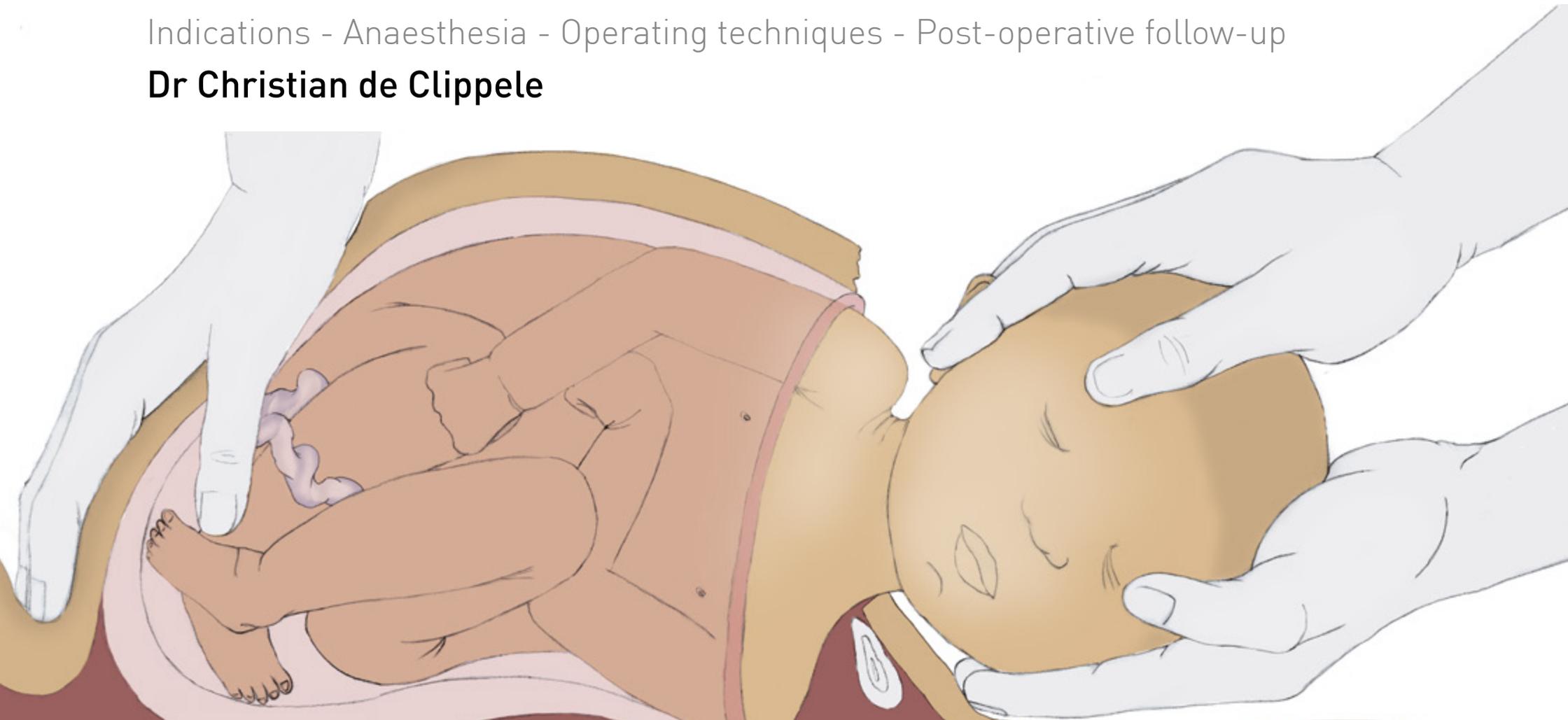


CAESAREAN SECTION

– IN CONDITIONS OF LIMITED RESOURCES –

Indications - Anaesthesia - Operating techniques - Post-operative follow-up

Dr Christian de Clippele



Currently, LSCS¹ is a well-established and perfectly regulated intervention, when it is performed by a properly trained and experienced person. The complications observed a few decades ago are no longer relevant and have considerably diminished.

However, it is important to note that over the past three decades, the caesarean section rate has increased significantly worldwide. The morbidity and mortality rate varies according to the logistical and technical conditions surrounding the practice of LSCS. The indications for LSCS and associated maternal pathologies can still be sources of significant morbidity in LSCS.

That is why, an emergency intervention can have a significant morbidity and mortality rate compared to the planned intervention, hence the importance of prenatal consultations by qualified individuals, which can prevent interventions being carried out in catastrophic conditions.

Some studies have shown that LSCS performed during the second half of the night and during weekends, in some health facilities, when junior doctors are working alone, are responsible for higher morbidity and mortality than caesarean sections performed during the day, when the whole team is available.

Experience therefore plays an important role in reducing the morbidity and mortality related to LSCS.

In numerous countries, the educational system only allows gynaecologists/obstetricians to perform this operation.

However, for many years in the DR Congo, the General Medicine degree also included the study of surgery and childbirth and made it possible to practice delivery and caesarean section operations.

Training was designed so that general practitioners could perform emergency surgery including LSCS, as well as delivery without being a gynaecologist/obstetrician.

With the explosion in the number of medical schools in the DRC and the plethora of trainees, it is becoming impossible for students to practice a sufficient number of LSCS to enable them to become proficient in the technique before graduation.

Assigned to remote areas, alone and without a training manual, they have to learn how to perform LSCS on their own.

The indications for caesarean section surgery, originally intended for cervical and mechanical dystocia, have evolved significantly, encompassing both maternal medical status and foetal conditions.

In remote areas, with no possibility of foetal monitoring, the main indication for LSCS is cervical and mechanical dystocia, which can be the cause of neonatal mortality, but also maternal lesions with serious consequences such as uterine rupture, urogenital and lower digestive fistulas. In our studies on fistulas associated with caesarean section, we observed that 24% of fistulas treated at HGR² Panzi were of iatrogenic origin. Instead of protecting against this pathology, when performed by an inexperienced person, caesarean section surgery becomes a significant cause of fistula.

1: Lower segment Caesarean section 2: General Reference Hospital (in DRC)

This percentage is staggering, especially compared to other African countries where LSCS is practiced by obstetrician/gynaecologists trained in the correct practice of this technique. Hence, the importance of this very practical manual, which teaches how to perform LSCS, step by step, from the indications to the late post-operative monitoring and the different stages of the technique itself.

The possibility of making such a tool available to young doctors, so they can learn how to perform this operation in a systematic and established manner, has been extensively discussed, the outcome of this technique is well documented and generally satisfactory.

This book could be a gift from the Ministry of Health to all General Medical graduates assigned to rural health areas where they often work alone.

Physicians should be thoroughly familiar with the use of this tool as a reference technique before considering variants of the caesarean section.

Reducing maternal mortality below 70/100 000 is no longer a dream. To achieve this sustainable development goal (SDG), there must be political will, a sense of responsibility, but also commitment from practitioners as well as initiatives such as those of Dr. Christian de Clippele, that deserve to be welcomed and encouraged by all of us who are called upon to treat iatrogenic lesions more than referred parturients.

It is only through proper training and the practice of correct techniques that we can ensure, insofar as possible, good maternal and neonatal health.

This guide is a simple, clear, understandable and very important educational tool in the hands of both the trainer and the novice.

This manual will now assist young general practitioners, working alone in isolated hospitals with no mentor. Finally, they will be able to refer to this complete guide but also to establish their practice of LSCS in order to avoid risky procedures, at the origin of dramatic complications for both the parturient and the newborn.

This will reduce morbidity and mortality and contribute to the achievement of the Millennium Development Goal (MDG) to reduce maternal mortality by the year 2030.

We would like to thank our friend and dear colleague Christian de Clippele for this initiative, which is the result of his long experience in hospitals in the DRC, in particular, at the Fomulac Hospital where, not only has he been a surgeon for a long time, but he has also trained young doctors in general and obstetrical surgery.

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Born in Bukavu, South Kivu, Democratic Republic of Congo, Dr. Mukwege is a Congolese obstetrician-gynaecologist and human rights activist. He is known as «*The man who repairs women*», and for the quality of his scientific and medical work, particularly in the treatment of vesico-vaginal fistulas. He has received numerous honours, including an honorary doctorate from the Catholic University of Louvain (UCL) and the prestigious Sakharov Prize. In 2018, the Norwegian Nobel Committee decided to award the prestigious Nobel Peace Prize to Dr. Mukwege and Nadia Murad for “their efforts to end the use of sexual violence as a weapon of war”.

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1. INTRODUCTION

A. OBJECTIVE OF THIS MANUAL

In areas with limited resources, caesarean section is still the most common surgical procedure [1-3].

However, even with strict adherence to surgical indications (caesarean sections for convenience are excluded), the maternal morbidity and mortality rate remains high [4].

The objective of this manual is to **reduce the perinatal and infant morbidity and mortality rate in Caesarean section**, by presenting a rigorous anaesthetic and surgical practice of Caesarean section adapted to **conditions with limited resources**.

We define this context of limited resources as the one that exists in many hospitals located in low-and middle-income countries [LIC or LMIC] [5]. These hospitals are mainly first referral hospitals [often called *General Reference Hospitals or GRHs*] and cover a health district of approximately 100 000 to 150 000 inhabitants.

B. WARNING

This manual does not replace a «textbook»!

It complies with the data and recommendations of the scientific literature, updated on June 30, 2020. However, it adapts these recommendations to the context of areas with limited resource conditions as described above.

This guide is therefore mainly intended for **general practitioners** and nurses, practising in hospitals as described above. These health care providers, usually in charge of other departments in the hospital (Internal Medicine, Surgery, Paediatrics...) are often required to perform caesarean sections on duty [6-7].

2. CAESAREAN SECTION INDICATIONS

The main indications for caesarean section are summarized below. We consider that foetal **monitoring is not available** *[This is the most common situation in conditions with limited resources]*.

If **foetal monitoring is available**, the reader is encouraged to follow the caesarean section indications, which are constantly updated by learned societies such as FIGO (International Federation of Gynaecology and Obstetrics) or CNGOF (French National College of Obstetricians and Gynaecologists) [8-11].

In practice, the practitioner will be confronted with one of the **3 following clinical situations** :

A. VERY URGENT CAESAREAN SECTION

B. EMERGENCY CAESAREAN SECTION

C. PLANNED CAESAREAN SECTION

A. VERY URGENT CAESAREAN SECTION

Must be performed immediately

[Only general anaesthesia can be performed, as performing spinal anaesthesia takes too long.]

1. Umbilical cord prolapse

2. Abruption Placentae if living child

[If the child is deceased and bleeding not significant (<200ml), prefer the vaginal route]

3. PPV: partial or total Placenta Prævia *[stage III or IV] in significant active haemorrhage*

[Even if the pregnancy is not at term: give priority to the mother.]

[If marginal placenta stage I or II, perform rupture of the membranes: when the head goes down, it will compress the placenta and usually reduce bleeding.]

4. Pre-rupture syndrome *[presence of Bandl's ring]*

5. Uterine rupture

6. Eclamptic seizure ^[12]

[Generalized convulsions]

7. Acute Foetal Distress (AFD) :

- Bradycardia: Baseline Foetal Heart Rate : *[FHR¹ less than 80 bpm for more than 10 minutes]*, heart rate that does not return to normal, to be checked on the operating table before incision or
- Late deceleration in the foetal heart rate *[at the end of contraction FHR less than 80 bpm]*, repeated for 30 minutes

 **Go to the operating room. This must be checked on the operating table.**

1 : Foetal Heart Rate

B. EMERGENCY CAESAREAN SECTION

1. Foetopelvic disproportion

[Very common in resource-limited areas]

- “Failure to progress» in labour :
 - › Dilation stopped or
 - › Obstructed labour or
 - › Stagnation of the presentation at mid pelvis

2. Dynamic dystocia

- Cervical dilation not responding to any treatment

3. Foetal presentation abnormalities

- Brow
- Face (mentum posterior)
- Shoulder or transverse
- Breech

4. Chorioamnionitis

- T° > 39°C
- Foul-smelling vaginal discharge
- Uterine tenderness outside contractions

5. Severe pre-eclampsia ^[13]

- Severe proteinuria > 5g/24hr and/or
- Persistent high blood pressure, DBP (Diastolic Blood Pressure) > 110mm Hg resistant to antihypertensive therapy

A fortiori with one or more of the following symptoms: persistent headache, blurred vision, epigastric pain, marked hyperreflexia

6. Foetal heart rate (FHR) abnormalities

- Foetal tachycardia: Persistent FHR > 180 bpm > 1 hour after reducing maternal hyperthermia with paracetamol and antibiotics
- Regular and late deceleration of FHR < 90 bpm for one hour

C. PLANNED CAESAREAN SECTION

(also known as elective)

1. Iterative Caesarean section [14-17]

- Previous caesarean section indication persistence
- History of two previous caesarean sections
- History of previous uterine rupture

2. Maternal causes

- Cervical and mechanical dystocia: pelvic abnormality, sacral promontory reached by vaginal touch, rickets-osteomalacia
- Active genital herpes (vesicles), condyloma acuminata
- HIV without antiretroviral therapy
- Genital mutilation, vesico-vaginal fistula (repaired or not) [18]
- Severe cardiac or neurological disease
 - › Heart : : acute heart failure contraindicating the cardiac effort required during labour
 - › Neurological : a neurological condition that prohibits pushing during childbirth, and without the possibility of instrumental delivery

3. Foetal causes

- Intrauterine Growth Restriction (IUGR) Chronic Foetal Distress (CFD)
[validated via an oxytocin test: infusion to obtain 10 contractions in 30 minutes: if synchronous or late decelerations → caesarean section]
- Non-reducible transverse position
- Twin pregnancy [19-21]
 - › Absolute indications
 - › First twin in transverse position *[primigravida and multigravida]*
 - › Breech-Cephalic presentation or Breech-Breech presentation *[primigravida]*
 - › Relative indications
 - › Cephalic - Cephalic or Cephalic-Breech presentation *[primigravida]*
 - › Foetal macrosomia
 - › Breech-Cephalic presentation or Breech-Breech presentation *[multigravida]*
 - › Second twin in transverse position

4. Placental causes

- Placenta Previa grade IV

5. Adnexal causes

- Praevia barrier: adnexal mass, uterine fibroma

3. ANAESTHESIA

A. PRE-OPERATIVE PREPARATION

PREPARING THE SURGICAL SITE

THE OBSTETRIC EXAMINATION

VAGINAL PREPARATION & BLADDER EMPTYING

B. ANTIBIOTIC PROPHYLAXIS OR THERAPY

PROPHYLAXIS

THERAPY

C. ANAESTHESIA

ANAESTHETIC CAPACITY DEVELOPMENT PLAN

PRACTICAL ANAESTHESIA

A. PREOPERATIVE PREPARATION

PREPARING THE SURGICAL SITE

On the eve of surgery [*elective cases*] the mother should have a shower with antiseptic soap or povidone iodine [22].

