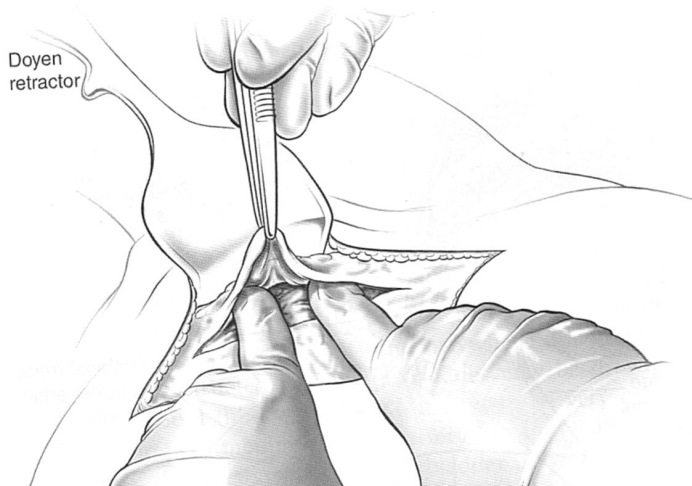
Uterine access

To deliver the baby an incision needs to be made through the uterus. It may be necessary to place a moist abdominal swab on each side of the uterus to keep the intestines out of the operative field. This may also prevent soiling of the abdominal cavity with liquor, especially if meconium is present. Packing abdominal swabs may increase the risk of post-operative ileus.

Open visceral peritoneum and push bladder down

The junction between the upper and lower segments of the uterus is marked by the level where the fixed peritoneal covering of the body of the uterus becomes loosely attached to the uterus in the area above the bladder. The area underneath the loose peritoneum is the lower segment and is covered by the bladder.

- Before the visceral peritoneum is opened it is important to identify the round ligaments to ensure there is no rotation of the uterus.
- Expose the lower segment by inserting a Doyen's retractor and identify the bladder. Pick up the loose peritoneum above the bladder with a dissecting forceps and make a transverse incision through the peritoneum with a scissors in the upper part of the lower segment (2-3 cm above the bladder)
- Push the bladder down for about 5 cm using two fingers or a swab by applying pressure more on the uterine side than the bladder (avoid injury to the bladder). The bladder should then lie 2-3 cm below where the uterine incision would be made. It might be useful to lift the bladder with a forceps to allow for the fingers to dissect underneath the bladder.



- Once the bladder is pushed down, move the Doyen into the space between the uterus and the bladder so the bladder is kept out of the way while incising the uterus.

Lower segment incision

The routine uterine incision should be a lower segment transverse incision. This should only be deviated from under exceptional circumstances. A vertical uterine incision carries a significant risk of rupture during the next pregnancy.

- Make an incision of 2-3cm below where the peritoneum was cut.
- The initial incision should be a transverse incision about 3 cm in the midline made by a scalpel. As you deepen the incision, feel how much tissue is remaining in between every stroke of the knife.
- To avoid accidental cutting of the baby, it is better to open the uterus bluntly⁴ when only a thin layer of uterus is left using the point of a closed scissors alongside your index finger, or the blunt end of a scalpel⁵.
- Once you are in the uterus, extend the incision laterally using your fingers. The surgeon and the assistant each insert an index finger into the incision and pull laterally and slightly upwards.
- Scissors or scalpel should not be used routinely for uterine incision as it has been shown to increase the risk of bleeding and tearing too laterally. The use of a scissor may be required in preterm deliveries where the lower segment is narrow and thick.
- Never extend the incision beyond the round ligaments, as you are likely to cut the uterine artery.
- Large veins over the lower segment are not a contraindication for incision, but haemostasis could be obtained with a haemostatic stitch above and below the incision line.

MISTAKES TO AVOID AT CAESAREAN SECTION

Avoid making the uterine incision too low especially when the lower segment is stretched following obstructed labour. Otherwise you can end up with:

- Tears + bleeding which can lead to maternal deaths if you fail to stop the bleeding.
- Bladder and ureteric injuries.

The lower segment begins where the peritoneum is loose. When the lower segment is stretched, this may be well above the bladder. In this situation, if you make the uterine incision below the bladder level, it will be far too low. This means you do not always have to push the bladder down.

(a) The peritoneal incision is made where the peritoneum is loose

(b) The uterine incision is made 2-3 cm below this and not any lower.

Circumstances when a higher lower segment incision is indicated⁶:

- Preterm pregnancies
- Bladder adherent to uterus
- Prolonged labour in full dilatation

Under these circumstances the incision should be made no more than 2 cm from the junction where peritoneum becomes adherent.

Delivery of the baby

The critical time at a CS is the uterine incision-delivery interval. If this interval exceeds 3-4 minutes, the risk for asphyxia of the baby increases. Carefully insert your hand between the lower segment and the head. Lever the head out of uterus and abdominal incision through an upwards and outwards manoeuvre. Rotate the shoulders to an anterior-posterior position. With the assistant maintaining fundal pressure, deliver the anterior shoulder, and then the posterior one. The rest of

the body is the easily extracted from the uterus. The umbilical cord is then clamped in two places with artery forceps and the cord cut between the two forceps.

Delivery of the placenta

Once the baby is delivered, remove the clamp and allow the cord to bleed⁷. This results in earlier separation of the placenta and reduces need for manual removal of the placenta. Due to the risk of postpartum haemorrhage it is recommended that a slow injection 3 IU of oxytocin be given after delivery of the baby⁸.

- Remove the placenta by a steady gentle traction on the cord⁹. This reduces blood loss and the risk of endometritis when compared with manual removal of the placenta¹⁰.
- After removal of the placenta inspect it to ensure that it is complete and there are no membranes remaining and good uterine contraction is maintained.
- If the placenta has to be removed manually, support the fundus of the uterus to avoid pushing the uterus upwards resulting and tearing the edges of the uterine incision.

Closure of the uterus

There is no evidence that exteriorising the uterus has any specific advantage over leaving the uterus inside the abdominal cavity during closure¹¹. Reduced risk of needle stick injuries has been suggested. The number of sutures is lower and surgical time is shorter with extra-abdominal repair, although moderate and severe pain at 6 hours is less frequent with in situ uterine repair¹².

During spinal anaesthesia it is not advisable to remove the uterus.

- Reinsert the Doyen retractor to increase visibility and to protect the bladder.
- If there is excessive bleeding from the incision edges, Green-Armytage forceps may be applied to reduce bleeding.
- Suture the lower uterine segment in one or two layers. There is no evidence of significant clinical difference between single layer and double layer repair¹³, although a recent large non-randomised trial suggested that subsequent uterine rupture is less common when a second layer was placed.
- Use an absorbable suture (Number 1 chromic catgut, Vicryl® or Dexon®) on a large diameter round-bodied needle.
- Avoid placing the needle through the uterine artery when placing angle sutures.

Single layer closure

- Before suturing the uterus inspect for bleeding from inside the uterus or trauma in the lower segment.
- The first stitch is placed just lateral to the angle of the incision in order to catch any possible bleeders.
- Suture the uterus with continuous inter-locking stitches and tie the knot just lateral to the other angle. Inspect to ensure that there are no bleeders over the sutured site.
- If there are bleeders secure these with figure-8 sutures.

Double layer closure

- It is important to catch each angle separately. The first suture is placed just lateral to the angle to arrest bleeding from the angle. The short end is secured with an artery forceps and the needle secured in the needle holder to prevent needle stick injury.
- After inserting the two angle sutures, check the uterine cavity for bleeding and the lower segment for tears.
- Suture the first layer with continuous sutures from left to right. The sutures are placed 1 cm apart and 1 cm from the edge of the incision. Note that the length of the lower incision is longer than the upper so spacing of the stitches should allow for this difference (gaps should be wider in the lower border to avoid “dogs-ear” developing on the one side).
- When you reach the other side, tie the suture to the short end of the angle suture (it can also be tied on itself).
- The second layer is placed with a continuous suture (does not have to be locked). It is only necessary to take the outer half of the uterine muscle.

A double layer closure of the uterine muscle is less likely to be associated with uterine rupture in a future pregnancy.

Closure of the peritoneum

There is no evidence of any benefit in closing the peritoneum. Advantages of leaving the visceral peritoneum open are:

- Less likely to pull bladder up to an abnormal position.
- Less likely to develop a haematoma
- Adhesions are less likely to develop

The disadvantage is bleeding and therefore important that the edges be inspected for bleeding prior to closure of the abdominal wall.

Closure of the abdomen

Before the abdomen is closed the following safety checks are necessary:

- Remove all abdominal swabs and check that all are accounted for.
- Check if the ovaries and fallopian tubes are healthy
- Check the posterior aspect of the uterus for any trauma or sutures that may have went through as it may have caught some bowel.
- Check if there is injury to the bladder

Midline incision

Mass closure of the peritoneum and rectus sheath in a single layer

- It is important to repair the rectus sheath properly
- Take care to suture the upper and lower ends of the incision adequately. This is where hernias often begin. Take at least 2cm bite from the margins of the peritoneum and rectus sheath.
- The suture material should be an absorbable slow absorbing suture (e.g. PDS) or non-absorbable suture (Nylon). The thickness of the material should be at least 1/0 or 0 on a large needle.

Transverse incision

- Closure of the parietal peritoneum is not essential, but it is important to make sure the bowel is out of the way while closing the muscle layer
- It is important to repair the rectus sheath properly
- Suture the sheath in a single layer with sutures 1 cm apart and not too tight. Laterally the sheath splits into two layers- make sure to identify and suture both layers.
- The suture material should be an absorbable slow absorbing suture (e.g. PDS) or non-absorbable suture (e.g. Nylon). The thickness of the material should be at least 0 or 1/0 on a large needle.

Fatty layer and skin

- The fatty layer normally does not require suturing. If it is thicker than 2 cm, obliteration of the dead space with interrupted or continuous absorbable suture has been shown to reduce risk of wound infection¹⁴.
- The skin should be closed with interrupted sutures (Nylon 3-0). Clips are equally effective but less acceptable by patients. Mattress sutures also increase discomfort and risk of infection.
- At the end of the operation, fundal pressure is applied to expel any clots. This will prevent old blood later being confused with haemorrhage.

Classical caesarean section

Classical CS refers to a vertical incision in, or extending into the upper uterine segment. This type of uterine access has a high risk of uterine rupture in the following pregnancy, and is associated with more post-operative complications. Patients should be counselled accordingly. Indications for this procedure include the following:

- Transverse lie, especially if membranes are ruptured or labour is advanced.
- Large fibroids that make access to lower segment impossible.

- Grossly disturbed anatomy in lower pelvis due to adhesions making access to lower segment impossible.

Access to the abdominal cavity is similar to that of a standard caesarean section. Midline access is preferable as it allows better exposure.

Uterine incision

- The peritoneum in the upper segment is firmly adhered to the uterus; therefore the incision includes both myometrium and peritoneum. The myometrium in the upper segment is much thicker than in the lower segment.
- Incise the myometrium vertically with a scalpel until you reach the membranes (or placenta) then extend the incision up and down with your fingers. Although the myometrium is thick, it does give way to firm digital pressure. It is often simpler to keep the entire incision in the upper segment.
- The bladder can be pushed down to allow the incision to be started in the lower segment and the incision is then extended upwards as far as is necessary to deliver the baby. The disadvantage of this method is that there is a risk of the incision tearing downwards behind the bladder into the vagina. A stay suture can be placed and tied at the lower end before you make the incision, to reduce the risk of downward extension.

Closure of uterine incision

- Suture the first layer with interrupted mattress stitches as closure of the upper segment is under great tension. A simple continuous suture would loosen as the uterus involutes.
- With the first layer, the inner half of the uterine muscle must be included. Place all the sutures first before tying them. Just clip the sutures to an artery before cutting the needle.
- Tie the sutures when all are in place. The assistant will be required to push the edges together to allow tying without tearing through the muscle.
- The second layer is closed with a continuous suture. If the second layer is very thick, interrupted sutures may be considered.
- Close the rest of the incision with a continuous locking stitch that also includes the attached peritoneal layer.

Operation Notes

It is the legal responsibility of the surgeon to ensure that adequate notes describing the procedure are written. The following elements must be included in the operation notes.

- Type of anaesthesia
- Operation: Indication
- Abdominal wall Incision: midline or transverse
- Uterine Incision: Lower segment/classical
- Delivery method: cephalic, breech
- Baby : Apgar score
- Liquor: clear/meconium-stained/foul smelling
- Placenta: controlled cord traction or manual
- Uterine Closure: layers & suture material;
- State of tubes and ovaries and other organs on internal examination
- Rectus sheath: Closure layers & material
- Skin Closure: material
- Estimated blood loss & any complications

Failure to generate or update records is a criminal offence in terms of the National Health Act

Post-Operative Orders

The surgeon is responsible for the postoperative care and comfort of the patient. See Chapter 9 referring to the post-operative care.

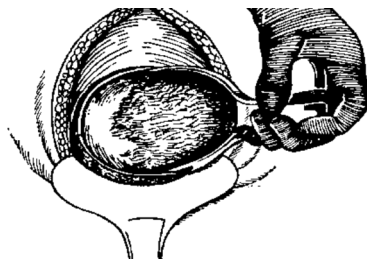
Special circumstances affecting delivery during Caesarean section

Delivery of the baby when the head is high

The head of the baby is often high when CS's are performed when the mother is not in labour. Applying continuous pressure at the uterine fundus should be sufficient to bring the head down. If there is difficulty in delivering the head, check if the head became extended as delivery is easier if flexed. If flexion does not solve the problem, identify possible causes of obstruction:

- Are the uterine and abdominal incisions wide enough?
Rarely it might be necessary to divide the rectus muscles if they are tight and do not allow delivery (This usually happen only with a transverse incision).
- If the head remains high, apply an outlet forceps¹⁵. The head is usually in the occipito-transverse position. Apply the posterior blade first followed by the anterior blade. The anterior blade might be more difficult to apply. It is helpful to lift the upper edge of the uterine incision with the left hand to allow insertion of the anterior blade.

(Wrigley's forceps is a small forceps and more ideal to use and ***should always be available*** in a caesarean section set)



- If the head floats up out of your reach or becomes transverse, it is usually best to find a foot and deliver the baby by internal version and breech extraction¹⁶. Find one foot and pull down steadily on it. If the liquor has drained away, internal version may be difficult. Either get the anaesthetist to relax the uterus or as a last resort, extend the uterine incision upwards as a J-incision.

Delivery of the baby when the head is deeply engaged

During labour the head may descend deep into the pelvis. The head should be carefully elevated out of the pelvis to above the uterine incision and rotated to an occipito-anterior position before it is delivered through the incision. This could be done in several ways:

- If the head is not deeply impacted, this could be done by applying pressure outside the uterus to push the head upwards instead of putting the hand between the head and the lower segment. This would prevent unintended injuries to the lower segment and bladder.
- If the head is well down, the hand could be placed between the head and the lower segment. Moving the fingers to below the head could assist in pulling the head up. Care needs to be taken to avoid the natural tendency to lever the head over the symphysis pubis as this may result in downward tears of the lower segment and resultant injury to the bladder.

Using the left hand for a surgeon standing on the right side of the patient will assist in lifting the head without levering the hand against the symphysis pubis.

- If the head is deeply impacted, an assistant should push the head upwards from the vagina. This carries an increased risk of infection and prophylactic antibiotics must be provided.

Delivering a breech presentation

Breech presentation is often an indication for abdominal delivery.

- If the feet are presenting, just pull on the baby's feet.
- In cases of an extended breech, reach into the uterus and bring the feet down. Delivery of the breech is similar to a vaginal breech delivery. Keep the back anterior with the umbilical cord pulled downwards when delivering the body. (If you allow the back to turn posteriorly with the umbilicus upwards, you may experience great difficulty in delivering the head. Mauriceau-Smellie-Veit manoeuvre is usually sufficient to deliver the head, but a forceps may be applied if difficulty is experienced.
- If the head remains stuck, the uterus should be enlarged with a J-incision to free it.

Placenta praevia

Caesarean section for placenta praevia can be difficult if the placenta is attached to the anterior uterine wall. Ideally these cases must be performed by an experienced surgeon, or have consultant obstetrician present at the procedure.

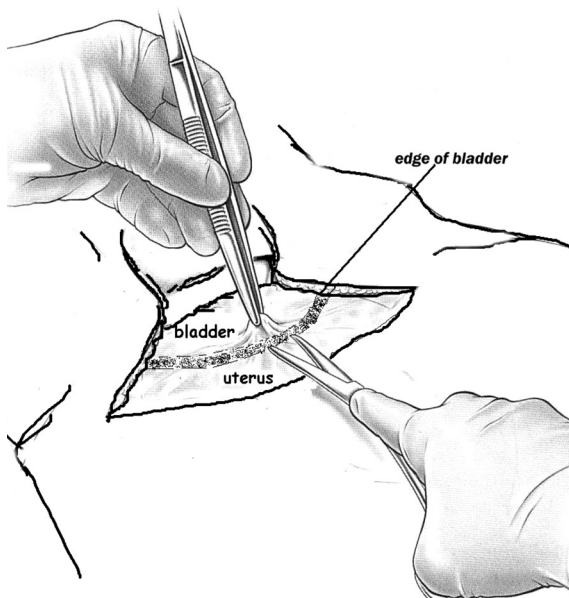
Cross matched blood must be available when surgery is contemplated. The following technical steps should be considered

- A lower segment CS is possible in most cases. Sometimes large blood vessels run over the lower segment. Provided that the uterus is opened and empties quickly, this should not prevent you from doing a lower segment incision. Bleeding from the placental site can be dealt with more effectively through a lower segment incision.
- A classical incision might be necessary in case of a transverse lie with a poorly developed lower segment.
- After the uterine incision, use your hand to get between the placenta and the uterine wall, pushing the placenta aside until you reach the membranes. Rupture the membranes and deliver the baby.
- It helps to know the position of the placenta prior to the operation. If the position is not known, the head of the baby will give an indication. The placenta is to the opposite side of the uterus than the head- therefore go to the side where the head is.
- Rarely, it may be necessary to cut through the placenta-and this can result in significant bleeding of the baby. This should only be considered if the placenta is morbidly adherent to the uterus or if you cannot find the edge of the placenta
- After delivery of the placenta, heavy bleeding may occur from the placental site. Do not close the uterus until the bleeding is controlled. The incision angles should be tied to reduce bleeding from these sites.
- Steps to stop placental site bleeding:
 - o Compress the bleeding area with a swab for 3-5 minutes
 - o Get the uterus to contract –give oxytocics
 - o Place figure-8 stitches over bleeding vessels. It is easy to see bleeding vessels on the posterior wall. If bleeding is from the anterior wall. Place 2 retractors inside the uterus to expose the bleeding areas.
 - o If these measures do not control the bleeding, consider bilateral uterine artery ligation (see discussion on haemostasis in chapter 7)
 - o If the above measures do not control the bleeding, the uterus can be packed with a long roll of gauze or 2 abdominal swabs sutured together. First pass one end through the cervix into the vagina, and then pack the bleeding area tightly. When closing the uterus, take care not to catch the pack in the uterine suture.
 - o Caesarean hysterectomy should be considered as a last resort.

Repeat caesarean section

This can be a difficult procedure if there are many adhesions. The following principles should be considered when operating a repeat procedure:

- If there is a large scar, it is better to excise it
- Open the abdomen carefully. The sheath may be adhered to the peritoneum and care should be taken to avoid injury to underlying bowel. It is of use to apply an artery forceps on either side of the area where you intend to incise and lift upwards to reduce risk of injury to the bowel.
- Beware of the bladder: The bladder might be drawn up to a higher level- the initial opening in the sheath should therefore be made as high as possible, close to the umbilicus. If you cannot find your way into the abdomen, it is easier to extend the incision upwards above the umbilicus. Once inside the peritoneal cavity, you may have to divide pelvic adhesions before the uterus and bladder can be seen.
- The bladder is often stuck to the uterine scar. An incision could be made above the adhesion if there is sufficient lower segment, or alternatively the bladder can be dissected off the scar with sharp dissection using a scissors. With your left hand, hold the bladder with tissue forceps and stretch the bladder downwards to expose the adhesions between the bladder and uterus (See sketch). With your right hand, use the scissors to dissect sharply between the bladder and the uterus with the tips of the curved scissors pointing towards the uterus. If you are cutting too close to the uterus you will open the scar. If this happens aim a bit closer to the bladder. If the tissue being dissected is very vascular, it is likely to be bladder wall. It is more important to keep your dissection close to the uterus and not the bladder to avoid making a hole in the bladder.
- Open the lower segment through the previous scar if possible. If the amount of scar tissue makes it unsafe to separate the bladder down far enough, then a new incision should be made higher in the lower segment than before. When closing the uterine incision, do not remove any scar tissue even if the scar was partially dehiscid.



Caesarean Section for transverse lie

This is potentially a difficult CS so get help where possible. The main problem when there is obstructed labour with a transverse lie is delivery of the baby. The baby's back is usually lying inferiorly and there can be great difficulty in reaching the feet.

Make a midline incision in the anterior abdominal wall so that this can be extended upwards if necessary. With the abdomen open, but before you open the uterus, try again to correct the lie.

The type of uterine incision you make depends on the state of the membranes:

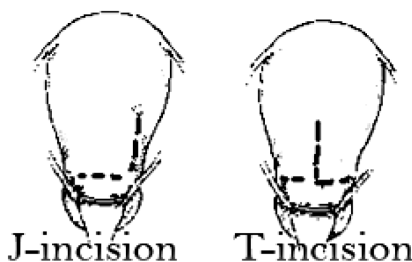
- **Intact membranes.** With the mother under anaesthesia, if the membranes are intact, try external version before opening the abdomen. If this fails, try again with the abdomen opened. If you manage to make the lie longitudinal, you can then do a LSCS provided that the lower segment is not too narrow. Should external version fail and the lower

uterine segment is well-formed, incise the uterus but keep the membranes intact. Grasp a foot through the intact membranes and deliver as for breech presentation. This is similar to delivering a second twin which is transverse.

- **Ruptured membranes.** It can be very difficult to reach a foot. All you can feel is the baby's back and often an arm comes out. It is a natural response to try to put the arm back in, but as it does not interfere with the delivery; there is no point in wasting time doing that. Instead try to work your way around the back to reach a foot. Your other hand can push the head upward from outside the uterus as this helps to bring the feet down. It is only necessary to get hold of one foot and then pull on this. A common mistake is to start looking for a second foot which only wastes time.

These manipulations are easier if the uterus can be relaxed. Ask the anaesthetist to increase halothane to 2% for 1 minute or enflurane to 5% for 1 minute. Any adverse effect on blood pressure must be detected and acted upon. If regional anaesthesia is being used, relaxation can be achieved by the mother inhaling a beta-mimetic or spraying glyceryl trinitrate under her tongue before incising the uterus.

If you have made a lower segment incision and you fail to deliver the baby, you will have to extend the incision up on one side (parallel to the round ligament, known as a J-incision) until you can reach a foot. This is better than making a T-incision, which is made by extending the lower transverse incision upwards in the midline. The T-incision is difficult to suture and is liable to avascular necrosis at the T-junction



Because of the difficulties in delivering a transverse lie through a LSCS, it is often safer in mothers with ruptured membranes to do a classical (vertical) CS. This can be started in the lower segment and extended upwards as far as is necessary to deliver the baby. First push the bladder down and insert a suture where the lower end of the incision is going to be. This is to prevent the incision extending down behind the bladder. Then make the incision.

Transverse lie with intact membranes can usually be delivered through a LSCS, but if the membranes are ruptured it is often safer to do a classical or J-incision.

Caesarean section in presence of fibroids

Large fibroids can make access to the lower segment impossible. If there is a fibroid in the lower segment obstructing delivery, a CS will be necessary. The decision should be made after 39 weeks, as the fibroid may be pulled upwards as the lower segment forms. Aim to make the incision where you will not have to cut through a fibroid. Preferably do a LSCS, but often a classical CS is necessary. Do not be afraid to extend the skin incision above the umbilicus to do this. You should not try to remove the fibroid. If you cut through a fibroid, it is likely to undergo necrosis in the puerperium as its blood supply is partly cut off. Therefore, if a fibroid is cut in the line of the incision it should be removed.

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COMPLICATIONS OF CAESAREAN SECTION

J Seabe and M G Schoon

Practitioners performing CS must be aware of the common complications associated with the surgery and should take care to avoid complications. Failure to recognize complications are associated with increased morbidity and mortality.

Intra-operative complications

Uterine lacerations:

Uterine lacerations, especially of the lower uterine segment, are more common with a transverse uterine incision. These lacerations can extend laterally or inferiorly. They are repaired easily. Take care to identify the uterine vessels when repairing a lateral extension. When repairing inferior extensions, the surgeon needs to identify the ureters.

If the laceration extends into the broad ligament, open the broad ligament medial to the ovaries to identify the course of the ureters.

Bladder injuries:

During CS injury to the bladder can occur under the following circumstances:

- When opening the abdominal wall.
- When separating the bladder from the lower segment in cases of repeat CS.
- If the uterus ruptures, there is also a rupture in the bladder in about 50% of cases.

Diagnosis: Suspect injury to the bladder if:

- Fluid leaks out before the uterus is opened
- the catheter is visible during the operation
- If you see the inside of the bladder which has a smooth surface like peritoneum. Confirm that it is the bladder by looking and feeling for the catheter bulb or by visualizing the urethral opening.

It is important to recognize the extent of the tear in the bladder. A high tear into the fundus of the bladder, is easy to repair. If the tear extends posteriorly towards the trigone, the ureteric openings are on the edge of the tear. This is situated 2cm above and lateral to the urethral opening. It could be visualized by looking for excretion of urine. (if no urine are seen, give Lasix 10 mgs IVI together with fluids to stimulate urine production.)

IF YOU CAN SEE THE CATHETER AT CAESAREAN SECTION, IT MEANS THAT THE BLADDER HAS BEEN OPENED. IT DOES NOT USUALLY MEAN THAT THE CATHETER HAS BEEN WRONGLY INSERTED INTO THE VAGINA.

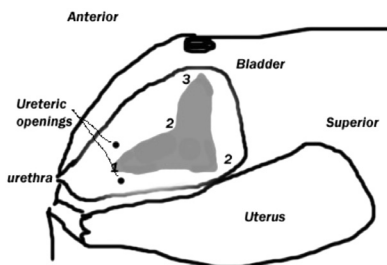


Diagram: Looking at bladder from the outside. The tear is the shaded area with the inner lining of the bladder exposed. If the tear is high up (points 3 to 2 i.e. fundus of bladder) it is easy to close it. However, if the tear extends down the posterior wall (points 2 to 1 near the trigone) the ureters are often in the edges of the tear.

The ureters are recognized by urine coming out and are situated about 2 cm above and lateral to the urethral opening. If no urine is seen, give frusemide 10-20 mg IV along with IV fluids.

Management of bladder injury

Repair the bladder injury after the baby is delivered and the uterus repaired.

The bladder needs to be freed for at least 2 cm around the tear before the opening can be closed. To identify the bladder edges, apply artery clips (or Allis or Babcock forceps) to the edges so that you see the complete opening.

- **If the tear is only superior** (points 3 to 2 in the diagram) close the bladder in two layers of continuous 2/0 chromic catgut or Vicryl. Start a separate stitch at each end (angle) of the tear and the two then meet in the middle. Take the full thickness of the bladder wall with the first layer. Then cover this by a second layer. Note that the closure is similar to that of the uterus.
- **Where the tear extends posterior** (points 2 to 1 in the diagram), the ureteric orifices should be identified to avoid putting a stitch through the ureters. A size 8 infant feeding tube or a ureteric catheter can be passed up each ureter to protect them during the closure. The free end of the catheter is brought out through a stab incision in the bladder and then through the abdominal wall. If you cannot identify them, it is best to just leave in a Foley catheter and refer the mother.

Post-operatively: Leave in a transurethral catheter for 14 days.

Bladder injuries not recognized at the time of operation can be difficult to diagnose. Abdominal distension after a CS usually means a re-laparotomy is required.

If a vesico-uterine fistula occurs: Sometimes a bladder injury is not diagnosed during the CS. It then presents later as a fistula between the bladder and the uterus through the uterine incision. This will present as incontinence or, later, as cyclical haematuria when menstruation restarts. If the diagnosis is made early, the initial treatment can be conservative with a catheter for 3-4 weeks. If conservative treatment fails, the fistula will have to be repaired in a similar way to a vesico-vaginal fistula using the abdominal approach.

Ureteric injury

This is uncommon with CS but is becoming increasingly common as the rate of CS are performed. It is only likely to occur when trying to stop bleeding from a uterine tear which has extended laterally and downwards. This tends to happen when the uterine incision is made too low after prolonged labour. As long as your sutures are applied to the uterus and not lateral to it, the ureter should not be caught.

If there is a possibility of ureteric injury at the time of CS, open the bladder as interiorly as possible (extraperitoneally). Then identify the ureteric orifices and pass a catheter (infant feeding tube) up the ureter.

A ureter could be injured in up to 0.1% of all caesarean deliveries. This is usually associated with repairing of extensive uterine lacerations. Ureteric injury (usually occlusion or transaction), is usually not recognized during the procedure.

Bowel injury:

Although bowel injuries occur in less than 0.1% of all CS, it has serious implications if not identified. The most common risk factor for bowel injury during caesarean delivery is adhesions from prior surgery. If the bowel is adherent to the lower portion of the uterus, dissect it using sharp dissection.

- Injuries to the serosa can be repaired with 3-0 PDS sutures.
- If the injury is into the lumen, perform a 2-layer closure. The mucosa can be closed with interrupted 3-0 absorbable (PDS) sutures placed in a transverse fashion for a longitudinal injury.
- For multiple injuries and injury to the large intestine, consider intraoperative consultation with a general surgeon.

Uterine atony:

Uterine atony is encountered in conditions which are more likely to end in a CS (multiple gestation, polyhydramnios, or a failed attempt at a vaginal delivery in which the patient was on oxytocin augmentation for a prolonged period, prolonged labour). In such cases, it is important to check for a well contracted uterus prior to closure of the abdomen.

Operative haemorrhage:

Bleeding may occur at operative sites- this is often associated with surgical technique and skill. The surgeon has to ensure that care is taken in appropriate slip-proof knots. Care must be taken that adequate homeostasis is achieved prior to closure of the abdomen. Refer to chapter 7 describing in more detail management of haemorrhage during CS.

Postoperative complications***Paralytic ileus and abdominal distension***

Paralytic ileus is when the bowel peristaltic activity decrease and it results in distension of the abdomen. This is diagnosed if by 48 hours post-operatively:

- The mother does not tolerate oral fluids
- No bowel sounds are heard after 1 minute of continuous auscultation
- Her abdomen is distended
- No flatus is passed.

Look for an underlying cause: ileus is a sign rather than a diagnosis. When ileus is present, always look for peritonitis and its cause especially if:

- She is not improving after 48 hours of drip and nasogastric suction
- There is rebound tenderness or general signs of severe sepsis. (Rebound tenderness may be absent in the puerperium even in the presence of major abdominal pathology)

The causes to keep in mind include severe uterine infection, bowel injury or a retained abdominal swab.

Treatment: The initial treatment is intravenous fluids and nasogastric tube (especially if she is vomiting green vomit). Opiates should be avoided as they suppress intestinal activity. The urea and electrolytes should be checked in case hypokalemia is a factor. Surgery may have to be considered if abdominal sepsis is diagnosed or if a cause could not be established.

Post-operative Ileus or distension is a sign of underlying abdominal pathology and must not be ignored

Ogilvie's syndrome

This is a severe form of paralytic ileus which can occur after any pelvic surgery, or even forceps delivery.

- It is due to inhibition of the parasympathetic nerves.
- The caecum becomes greatly distended.
- Mechanical obstruction can be ruled out by using a water-soluble contrast enema which will show free flow of contrast to the caecum.
- The management is initially conservative with drip and nasogastric aspiration. If the caecum on X-ray is more than 9-12 cm in diameter, then a laparotomy or decompression by colonoscopy is advised. A more recent method of treatment is to give neostigmine 2 mg IV. This should be the treatment of choice for those not responding to IV line and nasogastric suction. A response is seen within 3 hours by passage of flatus and reduction of distension.

Postpartum abdominal distention

Postpartum abdominal distention is an important sign not to be overlooked by staff providing postpartum care and may be the leading sign of postoperative infection resulting in peritonitis and ileus.

Postpartum women may have very little tenderness or guarding even in the presence of intra-abdominal inflammation. This could result in a practitioner not aware of this phenomena to miss major abdominal pathology.