THE OBSTETRIC EXAMINATION

The preoperative **vaginal examination** makes it possible :

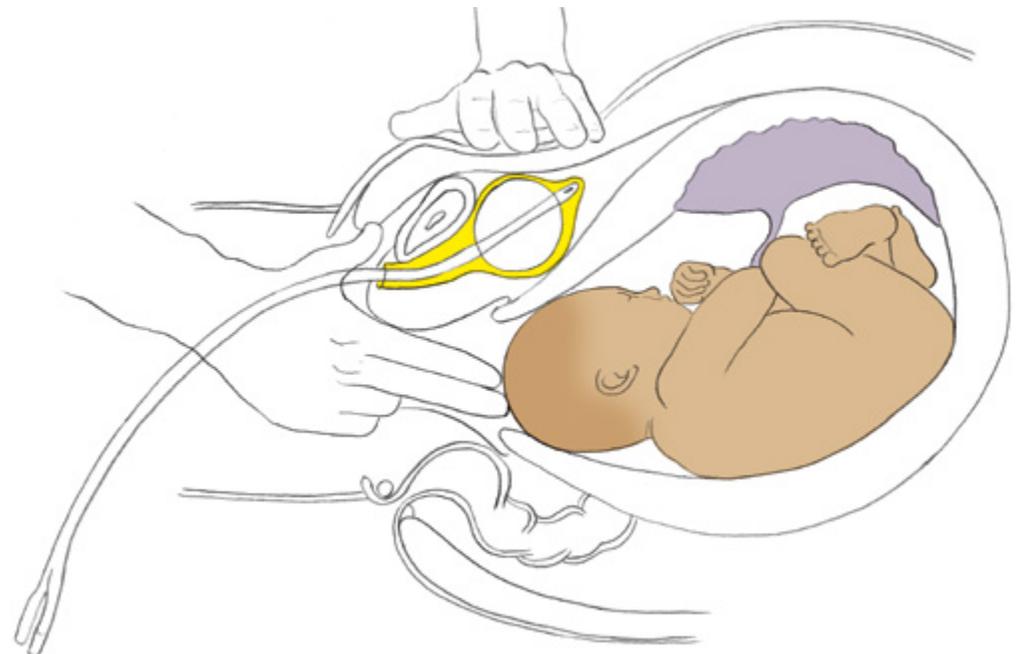
- to check that the bladder is empty [*following catheterisation*]
- to check the presentation and lie
- to check that the cord is pulsating in the event of prolapse

Abdominal palpation makes it possible :

- to locate the position of the foetal back
- to check the presentation

Auscultation of the foetal heart is a final check of foetal viability.

[Use a foetal stethoscope or doppler foetal monitor [*Sonicaid*®]]



VAGINAL PREPARATION AND BLADDER EMPTYNG

[This is best performed in the operating theatre.]

Following spinal anaesthesia

[More comfortable for the mother.]

Or preceding general anaesthesia

[Reduced exposure of the baby to anaesthetic drugs.]

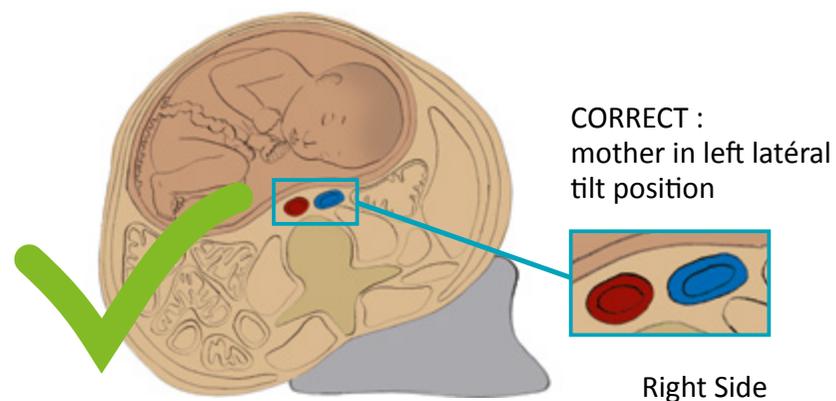
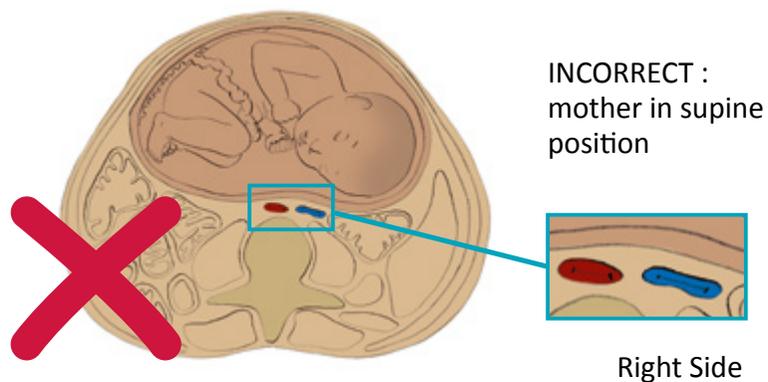
1 Equipment

- Foley catheter size Ch 14 or 16
- 20ml syringe
- 50ml gallipot with normal saline
- Povidone Iodine 5%
- Swabs
- Swab-holding forceps

2 Technique

- Pubic shave
- Mother in supine wedged position, soles of feet together
- Pillow 15cm high x 25cm wide x 25cm long beneath right hip, or table tilted 15° to the left!
[to minimise IVC compression by the gravid uterus]
- Place a small drape beneath the buttocks
- Disinfect the vagina with Povidone Iodine 5%
- Insert Foley catheter

Give tocolytics for acute foetal distress.



B. ANTIBIOTIC PROPHYLAXIS OR THERAPY

PROPHYLAXIS [23-29]

[Given systemically]

- Ampicillin: 2g IV bolus at induction of anaesthesia

THERAPY in the event of chorioamniotitis

[No longer prophylaxis!] three times/day x 7 days

- Metronidazole: 1g slow IV (30 min) then three times/day x 7 days or orally three 500mg tablets daily
[if IV Metronidazole unavailable]
- Gentamicin 160mg IV once daily for 7 days
- Ampicillin 1g IV three times/day x 7 days - change to oral as soon as possible
[Do not give amoxicillin + clavulanic acid before delivery, due to the risk of effect on the baby's intestinal and ENT flora.]

C. ANAESTHESIA

Anaesthesia during pregnancy is always a challenge ! [30-31]

A pregnant woman can never be considered as being fasted [There is always a risk of regurgitation of gastric contents]

Spinal anaesthesia carries a reduced risk of mortality and complications compared to general anaesthesia.

In resource-poor settings, with suitably trained staff, spinal anaesthesia can be used for up to 80% of C-sections.

Accidental complications can result from poor assessment and drug confusion

The main anaesthesia-related causes of mortality and morbidity during Caesarean section are :

- Hypotension with or without bradycardia
- Aortocaval compression
- Total spinal anaesthesia
- Regurgitation
- Failed intubation or oesophageal intubation
- Drug administration errors (type of drug, or dosage)

⚠ WARNING - DEATHS ALSO OCCUR IN THE POSTOPERATIVE PERIOD
[Correct postoperative care is essential]

A general anaesthetic protocol, without intubation, but with precise requirements, has been introduced with some success in isolated parts of Kenya. It is called the ESM-Ketamine programme (Every Second Matters for Mothers and Babies—Ketamine) It addresses emergency situations, including Caesarean sections, managed by non-physician surgeons and anaesthetists who have undergone intensive training. [32-33]

Insert an 18 gauge cannula, monitor blood pressure, pulse oximeter, give oxygen if available using face mask and reservoir (+ self-inflating bag), give ketamine 2mg/kg IV over 30-60 sec, then 1-2mg/kg every 10-15 min. Some other drugs are available; diazepam 5mg IM in case of agitation, promethazine 25mg IM for nausea and vomiting, atropine 0.5mg for hypersalivation and hydralazine 5mg IV over 1 min for pre-eclampsia and eclampsia.

N.B. Add ephedrine before anaesthesia [34-35]

FOUR-PHASE PLAN TO IMPROVE ANAESTHESIA FACILITIES IN CAESAREAN SECTION

[From the primary health care facility to specialist centres]

PHASE 1

Medical resources inadequate, no anaesthesia department.

OBJECTIVE :

→ up to 80% of patients receive spinal anaesthesia, no drug error

1. **Personnel** : « Generalist » nurses, with no specific qualification in anaesthesia, working part-time in anaesthesia.
2. **Equipment** : stethoscope(s), BP cuff, suction, face mask with reservoir, self-inflating bag, IV cannula, oropharyngeal airway, obstetric wedge for lateral tilt, pulse oximeter and oxygen concentrator if possible.
3. **Single-use** : 22G spinal needles, IV giving sets, IV cannulas 14/16/18G, nasogastric tubes.
4. **Drugs: lidocaine 1% or 2%** hyperbaric or isobaric bupivacaine 0.5%, ephedrine, atropine, adrenaline, IV fluids (saline), blood, ketamine, diazepam, IV antibiotics, oxytocics [*refrigerate*].
5. **Clear protocols** for spinal anaesthesia and general anaesthesia using ketamine.
6. A clear **labelling** and storage system for drugs.
7. **Postoperative patient care** [*recovery area and ward*] through to complete recovery with stable vital signs, with absence of bleeding, and a well-contracted uterus.
8. **Record system** covering every anaesthesia and complications (including postoperative complications).

PHASE 2

Medical resources limited, but with a dedicated nurse anaesthetist.

OBJECTIVE :

- reduction of post-spinal headaches
- increased safety of general anaesthesia
- detection of hypoventilation and reduction of ventilatory risks
- early detection of postoperative problems
- improved foetal outcome

1. **Personnel** : Dedicated «generalist» nurses, with no formal qualifications in anaesthesia but working full-time in anaesthesia and able to insert tracheal tubes and laryngeal masks.
2. **Additional equipment** : Several BP monitors, a good quality pulse oximeter *[to be used routinely during recovery]*, laryngoscope with No.3 blade *(or selection)*, Magill forceps, oxygen concentrator *[increases the safety of anaesthesia and improves resuscitation of the newborn]* several pulse oximeters *[for ward use]* and refrigerator.
3. **Additional single-use items** : 25G pencil point spinal needles *[to reduce the level of post spinal headaches below 30%]*. 6.5 & 7mm orotracheal tubes, second generation laryngeal masks *[for problem intubations]* nasogastric tubes, respiratory filters, intubating stylets/bougies.
4. **Drugs** : magnesium sulphate *[for eclampsia]*, antihypertensives, colloids for IV use.

PHASE 3

Limited medical resources, but with an anaesthesia department.

OBJECTIVE :

→ complete airway security, avoid all regurgitation

1. **Personnel** : the presence of a nurse, technician or physician trained in anaesthesia. The entire operating team is trained in the use of laryngeal masks, in case of failed intubation..
2. **Additional equipment** : anaesthesia machine, preferably draw-over such as the Glostavent (Diamedica) or Universal Anaesthesia Machine (UAM) with electrical backup; oxygen concentrator with compressor and 5bar/100 litre reserve tank; vaporizers for halothane & sevoflurane - or if too costly, Diamedica DPA system with manual ventilator; monitoring allowing simultaneous display of heart rate, oximetry, blood pressure, temperature and CO₂.
3. **Drugs** : Thiopentone, suxamethonium and/or pancuronium /vecuronium/atracurium; halothane [*isoflurane, sevoflurane if available*]; fentanyl and/or sufentanil; phenylephrine, sodium citrate 0.3M, metoclopramide, omeprazole or ranitidine.

PHASE 4

Adequate medical resources.

OBJECTIVE :

→ near-zero mortality, reduced complications

1. **Personnel** : in addition to the presence of a specialist anaesthetist, the entire team is trained in spinal anaesthesia, intubation and equipment maintenance.
2. **Equipment** : any kind of anaesthesia machine, provided there is a guaranteed supply of soda lime and that the machine can be serviced and repaired locally. Permanent supplies of oxygen and electricity. Complete monitoring, short-handle laryngoscope, supplementary airway devices [*airtraq, glidescope*], nerve stimulator [*postoperative residual curarisation is a significant cause of post-operative complication*].
3. **Drugs** : all drugs normally used in anaesthesia and resuscitation.