Post-operative abdominal distention should be regarded as serious. The following causes must be considered:

- **Intra-peritoneal bleeding**

This usually presents in the first 24 hours. Leading symptoms are usually tachycardia (with or without other signs of shock). This is usually due to ruptured uterus or bleeding from CS. Look carefully for shifting dullness or dullness on the sides because as bowel floats up, most of the central abdomen can be resonant. Aspirate through the abdominal wall for blood. Resuscitate and do a laparotomy.

- **Bladder injury at CS** with leakage of urine may present with a tachycardia and abdominal distension. Abdominal aspiration may reveal urine. There is usually heavy blood stained urine in the urine bag.

- **Intra-peritoneal sepsis.**

Usually present with fever and a persistent tachycardia. Vaginal examination could demonstrate adnexal and cervical motion tenderness. Consider laparotomy if there are signs of severe sepsis, especially if not responding to conservative treatment (see above).

- **Paralytic ileus**

The diagnosis of paralytic ileus is a diagnosis of exclusion. Always look for sepsis, as paralytic ileus is usually a sign of other problems rather than a diagnosis. Treat by naso-gastric tube and drip. Check electrolytes. Do an X-ray to exclude a retained swab, which will show if there is lead in the swab. If not responding after 2-3 days, consider laparotomy.

Wound infection

Prevention

The abdominal wound is the commonest site of infection after the uterus. Good haemostasis is necessary during surgery as most abdominal wound infections are associated with haematomas. Wound drainage makes no difference to the risk of sepsis. Good hemostasis is much more important. Antibiotic prophylaxis is more important for emergency CS when the membranes are ruptured than for elective CS.

Diagnosis

Pyrexia is an early sign of wound infection and may be present before there are any obvious localizing signs such as redness, swelling, heat and pain. A purulent discharge is a late sign. It may be necessary to remove some of the sutures to make the diagnosis as oedema and redness may not be obvious.

Treatment

- The essential treatment once there are localizing signs is to remove the sutures, open the skin and fat layer down to the sheath, and irrigate the wound with saline. This allows drainage of pus and removal of slough. The infection primarily involves the fat layer which has a poor blood supply. If the infection is localized to part of the wound, open only the affected part, although as a rule it is safer to open the whole wound. If there is any necrosis of the skin or soft tissues, or marked swelling which persists after removal of the skin sutures, take the mother to theatre and drain the wound carefully and exclude necrotizing fasciitis (see below).
- The wound can then be dressed with gauze soaked in saline which is absorbent, and ensures that the wound does not close over from above too soon.
- An antiseptic cream such as iodine (e.g. Betadine) or a tablespoon of sugar (anti-bacterial effect) may also be applied.
- The dressing should be changed often enough for it to absorb the exudate. Initially, the wound may need to be dressed 2-3 times daily, but as the exudate reduces, daily dressing is usually adequate. As the wound becomes clean, the frequency of dressings is reduced so that it may only need to be changed every 2-3 days. The modern types of dressings (e.g.

Granuflex) are best used when the wound is clean and dry as these can be left on for up to a week.

- Antibiotics are of secondary importance in wound infections and are really only indicated if there is cellulitis or induration of the surrounding tissues.
- It is important to look at the whole patient and not just the wound. Treat anaemia and give nutritional supplements if the mother has hypoproteinaemia. Exclude immunosuppressive conditions.
- Wound abscess must be drained. Give adequate analgesia such as pethidine IV to open the wound and drain the pus. It is not sufficient just to tell the nurse to remove the sutures.
- When a wound infection occurs, there may also be intra-abdominal sepsis. Remember to do a vaginal examination to exclude intra-abdominal sepsis.
- There are 3 ways the wound can close.
- The majority of infected wounds will heal by secondary intention and it is usually best to wait for this. Occasionally with neglected wounds, an overgrowth of granulation tissue occurs. As the epithelial edge will not grow up and over this, it is best to scrape it off.
- Occasionally, secondary suturing can be performed if the wound is clean and there is a wide gap. It is often better to undermine the edges to achieve good approximation. As a rule, you should avoid secondary suturing.
- When there is a very wide defect, a skin graft may be required.

Wound infections should be taken seriously as maternal deaths can occur if a wound infection is not adequately managed.

Necrotising Fasciitis

Necrotising fasciitis is a spreading wound infection which is often fatal. The name is misleading as the infection involves primarily the fat layer. The skin and fascia are not primarily infected although they may become so secondarily. There are two main types of organisms involved:

- (i) Anaerobic infection, which is often secondary to intraperitoneal sepsis. The wound is smelly.
- (ii) Streptococcal infection is not usually secondary to intraperitoneal sepsis and there is not usually any smell. It is important to give high doses of Penicillin G for this infection.

Diagnosis: The signs that should alert you to this are:

- The patient is toxic. Any patient with cellulitis who develops signs of severe sepsis should be considered to have necrotising fasciitis.
- The wound is obviously swollen.
- The skin can become oedematous with a peau d'orange appearance or blisters. Crepitus is a late sign.
- Skin discolouration may occur and there may be necrosis of the wound margins.
- The wound is very painful and requires opiates.
- Often the diagnosis is made when a swollen wound is opened and no pus is found
- The diagnosis can be confirmed at surgery by failure of the tissues to bleed following incision.

Often the diagnosis can be suspected if a mother has a bad wound infection that is not improving after opening the wound.

Treatment:

- The treatment is to debride the "dead fat and skin" until you reach tissue that bleeds. The fat should appear yellow and healthy rather than grey and dead.
- The key is to be aggressive from the start. You may have to extend the incision far laterally to do this. The aim should be to excise the swollen part of the wound. You often have to remove large amounts of tissue to debride the wound adequately. The tendency is to do too little. Be radical from the start.
- Inspect the wound daily. If the mother continues to be pyrexial, suspect there is continuing infection.
- Split-thickness skin grafts are used later to repair the defects.

Wound dehiscence

This can be divided into:

(i) **Superficial:** This is fairly common if a haematoma or infection occurs. The treatment is to dress the wound with antiseptic solution until it appears clean, and then suture if necessary. In these cases you should check that the rectus sheath is still intact.

(ii) **Full thickness:** This is also known as a burst abdomen. The rectus sheath has opened as well as the skin. Most burst abdomens are due to the suture tearing through the sheath, rather than the suture or knots giving way.

- It is usually diagnosed when the skin sutures are removed. As bowel and omentum often prolapse through, cover the wound with abdominal swabs soaked in saline.
- Sometimes fluid starts pouring out of the wound before the sutures are removed. In this case, remove a few sutures and check the wound.

If you are in doubt about whether a wound has a full thickness dehiscence or not, it is better to explore it under anesthesia as delay can have fatal consequences.

- Take the mother to theatre within 6 hours and start antibiotics.
- Even if it appears that only part of the wound is affected, you must re-open the whole length of the rectus sheath.

Treatment

- Check the uterine incision, as this may be septic as well.
- Do a saline washout of the peritoneal cavity. As the peritoneum is open, there will be early peritonitis.
- If the bowel is distended, pass a nasogastric tube before closure and squeeze bowel contents towards the stomach to facilitate easier closure.
- The correct way of closing “a burst abdomen” is to close it the way it should have been done the first time. Do mass closure, using nylon, Vicryl or Dexon but never catgut. Take bites of the sheath which are at least 2 cm from the margin and 1 cm apart. Only if the sheath is very friable is it necessary to use tension sutures. Be careful not to injure bowel stuck to the area around the wound.
- If there is abdominal distension, it may not be possible to close the peritoneum or sheath without causing tension. In this situation, use an empty plastic infusion bag to cover the defect. This is stitched in place. After one week as the distension reduces, it may then be possible to close the sheath.
- If the sheath has dehisced but the bowel is already fixed in place, the best treatment is to leave the sheath open and just dress the wound daily. The risk of infection spreading inwards is actually low. Once there is a clean granulating surface, the skin defect can be grafted to speed up healing. The mother may end up with an incisional hernia but this can be dealt with later.

When the liquor is infected at the time of CS, it is extremely important to continue antibiotics for 5 days and not to rely just on one prophylactic dose.

- Sutures should be removed on day 10. If she is obese, it is safer to leave them in until day 12-14. **NB!** Sutures should not be removed in health facilities with poor transport in case wound dehiscence occurs and the mother cannot be transferred rapidly to hospital.

If complications occur outside a specialist facility, the health practitioner is advised to discuss the merits of the case with the responsible medical practitioner

THE PREVENTION AND MANAGEMENT OF BLOOD LOSS AT CAESAREAN SECTION

S Fawcus

Background

Bleeding associated with Caesarean section (CS) was the most common causal subcategory of maternal deaths from obstetric haemorrhage in South Africa in 2008 -2010, accounting for 180 (26.2%) of the 688 maternal deaths due to haemorrhage. Related morbidities included obstructed labour, previous CS, abruptio placentae and placenta praevia. The majority of these deaths were clearly avoidable.

Lack of surgical skill to achieve haemostasis at the initial CS, lack of skill to perform the additional surgical measures required to arrest excessive haemorrhage and poor post CS monitoring were all avoidable factors^{1,2}.

PREVENTION

The following steps should be taken to minimize haemorrhage associated with CS:-

- Ensure that the partogram is completed fully and that the labour graph is interpreted properly, so that prolonged labour is diagnosed timeously, the appropriate interventions made, and late first and second stage CS are avoided.
- Ensure that the strict indications for CS are followed. If you know in advance that there is a major placenta praevia, this case should be referred to a regional or tertiary hospital. An obstetrician should be available, where possible, for all CS being carried out for major placenta praevia.
- Ensure that the Haemoglobin is known prior to the CS and if <8 gms/dl make sure that emergency or crossmatched blood is available.
- If the CS is being performed for obstructed labour, ensure that the most experienced medical officer performs the surgery.
- Ensure a dedicated medical officer/physician anaesthetist provides anaesthesia i.e. at least 2 doctors should be available for the procedure; one to carry out the anaesthesia and one to do the surgery. In emergency situations an experienced midwife can assist at the surgery.
- Ensure that appropriate surgical technique is used and that the incision in the uterus is not too low in the lower uterine segment, particularly in CS for obstructed labour and those in the second stage of labour.
- The use of blunt dissection rather than sharp dissection for abdominal entry and Controlled Cord Traction rather than manual removal to deliver the placenta have both been shown to reduce blood loss at CS³.
- **DO NOT “RUSH” THE SURGICAL PROCEDURE.** A CS SHOULD TAKE ABOUT 30 to 40 minutes.
- **Do not** “close the abdomen” prior to checking that haemostasis has been achieved and the uterus is contracted and check with the anaesthetist that the patient is haemodynamically stable. If intra-operative bleeding persists call for help.
- **Ensure** that after delivery of the baby, 2.5 i.u of Oxytocin by slow iv injection is given and 10 units is inserted into a litre of Ringers Lactate or similar fluid and continues to “run”

during the operation, following the operation in the recovery room and in the ward for **at least 2 hours**. Do not stop the Oxytocin drip at any stage during the transfer of the patient from the theatre to the ward. A separate IV line for the Oxytocin infusion is preferable.

- **Ensure** that prior to the patient leaving the operating table and the recovery room, the uterus is palpated to ensure that it is well contracted. Also check to assess the amount of vaginal bleeding and empty the uterus of all blood clots.
- **Transfer the patient from the operating theatre /recovery room only after ensuring that the pulse rate, blood pressure are stable and that the spinal anaesthesia (if given) is <T8 and receding. Also check for uterine /vaginal bleeding (“pad checks”).**
- Ensure observations in the following manner
 - Half hourly for 2 hours
 - Hourly for a further 4 hours
 - 2- hourly for a further 6 hours and then 4 hourly until discharge.

Observations to be recorded:

- pulse rate
 - blood pressure
 - respiratory rate
 - vaginal bleeding(pad checks)
 - urine output 4 hourly.
- The patient should be nursed in an area where there are health care professionals that can do the observations regularly and not put in a ward where observations are difficult to perform.

MANAGEMENT OF EXCESSIVE BLEEDING AT C/S

The following algorithms have been developed for the prevention and management of bleeding at and after CS and can also be found in the Monograph of the Management of Postpartum Haemorrhage (4).

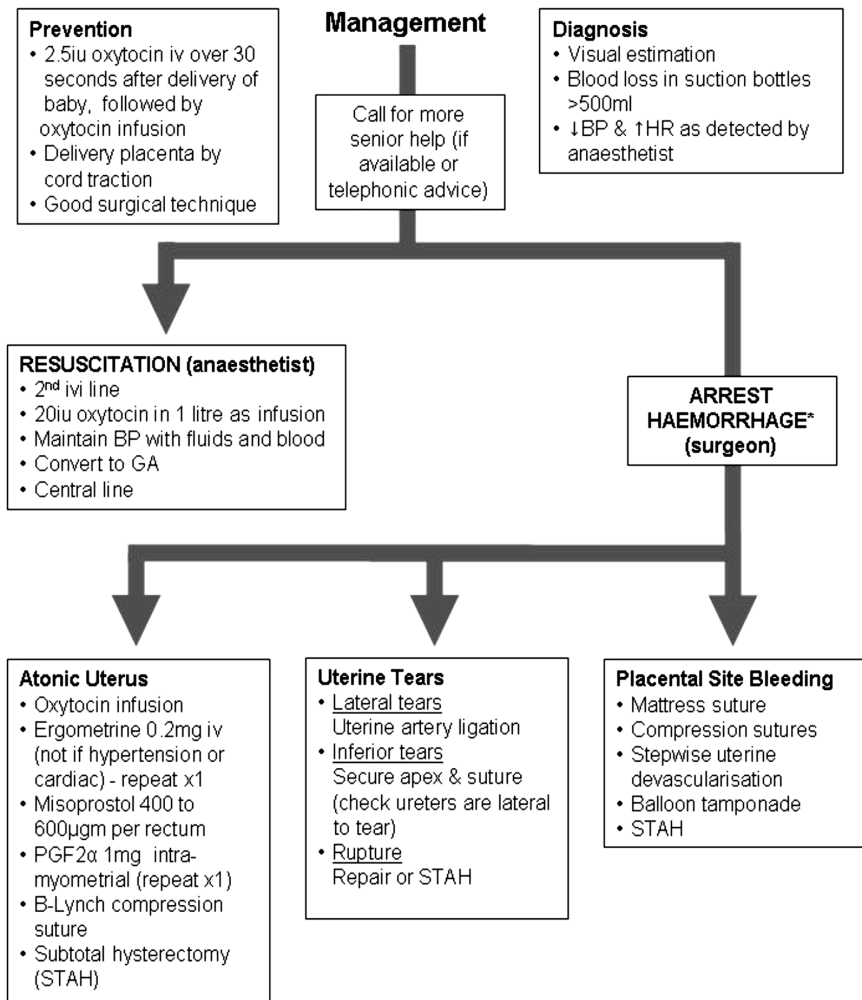
Bleeding at Caesarean Section

Excessive bleeding at CS is defined as estimated blood loss in excess of 1000 mls.

Bleeding at CS is usually underestimated by swab counts and suction bottles. Visual inspection and reporting by the anaesthetist on the haemodynamic status of the patient are an important part of the recognition of PPH. The anaesthetist needs to take responsibility for the resuscitation and there needs to be regular communication between surgeon and anaesthetist.

The surgeon must diagnose the cause of the bleeding; uterine atony, tears and lacerations, placental site bleeding and coagulopathy. The first two causes may be due to prolonged labour. Uterine sepsis and abruptio placentae can also cause uterine atony and coagulopathy. Placenta praevia and morbidly adherent placenta can cause placental site bleeding. Inappropriately placed uterine incisions; too low or too lateral can result in tears which cause haemorrhage.

Bleeding At Caesarean Section



NB. Proceed immediately to STAH if: uterine rupture that is irreparable
placenta increta or percreta

As indicated in the algorithm the following treatment modalities can be used for the different causes:

1. Atonic uterus- stepwise use of oxytocics (oxytocin infusion, ergometrine, prostaglandins),
1. B lynch compression suture
2. Lateral tears into broad ligament – unilateral or bilateral uterine artery ligation.
3. Tears down lower segment of uterus - haemostatic sutures, ensure get apex of tear, check ureteric path if tear goes lateral.
4. Bleeding from placental bed – individual haemostatic sutures and uterine artery ligation, balloon tamponade
5. If morbidly adherent placenta – as previous, consider use of Baum's curette
6. Aortic compression can be applied by an assistant as a temporising measure while help is called
7. Some practitioners have described the use of a Foleys catheter or feeding tube tied as a tourniquet around the lower part of the uterus as is sometime done during myomectomy⁵. This compresses the uterine vessels and reduces blood loss while awaiting help or during transfer of patient to a level of care with more expertise. This technique has not been properly evaluated but there are individual case reports in South Africa of women transferred in from a level one hospital following bleeding at CS with a uterine tourniquet in situ who have had successful outcome. It is not known as to how long such a tourniquet can be placed in situ without causing permanent irreversible ischaemic changes to the uterus.

Details of procedures such as B Lynch uterine compression suture, balloon tamponade and uterine artery ligation can all be found in chapter 6 of the Monograph of the Management of Postpartum Haemorrhage⁴.

It sometimes requires more than one modality of treatment to arrest the haemorrhage.

In cases of irreparable uterine rupture or placenta increta or percreta (placenta that has invaded into the myometrium and/or beyond) it is necessary to proceed immediately to Sub Total Hysterectomy without attempting conservative measures.

Occasionally with a placenta increta which fails to separate from the uterine wall after administration of oxytocin and in the absence of any bleeding, it is best not to attempt placental removal at all, but rather to leave it in situ and await spontaneous expulsion.

This chapter will give details of how to perform a Subtotal Hysterectomy.

Bleeding after Caesarean section

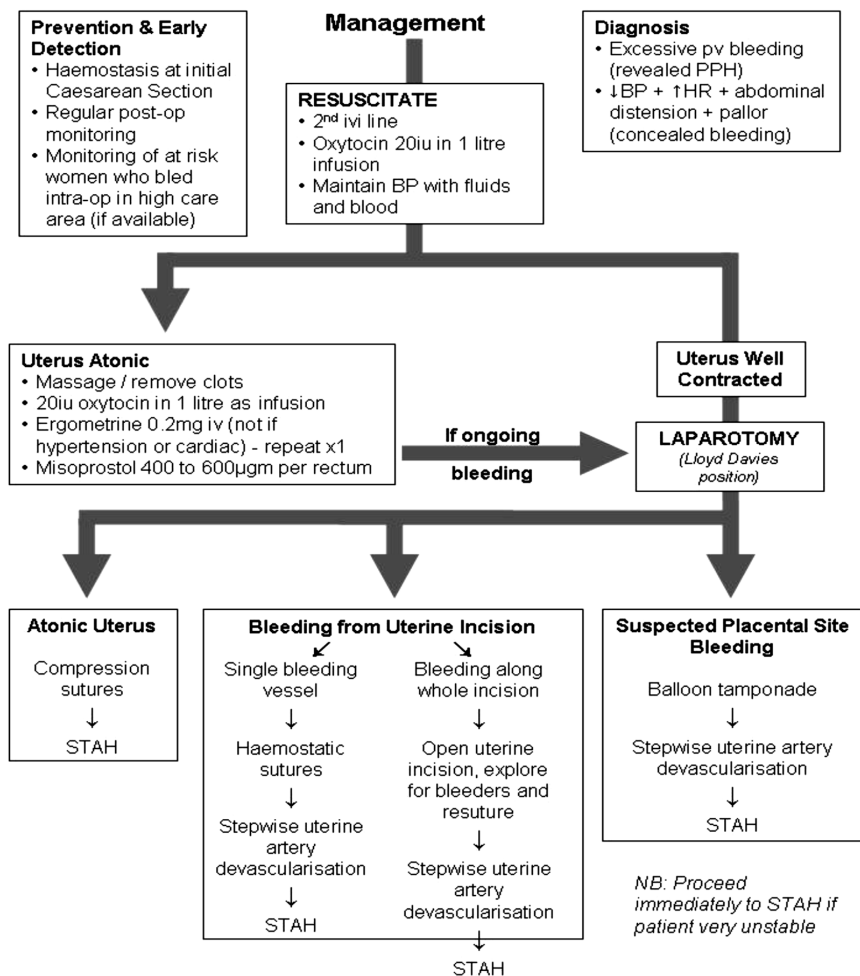
This problem should be minimised by ensuring haemostasis at the initial CS, treating uterine atony and carefully inspecting the uterus anteriorly and posteriorly for tears or haematomas. In addition, bleeding can sometimes occur under the rectus muscle, under the rectus sheath and in the subcutaneous tissue so these should all be inspected before closing the abdomen.

Vigilant postoperative monitoring can allow the PPH to be detected and treated timeously. Excessive bleeding per vaginam is more easily detected and most commonly is due to ongoing uterine atony, but also can be due to placental site bleeding especially in placenta praevia. Occasionally bleeding vessels in the uterine angle, which were not adequately ligated, point inwards to the uterine cavity and cause post-operative vaginal bleeding. Intra-abdominal bleeding is more difficult to detect because the bleeding is concealed. Deteriorating vital signs in terms of tachycardia above 110 beats/minute and BP systolic < 100 mm Hg with pallor are clues. Do not diagnose hypotension as a side effect of a spinal anaesthetic unless haemorrhage has been excluded. Intrabdominal bleeding is usually due to bleeding from the angle of the uterine incision which may cause free blood in the peritoneal cavity or a broad ligament haematoma.

Management is shown in the algorithm which follows. It involves volume resuscitation and use of blood and blood products as appropriate. It is very important to diagnose the cause of the bleeding.

Uterine atony can initially be treated medically. Placental site bleeding if anticipated because it follows a placenta praevia or placenta accreta could be treated with balloon tamponade. However if there is poor response to these measures and/or the bleeding is massive, a relaparotomy must be performed without delay. A Hayman uterine compression suture is indicated for uterine atony which is not responsive to medical therapy. Haemostatic sutures can be inserted for bleeding at the uterine angle together with a unilateral uterine artery ligation especially if the bleeding is thought to be from vessels in the broad ligament. However if there is vaginal bleeding in association with a well contracted uterus, and there was no risk for placental site bleeding, then it is advisable to reopen the uterine incision and look for arterial bleeders at the angles which can be ligated. If all these measures fail proceed to hysterectomy.

Bleeding After Caesarean Section



Level of care

Uterine compression sutures, balloon tamponade, and uterine artery ligations are all procedures that need to be learnt by any doctor trained to perform a CS and are procedures that can be done in a district hospital with emergency blood available. The skill to perform subtotal hysterectomy may not be available at this level, but should be available at all regional and tertiary hospitals which, in the ideal situation, are the more appropriate level of care to manage patients with massive haemorrhage.

Other measures

Internal iliac ligation could be considered if fertility needs to be preserved and a hysterectomy is indicated. However, an experienced surgeon is required and a success rate of 50% needs to be kept in mind. Some tertiary institutions may have the radiological equipment and skills to perform uterine artery embolization. This will be the procedure of choice if available, but requires a well resuscitated patient. Keep in mind that internal iliac ligation rules out the possibility of embolization.

Abdominal hysterectomy

NB: proceed straight to hysterectomy if placenta percreta, ruptured uterus which is irreparable, or when above conservative measures are unsuccessful.

A subtotal hysterectomy (STAH) is usually sufficient to control the bleeding. However if there are tears going down into the cervix, a uterine rupture extending into the cervix or lower segment bleeding following a major placenta praevia, the cervix will also need to be removed i.e. total abdominal hysterectomy (TAH).

Technique of Subtotal abdominal hysterectomy

- Pack away bowel with moist packs
- Self retaining retractor and retractor for bladder.
- Suction / Hysterectomy pack

Surgical steps

1. Lift uterus out of pelvis
2. Clamp and cut round ligaments and open up broad ligament by cutting anterior leaf medially and posterior leaf medially.
3. Press finger through translucent area from the posterior leaf of broad ligament through anterior leaf thus creating a pedicle of the ovarian ligament, tube and part of the broad ligament. Place two clamps, ensuring both clamps are medial to the ovary so this is preserved on either side. Cut in between the clamps.
4. Pick up the utero-vesical peritoneum, make a small cut and extend transversely with the scissors (NB. This step will have already have been done if at caesarean section.)
5. Grasp the cut edge of the utero-vesical peritoneum with a non toothed forceps and using the fingers or scissors gently push the bladder further down off lower segment. This step allows bladder and ureters to be displaced downwards.
6. Clamp the uterine arteries with one clamp superior and two inferior. The clamp should be placed horizontally and extend as far as the lateral border of the uterus. Cut below the superior clamp.
7. At this stage bleeding should diminish and all pedicles can be tied. (Transfix and double ligate using no 1 chromic catgut or vicryl on a round bodied needle)
8. Amputate the uterus above where the uterine arteries are ligated using scissors
9. Close the cervical stump with interrupted sutures (above material)
10. Check very carefully for haemostasis.
11. If haemostasis is not satisfactory after STAH, a suction drain can be left in situ. If coagulopathy is evident after the STAH/TAH, then consider abdominal packing to tamponade the abdominal cavity. At least 5 paediatric swabs followed by abdominal swabs can be used. The patient will need to be kept ventilated and the packs removed after 48hours.
12. Observe in high care area where vital signs including urine output can be monitored and blood products replaced as necessary

WHAT CAN BE DONE TO REDUCE DEATHS FROM CS BLEEDING?

Algorithms, posters and booklets are useful and require to be distributed to the relevant health workers but on their own they are insufficient. It is very important to emphasise the need for 'hands on' surgical training for all doctors performing CS, as well as an approach to and demonstration of additional surgical skills to arrest bleeding should it be excessive. The availability of experienced specialist assistance for difficult cases preferably on site or easily available telephonic advice in the case of a remote rural hospital is also important. Clinical outreach can help maintain skills and include surgical training.

The clinical managers of maternity services should monitor CS associated bleeding as an indicator, ensure that guidelines are in place, that surgical training occurs and that senior assistance is available. In addition the ensuring of constant availability of emergency blood, adequate staffing and functional theatres are essential.

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KEY PRACTICE POINTS

1. Excessive bleeding at Caesarean Section (C/S) causes maternal deaths in South Africa
2. Preventive measures such as timeous C/S for prolonged labour, oxytocin and careful surgical technique can reduce bleeding at C/S.
3. Vigilant postoperative monitoring can allow earlier detection and earlier treatment
4. Algorithms are available to guide management for the various causes of bleeding at C/S
5. Management requires team work between surgeon, anaesthetist and midwives.
6. Surgeons who perform C/S need to know the medical treatment of uterine atony and be able to perform additional surgical procedures for arresting haemorrhage and preferably subtotal hysterectomy
7. Post C/S bleeding may be concealed (intra abdominal) as well as revealed (per vaginam)
8. Post C/S bleeding not responding to medical or conservative measures requires urgent re-laparotomy.

CAESAREAN SECTION IN THE IMMUNOCOMPROMISED PATIENT WITH AIDS: A GUIDELINE

N Moran

Purpose of Guideline

To minimise adverse outcomes resulting from caesarean section (CS) in the patient with AIDS

Need for a Guideline

It is now a common occurrence, particularly in KZN, to have to perform a CS in a patient with AIDS (HIV +ve and CD4 < 200 or AIDS-defining illness). These patients are immunocompromised and often have a high viral load, which means that CS carries a high risk of adverse outcomes including:

- Puerperal sepsis
- Vertical transmission of HIV at delivery
- Transmission of HIV to health worker if occupational injury occurs at CS

This guideline offers suggestions for preventing these adverse outcomes when performing a CS in the AIDS patient.

Pre-operative Measures

- Ensure that the CD4 result is obtained prior to any CS for an HIV +ve patient, so that patients with AIDS can be identified and the following measures implemented.
- In maternal interest, try to avoid CS in the AIDS patient unless strongly indicated. For example, allow vaginal birth after previous CS x1, and consider ECV or vaginal breech delivery rather than CS for breech presentation
- Start HAART before CS, so as to bring down the viral load before delivery. Even starting HAART a few days before delivery should be effective. There is no upper limit to the gestation at which HAART can be started. If necessary postpone an elective CS to allow time for HAART to be started. Do not omit HAART on the day of the CS.
- Start therapeutic intravenous broad-spectrum antibiotics (e.g. Co-amoxycylav) as part of the pre-op prep, before the patient is sent to the theatre.

Intra-operative Measures

- The operation should be performed by an experienced surgeon who must not rush the surgery.
- Full protective clothing (double gloves, eye protection, aprons etc) must be worn by surgeon, assistants and scrub sister.
- The skin incision should be either midline or Joel-Cohen (high transverse) to allow good exposure with minimal dissection. Avoid going through a Pfannenstiel (low transverse) scar from a previous C/S, as this often requires extensive dissection.
- Enter the uterus with extreme care, preferably by blunt entry, to avoid any laceration to the baby.
- Avoid forceps delivery of the baby's head, unless essential to achieve delivery of a high head.
- Avoid suctioning of the baby at birth unless required for resuscitation
- Have a warm wet swab at hand to wipe maternal blood from the face and body of the baby immediately at birth
- If the baby sustains a laceration at delivery, clean it immediately with hibitane and dress it to prevent further contamination.
- Consider the use of blunt needles for suturing the uterus, and for tubal ligation where applicable, to reduce needle stick injuries.
- Perform a thorough washout of the pelvis following closure of the uterus.
- Close the skin and subcutaneous tissue together, with a few interrupted deep mattress sutures. Avoid subcuticular or staple closure of the skin, leaving the subcutaneous layer unsutured, as this predisposes to wound haematoma and subsequent sepsis.

Post-operative Measures

- Ensure baby receives prophylactic ARVs according to protocol, and institute appropriate feeding method as decided antenatally.
- **If the baby has sustained a laceration at delivery, a one-month course of dual prophylactic ARV therapy should be given to the baby.**
- For the mother, continue the therapeutic broad-spectrum antibiotics for 3 days post-op.
- The mother should continue HAART daily for life.
- Keep the mother as an in-patient for 5 to 7 days until skin sutures are removed, to allow close monitoring for early signs of puerperal sepsis

CAESAREAN SECTION AND THE PAEDIATRICIAN

M Adhikari

Caesarean Delivery for Abnormal Labour

Caesarean section may be indicated for disorders of labour and include

- Failed induction
- Disorders of the active phase of labour
- Second stage disorders

Appropriately grown fetuses who enter the second stage in *good condition seldom suffer asphyxia if carefully monitored¹.

Action

- Prepare for delivery
- Check equipment
- Place baby under overhead warmer or draft free area
- Dry,
- Keep warm
- Suction – if secretions present,
- Oxygen as required to keep saturations between 88-92%
- Check blood sugar – preferably above 2.5mmols/l

If baby settles and needs no further management, arrange for referral to mother or short stay in nursery till the mother is ready to handle her baby.

If HIV exposed, commence antiretrovirals according to National Guidelines

If there are any concerns, the baby should be admitted for a short period (12-24 hours) to the nursery for observation and monitoring of

- Temperature
- Blood sugar levels
- General behaviour
- Signs of CNS involvement- poor responsiveness, apnoea convulsions
- Feeding – if mother cannot breast feed offer formula till she can breast feed baby
- If HIV exposed commence NVP.

The term infant who has poor growth indicating poor reserve may require resuscitation at birth. Further careful monitoring for hypothermia, hypoglycaemia and neurological affectation is important

- Prepare for delivery
- Check equipment
- Note if there is meconium staining of the liquor and the degree of thickness of the meconium. Grade 2 and 3 could be problematic

Resuscitation procedure – see below

Following resuscitation the baby should be admitted to the neonatal unit for observation

- Temperature
- Blood sugar levels
- General behaviour
- Signs of respiratory distress
- Signs of CNS involvement- poor responsiveness, apnoea, convulsions
- These babies may be slow to feed – pass a nasogastric tube and feed till recovery occurs – encourage sucking at every feed
- Feeding – if mother cannot breast feed offer formula till she can feed baby
- If HIV exposed commence NVP.

Within 4 hours the baby will have evidence of clinical improvement or deterioration.

Deterioration includes

- Increasing respiratory distress, apnoea, increasing oxygen demands
- Convulsions which may be overt or more subtle
- Abnormal behaviour- jittery, limited movements with poor response to stimulation, irritability. Determine if these are subtle convulsions or not.

A decision has to be taken to refer the baby or manage on site. If the baby is at a level one facility. Increasing respiratory distress should be referred to level 2 facility for respiratory support.