PRACTICAL ANAESTHESIA

1 CHOOSING BETWEEN REGIONAL ANAESTHESIA (RA) AND GENERAL ANAESTHESIA (GA)

- A. REGIONAL ANAESTHESIA
- B. GENERAL ANAESTHESIA

2 SETUP AND PATIENT PREPARATION Common procedures for regional and general anaesthesia

3 REGIONAL ANAESTHESIA

A. DRUG AND EQUIPMENT PREPARATION :

- ANTIBACTERIAL PREPARATION OF A STERILE FIELD
- LOCAL ANAESTHESIA OF THE PUNCTURE SITE
- REGIONAL ANAESTHESIA
- BLOOD PRESSURE MAINTENANCE

B. POSITIONING THE PATIENT - SPINAL FLEXION

C. ASEPSIS AT THE INJECTION SITE

D. CHOICE OF VERTEBRAL LEVEL

E. INSERTION TECHNIQUE

F. INJECTION OF ANAESTHETIC PRODUCTS

G. PATIENT POSITIONING AFTER SPINAL BLOCK

H. INTRAOPERATIVE MONITORING

- PATIENT POSITIONING
- HEIGHT OF THE ANAESTHETIC BLOCK
- BLOOD PRESSURE
- EARLY SIDE EFFECTS

I. POSTOPERATIVE MONITORING

- IMMEDIATE POSTOPERATIVE PERIOD
- LATE SIDE EFFECTS

4 GENERAL ANAESTHESIA

A. SETUP AND PATIENT PREPARATION (SEE 2)

B. PATIENT INSTALLATION FOR TRACHEAL INTUBATION (if applicable)

C. ANAESTHESIA

- TECHNIQUE WITHOUT INTUBATION OR LARYNGEAL PROTECTION
- TECHNIQUE WITHOUT INTUBATION BUT WITH LARYNGEAL PROTECTION
- TECHNIQUE WITH INTUBATION

D. INTRAOPERATIVE MONITORING

E. POST-OPERATIVE MONITORING

1 CHOOSING BETWEEN REGIONAL AND GENERAL ANAESTHESIA

WITH THE EXCEPTION OF CLEAR CONTRAINDICATIONS REGIONAL ANAESTHESIA SHOULD BE THE STANDARD! [36]

A. REGIONAL ANAESTHESIA

INDICATIONS : When there are no contraindications!

- RA is superior to general anaesthesia provided the risks of high block and low blood pressure are eliminated
- RA enables better bonding between mother and baby.

CONTRAINDICATIONS :

Absolute :

- uncorrected hypovolaemia or cardiovascular instability
- coagulopathy
- infection at the insertion site

Relative :

- spinal deformity
- previous spinal surgery
- extreme urgency (cord prolapse, uterine rupture...)
[GA is quicker to perform]

B. GENERAL ANAESTHESIA

INDICATIONS :

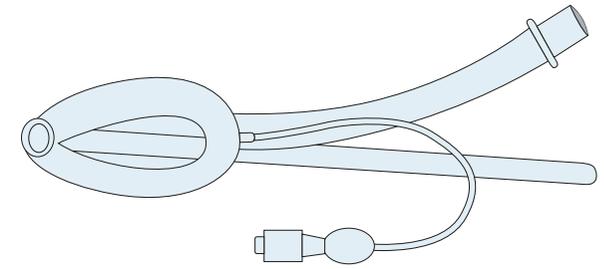
- when spinal anaesthesia is contraindicated.
- extreme urgency or uncontrolled hypotension

2 SETUP AND PATIENT PREPARATION

Procedures common to regional and general anaesthesia

1 Equipment

- a) Suction device, facemask with reservoir, self-inflating bag-valve-mask (Ambu®), oropharyngeal airways, obstetric wedge for lateral tilt, oxygen (cylinder or concentrator)
- b) Intubation equipment if available: laryngoscope, 6.5 & 7mm orotracheal tubes, 10ml syringe for cuff inflation, adhesive tape, second generation laryngeal mask.



Second generation laryngeal masks

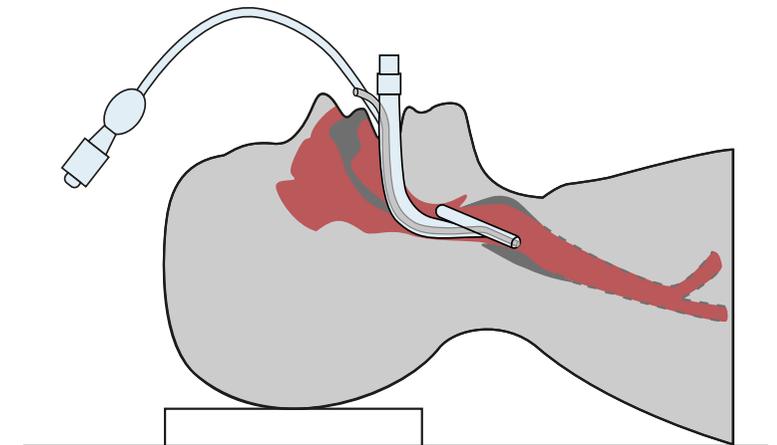
2 Monitoring (if available)

Stethoscope(s), Sphygmomanometer, pulse oximeter
[available at low cost]

3 Antacid premedication

[Preferably oral, 30 min before anaesthesia]

- a) Sodium citrate 0.3M, 30ml orally or
- b) Ranitidine 50mg/2ml for injection or ranitidine 150mg or omeprazole 40mg orally or
- c) Metoclopramide 10mg/2ml IV slowly



Position of laryngeal mask in cases of failed intubation.

Keep Patient warm !

4 Venous access

- a) Usually a SINGLE 18G cannula is sufficient, with an infusion of Ringers Lactate or Normal saline (0.9%) 500-1000ml
[Do not pre-load the patient if you intend to use vasopressors, otherwise give 500-1000ml preload before starting anaesthesia.]
- b) For emergencies, use TWO intravenous cannulas :
- 18G as above for Ringers Lactate or Normal saline
- 16G or (better) 14G for rapid infusion and/or blood transfusion

5 Atropine *[Routine use - Recommended]*

- Absolute indication
- Nausea
 - If ketamine is to be used *[To prevent hypersalivation]*
- 0.01mg/kg or 0.5mg :
[Atropine ampoules may contain 0.25mg/ml or 0.5mg/ml or 1mg/ml. Check carefully!]

6 Rapid filling

- Only if there is mild hypotension (suggesting bleeding ...)
- Or if no vasopressors are available

Immediate correction of fluid deficit with Ringers Lactate or Normal saline to maintain blood pressure before starting spinal anaesthesia.

7 Tranexamic acid

- Tranexamic acid should be administered at a dose of one gram, once only, in a slow IV (risk of hypotension).
- To be started after severe bleeding onset.
- Prevent the patient from getting cold :
 - stop or adjust the air conditioning
 - or cover the patient

8 Vasopressors

1st choice : phenylephrine infusion (10mg/100ml (=100micrograms/ml) or bolus of 25-50micrograms/min
[phenylephrine may be expensive!]

or

2nd choice: Ephedrine 5mg bolus repeated as required

[ephedrine 30mg SC (can lead to hypertension) (cheaper than phenylephrine)

or

3rd choice: adrenaline 0.1mg IV repeated as required [37]

[if neither phenylephrine nor ephedrine available]

3 REGIONAL ANAESTHESIA

Spinal anaesthesia produces a triple block :

1. Sensory
2. Motor
3. Sympathetic → vasodilation

[The technique is similar to a lumbar puncture.]

A. DRUG AND EQUIPMENT PREPARATION

SKIN ASEPSIS

Surgical gloves, 2 swabs, 10% povidone iodine

LOCAL ANAESTHESIA AT THE INJECTION SITE

5ml syringe; 18G drawing-up needle; 21G (23G) injection needle; lidocaine 1% or 2%

SPINAL INJECTION

5ml **syringe**; 18G drawing-up needle

Spinal needle :

- > either a 25G spinal needle (Preferably pencil-point)

[The blunt tip reduces the size of the hole in the dura mater, minimising CSF leak and post-dural puncture headache (PDPH)]

- > or 22G spinal needle (if 25G not available)

Regional anaesthetics :

- › either bupivacaine 0.5% hyperbaric (heavy) (first choice), or bupivacaine plain (isobaric) 0.5% (second choice) :
volume 1.8-2.8ml adjusted according to patient height [38]
→ See Table 1: Spinal injection volumes, with only bupivacaine 0.5% volume in relation to maternal height
→ See Table 2: Spinal injection volumes with opiate: 4ml Bupivacaine + 1ml opiate (Fentanyl or Sufentanil) in relation to maternal height
- › or (not recommended) lidocaine 5% hyperbaric if bupivacaine unavailable,
→ See Table 4: late side effects of spinal anaesthesia

⚠ Possible risk of neurotoxicity

Opioids as adjuvants :

- › Either morphine (preservative-free) 0.1mg (=100micrograms) :
 - To prepare, first dilute a 10mg ampoule of morphine (1ml) in 9ml of normal saline to give a dilution of 1mg/ml
 - then dilute 1ml of this solution with a further 9ml of normal saline. This gives a concentration of 100micrograms/ml

[instead of the second dilution, you can take up 0.1ml of the first solution into a 1ml syringe - this also gives a 100micrograms dose]

Dilute a 10mg morphine ampoule by a factor of 100 The final dilution should be 0.1mg/ml (100micrograms/ml)

- › or Fentanyl 20micrograms: = 0.4ml of a 50micrograms/ml solution
- › or Sufentanil 2micrograms: = 0.4ml of a 5micrograms/ml solution

→ see Table 1: Volume of bupivacaine 0.5% only

⚠ A commonly used technique is to draw up 4ml of heavy bupivacaine into a 5ml syringe, add 1ml of fentanyl or sufentanil, and inject the volume of the corresponding mixture shown in Table 2.

The use of spinal opioids carries risks of respiratory depression.

The practitioner must be trained in the correct dilution technique.

The usefulness of a morphine for intraoperative comfort and the management of postoperative pain. is well demonstrated !

[Another common side effect: pruritus.]

MAINTAINING BLOOD PRESSURE

Vasopressors : To support vital signs: [39-40]

- > Either Phenylephrine administered continuously (10mg/100ml = 100micrograms/ml) maximum 100micrograms/min (first choice) or as a bolus of 25-50micrograms/min *[At higher doses there is a risk of bradycardia and a decrease in cardiac output. Phenylephrine is sometimes expensive] Since it has no inotropic effects it is superior to ephedrine, although ephedrine may be associated with less foetal acidosis]*
- > or repeated 5mg boluses of ephedrine (2nd choice)
[cheaper]
[s/c administration can result in uncontrolled hypertension]
- > or adrenaline *[if other vasoconstrictors are unavailable]* (3rd choice)
dilute 1 ampoule (1mg) with 9ml saline to give a concentration of 100micrograms/ml. Inject boluses of 1ml (= 100micrograms). Repeat if necessary.

- ⚠ **In most countries, the various drugs are presented in similar ampoules with similar inscriptions.**
- ⚠ **Even in emergencies, it is vital to carefully check that the drug formulation and dosage is the correct one.**
- ⚠ **It is good practice to have the ampoules read aloud by a third person, as well as by the anaesthetist.**

TABLE 1 : Spinal injection volumes, with only bupivacaine 0,5% volume in relation to maternal height

Under 150cm	2,0ml
151 - 160cm	2,2ml
161 - 170cm	2,4ml
171 - 180cm	2,6ml
Over 180cm	2,8ml

[Note that if a caesarean section is to be performed at 26-33 weeks, the dose should be increased with 0.4ml]

TABLE 2 :

**Spinal injection volumes with opiate
4ml Bupivacaine 0.5% + 1ml opiate (Fentanyl or Sufentanil)
in relation to maternal height**

Under 150cm	1,8ml
151 - 160cm	2,0ml
161 - 170cm	2,2ml
171 - 180cm	2,4ml
Over 180cm	2,6ml

B. POSITIONING THE PATIENT - SPINAL FLEXION

Position the mother

- > Sitting : forearms resting on thighs with legs hanging down, helps the mother to stay in position
- > Left lateral : head and knees towards the chest

[More comfortable for the mother, but more difficult for inexperienced anaesthetists. Not recommended].

C. ASEPSIS OF THE INSERTION POINT

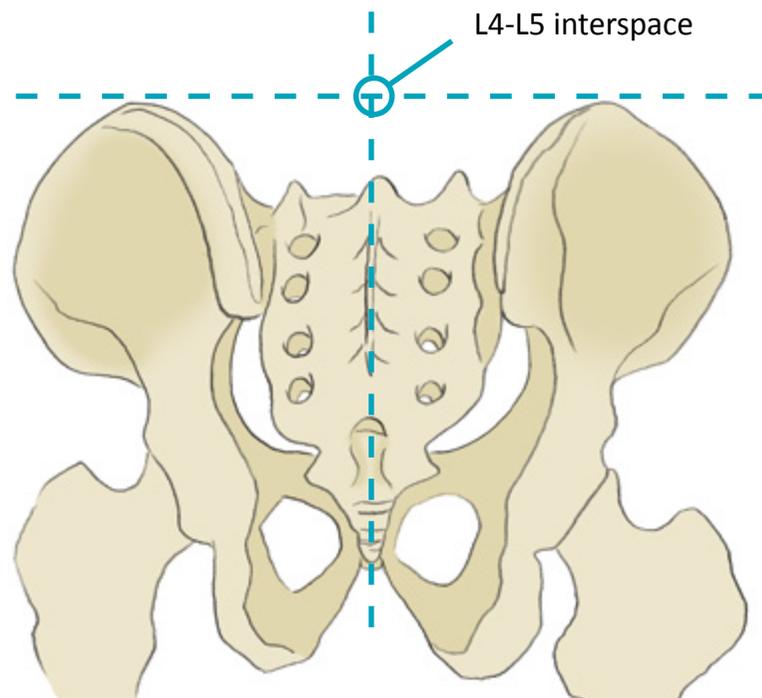
[Anaesthetist: cap, mask, surgical scrub, sterile gloves]

- Antiseptic applied from the lower end of the scapula to the tip of the coccyx, spiraling out from the insertion point.
- Place one or more sterile towels.