Convulsion can be managed by administering an anti-convulsant such as phenobarbitone see dosage below

Complications of prematurity in late preterm births

Infants born at 34 0/7 to 36 6/7 week's gestation compared to term infants suffer more difficulties with

- Feeding - difficulties include the poor suck-swallow reflex, slow intestinal motility leading to breastfeeding difficulty with a higher likelihood of poor weight gain and dehydration.
- Hypoglycaemia)
- Jaundice
- Temperature instability
- Apnoea
- Respiratory distress
- Unnecessary investigations for sepsis based on some of the above

Often intravenous fluids are required while establishing feeds

- Volume of fluid – 60ml/kg/day of Neolyte on day 1, 80 ml/kg day two, gradually increasing IV volume and feed to a total of 180ml/kg/day by about day 7.
- Evaluations for sepsis is important if the indication for delivery is suggestive of a background of sepsis e.g. PPRM or PTL
- Mechanical ventilation for HMD or transient tachypnoea of the newborn

When called to a caesarean section delivery one must be aware of the risk of prematurity and the above possible complications

Prepare for the delivery;

Check equipment

Resuscitate – see below

Following resuscitation these babies should be admitted to the neonatal ward

The following careful observations and must be recorded

- Respiratory distress and
- The need for oxygen to maintain saturations at 88-92%
- Apnoeic episodes
- Poor peripheral perfusion (capillary re-fill > than 2 to 3 seconds) – may indicate the need for volume to be given (10-20mls/kg Ringers solution over 30 minute) Suggest giving 10mls/kg and re-assess perfusion if still reduced repeat dose.)
- Blood sugar monitoring (BS > 2.5mmol/L)
- Maintain temperature
- Monitor urine output (<0.5ml/kg/hr = oliguria)
- Check for signs of sepsis – see guideline attached
- FBC and blood culture should be performed
- A CRP (C reactive protein) estimation if available
- Penicillin should be commenced - 50 000units/kg IVI over 10 minutes 8 hourly till culture results obtained. If negative penicillin must be stopped. If the blood culture is positive change antibiotics according to sensitivity of the organism

Deteriorating signs includes

- Increasing respiratory distress,
- Apnoea,
- Increasing oxygen demands
- Floppiness
- Persistently low blood sugar despite adequate IV fluids and feeds

A decision has to be taken to refer the baby or manage on site. If the baby is at a community health centre or district hospital, and develops increasing respiratory distress, the baby should be referred to a regional facility for respiratory support.

Low blood sugar – feed if possible/15% glucose if no response i.e. blood sugar remains low – refer

Convulsions can be managed by administering an anti-convulsant such as phenobarbitone (loading dose 20mg/kg i.m., if still convulsing after 18 hours the maintenance dose of phenobarbitone is 5-8 mgs/kg daily)

Hospital readmissions of late preterm infants

Following discharge within a few days after birth, late preterm infants are re-admitted to hospital 1.5 to 3 times more often than term infants. The primary reasons for re-admissions are :-

- Hyperbilirubinaemia – inadequate feeding
- Suspected infection
- Feeding difficulties as maternal milk increases baby may not be able to cope with the volume of milk

These problems reflect the processes of the development physiological and metabolic functions. It is important to be aware of this following discharge of these babies.

It is therefore important for staff to inform mothers so they are aware of the possible problems and access health care earlier rather than later.

Perinatal and infant mortality after caesarean delivery

For some years, United States vital statistics data have indicated a 1.5 fold increased risk for neonatal mortality after CS planned and unplanned compared to vaginal delivery. It has also been assumed that these babies were delivered of high risk pregnancies³.

Neonatal death following elective CS must be weighed against the risk of fetal demise in utero in the ongoing pregnancy. Stillbirth rates increase with advancing gestational age from 38 weeks to 41 weeks.

Respiratory Morbidity – this has been indicated above**Neonatal asphyxia or encephalopathy**

It was proposed that elective caesarean section deliveries are atraumatic and would reduce the risk of intrapartum neurological injury and cerebral palsy.

However despite the consistently increasing CS rates over the last decade, cerebral palsy rates in term infants (>2500gms) have not decreased.

It is argued that some cases of elective CS at 39 weeks are expected to pre-empt unpredictable catastrophic obstetric events (Abruptio of the placenta).

Intracranial haemorrhages

The mode of delivery is thought to influence rate of intracranial bleeds such as subdurals, cerebral, intraventricular and subarachnoid. A large retrospective review of 583,000 births of 2500-4000gm babies to nulliparous women conducted by Towner and colleagues found that the data suggested that intracranial haemorrhage may be related to abnormalities of the dysfunctional labour process, rather than the mode of delivery⁴.

Behavioural problems

Clinically significant behavioural problems may occur in about 20% of these babies born between 34-37 weeks gestation. In addition, compared to babies born at term these babies have an 80% increased risk of childhood attention-deficit/ hyperactivity disorder⁵.

Sudden Infant Death Syndrome (SIDS)

Studies have demonstrated an increased risk of mortality. One study demonstrated a two to five fold increased risk of infant death among late preterm infants and a two fold increase risk of SIDS when compared to babies born at term.

In Summary

In deciding the optimal timing for delivery at all gestational ages, it is important to weigh the risks of continuing a pregnancy against the risks of delivery and the possible associated complications of prematurity

Published guidelines indicating the appropriate timing of elective induction of labour and elective CS should be followed to avoid iatrogenic prematurity (39th week of gestation).

KEY MESSAGES

- 1. Be prepared for a resuscitation procedure at every delivery**
- 2. Expect the baby to suffer some degree of respiratory depression at CS performed at 34-37 weeks gestation**
- 3. Always monitor babies delivered at 34 -37 weeks gestation and those babies who are term and wasted.**
- 4. Be aware of the signs of clinical deterioration and refer appropriately**
- 5. Careful frequent counselling of the mother is very important**

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ANNEXURE

RESUSCITATION TAKEN FROM ESMOE WITH MINOR MODIFICATIONS

CHECK LIST

Calls for help, requests for extra personnel
Makes sure that the room is warm and or turn on the radiant warmer
Ensures availability of warm linen towels
Suction catheter
Mechanical suction device
Resuscitator bag and checked that is complete & functioning
Appropriate size face mask (2 different sizes)
Ensures that oxygen tubing is attached to Oxygen flow meter and the bag
Laryngoscope and appropriate size blade
Appropriate size endotracheal tube (different sizes)
Introducer/ stylet
Tape to secure endotracheal tube
Adrenal in (1: 1000)
Knows how to dilute adrenalin to 1:10 000 and the dose
Normal saline solution
Syringes and needles

RESUSCITATION

Places baby on a preheated warmer

Airway

Position the baby in neutral position (chin lift! head tilt)

Looks for secretions if there are, suction if there are, if there are no secretions do not suction

If meconium is present suck the nose and mouth gently,

Check the pharynx by inserting the laryngoscope and suck the pharynx gently if necessary

Dry the baby (body and head) and removes wet linen

Check if the baby is breathing (look, listen, feel)

Check the heart rate by auscultating for 6 seconds

If the baby is breathing, what is the heart rate and colour'!

If cyanosed

Choose correct size mask attached to bag and position the mask correctly

Provide positive pressure ventilation and bag

Observe for chest movement – if moving

Continue bagging for 30 seconds at a rate of 60 breaths/ min

After 30 seconds assesses respiration, heart rate and colour

The heart rate responds first followed by even regular respiration

Gradually discontinue positive pressure ventilation by “bagging”

Give oxygen via mask or tubing

Keep baby warm- covered with dry warm blankets, put on a hat

Check respiration, heart rate and colour again

Baby is pink, heart rate 15 beats in 6 seconds, breathing at a rate of 50/ minute

Check or ask for blood glucose to be checked

Check temperature

Transfer baby to nursery/ calls paediatric doctor or nurse

Note monitoring after resuscitation as indicated above.

INFECTION

Non-Specific signs of infection

Poor temperature control

Poor feeding – vomiting, abdominal distension

Apnoea

Respiratory distress

Low blood sugar

Irritability

Very quiet

Hypotonia

Superficial infections – eye, umbilicus, skin

Specific signs of infection

Hepatomegaly

Splenomegaly

Skin lesions of specific entities such as syphilis

Purpura

Pallor

Jaundice

COUNSELLING : GENERAL PRINCIPLES

The components of counseling include having adequate information about the baby, having a good idea of the outcome and prognosis, passing on relevant information to the parents and consideration is given to the psychological state of the patient.

WHAT MAKES A MOTHER/PARENT COMFORTABLE?

Most importantly it is enough time. Parents state they are comfortable with a doctor 'who gives us enough time' Try to be calm and not look 'rushed' Some doctors can do this in a relatively short time, others may take longer to achieve this, it is a skill that is acquired with time.

COMMUNICATION

The language must be understood by the patient, Listening to the patient is important and give them time, clear talking. It is important before one indicates what is wrong with the baby to ask mother/parents what do they see happening to their baby or what is wrong. Often they say enough to make one proceed more smoothly with the counseling. Do not use terms such ventilator, avoid using terms like brain, renal, cardiac – patients are fearful of these.

Other fear-inducing terms – pneumonia, meningitis, TB, HIV

An empathic presence is important. Being sensitive to the patient's feelings and experiences, face the patient squarely, adopt an open stance, lean toward the patient, maintain good eye contact and be relatively relaxed or natural.

HOW PARENTS and FAMILY FEEL

It is important to ask how they feel, express empathy & support stating some of the following. 'this must have been a difficult time for you' 'you must be very worried' "you have done well'

Management plans become easier

Empathy is NO substitute for scientific knowledge

Empathy is the expression of true insight into how families & patients feel

ACTUAL COUNSELLING

- Establish a calm atmosphere
- Maintain privacy, no distractions
- Sustain eye contact
- Continue steady logical flow of content
- Be focused and clear
- Listen carefully to mother/parents (both verbal and nonverbal messages)
- Observe carefully
- Regular expressions of support
- If possible ask of previous experience
- Aware of anyone else with problem
- Try not to implicate anyone as a cause
- Do not in any way indicate mother is responsible
- Mother always feels guilty
- Family will inevitably blame her or will make her feel she must have some influence on what has occurred
- Indicate you understand how bad she feels
- Patients only listen for 10-15 min when expecting bad news
- No point in talking for much longer unless the parents are responding & asking questions
- Summarize

In the above scenario, it is important to indicate the following

- The baby was not quite well at birth due to prematurity, or mild lack of oxygen during delivery
- Steps have been taken to treat baby and baby is responding but needs time
- Regular discussions will be held with the mother.
- Importance of early recognition of illness and attending a health facility
- Follow up at a neonatal clinic if it exists

ISSUES AFFECTING PERIOPERATIVE CARE

M G Schoon

Caesarean section, like most other surgical procedures, needs careful planning and preparation to ensure no unwanted complications. The fact that surgery is contemplated results in anxiety and appropriate information and support will help to allay any fears and anxiety in the patient.

Whenever the decision for operative delivery was taken, a team effort is required to ensure that this is done safely and that all the necessary precautionary steps have been taken. Standard protocols and operating procedures will assist reduction in human error resulting in unwanted outcomes.

Preoperative issues

Operative abdominal delivery can be classified as either planned (elective) or un-planned in which case the surgery is either extremely urgent (maternal or fetal immediate life threatening conditions), urgent (maternal or fetal compromise without immediate life threatening situation) or emergency (no maternal or fetal compromise but require early delivery).

Planned delivery refers to a situation where the delivery could be scheduled electively to accommodate either the patient or staff.

The following preoperative issues need specific mentioning:

Fetal lung maturity

Iatrogenic lung disease of the newborn could result from elective delivery prior to term. It is therefore advised that elective deliveries need to be planned after 39 weeks gestation.

Amniocentesis for fetal pulmonary assessment is indicated if elective caesarean section is planned at less than 39 weeks in a patient no medical or obstetrical complications and does not meet the following criteria¹.

- It has been 36 weeks since a serum or urine human chorionic gonadotropin pregnancy test was found to be positive.
- Fetal heart tones have been documented for 30 weeks by Doppler.
- Ultrasound measurement at less than 20 weeks of gestation supports a gestational age of 39 weeks or greater.

Prevention of postoperative infection

Caesarean sections are prone to post-operative infection, especially if performed during labour as an emergency procedure. All staff should take precautions to prevent infection. This includes washing the abdomen with an antiseptic soap and taking care not to shave the abdominal wall. In women with excessive hair growth, the hair can be trimmed with a scissor in the area where the incision will be made. Shaving is associated with an increased risk of infection.

Prophylactic use of antibiotics in women undergoing caesarean section reduces the risk of infection-related complications and serious infection post operation. Antibiotic prophylaxis should be used in all cases of caesarean section².

The current South African maternity guidelines³ advise the use of a first generation cephalosporin e.g. cefazolin 2g iv at the time of the operation. Recent⁴ evidence suggests that pre-incision broad-spectrum antibiotics are more effective in preventing post-caesarean infections than post-clamping narrow-range antibiotics, without prejudice to neonatal infectious morbidity. [However, side effects cannot be excluded in the newborn baby and therefore it is recommended that intra-operative antibiotics be given after clamping of the umbilical cord \(see chapter 4\).](#)

Associated risk factors for postpartum infection include multiple vaginal examinations and offensive amniotic fluid⁵. If infection is found at the time of surgery (such as offensive liquor),

it is advised to commence therapeutic antibiotic therapy to prevent the infection spreading or developing postpartum sepsis.

Fetal well being

It is important for the surgeon to know the fetal status. This is especially important in emergency caesarean sections where the fetus may be compromised.

In the planned (elective procedures): If the non-stress test is reactive, no further monitoring is indicated. In non-reactive tracing, prolong the monitoring.

In emergency procedures: There need to be continuous monitoring of the fetus. This should be at least with intermittent auscultation of the fetal heart. The use of CTG's have not been shown to improve perinatal outcome⁶. This may well be a good form of monitoring in areas under-served with staff to provide care to the women during labour. [Persistent pathological cardiotocograph traces may indicate fetal distress](#).

When the indication for the caesarean sections is fetal distress, it is important for the surgeon to establish that the baby is alive when commencing the procedure.

There is insufficient evidence at present to advise on how to monitor fetal well-being prior to delivery.

Thromboembolism

Pulmonary embolism is a risk during the puerperium for women with moderate to severe risk of thrombosis⁷. Although early mobilization is advised for low risk women, any of the following conditions in a woman undergoing a planned (elective) abdominal delivery is an indication for thromboembolism prophylactic medication:

- Age over 35 years
- Parity of 4 or more
- Overweight >80kg at booking
- Labour duration 12 hours or more
- Current infection
- Gross varicose veins
- Pre-eclampsia
- Major current illness
- Previous history of thrombo-embolism

Emergency caesarean section in its own right is a major contributor to thrombo-embolism and should be regarded as an indication for prophylaxis.

Early mobilization is advised in all cases. Enoxaparin (Clexane) 40 mg daily until discharge or sodium heparin 10,000 iu 2x per day until discharge is advised. High risk cases must be discussed with an appropriate specialist to determine the appropriate therapy.

Bladder catheterization

Current practice is to place an indwelling catheter for caesarean sections. This is known to be associated with a high incidence of urinary tract infections. Randomized control trials suggest⁸ that non-use of indwelling urinary catheters in caesarean section is associated with less UTI's and no increase in either urinary retention or intra-operative difficulties. Use of indwelling catheters, removed direct after surgery unless indicated for urinary monitoring have been suggested^{9,10} and reconfirmed recently with systematic literature reviews.

The early removal of urine catheters in the absence of the need for urine output monitoring should be considered in women delivered by caesarean section.

Pre-operative laboratory investigations

Very few investigations are required prior to a caesarean section unless there are clear clinical indications. A baseline haemoglobin (Hb) must be available. If the Hb was done in the preceding 4 weeks that should be sufficient if the patient is in a stable condition.

Urea and electrolytes and platelets should not be done routinely in healthy women¹¹.

Indications for urea and electrolyte investigations include pre-eclampsia, endocrine diseases and the presence of sepsis.

Platelet counts are required in pre-eclamptic cases and is advisable in women who are HIV positive, especially in the presence of anaemia or advanced disease.

In patients with clinical abruptio placenta, at least a hand clotting time must be done prior to the procedure if coagulation tests could not be done.

Aspiration prophylaxis

All pregnant women from the second trimester develop an increased risk of regurgitation of stomach contents. Potential exposure to general anaesthesia in the peri-delivery period highlight the potential risk of gastric aspiration. The Cochrane review¹¹ found some limited evidence that drugs like antacids may reduce the chance of vomiting in labour, H₂ receptor antagonist drugs (like ranitidine) appeared to have a similar impact on outcomes as antacids and dopamine antagonists (like metoclopramide) may reduce the chance on vomiting in labour when given alongside pethidine. Overall, there was no evidence that any of these drugs reduced the incidence of gastric aspiration or Mendelsohn's syndrome.