D. CHOICE OF PUNCTURE SITE

Usual technique

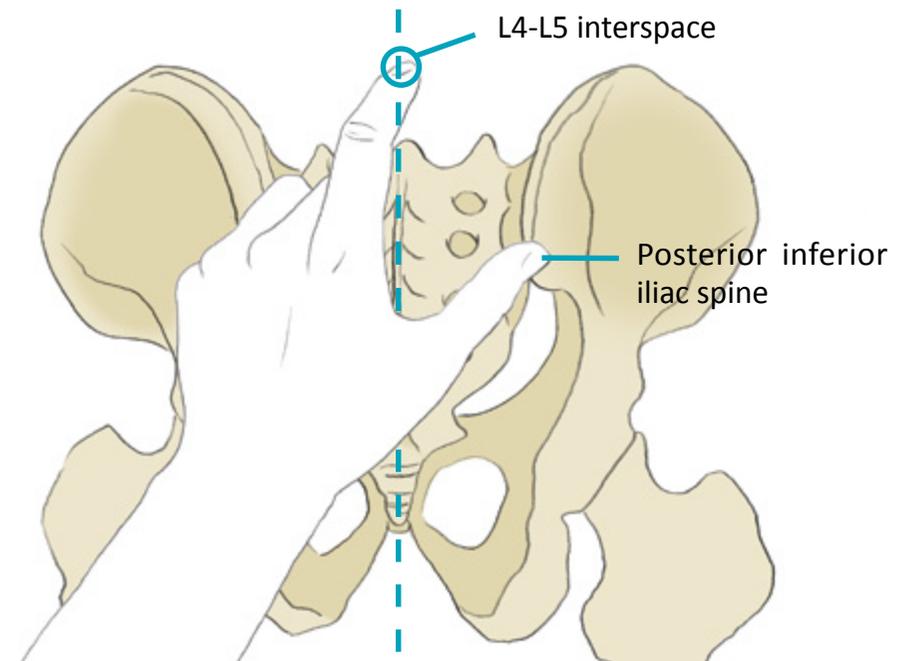
- Puncture at the intersection of the median line (of spinous processes) and horizontal line at highest points of the iliac crests (Tuffier's line). Usually corresponds to the level of L4
[But in obese patients may lead to puncture at a higher level]



Alternative technique *[for trained practitioners]*

Locate L5 from the posterior inferior iliac spines. In obese patients, ask the mother to tell you where she feels the midline to be.

⚠ Puncture above L2-L3 carries a risk of spinal cord damage with permanent neurological sequelae!



E. INSERTION TECHNIQUE

⚠ During preparation, clearly mark syringes for local anaesthetic.

- 1**

Local anaesthesia
Inject 1-2% lidocaine up to 5ml to anaesthetize the skin, subcutaneous tissues and interspinous ligament

- 2**

Regional anaesthesia
If you are using a 25G needle, first insert an introducer *[if not available use a short 22G needle as introducer]*.

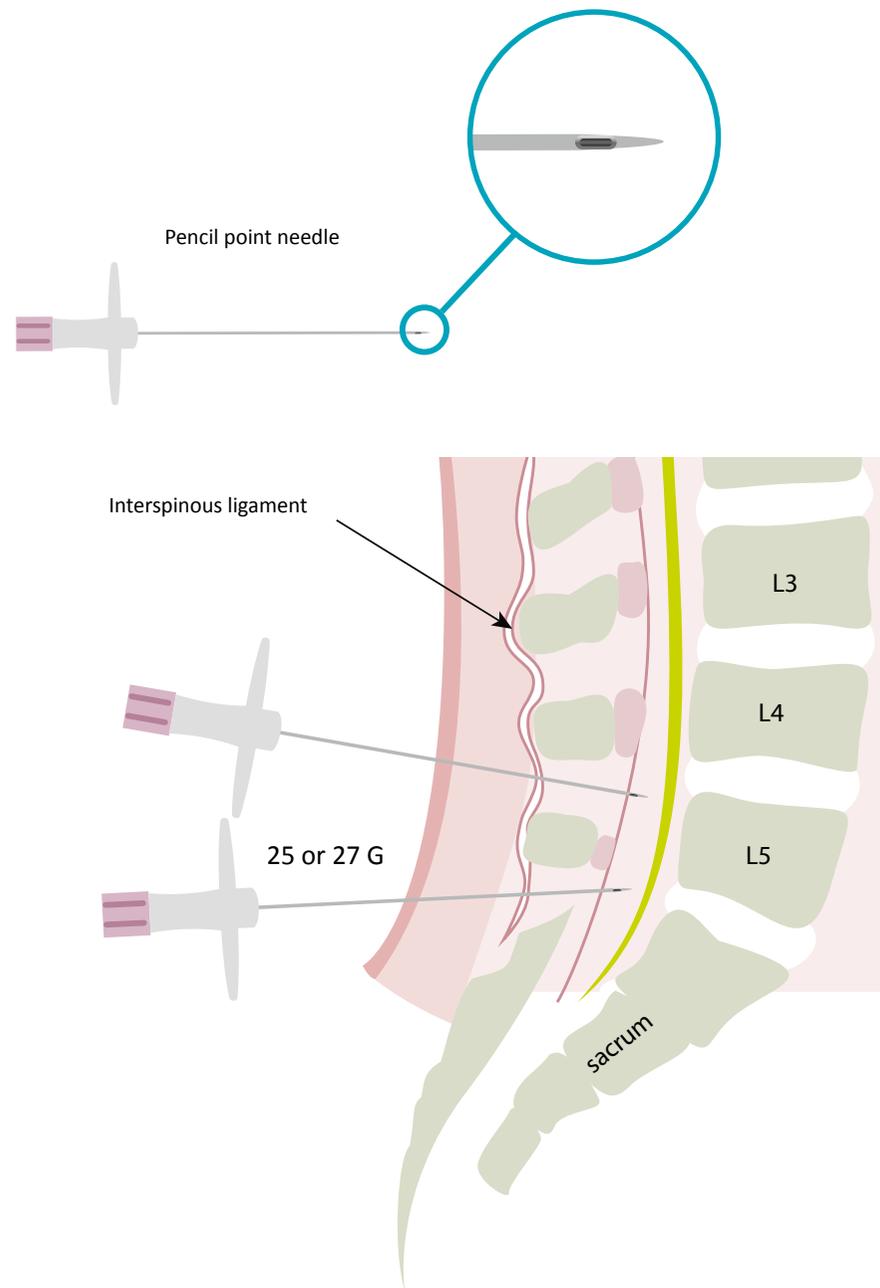
The spinal needle should pass easily through the subcutaneous tissue meeting resistance in the interspinous ligament and ligamentum flavum.

You may feel a click when penetrating the dura.

 - **If you strike bone**, withdraw, and reposition the needle slightly up or down. Successful dural puncture is confirmed by a flow of clear CSF¹ through the needle
[You may be able to distinguish reflux of local anaesthetic solution from CSF by its temperature - drops of local anaesthetic falling on your forearm will feel cooler than CSF]
 - **If blood flows from the needle, or if no CSF flows**, reposition the needle, but if a little initial blood is followed by clear CSF, proceed with injection.
 - **If a little initial blood is followed by clear CSF**, proceed with injection.

⚠ Patients may feel paraesthesia (an electric tingle) if the needle touches a nerve root when introduced. If paraesthesia occurs during injection, stop injecting (risk of nerve or spinal damage).

1: Cerebrospinal Fluid



F. INJECTION OF ANAESTHETIC PRODUCTS

Table 1 and 2: volume of product to be injected in relation to maternal height AND whether or not opiate is added

- > **Either hyperbaric bupivacaine 0.5% (1st choice)**
dose varies between 1.8 and 2.8ml depending on height and use of opioids *[Mean onset time: 5 to 10 min]*
Duration of effect 1- 2 hours
- > **or isobaric bupivacaine 0.5% (2nd choice)** harder to predict upper block height *[Mean onset time: 5 to 10 min]*
Duration of effect 1-2 hours
- > **or hyperbaric lidocaine 5% (heavy) (not recommended)**
 Only if bupivacaine is not available, *[Can be used for subcutaneous anaesthesia]*
Duration of effect 45 to 90 minutes

Avoid lidocaine for spinal anaesthesia *[risk of neurotoxicity and nerve root damage]*

→ see Table 4: late side-effects of spinal anaesthesia

TABLE 1 : Spinal injection volumes, with only bupivacaine 0,5% volume in relation to maternal height	
Under 150cm	2,0ml
151 - 160cm	2,2ml
161 - 170cm	2,4ml
171 - 180cm	2,6ml
Over 180cm	2,8ml

TABLE 2 : Spinal injection volumes with opiate 4ml Bupivacaine + 1ml opiate (Fentanyl or Sufentanil) in relation to maternal height	
Under 150cm	1,8ml
151 - 160cm	2,0ml
161 - 170cm	2,2ml
171 - 180cm	2,4ml
Over 180cm	2,6ml

Note that if a caesarean section is to be performed at 26-33 weeks, the dose should be increased with 0.4ml.

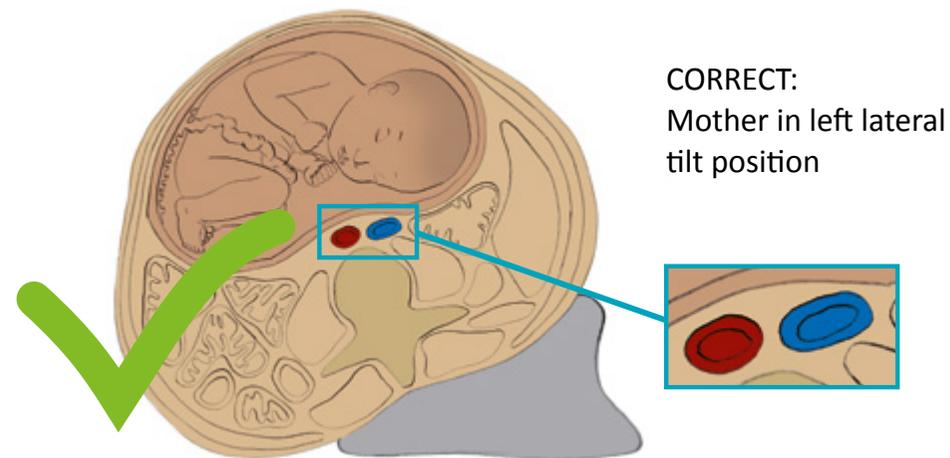
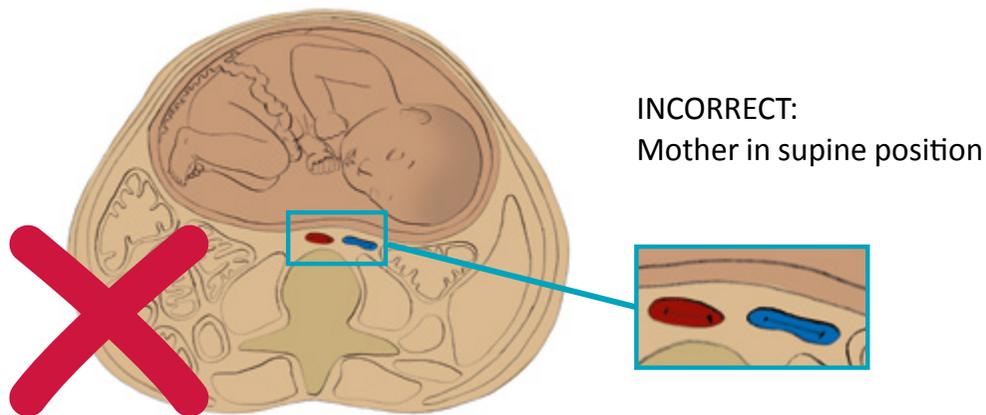
G. PATIENT POSITIONING

(After spinal block)

Left lateral uterine displacement until the baby is delivered.
Keep patient warm !

PATIENT POSITION

- **Installation with cushion/wedge** [15cm deep, 20cm wide, 25cm long], below the right buttock to avoid compression of the mother's inferior vena cava by a gravid uterus].
- OR
- **15° Left lateral tilt of the operating table** [if possible with this type of table].
[Test the block level with cold (e.g. ether) or a needle pin prick, not by touch - anaesthesia can be satisfactory even though the patient feels touch. Ideally the block level indicated by cold or needle should be T6 (just below the breast).]



H. INTRAOPERATIVE MONITORING

Intensive blood pressure monitoring!

Use vasopressors if blood pressure falls!

If it is necessary to redo the spinal anaesthesia, never add morphine to the mixture

PATIENT POSITION

Check that the 15% tilt of the operating table has been applied *[if possible]* or that a wedge or pillow is in position to ensure left uterine displacement.

ANAESTHETIC BLOCK HEIGHT

- **Only if no block at all is detectable** 10 minutes after injection
 - > repeat the block (see Table 1)
- REMEMBER: do not add opioids!
- **If the patient is short of breath**
 - > Check the upper level block: above T4 - nipple level is a high block
 - > Put the table in a head-up position if hyperbaric solution has been used
 - > Resuscitate: See Table 3: Immediate side effects

BLOOD PRESSURE

Check BP continuously !

- INITIALLY : every 1 -2 minutes until delivery and until BP stable at a normal level.
- THEN : every 3 minutes. More frequently if nauseated, or other problems

[In this case maintain blood pressure control every minute].

Intensive blood pressure monitoring.

The prophylactic use of vasopressors should be systematic.

HYPOTENSION : STANDARD DEFINITION [41]

Hypotension occurs when systolic blood pressure drops more than 20% from its initial level, but in the case of a pregnant woman undergoing spinal anaesthesia, hypotension may be expected, and should be treated following a drop of more than 10%.
[In practice, if a patient has a systolic pressure of 130mmHg before spinal anaesthesia and BP falls to 117mmHg, speed up the drip and give a vasopressor]
 → See below: Table 3: immediate side effects

HYPOVOLEMIA: DEFINITION ADOPTED ACCORDING TO THE SHOCK INDEX [42-43]

Shock Index:
 Heart rate divided by systolic BP
[expressed in mmHg]
0.9 is the threshold value above which the risk of complications rises; it requires immediate action.
The risk of death is significantly increased at 1.4.

IMMEDIATE SIDE EFFECTS [44]

TABLE 3 : Immediate side effects			
Clinical Finding	Observation	Treatment	
1 Hypotension and tachycardia	Common event!	Refilling	Hartmann’s solution (Ringer Lactate) or NaCl 0.9% 500-1000ml
		Vasopressors	1/ Phenylephrine infusion (1st choice) (10mg/ 100ml = 100micrograms/ml) or boluses of 25-50 micrograms/min. <i>[Expensive !]</i>
			2/ Ephedrine (2 nd choice) 5mg bolus <i>[most commonly used]</i>
		(Anticholinergics)	3/ Adrenaline (3 rd choice) 0.1mg iv bolus repeated if necessary <i>[if no other vasopressors available]</i>
Anticholinergics only if bradycardia FOLLOWS IV fluid therapy and vasopressors, and if hypotension persists Atropine: 0.01mg/kg or 0.5mg IV (Check ampoule strength) ⚠ Atropine ampoules are dosed at 0.25mg/ml or 0.5mg/ml or 1mg/ml: check carefully!			