The following guideline will assist to reduce acid aspiration:

- Oral intake of modest amounts of clear liquids may be allowed for uncomplicated labouring patients¹²
- The uncomplicated patient undergoing elective delivery may have modest amounts of clear liquids up to 2 hours before induction of anaesthesia
- The volume of liquid ingested is less important than the presence of particulate matter in the liquid ingested
- Patients with additional risk factors for aspiration (e.g., morbid obesity, diabetes, difficult airway) or patients at increased risk for operative delivery (e.g., non-reassuring fetal heart rate pattern) may have further restrictions of oral intake, determined on a case-by-case basis
- Solid foods should be avoided in labouring patients
- Patients undergoing elective surgery (e.g., scheduled delivery or postpartum tubal ligation) should undergo a fasting period for solids of 6–8 hours depending on the type of food ingested (e.g., fat content)
- Before surgical procedures (i.e., delivery, postpartum tubal ligation), practitioners should consider timely administration of non-particulate antacids, histamine (H₂) receptor antagonists, and/or metoclopramide for aspiration prophylaxis

The following is recommended by the South African Maternity guidelines (2007)

Scheduled caesarean delivery (not in labour)

Cimetidine 200mg po 12 hours and 2 hours pre-operatively

Metoclopramide 10mg po 2 hour prior to surgery

Sodium citrate 0.3M 30ml not more than 30 minutes prior to surgery

Emergency caesarean delivery (in labour)

Cimetidine 200mg slowly ivi

Metoclopramide 10mg ivi

Sodium citrate 0.3M 30ml not more than 30 minutes prior to surgery

Particulate ant-acids such as magnesium trisilicate should be avoided even if sodium citrate is unavailable

Informed consent

The responsible obstetrician who will be performing the procedure is responsible to provide appropriate information and obtain informed consent for performing a caesarean section. Pregnant women should be given evidence-based information about caesarean section (C/S) during the antenatal period, because about 1 in 5 women will have a C/S. This should include information about C/S such as:

- indications for CS (such as presumed fetal compromise, failure to progress in labour, breech presentation)
- what the procedure involves
- associated risks and benefits. Specifically refer to the risk of pulmonary embolism and increased risk for PPH.
- implications for future pregnancies and birth after CS

When the decision is made to perform a C/S, a record should be made of all the factors that influence the decision, and which of these is the most influential. The informed consent should be in writing with additional notes in the patient records.

Women from the age of 12 can give informed consent for operative procedures, although the obstetrician should ensure that a child under 16 understand the implications.

POST OPERATIVE ISSUES

Post operative care commence at the point when the patient is signed out of the theatre. Careful documenting of all theatre events must be done by the surgeon, anaesthesia professional and the theatre scrub staff. Facilities have routine procedures for post-operative care. With respect to caesarean delivery the following issues are of importance.

Post operative observation program

Women after caesarean section are at high risk for post-delivery complications as the indications for caesarean delivery are often associated with complications in the puerperium. Postpartum haemorrhage, deterioration of preeclampsia and metabolic problems are to be expected in the immediate post delivery period. These patients need to be regarded as high risk and should be subjected to a vigorous monitoring process in the first few hours post delivery.

Vital information such as colour, level of consciousness, pulse rate, blood pressure, respiratory rate, vaginal blood loss, bleeding on operated site must be observed at regular intervals. The following is recommended:

- Quarter hourly while in the recovery room*
- Half hourly for a further 2 hours
- 2 hourly for a further 4 hours
- 4 hourly for a further 12- 16 hours.

The patient should be nursed in an area where there are health care professionals that can do the observations regularly. Avoid to send a post-operative woman to a general ward where observations are difficult to perform. **NB!** Any abnormality detected at any stage requires frequent observations to be done.

- If there is no dedicated recovery room the observations must be done in the theatre until the patient is stable to be transferred to the ward
- The use of colour coded early warning observation charts will assist staff to detect problems and notify the responsible medical practitioner

Post-operative pain management

Adequate postoperative analgesia following caesarean delivery hastens ambulation, decreases maternal morbidity, improves patient outcome, and facilitates care of the newborn¹³. There is unfortunately no golden standard. International standards include the use of intrathecal opioids, self-administering of analgesia and local infiltration to reduce the needs of morphine post operatively. The number of options is large and the choice of method is at least partly determined by drug availability, regional and individual preferences, resource limitations and financial considerations¹⁴.

Intramuscular morphine or pethidine remains the golden standards of treatment in our general hospital settings augmented by non-steroid anti-inflammatory analgesic drugs

Pethidine is the drug of choice with an optimal dose of 1 mg/kg every 4-6 hours for the first 24-hours. In high care settings this could be given as an intravenous infusion at a rate of 10mg/h irrespective of the weight and individual demand of the patients.

Parentally administered non-steroidal analgesics such as ketorolac¹⁵ and diclofenac^{16,17} have been proven to be of advantage.

In a more resourced setting, the postoperative pain management should be provided by the anaesthetist as part of a pain relief program. If this is not possible, it is advised that intramuscular pethidine in combination with a non-steroidal analgesic be used for pain relief.

An operation translates into intentional consensual assault, and is therefore the responsibility of the surgeon to ensure that the patient do not suffer from painful consequences of the resulting trauma

Post-operative fluids and meals

Post-operative management was traditionally influenced by the surgeons with respect to abdominal surgery. Abdominal delivery however, does not affect the bowels and should therefore be managed differently.

Randomised trials have proven that there is no additional risk¹⁸ in early feeding but with improved maternal satisfaction. Clear fluids had no advantage over unlimited solid fluids given within 30 min of a spinal anaesthesia¹⁹. One of the great advantages of early post operative feeding is that IV lines can be removed earlier, earlier mobilization and earlier initiation of breast feeding.

Patients who are not able to manage oral fluid and food intake, should remain on an IV infusion of a maintenance fluid at a rate of 3 litres per day unless there is challenges with the fluid output.

It is recommended that women can be offered food in the early post caesarean delivery period. If she had a general anaesthesia, first offer fluids to see how she tolerates the intake prior to offering a full meal.

Post operative wound care

The occurrence of a wound complication is the most important factor influencing post operative patient satisfaction²⁰.

Management of the surgical wound starts with surgery. There is no evidence that there is any advantage in keeping the wound covered for longer than 24-48 hours.

The wound should be opened without resulting in any further trauma. The wound should then be kept open and dry. If the wound is exposed to friction from the clothes, it could be covered with a dry dressing to avoid unnecessary trauma to the wound. Patients can clean their wound with tap water (of a standard that it is drinkable).

Care must be taken to identify areas of local infection. The typical symptoms is increasing pain and throbbing. The wound will be swollen and red and may have some oozing of a purulent fluid. Other common wound complications are wound haematoma's and wound dehiscence.

Advise the patient to have the sutures removed in 3-5 days (transverse abdominal incisions) and 6-10 days (longitudinal incisions).

Observe the wound site for signs of separation, tenderness, discharge, localised heat or swelling, and redness around the incision line.

Baby and Feeding

It is essential that the delivery, as for any other delivery, initiate breast feeding as soon as possible including skin-to-skin contact with the baby²⁰. This should ideally be done as soon as possible after the delivery. In patients where the procedure was done under a local anaesthesia, this could be done earlier than those exposed to a general anaesthetic.

Women who delivery through a caesarean section will require more support in initiating breast feeding. Sufficient pain relief will assist in getting the mother to comply with breast feeding. It is important to reassure the women that breast feeding is a skill and needs to be learned.

Sore nipples, painful breasts and a perceived lack of milk are similar than in those who deliver vaginally and should be attended to in the post operative period.

SAFETY AND CAESAREAN SECTIONS

Like with any surgical procedure, it remains the responsibility of the health care workers to ensure the safety of patients exposed to operative deliveries.

These safety checks commence in the pre-operative period and extend into the post operative period. The World Health Organization (WHO) strongly recommend the use of safety checklists to ensure that all possible is done to maintain patient safety. Basic checklists assist health care workers of all professions to ensure that safety is maintained.

Responsibility for informed consent, preoperative care and observations is the responsibility of the obstetrician.

The obstetrician is also responsible to ensure that there is appropriate postoperative care including appropriate pain relief. Even in cases where the anaesthetic doctor manage the post operative pain management, the responsibility remains with the obstetrician that his patient is adequately cared for and he has to ensure that there is confirmation of the anaesthetic team that the postoperative care will be addressed.

The nurse professionals have the responsibility to cross control that the patient was appropriately prepared and that the required consent was obtained as prescribed by law.

Safety is the responsibility of every member of the team. The surgeon (obstetrician) as the primary physician of the patient has the overall accountability to ensure that the best interest of his patient is a priority at all times.

Hospital facility managers and surgeons alike have the responsibility to introduce some quality assurance program on their activities. This would include some specific outcome measurements such as the section rate, intra-operative as well as post operative complications, and outcomes of infants born through sections.

Routine use of the following surgical safety checklist, adjusted for caesarean sections is recommended for all sites conducting operative deliveries. This will help to ensure that safety aspects are adhered to, including optimal operative staff to ensure a safe procedure.

CAESAREAN DELIVERY SAFETY CHECK LIST

<p>Sign IN BEFORE INDUCTION OF ANESTHESIA (To be said aloud)</p> <p>Patient have confirmed</p> <ul style="list-style-type: none"> • Her identity • That consent was signed <ul style="list-style-type: none"> o Caesarean section o Sterilisation • Type of Abdominal incision <p>Anaesthetics doctor</p> <ul style="list-style-type: none"> • Anaesthetic equipment was checked and is operational • Pulse-oxymeter on patient and functional • Risk factors <ul style="list-style-type: none"> o Allergy o Risk of bleeding/blood loss o Potential difficult intubation o Acid prophylaxis <p>Obstetrician</p> <ul style="list-style-type: none"> • Condition of fetus (Alive/dead) • Assistant present <p>Paediatrician</p> <ul style="list-style-type: none"> • Present in theatre • Neonatal resuscitation equipment checked <p>Midwife</p> <ul style="list-style-type: none"> • Present in theatre • Baby warmer on and functional 	<p>TIME OUT BEFORE SKIN INCISION (to be said aloud)</p> <p>Theater team</p> <ul style="list-style-type: none"> • Identify each other including roles • Verbally confirm <ul style="list-style-type: none"> o The patient o Procedure <p>Anaesthetics doctor</p> <ul style="list-style-type: none"> • Are there any patient specific concerns • Confirm that prophylactic antibiotic was given <p>Obstetrician</p> <ul style="list-style-type: none"> • What are critical or unexpected events <ul style="list-style-type: none"> o Duration of procedure o Anticipated blood loss <p>Pediatrician</p> <ul style="list-style-type: none"> • Present in theatre • Neonatal resuscitation equipment checked <p>Nursing team</p> <ul style="list-style-type: none"> • Has sterility been confirmed • Any equipment concerns • Ready to receive the baby
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PRE AND POST OPERATIVE CARE: A MIDWIVES PERSPECTIVE

M Masasa and A Mafunisa

Caesarean section is associated with an increased risk of maternal infection, haemorrhage, thromboembolism and maternal death. Midwives need to always bear this in mind and exercise particular vigilance while nursing patients who have had a CS.

As a preventive measure for haemorrhage, midwives need to ensure that the partogram is not only completed fully but that the labour graph is interpreted properly, so that prolonged labour is diagnosed timeously,

Women are usually anxious in labour or prior to any obstetric procedure, therefore full and proper communication and genuine empathy are important in the peri operative phase. Women and their families need to be provided with full information about the procedure and the baby's wellbeing. Practical assistance, information and support will help allay any fears and anxiety.

PREVENTION OF INFECTION

Puerperal sepsis is one of the major conditions responsible for maternal deaths and HIV/ AIDS make the situation worse. Hence all women who undergo CS should receive prophylactic antibiotics prior to the initiation of the procedure.

General Hygienic measures also must always be taken to prevent infection and include simple hand washing before and after every procedure and also after removing gloves; wearing gloves before touching secretions and excretions; and use of protective clothing if splashes and spills of any body fluid are anticipated. Adhering to aseptic techniques for the cleansing of instruments and the proper disposal of medical waste will also reduce cross infection.

PREPARING FOR THE SURGICAL PROCEDURE OF CAESAREAN SECTION

- Identification procedures and documenting of the type of operation must be done
- Explain the procedure and purpose to the woman and/or a family member if she is unconscious.
- Obtain written informed consent in the appropriate hospital form and include tubal ligation if this needs to be performed. Ideally consent for tubal ligation should take place in the antenatal period, when the woman and or her family can be given full information and the complexities of such consent explained in detail
- Ensure a recent Hb estimation (within last 4 weeks) is present. In circumstances in which the patient is having a CS for pre eclampsia ensure that there are blood results available for Hb, platelets, urea and electrolytes. All HIV infected women should also have an Hb and platelet count available. In some circumstances cross matched blood may be required and this needs to be ascertained.
- Attend to the patients hygiene status if this was not done earlier
- Review her history and physical well being
- Monitor and record all vital signs and fetal wellbeing regularly while she is waiting to get to the operating theatre. In cases of fetal distress intrapartum resuscitation will be necessary and therefore any oxytocin drip, must be stopped and the drip removed, oxygen given to the mother and it should be emphasized that all mothers be positioned on their sides.

- Keep the bladder empty by inserting an indwelling catheter
- An intravenous infusion must be commenced if not running already. It is always advisable during labour not to administer food and oral fluids if there is likelihood for CS
- Give pre medication in line with the hospital policy
- Remember that prophylactic antibiotics are a standard protocol for both elective and emergency CS. In certain cases, therapeutic antibiotics will have been prescribed.

POST OPERATIVE CARE

Safety

Identify patient

Vital Data

Colour, conscious state, pulse rate, blood pressure, respiratory rate and vaginal blood loss, bleeding on operated site must be done:

- Quarter hourly for 2 hours in the recovery room
- Half hourly for a further 4 hours
- 2 hourly for a further 6 hours
- 4 hourly for a further 16 hours.

The patient should be nursed in an area where there are health care professionals that can do the observations regularly and not put in a ward where observations are difficult to perform.

NB: Any abnormality detected at any stage requires frequent observations to be done.

Hydration and Elimination

- Urine output 4 hourly
- Intravenous infusion rate and type will be determined by attending doctor's orders or hospital policy according to patient's condition.

Anaesthesia and Pain Management

- If epidural was used sensation needs to be checked regularly
- Assess level of pain, pain relief to be given as required 3 -4 hourly per doctor's order and patient must be offered as some may not be aware of its availability.

Wound care

To be done in line with hospital policy or doctor's orders. Check operation site for bleeding and when dressing is no longer on check for swelling or haematoma.

NB: Report any abnormal bleeding immediately

Lochia and Uterus

- Assess contraction of uterus, amount and type of lochia.

Skin Integrity

- Assess for redness or bruises on heels and buttocks

Medication

- Note prescriptions and record accordingly

Orientation

- Inform patient about how to call for help in the ward, including incase of an emergency

Baby and Feeding

- Initiate and support breastfeeding 1 to 2 hours post op, rest baby skin to skin.
Immediate Postoperative care is essential particularly in "at risk" women, therefore in such women e.g. difficult CS; PPH at CS, eclampsics must have "one on one" nursing or at least it should be strongly considered.

Guidelines for Delivery Following a Previous Caesarean Section

N Moran

Introduction

A pregnant woman who has had a previous CS must be regarded as a high-risk patient. The decision as to whether to plan for a vaginal birth after the previous caesarean (VBAC), or whether to opt for elective caesarean section (ELCS) is not always easy to make, as each option has advantages and disadvantages. Irrespective of the chosen mode of delivery, there are greater dangers for the patient compared to a pregnancy in a woman with an unscarred uterus.

Advantages of Vaginal Birth after Caesarean Section (VBAC)

1. Avoids the possible maternal complications of caesarean section, including anaesthetic complications, intra-operative and post-operative complications. (Note: the most common scenario for maternal death due to PPH in South Africa is bleeding associated with CS1)
2. Less pain post-delivery
3. Shorter hospital stay
4. There may be greater psychological satisfaction for the mother who has achieved a “natural” birth
5. Reduced costs for the patient and/ or state

Disadvantages of Vaginal Birth after Caesarean Section (VBAC)

1. Labour pains.
2. Approximately 1% risk of uterine rupture associated with attempted VBAC. In the South African setting, uterine rupture during attempted VBAC will often result in perinatal morbidity and mortality, and hysterectomy will sometimes be necessary. At worst, maternal death can occur².
3. If vaginal birth is not achieved (e.g. due to poor progress in labour), then the patient will have to undergo an emergency caesarean section, which is more dangerous and less desirable for the mother than an ELCS.

Advantages of Elective Caesarean Section

1. It is convenient for the patient and her family, as the date of the procedure can be planned in advance
2. Safer for the mother than emergency caesarean section
3. Lower risk of uterine rupture than when VBAC is planned
4. Lower risk of perineal trauma than when VBAC is planned
5. Tubal ligation can be performed at the same time, should the patient request it.
6. In the HIV positive woman, ELCS may slightly reduce the risk of vertical transmission of HIV, compared with a plan for VBAC³

Disadvantages of Elective Caesarean Section

1. More dangerous for the mother (anaesthetic and surgical complications) than an uneventful vaginal delivery, especially in a severely immunocompromised patient. A particular surgical challenge in women with one or more previous caesarean sections, is the relatively common problem of severe adhesions encountered on opening the abdomen.
2. Higher risk of Respiratory Distress Syndrome and Transient Tachypnoea of the Newborn compared to uneventful vaginal delivery. The risk depends on the gestational age (GA) at which CS is done (the rate increases at GA less than 39 weeks⁴)
3. Almost certainly eliminates future chances of vaginal birth. This is not an issue if a tubal ligation has been performed.

A good outcome for mother and baby in the context of a previous caesarean section requires:

1. Careful selection of appropriate candidates for VBAC
2. High quality intrapartum and post-partum care for those attempting VBAC

3. Competent anaesthesia, surgical skills and post-operative care for those having caesarean section

These guidelines are intended to enhance safety and improve outcomes in pregnant women with previous caesarean section, and are written particularly (but not exclusively) for those working in the South African setting.

Site of Antenatal Care

Most women with a previous CS will book for antenatal care in the primary health care setting (local clinic). At the first visit, the woman should be identified as a high-risk patient (e.g. using a checklist for risk factors such as the Basic Antenatal Care (BANC) checklist⁵). The patient should then be referred to the hospital antenatal clinic or to a visiting obstetric doctor for an initial assessment. If no other problems are identified, the patient could carry on with antenatal care at the primary health care level, but will need to be referred to the hospital where delivery is planned to take place, for a visit at 36 weeks. Thereafter further antenatal care should take place at the hospital.

Planning the Mode of Delivery

The first step in planning the mode of delivery for the patient is to assess whether she is a suitable candidate for a VBAC. The second step is to discuss the options for mode of delivery with the patient. Initial discussion with the patient about the mode of delivery should take place during the antenatal period and should not be left until the patient presents in labour.

If the patient is assessed to be suitable for VBAC, then the pros and cons of VBAC vs. ELCS must be discussed with her. The final decision about the planned mode of delivery should be the patient's, and should be respected, and documented in the patient's antenatal record.

If, however, the patient is assessed as not being suitable for VBAC, then she should be counselled accordingly, and advised that it would be best for her to have an ELCS.

The patient should not be asked whether she would prefer vaginal delivery or ELCS before an assessment of suitability for VBAC has been made.

Before documenting in the patient's antenatal record that she agrees to VBAC, it should be clearly documented that she is suitable for VBAC. Too often antenatal records specify that the patient agrees to or requests VBAC, without any indication as to whether it is a suitable option. This is a dangerous practice which could lead to women inappropriately attempting VBAC.

Assessing suitability for VBAC

This process starts from the first antenatal visit, but any decision made to allow VBAC must be only a provisional one, which should be reviewed at each subsequent antenatal visit, and on admission in labour, as new factors may arise which affect the final decision. For example, at 36 weeks the patient may appear to be suitable for VBAC, but at 40 weeks the estimated weight of the fetus might have increased to a level which is considered too big for safe VBAC.

Assessment should include the following:

History

- Number of previous caesarean sections
 - Indication for previous caesarean sections
 - Any complications associated with previous caesarean sections (maternal or fetal / neonatal)
 - Any other surgical procedures involving the uterus (e.g. evacuations, myomectomies)
 - Any verbal or written information given to the patient at the time of the previous caesarean pertaining to the mode of delivery in the current pregnancy. For example the patient may have been told that she must avoid VBAC in any future pregnancy.
 - If there is a lack of clarity about the details of a previous CS, e.g. indication or type of CS performed, the old case notes from the time of the previous CS should be reviewed

if they are accessible.

- Number and outcome of previous vaginal deliveries, including birth weight
- Any problems in the current pregnancy
- Patient's family planning needs (does she want a sterilisation?)
- Patient's transport plan for getting to hospital if she goes into labour

Examination

- Check for type and number of laparotomy scars.
- Exclude multiple pregnancy
- At 36 weeks and beyond, check the symphysis-to-fundal height to aid estimation of fetal size
- At 36 weeks and beyond, check the lie, presentation and attitude of the fetus
- Exclude an obviously contracted pelvis by clinical (not radiological) examination
- Assess liquor volume
- Assess fetal condition (fetal kick counts, auscultation or doppler), once the fetus is at a viable gestational age.

Investigations

- HIV status and CD4 count may influence decision on mode of delivery
- Early ultrasound scan (before 22 weeks) to confirm gestational age

Contraindications to Vaginal Birth after Caesarean section (VBAC)

- Multiple previous CSs (2 or more)
- Previous classical CS, including any hysterotomy / caesarean where the lower segment of the uterus was not yet formed
- Previous lower segment caesarean section where incision may have extended into upper segment of the uterus (e.g. DeLee, inverse T, and J type incisions)
- Previous surgery involving incision of the body / fundus of the uterus (e.g. cornual ectopic, myomectomy)
- Previous perforation of the uterus at evacuation or other procedure
- Previous uterine rupture
- Previous stillbirth or neonatal death related to problems during labour
- Grossly contracted pelvis, obvious by clinical pelvic examination, (unless the fetus is very small / preterm at time of labour)
- Large fetus. The appropriate cut-off value for estimated fetal weight (EFW), above which it would be safer to plan for ELCS is controversial. However, there is some evidence from the South African experience that suggests that the success rate of VBAC is poor when the baby is born with a birth weight over 3.2kg⁷. A weight of 3.2kg corresponds approximately to a symphysis-to-fundal height (SFH) of 37cm⁸. Thus any patient with a SFH of 38cm or above should be planned for ELCS unless reviewed by an experienced obstetrician and felt to be a good candidate for VBAC. Note that ultrasound scan cannot be relied upon to provide an accurate EFW at term.
- Breech presentation or transverse lie at term
- Antepartum haemorrhage due to abruptio placentae
- Any other maternal or fetal condition which would normally require a caesarean section for safe delivery (e.g. placenta praevia, large fetal hydrocephalus etc.)
- Any other maternal or fetal condition during the antenatal period that requires urgent delivery (e.g. severe pre-eclampsia). Induction of labour is not usually appropriate in such situations when the patient has a previous caesarean section.

Site of Intrapartum Care for VBAC

It is not safe for a midwife-run obstetric unit at the primary health care level to conduct VBAC. Thus, once a plan for VBAC has been made with the patient, arrangements must be made to ensure that she will be able to present herself promptly to the hospital when she goes into labour. Ideally she should arrange a reliable transport plan. For women who do not have access to reliable transport, it would be useful to have access to a "waiting mothers area" in the vicinity of the hospital, where she could stay and await labour. If no plan can be made to ensure that the mother

can get to hospital promptly when in labour, it would be safer for her to have an ELCS at term.

In principle, any hospital providing maternity services, whether District, Regional or Tertiary Level, should be an appropriate site for VBAC. A hospital where VBAC is performed should ensure that it can meet the following requirements for safe VBAC:

- The hospital must be adequately equipped and staffed for emergency caesarean section at any time of the day or night.
- It must be possible to perform an emergency CS within 60 minutes of the decision for caesarean section being made (30 minutes would be preferable).
- There must either be a blood bank on the premises, or an emergency blood fridge routinely stocked with at least three units of emergency packed red cells.
- There must be midwives present in the labour ward at all times
- There must be at least two doctors present on the hospital premises at all times. One of these must be available to respond immediately when called to assess problems in the labour ward. At least one doctor must be competent to administer an anaesthetic and at least one must be competent to perform a caesarean section.
- At least two doctors should be present in theatre at the time of caesarean section, one to perform the surgery, and the other to monitor the mother / anaesthetic.

District Management should monitor whether the hospitals in the District are able to comply with these requirements. If a hospital does not fulfil the above requirements for safe VBAC, the District Management should liaise with the Hospital Management to see if changes can be implemented at hospital level which would allow VBAC to be conducted safely. If this is not feasible, there are two options:

1. Plan elective caesarean sections (ELCS) for all women with previous caesarean section, at a site, and a time where ELCS can be safely performed.
2. Make arrangements for those women who are suitable for VBAC and prefer VBAC, to book for delivery at another hospital where VBAC can be safely managed.

Intrapartum Care for VBAC

- Patients with a plan for VBAC who present to the hospital with labour pains must be promptly assessed as priority cases.
- If a diagnosis of labour is made, the patient must be kept under supervision in the labour ward, irrespective of whether the patient is in the latent or active phase of labour.
- If it is not clear from the initial assessment whether the patient is in labour or not, then she should be kept under observation in the labour ward for four hours. A decision about whether she is in labour can then be made, based particularly on whether there are persistent regular painful contractions. After four hours, if the patient is not contracting, and there is no change in the cervix, and if fetal condition remains good, it is reasonable to discharge the patient from the labour ward. Note that if the cervix remains closed despite regular painful contractions, the patient must not be discharged or sent to an area with less supervision, as it is a possible scenario for rupture of the uterus. She should rather be managed as a patient in latent labour, and kept in labour ward
- Once labour is diagnosed, an intravenous line should be set up
- A haemoglobin level should be checked
- The patient can take oral fluids and snacks
- Indwelling catheterisation of the bladder is not routinely necessary
- Continuous electronic monitoring of fetal heart and maternal contractions (CTG) is ideal, but VBAC may be conducted without it as long as monitoring of contractions and of fetal heart (by auscultation or doppler) is strictly performed and documented according to the following schedule:
 - o hourly during latent phase
 - o ½ hourly in the active phase of labour
 - o in the second stage of labour, fetal heart rate should be checked after every second contraction
- Analgesia should be offered to the patient. Opiate analgesia, and entonox (nitrous oxide

/ oxygen) should be available in all hospitals. Epidural anaesthesia for VBAC can be administered if there is adequate expertise to do so and adequate staff to monitor the epidural.

- A partogram must be used to monitor the labour. The partogram must be started at the time when the diagnosis of labour is made, irrespective of whether the patient is in the active or latent phase of labour. Per vaginal examination should be 4-hourly in the latent phase, and 2-hourly in the active phase.
- In the active phase of labour (from 4cm onwards), progress must be along the alert line or to the left of the alert line.
- If progress is to the right of the alert line (even if it does not reach the action line), then action should be taken. If maternal and fetal condition are good and membranes still intact, the initial action should be to rupture the membranes. Progress can then be re-assessed after two hours.
- Augmentation of the labour with oxytocin should be avoided
- Indications for abandoning VBAC attempt in favour of emergency caesarean section:
 - o Prolonged latent phase of labour beyond 8 hours from the time of diagnosis of labour
 - o Poor progress in the active phase of labour (less than 1cm per hour over any 2 hour period) despite rupture of the membranes
 - o Fetal heart decelerations, and /or persistent fetal tachycardia (these may be warning signs for rupture)
 - o Thick meconium stained liquor unless delivery imminent
 - o Prolonged second stage of labour (>30 minutes) unless suitable for instrumental delivery (see below)
 - o New vaginal bleeding or haematuria (signs of possible rupture)
- Pain and tenderness in between contractions over the lower part of the uterus are not reliable indications of impending rupture but should be considered together with the other factors above in making a decision to abandon the VBAC.
- Instrumental delivery may be performed if CPD is excluded, the fetal head is $\leq 1/5$ above the pelvic brim, and the mother is failing to deliver despite repeated pushing efforts
- There is no need to routinely examine the uterine scar via the vagina following delivery of the placenta. However, there should be close monitoring for PPH immediately post-delivery.
- If the placenta is retained, despite active management of the third stage of labour, do not use excessive force to try to deliver the placenta. If an attempt at manual removal of placenta fails to separate the placenta from the uterus, do not try to scrape or pull the placenta off with instruments, as the placenta may be adherent to the old scar and a rupture / uterine tear may result. In such cases of morbidly adherent placenta, as long as there is no active bleeding, the cord can be ligated and cut as short as possible, and the placenta can be left in the uterus. Broad spectrum antibiotic cover can be started, and the patient kept under observation. The placenta will either eventually separate and deliver, or occasionally may remain attached and be resorbed.

If there is heavy ongoing bleeding, and manual removal has failed, the patient will need a laparotomy, and possible hysterectomy.

Induction of Labour

There are some specific circumstances in which induction of labour can be considered for women with one previous caesarean section, with a view to eventual VBAC. These include:

- Intra-uterine death (rupture of the uterus excluded), especially if the mother is psychologically distressed by having to carry a dead fetus
- Any indication for delivery where the mother is unwilling to undergo ELCS, and where VBAC is not contraindicated (e.g. post-term pregnancy)

Induction with prostaglandins or oxytocin should be avoided.

Appropriate methods of induction include:

- Foley's catheter bulb induction with or without extra-amniotic saline infusion

- Digital stretching of the cervix and sweeping of the membranes
- Amniotomy, if the cervix is favourable. (Not advised for cases of intra-uterine death, or for HIV positive patients)

Mode of Delivery for HIV Positive Mothers

Although there is evidence that mother-to-child transmission of HIV can be slightly reduced by performing ELCS for HIV positive women³, there are also potential hazards for these women if they have ELCS. In particular these women are prone to post-operative sepsis, and the risk is highest for those who are severely immunocompromised with CD4 counts below 200 cells/mm³. Furthermore, in South Africa, according to the latest National Department of Health Guidelines⁹, all women should be taking anti-retroviral drugs during the antenatal period and during labour, and all newborns should be taking prophylactic Nevirapine for six weeks. This should minimise the risk of MTCT, irrespective of the mode of delivery. In this context, the Department of Health recommends that ELCS for HIV positive mothers be performed only for obstetric indications, not specifically for prevention of MTCT.

Accordingly, in the South African setting, being HIV positive should not be regarded as a contraindication for VBAC. Assessment of suitability for VBAC should be made in the same way as with an HIV negative patient, and the patient then counselled accordingly. In cases of severe immunocompromise, if there are no contraindications, VBAC should be encouraged, as the risk of morbidity or mortality for the mother resulting from caesarean section is high.

Patient Booked for Elective Caesarean Section (ELCS) who Presents in Active Labour

Patients with previous caesarean(s) who have been booked for ELCS will sometimes go into labour before the date of their scheduled ELCS. When such a patient presents to the labour ward, the following approach is advised:

- Prepare the patient for caesarean section
- Review the indication for the ELCS
- Assess maternal and fetal condition
- Assess the stage / progress of labour
- If the patient was suitable for VBAC, but had opted for ELCS, she should be re-counselled about the mode of delivery. Now that she is already in labour, she may prefer to attempt VBAC. If she still requests caesarean, this should be arranged.
- If the patient was assessed as being unsuitable for VBAC, then she should proceed to have an emergency caesarean
- In either case, if clinical assessment reveals that mother and fetus are well, and that the patient is in advanced labour and will imminently deliver, she should be counselled accordingly and preparations should be made for vaginal delivery.

Rupture of the Uterus in Women Undergoing VBAC

Diagnosis

There are various possible presentations of rupture of the uterus in women undergoing VBAC. There may be a sudden catastrophic deterioration in the mother's condition (hypovolaemic shock) associated with per vaginal bleeding and sudden fetal demise. However, the presentation may not be so obvious:

- There may be no per vaginal bleeding, as bleeding may be confined to the peritoneal cavity or to the retroperitoneal compartment (e.g. broad ligament haematoma)
- There may be relatively little haemorrhage, with no evident compromise of the maternal circulation, as the site of the rupture is usually the old caesarean section scar, which may be relatively avascular. Major haemorrhage tends to occur if the rupture extends beyond the old scar into more vascular territory such as the uterine artery laterally or the cervix inferiorly.
- The rupture may only occur or be revealed at the time of delivery. A healthy baby may be born, followed by severe haemorrhage.