Clinical Entity	Observation	Treatment	
2 Hypotension and bradycardia	Vasovagal reflex	Anticholinergics <i>[symptomatic treatment]</i>	Atropine: 0.01mg/kg or 0.5mg IV (check ampoule strength) ⚠ Atropine ampoules are dosed at 0.25mg/ml or 0.5mg/ml or 1mg/ml: Check carefully!!
		IV therapy	Hartmann's solution (Ringer Lactate) or NaCl 0.9% 500-1000ml
		Vasopressors	1/ Phenylephrine infusion (1st choice) (10mg/ 100ml = 100micrograms/ml) or boluses of 25-50micrograms/min. <i>[Expensive!]</i>
			2/ Ephedrine (2 nd choice) 5mg bolus <i>[most commonly used]</i> 3/ Adrenaline (3 rd choice) 0.1mg iv bolus repeated if necessary <i>[if no other vasopressors available]</i>
3 Refractory Hypotension to anticholinergic or vasopressor therapy	Suspect unrecognised hypovolemia!		High risk situation!! Intensive resuscitation required with treatment of hypovolemic shock.
	Uncompensated blood loss?	IV therapy	Blood transfusion; (colloids) after loading with 2000ml of crystalloids: Hartmann's solution (Ringer Lactate) or NaCl 0.9%
	Maternal cardiac problem?	Treat cause	Inotropes, diuretics
	Preeclampsia with cardiac failure?		Avoid vasopressors before spinal, use reduced doses after spinal
4 High block Low/zero Blood Pressure [45]	Hypotension, bradycardia, loss of sensation & motor function in upper limbs, dyspnoea	Resuscitation	Oxygen, head-up position if hyperbaric spinal, treat hypotension
	Apnoea	Resuscitation	Sedation, mask ventilation, intubation
	Cardiac arrest	Resuscitation	Adrenaline 0.1mg IV, repeat as needed
5 Isolated tachycardia	May be normal at term (increase of 10 -20bpm1) May indicate hypovolaemia before hypotension occurs	IV fluids if HR>100 or increase following spinal	Oxygen Hartmann's solution (Ringer Lactate) or NaCl 0.9% 500-1000ml
6 Nausea & vomiting	Often associated with hypovolaemia and/or hypotension <i>[through hypoxia at vomiting centre and sympathetic/parasympathetic imbalance]</i>	Anticholinergics <i>[symptomatic treatment]</i>	Atropine 0.01mg/kg or 0.5mg IV
		IV therapy	Hartmann's solution (Ringer Lactate) or NaCl 0.9% 500-1000ml
		Vasopressors	1/ Phenylephrine infusion (1st choice) (10mg/ 100ml = 100micrograms/ml) or boluses of 25-50micrograms/min. <i>[Expensive !]</i>
			2/ Ephedrine (2 nd choice) 5mg bolus <i>[most commonly used]</i> 3/ Adrenaline (3 rd choice) 0.1mg IV bolus repeated if necessary <i>[if no other vasopressors available]</i>

1: Beats per minute

I. POST-OPERATIVE MONITORING

Intensive monitoring of vital signs.

Haemodynamic and uterine monitoring in the first hours after delivery.

IMMEDIATE MONITORING

- Return from the operating suite :**
- When the patient is fully awake.
 - When BP AND heart rate are stable.
[In young patients a raised heart rate often compensates for hypovolaemia, initially maintaining BP which does not fall until later.]
 - When vaginal discharge is minimal and the uterus remains well contracted

LATE SIDE EFFECTS

TABLE 4 : Late side-effects	
Effects- Symptoms	Action to be taken / Treatment / Evolution
Urine retention	Catheterisation
Headache <i>[Reduce risk by using 25G needle, pencil point if possible.]</i>	Nurse in supine position <i>[if persistent after 48 hours, consider blood patch if suitably experienced person available, able to perform epidural and inject 20ml of sterile, autologous blood.]</i>
Trauma to nerve root or spinal cord	Specialist neurological consultation.
Hematoma + nerve compression Persistence of paralysis/paresis of the lower limbs immediately after the operation	Treat surgically.
Transient nerve symptoms. [46] Pain in the pelvis, back, legs lasting 1-7 days, no motor deficit, possibly related to the neurotoxicity of local anaesthetics.	15% incidence after 5% lidocaine spinal. Resolves spontaneously.
Cauda equina syndrome - progressive onset over 24hr of a sensory-motor deficit affecting pelvis & lower limbs.	Linked to lidocaine neurotoxicity. Incidence approx. 1:5000. Outcome often poor.
Spinal Sepsis.	Antibiotic as for meningitis.

4 GENERAL ANAESTHESIA

A. SETTING UP AND PATIENT PREPARATION

Procedures common to regional and general anaesthesia

→ See **2** *setup and patient preparation*

B. PATIENT INSTALLATION FOR TRACHEAL INTUBATION

(if appropriate) [47-48]

NO diazepam before delivery

[to avoid neonatal respiratory depression.]

Intubation highly recommended for non-fasting patients, those with uterine rupture, and for any procedure likely to last more than one hour.

Significant risk of difficult intubation in pregnancy, due to increased weight, larger breasts, and soft tissue swelling.

1 Tracheal intubation

Highly Recommended for every general anaesthesia.

A trained person is required to perform the procedure.

- ⚠ **Essential in the event of uterine rupture**
- ⚠ **Functioning sucker essential**
- ⚠ **Intubation may be quite difficult in obese women and women with pre-eclampsia,**
- ⚠ **Changes in a woman's voice suggests the presence of laryngeal oedema, which may make intubation impossible**

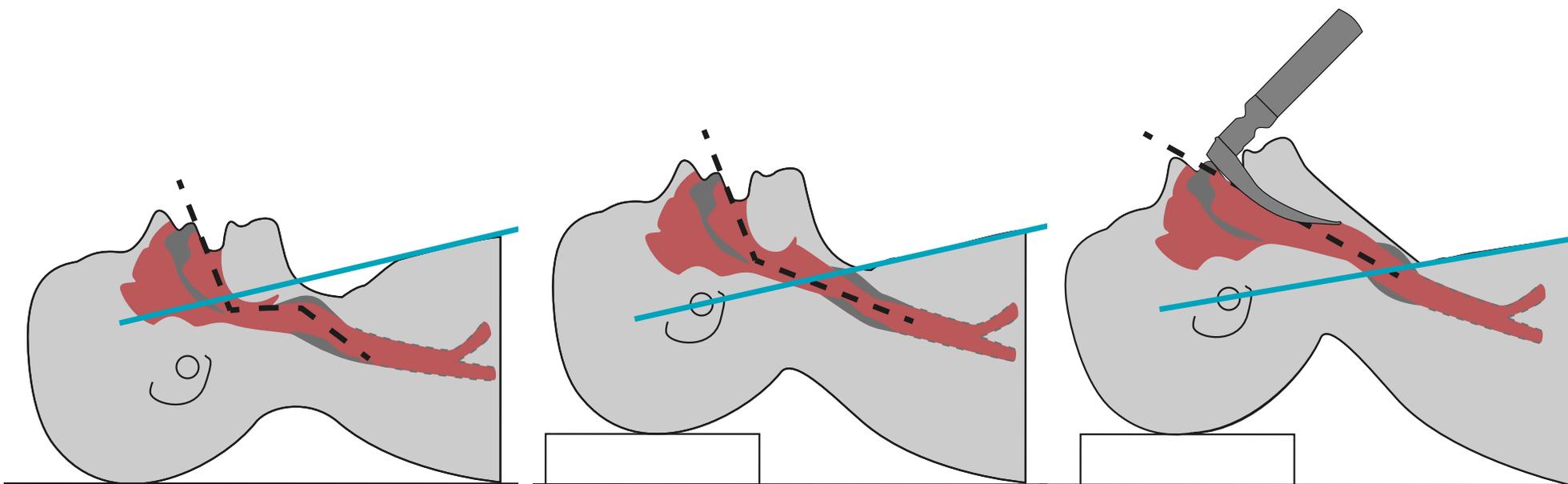
→ Prepare a smaller tube than usually required (e.g. 6.5)

→ Use a bougie if available, have Magill forceps ready

After intubation, check by auscultation that air entry is bilaterally equal. In cases where the tube is too far in, it is usually the right main bronchus that is intubated, and the right lung only expands. Gently withdraw until air entry is equal on both sides.

Initiating, embarking on intubation when you are not familiar with it, may be dangerous and counterproductive (desaturation, oesophageal intubation, wake-up and regurgitation...) and may increase the risk of maternal morbidity and mortality.

→ good positioning of the patient, head raised (sometimes shoulders too) to bring the external auditory meatus on a level with the chest wall, the head in extension gives best visualisation of the vocal cords.



C. ANAESTHESIA

① WITHOUT INTUBATION AND AIRWAY PROTECTION *[Least secure]*

No opioids or diazepam before delivery! Oxygen by face mask for the duration

INDUCTION :

- Ketamine 2mg/kg IV; first bolus over 30-60sec
[Higher dose may affect the baby]

MAINTENANCE :

- Diazepam 5mg IV **AFTER** delivery!

② WITHOUT INTUBATION BUT WITH LARYNGEAL PROTECTION *[Relatively secure]*

→ See ② *setup and patient preparation*

No opioids or diazepam before delivery!

Use a laryngeal mask

[preferably LMA Proseal® with a separate lumen tube for gastric aspiration]

INDUCTION :

- Ketamine 2mg/kg IV; initial bolus over 30-60sec
[higher doses may affect the baby]

MAINTENANCE :

- Further ketamine boluses of 1-2mg IV (approx. 75-100mg) as required, usually about every 10-15 min
- Diazepam 5mg iv **AFTER** delivery!

③ WITH INTUBATION *[most secure]*

No opioids, no diazepam before delivery!

RAPID SEQUENCE INDUCTION :

- Pre-oxygenation
- Cricoid pressure
- either Thiopentone 4-5mg/kg
- or Ketamine 2mg/kg (if the patient is haemodynamically unstable)

INTUBATION :

- Suxamethonium 1.5mg/kg
- Tube size 6,7 or 5mm

MAINTENANCE :

- Ketamine boluses 1-2mg/kg as required, typically every 10-15 min
- Diazepam 5mg IV **AFTER** delivery
- or Inhalational anaesthetic (no more than 1 MAC until delivery)

EXTUBATION :

- When the patient is breathing spontaneously at adequate minute volume, and responds to simple commands (open eyes, squeeze hand).
- Check neuromuscular function if possible.

D. INTRAOPERATIVE MONITORING

→ See H. Intraoperative monitoring.

E. POST-OPERATIVE MONITORING

Intensive monitoring of vital signs.

Haemodynamic and uterine monitoring in the first hours after delivery.

RECOVERY ROOM DISCHARGE TO THE WARD :

- When the patient is fully awake
- When BP AND heart rate are stable
[In young patients, a raised heart rate often compensates for hypovolaemia, initially maintaining BP which only drops later.]
- When vaginal discharge is minimal, and the uterus remains well contracted.

4. SURGICAL PROCEDURE

1 INSTRUMENTS

- A. OBJECTIVE
- B. OBSERVATIONS
- C. CONTENTS OF THE C-SECTION KIT

2 ABDOMINAL WALL OPENING

- A. OBJECTIVE
- B. CHOICE OF INCISION
- C. TECHNIQUE

JOEL COHEN INCISION (MISGAV- LADACH TECHNIQUE)

VERTICAL MIDLINE INCISION

PFANNENSTIEL INCISION

3 UTERINE OPENING

- A. OBJECTIVE
- B. TECHNIQUE

INCISION (WITH POSSIBLE DETACHMENT) OF THE PERITONEUM

UTERINE INCISION (AND AMNIOTOMY)

4 CHILD DELIVERY

- A. OBJECTIVE
- B. TECHNIQUE
- C. COMPLICATIONS

5 PLACENTAL DELIVERY

- A. OBJECTIVE
- B. TECHNIQUE

USUAL CASE

COMPLICATIONS

6 UTERINE CLOSURE

- A. OBJECTIVE
- B. TECHNIQUE

USUAL CASE

COMPLICATIONS

7 WALL CLOSURE

- A. TECHNIQUE

AFTER PFANNENSTIEL INCISION OR AFTER JOEL-COHEN INCISION

AFTER MIDLINE VERTICAL INCISION

8 OPERATING PROCEDURE REPORT

1 INSTRUMENTS

A. OBJECTIVE

To have the appropriate and sufficient number of instruments to perform the Caesarean section procedure correctly, regardless of whether it is complicated or not.

[Avoid having too many instruments in the C-section kit as this hinders the progress of the procedure]

B. OBSERVATIONS

- Each operator or institution will have their own preferences regarding the choice of instruments.
- The following list does not propose a specific instrument (some exceptions are however mentioned), but a reference chosen within a «class of instruments», which are either systematically used or essential in the event of complications.
- In order to reduce the number of instruments, the choice has been made to use curved forceps, clamps or scissors rather than straight ones. Curved instruments can be used to do (almost) everything that straight instruments can do, whereas the reverse is not true.