Key messages:

1. **Rupture of the uterus should be suspected in any woman with a previous caesarean section who presents with an “intra-uterine” fetal demise and abdominal pain, particularly where the fetal demise has occurred during labour.**
2. **Rupture of the uterus should be suspected in any woman with a previous caesarean section who has a post-partum haemorrhage immediately post-delivery.**

Differential diagnosis (patient not yet delivered) includes severe abruptio placentae where the fetus will also be dead. A useful distinguishing feature is that in abruption, the uterine outline can be clearly felt, whereas with rupture, it may be difficult to clearly palpate the uterus. In abruption, the uterus itself will be tender and tense, whereas with rupture there may be generalised abdominal tenderness or peritonitis.

If available, ultrasound scan will be helpful in making the diagnosis of rupture in those cases where the diagnosis is still in doubt after clinical assessment. An empty uterus with a dead fetus seen outside it will be clear evidence of a rupture of the uterus.

Management

- Once the diagnosis has been made, the first priority is to assess the maternal condition and start resuscitation accordingly.
- If the mother is haemodynamically stable, and there is limited anaesthetic and surgical expertise on site, refer the patient to the nearest centre where a hysterectomy can be competently performed.
- If the mother is shocked, she will need to have a laparotomy on-site as soon as possible in order to prevent her from bleeding to death.
- Take informed consent, explaining that the uterus will be repaired if feasible, but that a hysterectomy may be required. If you judge the patient to be in a sound state of mind, then also discuss with the patient whether she would want to have a tubal ligation should a repair of the uterus be feasible, taking the fetal outcome into consideration.
- Make arrangements for blood to be available for transfusion
- She will need a general anaesthetic
- Broad spectrum antibiotics should be started
- Open the abdomen with a midline incision, which can be extended as far up as necessary to gain adequate access for the procedure
- Unless already delivered, extract the fetus and placenta from the abdomen
- The priority is then to arrest or minimise haemorrhage. If the patient remains in shock, the following steps can help with resuscitation of the patient and can be maintained while conducting the surgery:
 - o The patient can be placed in the Trendelenburg position (body tilted with the head down and the legs up) (gravity will reduce the blood flow to pelvis).
 - o Each lower limb can be wrapped in a pressure bandage from the foot down to the thigh (these two measures reduce venous pooling in the legs)
 - o Aortic compression with a fist against the lower lumbar spine can be maintained by an assistant, but should be intermittently released to prevent ischaemia of the lower limbs and to allow proper assessment of haemostasis
 - o Manual rubbing up and compression of the uterine body to encourage contraction
 - o Direct pressure to bleeding points with swabs or clamps
- Ensure an oxytocin infusion is running, 20 units in a litre, at about 100mls per hour, in addition to resuscitation fluids.
- Exclude bleeding from the placental site
- Assess the extent of the uterine tear. If it extends close to or behind the bladder, mobilise the bladder down off the lower segment using blunt dissection or sharp if the bladder is adherent. At this stage, any bladder tear caused by the rupture of the uterus should be identified (you will be able to see the Foley's catheter bulb through the tear).
- If a large bladder tear is identified, examine the bladder from inside to confirm the extent of the injury. Identify the ureteric orifices about 2cm posterior and lateral to the urethral

opening. The ureters may be injured if the tear extends down the posterior wall of the bladder. In this case, pass a size 6 or 8 infant feeding tube up each ureter. Passage of urine through each tube will confirm the integrity of the ureters. The presence of the feeding tubes in the ureters can help you to identify their location in the pelvis when you are subsequently repairing the uterus or doing a hysterectomy, and can thus help prevent injury to the ureters. The bladder tear itself can be repaired after attending to the uterus. If you suspect or confirm a ureteric injury, you will need to refer patient to an expert in urological surgery, when you have finished operating on the uterus.

- Use Green-Armytage forceps or equivalent to trace the margins of the uterine tear. If the margins are clearly identified and can be easily approximated to close the tear, then do so, using chromic catgut suture 0 or 1. If the tear extends inferiorly, towards the cervix, start the repair by placing a stitch at the inferior apex of the tear and work back upwards. The number of layers used to close the tear will depend on the thickness of the uterine tissue at the site of the tear, but usually a two layer closure is appropriate. Additional sutures (e.g. figure of eight sutures) may be required for haemostasis.
- If the tear extends into the region of the uterine artery laterally, it may be difficult to achieve haemostasis in that region. In this case, ligate the uterine artery below the level of the tear with a chromic catgut suture 1. If bleeding persists, ligate the uterine artery above the tear.
- If the tear extends laterally and inferiorly, there is a small risk that the ureter has been injured, and there is a risk of injuring or ligating the ureter when placing sutures to repair the tear. Mobilising the bladder right down off the lower segment of the uterus and the cervix will usually prevent this from happening, but ideally the course of the ureter as it crosses the pelvic floor and passes around the cervix to enter the bladder should be traced to detect any injury and to ensure that it is avoided when placing sutures.
- In the context of rupture of the uterus with previous caesarean section, hysterectomy should be done in the following situations:
 - o Extensive uterine tear where the margins cannot clearly be identified or approximated
 - o Failure to achieve haemostasis at the margins of the tear when attempting repair
 - o Persistent atonic uterus with bleeding from the placental site
 - o Septic uterus
- The ovaries should be conserved when performing a hysterectomy for ruptured uterus
- In most cases, when doing a hysterectomy for ruptured uterus, a subtotal hysterectomy is the procedure of choice, as it is quicker, easier and causes less bleeding. After clamping and cutting the upper attachments of the uterus, the uterine arteries are clamped and cut at the level of the cervix, making sure that the bladder has first been mobilised off the cervix. The uterus is then excised just above the uterine artery pedicles leaving a stump of cervix, which can be sutured closed to achieve haemostasis.
- If the tear extends through the cervix, a subtotal hysterectomy is still done. Once the body of the uterus has been excised, it is much easier to trace the cervical tear downwards, sometimes into the upper vaginal tissue, and to suture it from the inferior apex to restore the anatomy of the cervix.
- Any bladder tear previously identified can now be repaired. Close the tear with 2 layers of chromic catgut 2/0, the second layer covering the first. Leave a foley's catheter in-situ for at least 10 days (14 days if the tear is large). If the tear passes near the ureteral orifices, close this end of the tear first with infant feeding tubes in the ureters as described above to help avoid putting a stitch through the ureter. When you are safely away from the ureters, remove the tubes before completing the closure.
- Following hysterectomy, if there is persistent bleeding from the pelvic peritoneal surfaces, which does stop with haemostatic sutures, then it is probably due a coagulopathy. Pack the pelvis tight with at 4 or 5 large abdominal swabs to control the bleeding, and close the abdomen. Take measures to treat the coagulopathy and refer to a centre with an ICU. Once the coagulopathy is resolved, the abdomen could be re-opened and the swabs removed.
- If it is not feasible to repair the uterus, and you don't have the skills to perform a subtotal

hysterectomy, then control the bleeding from the uterus by tying a foley's catheter tight, as low down as possible around the base of the uterus, including the round and broad ligaments. Close the abdomen and refer the patient to a centre where a hysterectomy can be done.

Audit of Management of Women with Previous Caesarean Section

At any particular institution, if the success rate of VBAC (the % of women attempting VBAC who eventually deliver vaginally) is less than 50%, then the selection of women for VBAC should be reviewed. Being more selective and choosing a smaller number of women with the best chance of successful VBAC should ensure a better success rate, with fewer complications.

Adverse events related to attempted VBAC or to ELCS performed in women with previous caesarean sections should be routinely reviewed and discussed within institutions. Areas where in service training is needed may thus be identified, and policies and protocols with regard to the management of women with previous caesarean section may need to be changed.

Conclusions and Recommendations

With increasing rates of caesarean section being performed in South Africa, in line with trends in many other parts of the World, pregnancies with a previous caesarean section are also encountered more and more often. Such pregnancies are high-risk, and there are dangers whether VBAC is attempted or not. Hospitals are often not ideally staffed or equipped to allow safe VBAC, but complications of elective caesarean sections also occur due to factors including severe adhesions, lack of competence of surgeons and anaesthetists, and inadequate post-natal monitoring. To minimise adverse outcomes associated with these pregnancies, the following recommendations are made:

- At all hospitals care should be taken to avoid unnecessary caesarean sections in women with unscarred uteri. This will reduce the numbers of pregnant women with previous caesarean section. In order to reduce the number of primary caesarean sections, external cephalic versions for breech presentation must be performed when appropriate, and there must be competent management of labour including correct CTG interpretation and instrumental delivery when indicated. Doctors and midwives working in labour wards must be regularly trained to learn or consolidate such skills.
- All doctors working at District Hospitals should be competent in administering an anaesthetic for caesarean section, and in performing caesarean sections. There must be adequate training to ensure this, both during internship, and thereafter.
- Careful selection of suitable candidates for VBAC is the key to safe outcome with a high success rate. Midwives and doctors working in antenatal care and labour ward settings must be trained in the assessment of suitability of pregnant women for VBAC.
- Hospitals should monitor success rates and complications associated with VBAC, as well as major complications from caesarean sections. Districts should ensure that sites performing VBAC and/or caesarean section are competent to do so.

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AUDIT OF CAESAREAN SECTIONS

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There is a world-wide epidemic of caesarean sections (CS) and this is clearly leading to an unnecessarily increased morbidity and mortality globally^{1,2}. It is not known what the true CS rate for South Africa is, and it differs depending on whether an analysis is made of private hospitals, public hospitals and the designated level of care of the hospital. In 2005-2007 there were 477 210 CS performed in public hospitals in South Africa according to the District Health Information System (DHIS) database. (The DHIS database excludes private hospitals). The CS rate during this period was calculated as 18.4%³. The maternal mortality rate for vaginal delivery during this period was 77.8/100 000 live births and the maternal mortality rate for CS was 198.2/100 000 live births. There was 2.5 times increased risk of dying from a CS in South African public hospitals³ (Saving Mothers 2005-2007)

The CS rate varies per hospital throughout the country with District Hospitals having rates around 12-18%, Regional Hospitals around 25- 32%, Provincial Tertiary Hospitals 32-38% and National Central Hospitals 40-45%⁴. However these proportions can vary considerably with the type of hospital and depending on the circumstances surrounding the hospital. It is not useful to have a single figure for all hospitals in South Africa as that does not take into consideration the referral patterns in the region. Ideally each district should be able to calculate its own CS rate (by dividing all caesarean sections in the district by all births in the district) and comparison can be made between similar types of districts.

However, the question remains, is South Africa doing too many unnecessary CS to the detriment of the pregnant woman and her child?⁵ Examining the CS rates will tell us very little about whether CS are unnecessary or not, a classification system is required that will provide us with a simple, logical system that will allow us to come closer to answering questions about unnecessary CS.

Robson from the Dublin Maternity Hospital has provided such a system⁶. The unique aspect of his Ten Group Classification system is that all groups are mutually exclusive and it covers the whole pregnant population. The Robson Ten Group Classification system allows the possibility of improving perinatal care by comparisons of CS over time in one unit and between different units. This classification system incorporates all the parameters used in the other classification system i.e. overall rates, previous CS, indication for previous CS as well as other parameters such as presentation, parity, lie and gestational age. By including all these parameters and dividing it into ten groups, it allows for the calculation CS rates within each group thereby identifying specific groups of patients to which modifications can be made in order to decrease the overall CS rate. The 10 groups are given below in Table 1.

The groups where one can monitor the quality of care in labour are Group1 (nulliparous, single cephalic, ≥ 37 week, in spontaneous labour) and Group 3 (multiparous (excluding prev. CS), single cephalic, ≥ 37 weeks, in spontaneous labour). In Group 3 one would expect the lowest CS rate and would expect it to be well under 10%, Group 1 will have a slightly higher CS rate but it should still be lower than 15%, if labour is managed properly.

Group 5 indicates how active the hospital is in encouraging a vaginal delivery following a previous caesarean delivery. Groups 2 and 4 give an indication of the induction success rate and elective CS rates. It is best to separate these out into sub-groups 'a' induction of labour and 'b' elective CS as this will automatically give the induction success rate and might indicate where a problem lies (see later).

Table 1: Robson Ten Group Classification System⁶

1.	Nulliparous, single cephalic, ≥ 37 week, in spontaneous labour
2.	Nulliparous, single cephalic, ≥ 37 weeks, induced or CS before labour
3.	Multiparous (excluding prev. CS), single cephalic, ≥ 37 weeks, in spontaneous labour
4.	Multiparous (excluding prev. CS), single cephalic, ≥ 37 weeks, induced or CS before delivery(elective CS)
5.	Previous CS, single cephalic, ≥ 37 weeks
6.	All nulliparous breeches
7.	All multiparous breeches (including prev. CS)
8.	All multiple pregnancies (including prev. CS)
9.	All abnormal lies (including prev. CS)
10.	All single cephalic, ≤ 36 weeks (including prev. CS)

Suliman et al.,⁷ have classified all CS occurring in Central and Eastern Tshwane using the Robson Ten Group Classification system from 1st July 2008 to 30th June 2009. Their results are shown below and are used as an example of the value of using the Robson Ten Group classification system.

The overall CS rate was 22.7%, but varied from 58.2% in Steve Biko Academic Hospital, 10.4% in Tshwane District Hospital and 6.6% Mamelodi Hospital, the three public hospital performing CS in the area.

Three groups 1, 3 and 5 contributed to 67.9% of all CS in the area. The biggest contributor being Group 5 (previous CS, single cephalic, ≥ 37 weeks); 83.5% of women in this group had repeat CS. There are two points to be made here, the first being it is important to prevent the first CS, as if one is performed it is most likely that another will then follow. The second point is that a trial of scar is not often practiced in the area. This may be for important reasons such as not having adequate facilities to monitor labour or quick access to a theatre for a caesarean section.

Groups 1 and 3 reflect the management of normal labour with CS rate of 15.3% for Group 1 (nulliparous, single cephalic, ≥ 37 week, in spontaneous labour) and 9.6% for Group 3 (multiparous (excluding prev. CS), single cephalic, ≥ 37 weeks, in spontaneous labour). The CS rates for Dublin Maternity Hospital were 7.3% and 1.1% respectively, Latin America⁸ 23.4% and 9.9% and Queensland⁹ 15.8% and 2.4%. This might suggest there is room to improve in the general management of labour. The great value of this is that like is being compared with like so valuable conclusions can be drawn, further it can be used to improve care¹⁰.

Groups 2 (nulliparous, single cephalic, ≥ 37 weeks, induced or CS before labour) and 4 (multiparous (excluding prev. CS), single cephalic, ≥ 37 weeks, induced or CS before delivery) contributed 11.4% to the number of CS. Suliman et al.,⁷ divided these groups up into sub-groups 'a' induced labour and 'b' elective CS. In Group 2a, 61.0% of induced labours failed and ended up with a CS and in 4a, 43.2% had a failed induction. This indicates there might be a problem with how labours are induced.

Table 2. Classification of caesarean sections performed in the Central and Eastern Tshwane using the Robson Ten Group Classification system⁷

Robson Group	NVD	CS	Total	No. of CS over total no. of women in each group	CS rate in each group (%)	% of all
CS						
1	3325	601	3926	=601/3926	15.3	20.3
2	53	156	209	=156/209	74.6	5.3
3	5425	579	6004	=579/5425	9.6	19.6
4	105	182	287	=182/287	63.4	6.1
5	164	831	995	=831/995	83.5	28.0
6	39	72	111	=72/111	64.9	2.4
7	85	130	215	=130/215	60.5	4.4
8	51	119	170	=119/170	70.0	4.0
9	0	34	34	=34/34	100.0	1.2
10	809	256	1065	=256/1065	24.0	8.7
Total	10056	2960	13016			100

Conclusion and Recommendation

All health institutions performing CS should classify the CS into the Robson Ten Group Classification system. To achieve this all labour ward registers should collect basic information on all pregnant women giving birth in their unit as illustrated in Table 3.

Table 3. Basic data necessary to classify all births into Robson's Ten Group Classification system

Obstetric Concept	Parameter
Category of pregnancy	Single cephalic Single breech Multiple Transverse or oblique
Previous obstetric record	Nulliparous Multiparous(without a uterine scar) a uterine scar) Multiparous(with
Course of labour and delivery	Spontaneous labour Induced labour CS before labour(elective or emergency)
Gestation	Gestational age in completed weeks at time of delivery

The Robson Ten Group Classification Table should be grouped with other institutions within their district so that a district Robson Ten Group Classification table can be derived. Each district should then analyse each group to see where their service can improve.

Further Robson's Ten Group Classification system should be modified so that Groups 2 and 4 have sub-groups 'a' – induced labour; 'b' – elective CS. This is necessary to audit the success rate of induction of labour.

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