C. CONTENTS OF THE C-SECTION KIT

NAME	QUANTITY
Instrument kit: height 12cm width 20cm length 50cm <i>[Avoid a too small box]</i>	1
Safety pin 13.5cm	2
KOCHER Artery Forceps, toothed, curved 14cm	14
Swab forceps or sponge-holding forceps, curved handle (Cheron or Maier or Museux), straight 25cm <i>[1 for vaginal disinfection, 1 for surgical drape disinfection]</i>	2
Scalpel handle #4	1
BACKHAUS Towel Clamp 13cm	6
Flexible polyethylene suction hose (over 2 meters long)	1
POOLE suction cannula straight 22cm Ø10mm (30Fr) <i>[Amniotic fluid will often be aspirated directly with the flexible suction tube (without the cannula), especially if it is meconium]</i>	1
Tissue dissecting forceps, with 2x3 teeth 16cm <i>[Only for strong tissue like abdominal wall aponeurosis]</i>	2
MAYO-HEGAR Needle Holder, heavy pattern 20.5cm <i>[intended for N°1 suture and finer]</i>	1
MAYO-HEGAR Needle Holder 17cm <i>[intended for N°1 suture and finer]</i>	1
HALSTED-MOSQUITO Artery Forceps, curved 12cm	4
KELLY Artery Forceps, curved 16cm	4
FAURE Artery Forceps, curved 22cm <i>[Uterine tears, uncontrollable bleeding]</i>	4
BENGOLEA Artery Forceps, curved 24cm <i>[Fine and precise ligation of the ruptured uterine pedicle]</i>	4
MAYO Dissecting scissors Blunt/Blunt, curved blades 17cm	1
METZENBAUM Dissecting scissors, Curved 18cm	1
FOERSTER or LOVELACE or WILLIAM non-triangular forceps, straight 18cm <i>[For grasping uterus and haemostasis of the hysterotomy edges. Do not use the triangular forceps shape: it hinders sliding of the stich during uterine suture]</i>	4
DEBAKEY vascular forceps 3.5mm jaw 16cm length atraumatic dissecting, 20cm <i>[Expensive but very useful for a solid and atraumatic grip on the uterus, bladder, intestine...] [Toothed forceps are traumatic, non-toothed forceps... slide and traumatize.]</i>	2
SEBRECHTS-KIRSCHNER RETRACTOR: 250 X 250MM FOLDING SQUARE FRAME AND 4 BLADES. <i>[This retractor gives excellent exposure if a wider approach is required, or patient is poorly released. Given its size and infrequent use, it is better to keep it in a separate box or to wrap it in sterile cloth (double layer)]</i>	1
GOSSET retractor: alternative to the SEBRECHTS-KIRSCHNER retractor. 3 blades: 1 mobilizable median and 2 lateral, 160mm maximum distance between lateral valves <i>[Cheaper than the Sebrecths-Kirschner retractor and above all less cumbersome, it is usually found in most caesarean section kits. However, it gives less exposure than the SEBRECHTS-KIRSCHNER Retractor]</i>	1
DOYEN or RICARD mobile retractor 48mm depth x 135mm width X 300mm length (If possible, matte). The most common! Especially in the Misgav-Ladach's intervention. <i>[A width of 135mm provides good exposure of the uterine isthmus]</i>	1

2 ABDOMINAL WALL OPENING

- A. OBJECTIVE
- B. CHOICE OF INCISION
- C. TECHNIQUE

JOEL COHEN INCISION (MISGAV- LADACH TECHNIQUE)

VERTICAL MIDLINE INCISION

PFANNENSTIEL INCISION

A. OBJECTIVE

To access the lower segment of the uterus :

- Giving adequate exposure at the hysterotomy site
- Causing minimal tissue damage

The Misgav-Ladach technique based on the Joel-Cohen incision as become the gold standard. [49-56]

The Joel Cohen incision has fewer complications than other incisions.

B. CHOICE OF INCISION

The Misgav Ladach technique based on the Joel Cohen transverse incision	
Indications	<ul style="list-style-type: none"> • C-section with no anticipated complications • No history of previous laparotomy (whether performed for caesarean section or not)
Advantages	<ul style="list-style-type: none"> • More anatomical (tissue friendly) • Stronger wall repair • More aesthetic appeal • Less infection to wound, • less postoperative pain <p><i>[This technique separates tissue instead of cutting it]</i></p> <p>} than the vertical midline incision</p>
Disadvantages	<ul style="list-style-type: none"> • Operating field not as well exposed as with a vertical midline incision. Difficult to extend if required
Contraindications	<ul style="list-style-type: none"> • History of lower abdominal incision; Pfannenstiel; lower abdominal scars

Vertical midline incision	
Indications	<ul style="list-style-type: none"> • History of vertical midline incision • Possible complications during surgical intervention (uterine rupture, infection)
Advantages	<ul style="list-style-type: none"> • Better exposure and possibility of enlargement of surgical field if complications arise
Disadvantages	<ul style="list-style-type: none"> • Weaker wall repair (risk of incisional hernia) • Less cosmetically appealing • More infections to wound • More postoperative pain <p>} than the Misgav-Ladach technique</p>
Relative contraindication	<ul style="list-style-type: none"> • History of previous Pfannenstiel incision [To avoid the «inverted T-scar”]

Pfannenstiel Incision	
Indications	<ul style="list-style-type: none"> • Trained in Pfannenstiel technique <u>and</u> • Presence of an old transverse incision <u>and</u> • C-section with no potential complications
Advantages	<ul style="list-style-type: none"> • Greater wall repair than vertical midline incision • More cosmetically appealing than vertical midline incision
Disadvantages	<ul style="list-style-type: none"> • Longer surgery time • Limited exposure • Requires in-depth knowledge of anatomical planes • More frequent wall hematomas <p>} compared to Joel Cohen incision or Vertical midline incision</p>
Relative contraindication	<ul style="list-style-type: none"> • Extreme urgency • Complicated procedure (transverse presentation, uterine rupture, fibromatous uterus, twins pregnancy, macrosomia...)

C. TECHNIQUE

JOEL-COHEN INCISION (MISGAV-LADACH TECHNIQUE) [57]

1

- Brush and wash hands thoroughly.
- Put on apron, then surgical gown and gloves.
- Disinfect the surgical field thoroughly and twice with iodized alcohol or 10% povidone iodine.
[from the sub mammary line to the thighs.]
- Drape the operating field.

2

- The right-handed surgeon stands to the right of the patient
- The left-handed surgeon stands to the left of the patient.
- Check that the scalytic lamp is well orientated towards the future incision site
- Check that suction is working
[The technique using electric diathermy will not be presented here, because it is rarely available in limited resource conditions.]

1

With a scalpel, make a horizontal incision in the skin and fascia superficialis of at least 12 to 15cm, 4cm above the pubis, along the line between the two anterior superior iliac spines.
[Allows easy delivery of child's head.]

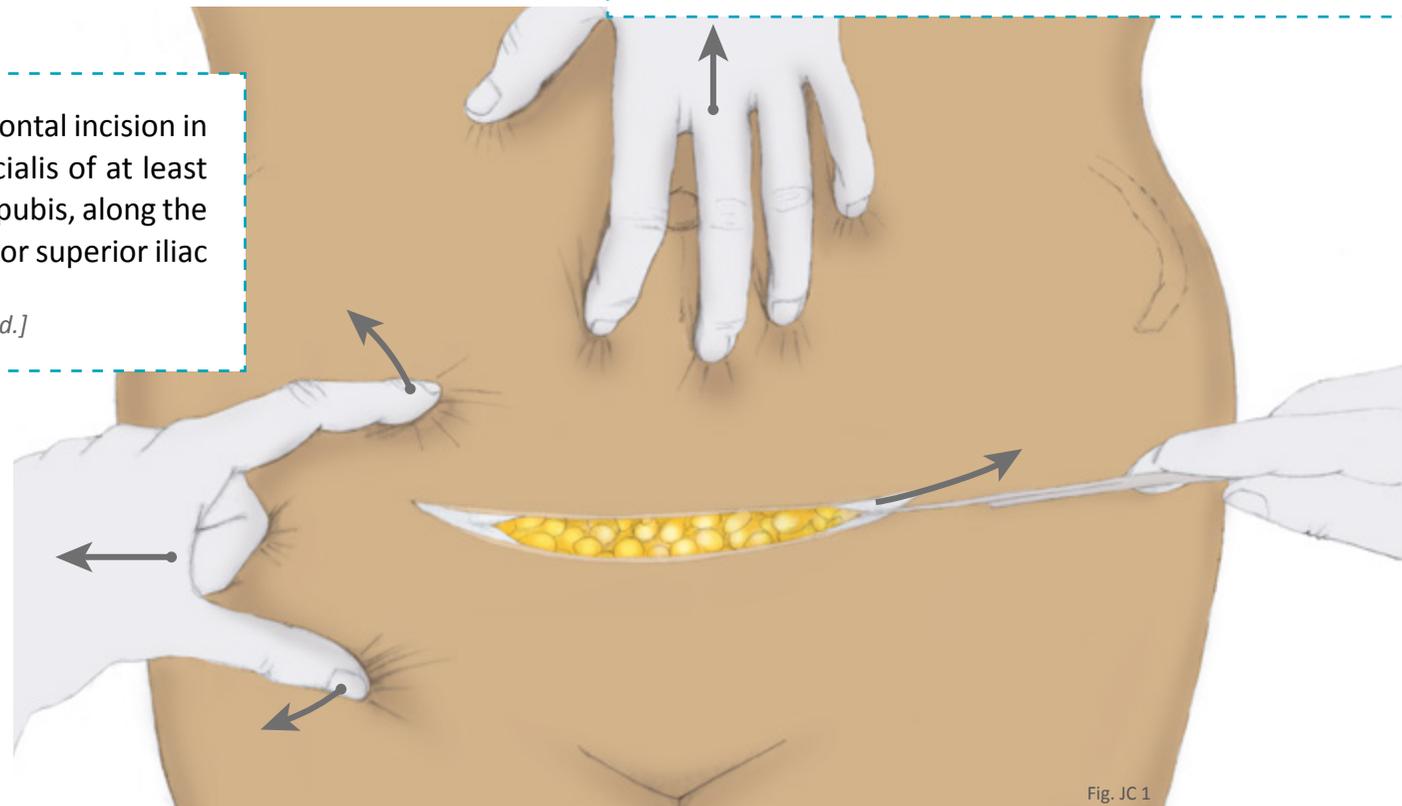


Fig. JC 1

2

At the medial of the incision, make a 4cm horizontal incision only into the subcutaneous tissue down to the anterior wall of the rectus sheath. The assistant retracts the upper edge of the wound with a Farabeuf or hook retractor.

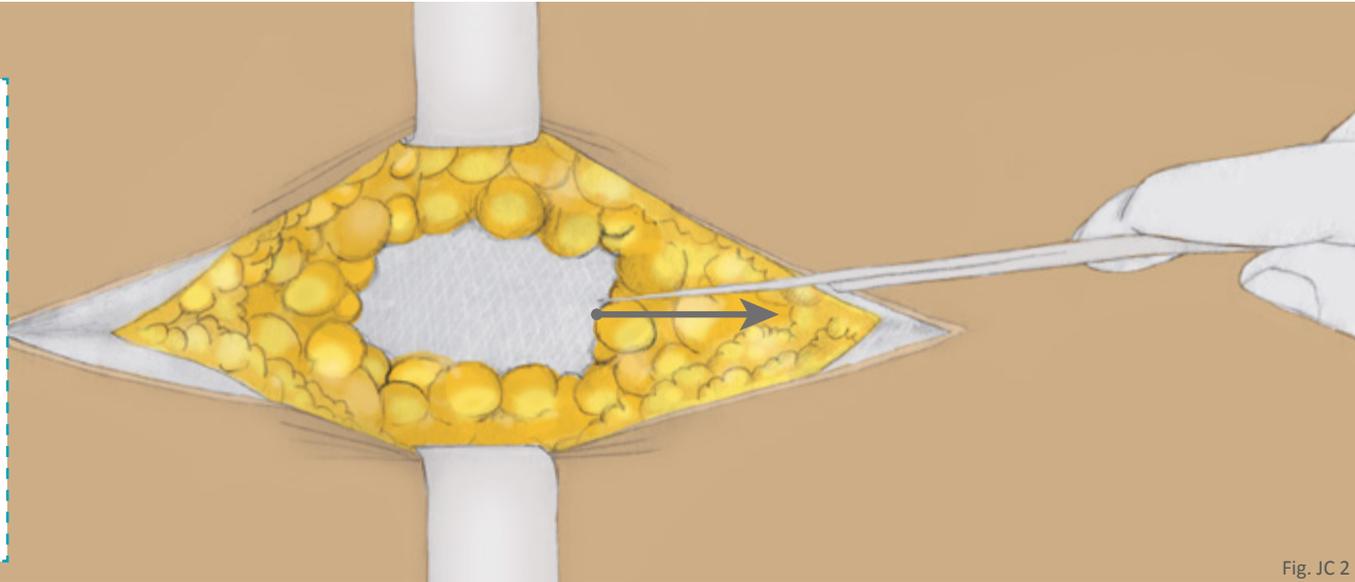
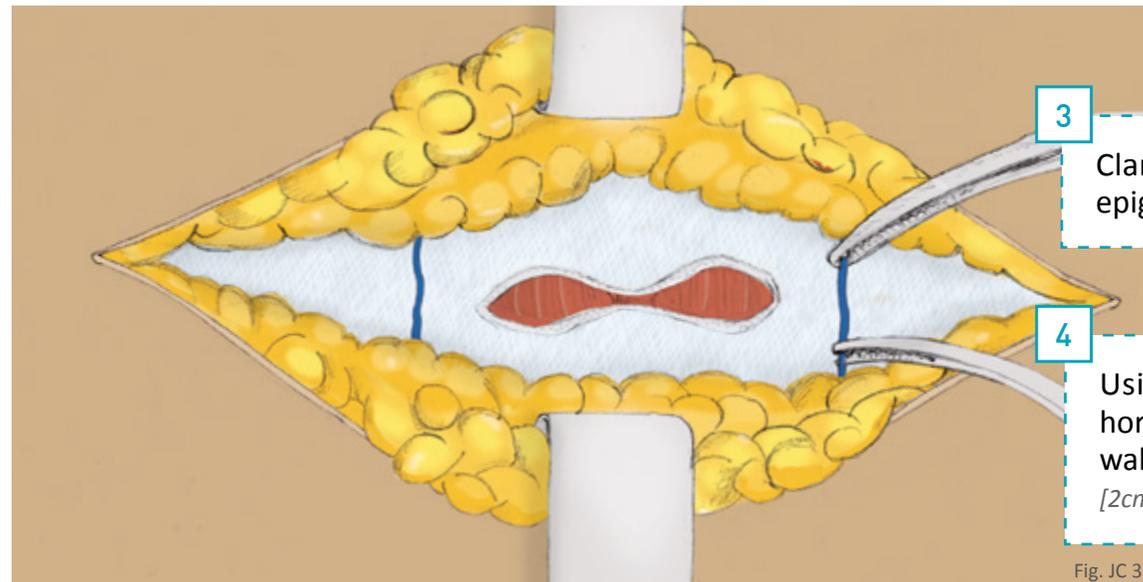


Fig. JC 2



3

Clamp and cut the 2 superficial epigastric veins.

4

Using a scalpel make a 4cm horizontal incision on the anterior wall of the rectus sheath.
[2cm on each side]

Fig. JC 3

5

Use a semi-opened scissors to expand laterally **under** the anterior sheath of the rectus abdominis muscle to 3-4cm on each side of the median line.

[6-8cm overall]

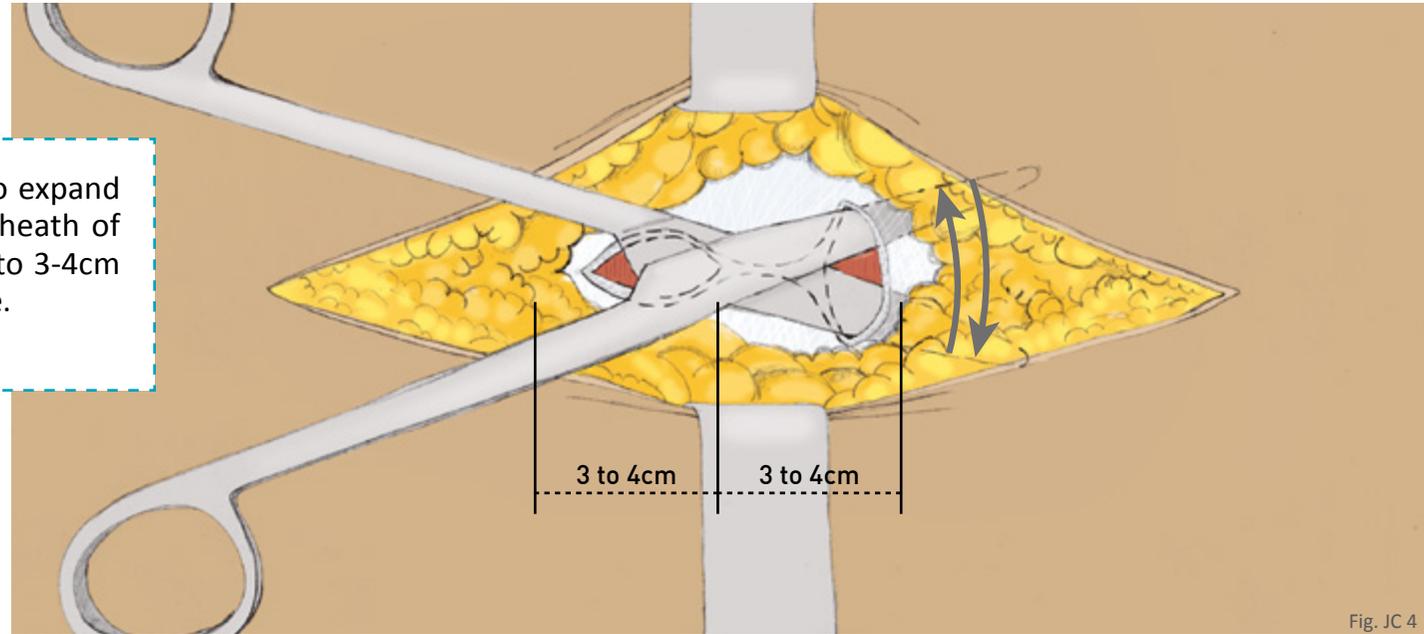


Fig. JC 4

6

Stretch the aponeurotic incision bilaterally with 4 X 1 finger (4 hands).

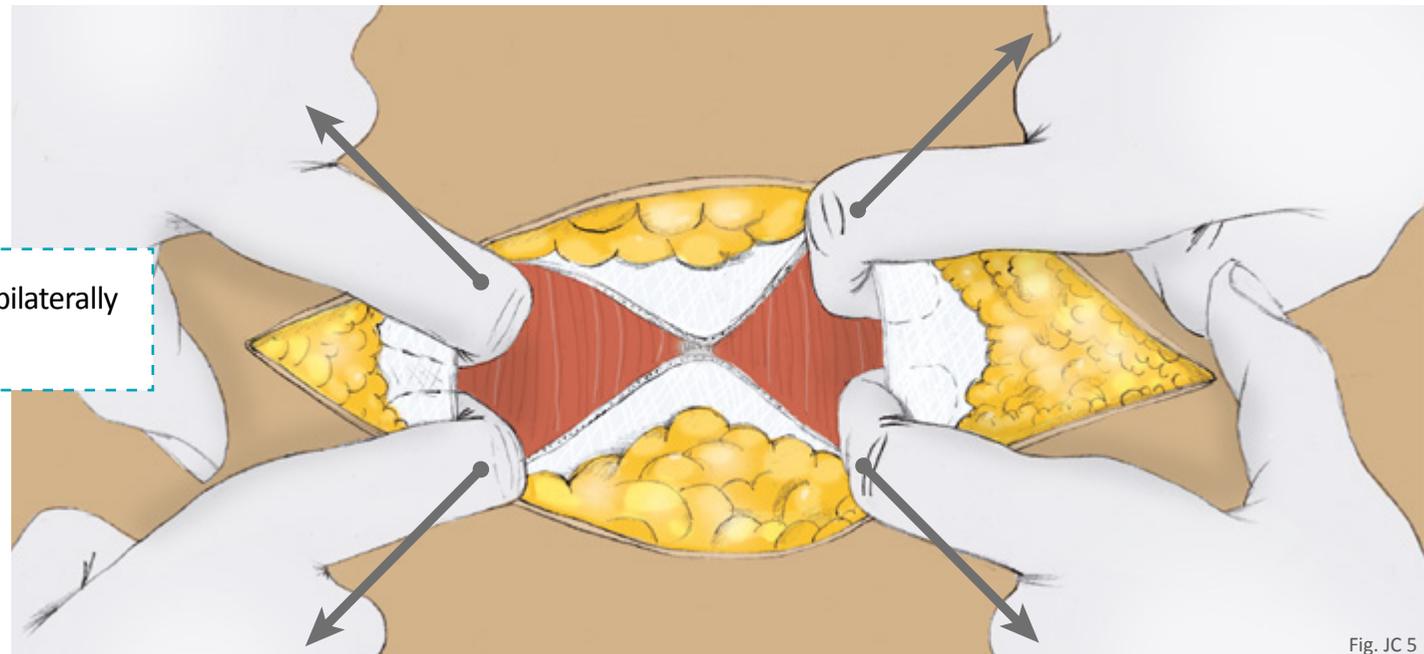


Fig. JC 5

7

Create a curved opening (expanding) pull upwards and laterally using 4 X 1 fingers....

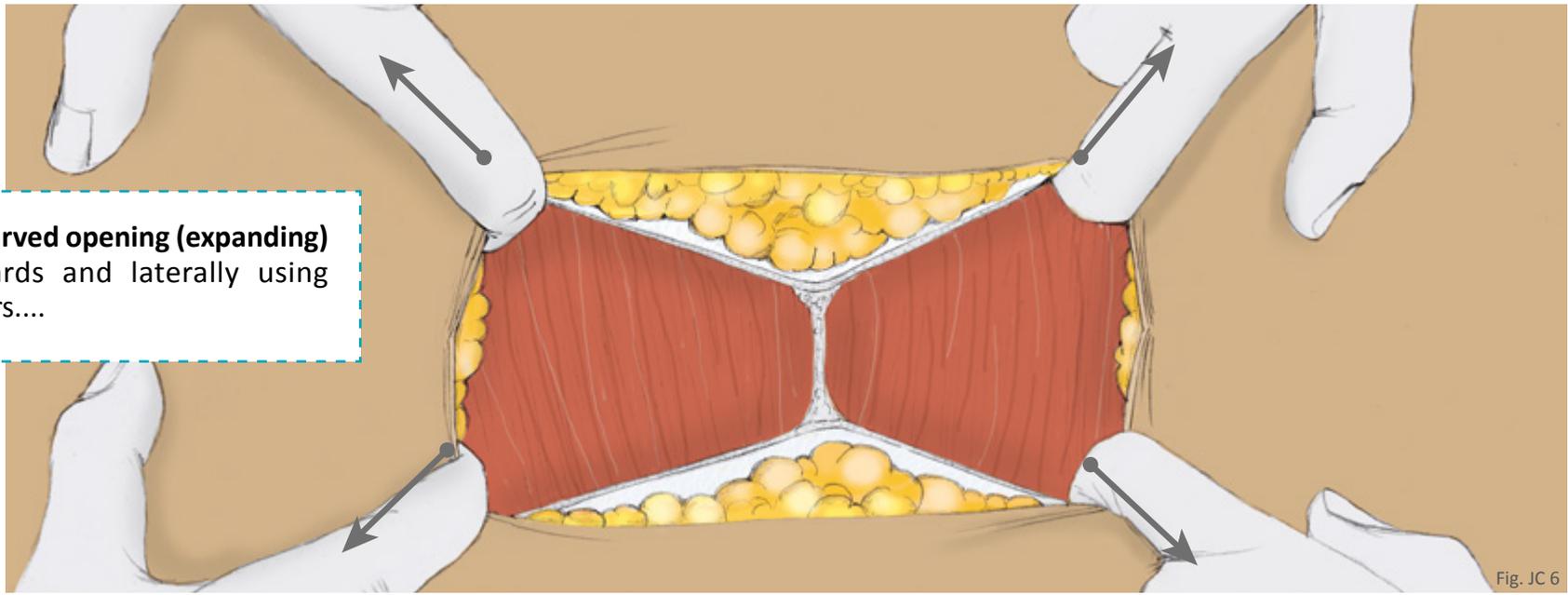


Fig. JC 6

8

... then pull upwards and laterally using 4 X 2 fingers (4 hands).

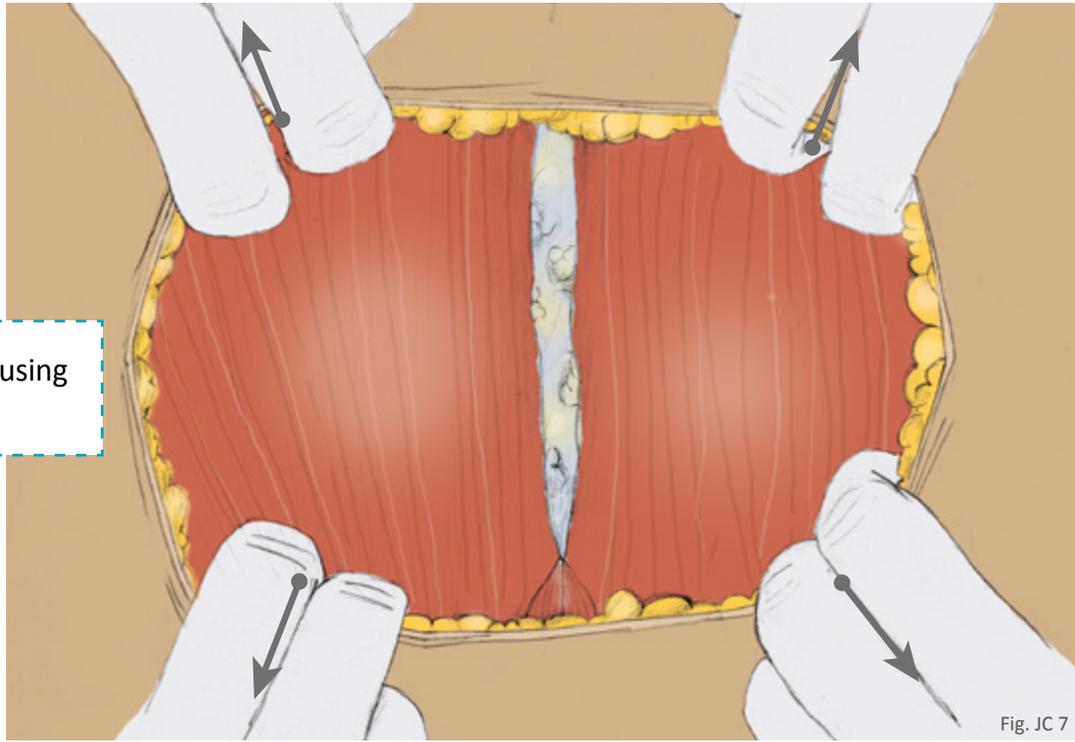


Fig. JC 7

9

Open the peritoneum at the upper part of the wound midline with your fingers (better than scissors)

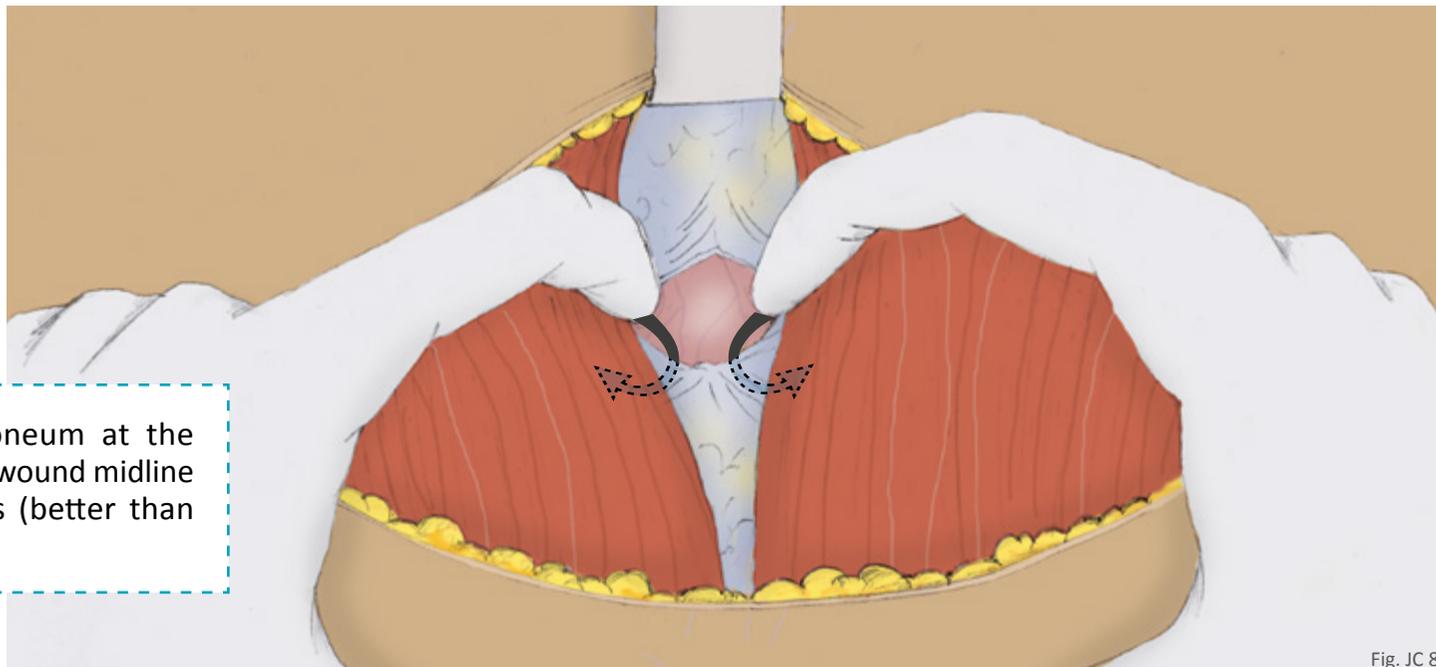


Fig. JC 8

10

Increase the size of the orifice, pulling upwards and laterally with 4 X 2 fingers (4 hands) grasping the entire wall thickness.

[Some force is required.]

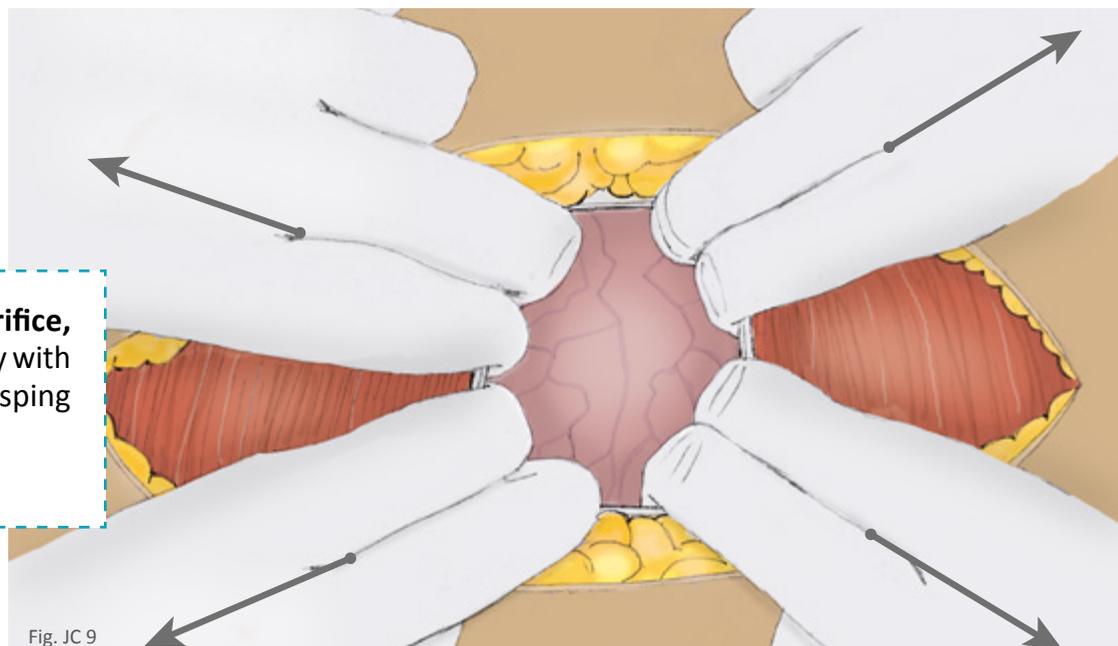


Fig. JC 9

11

Check that the enlarged orifice is wide enough to allow the head of the foetus to pass through.

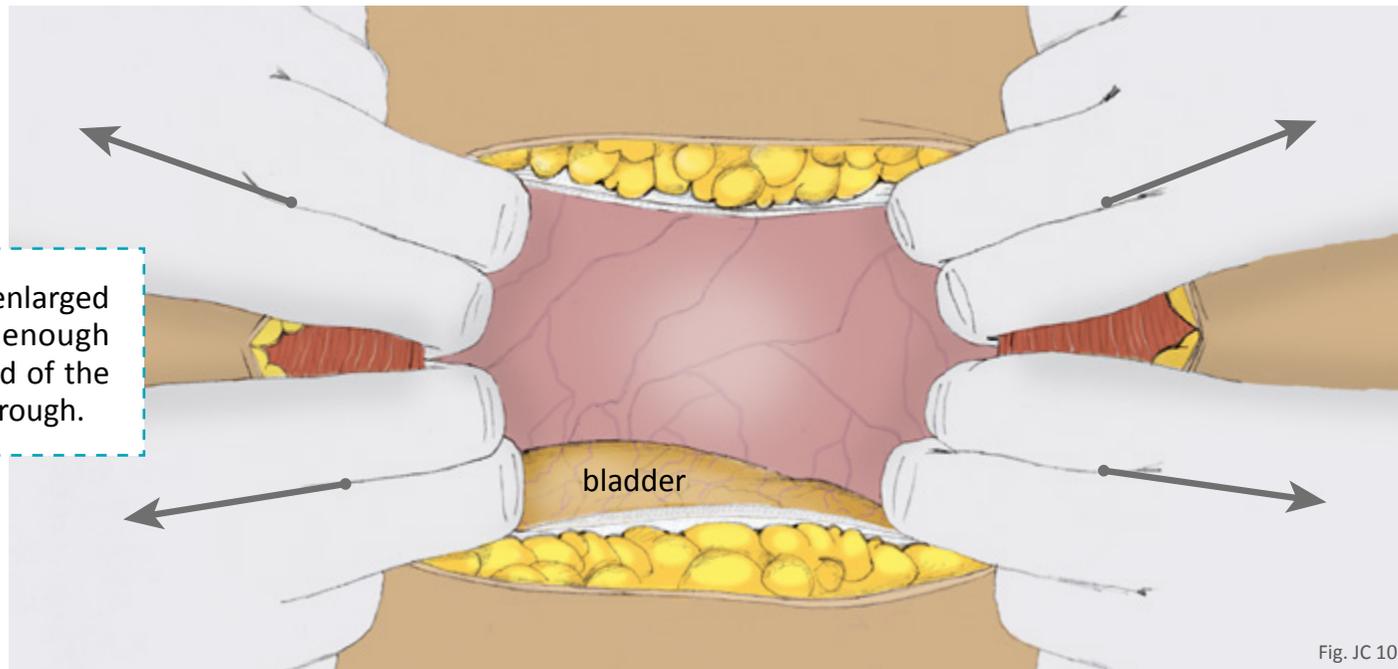


Fig. JC 10

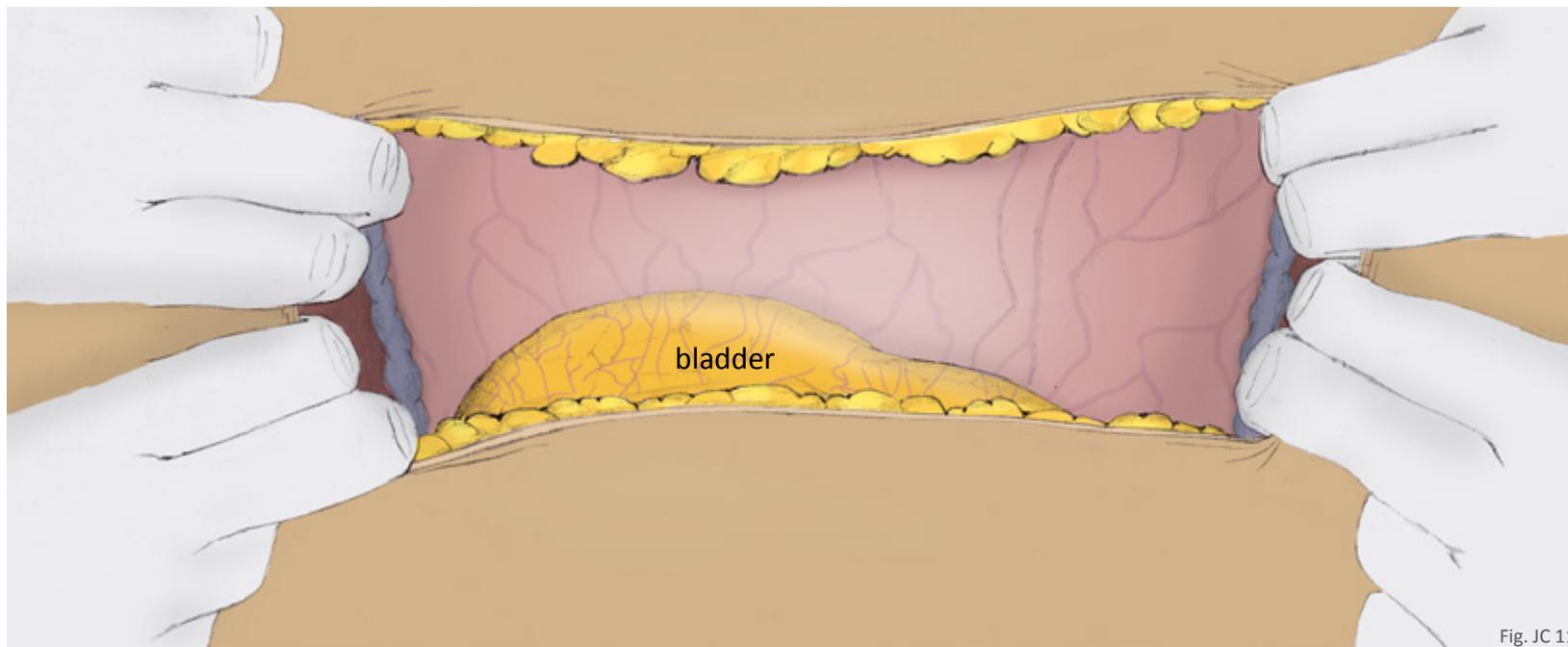


Fig. JC 11

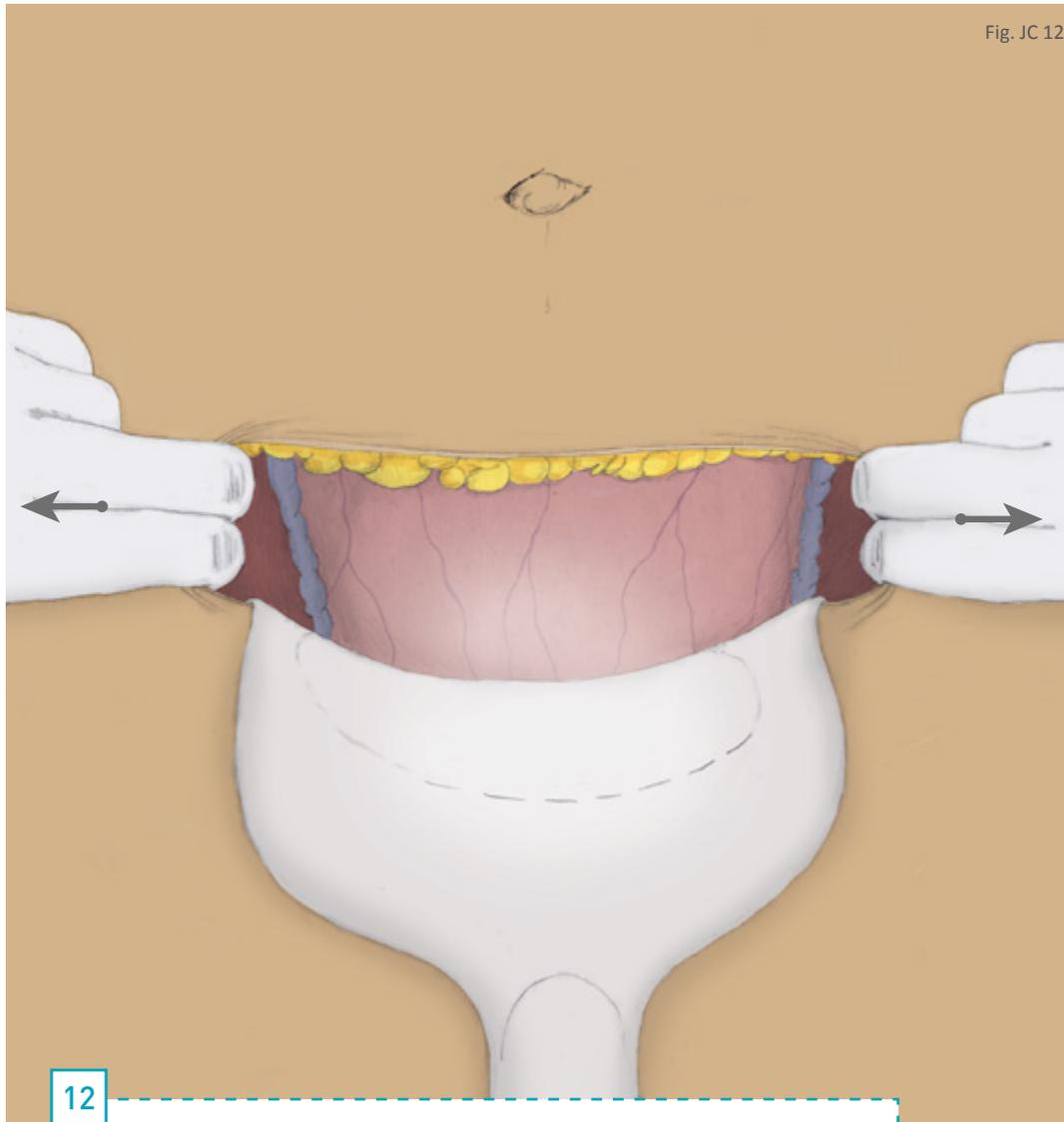


Fig. JC 12

12

Install the mobile retractor
[if possible: matte and 14cm wide].

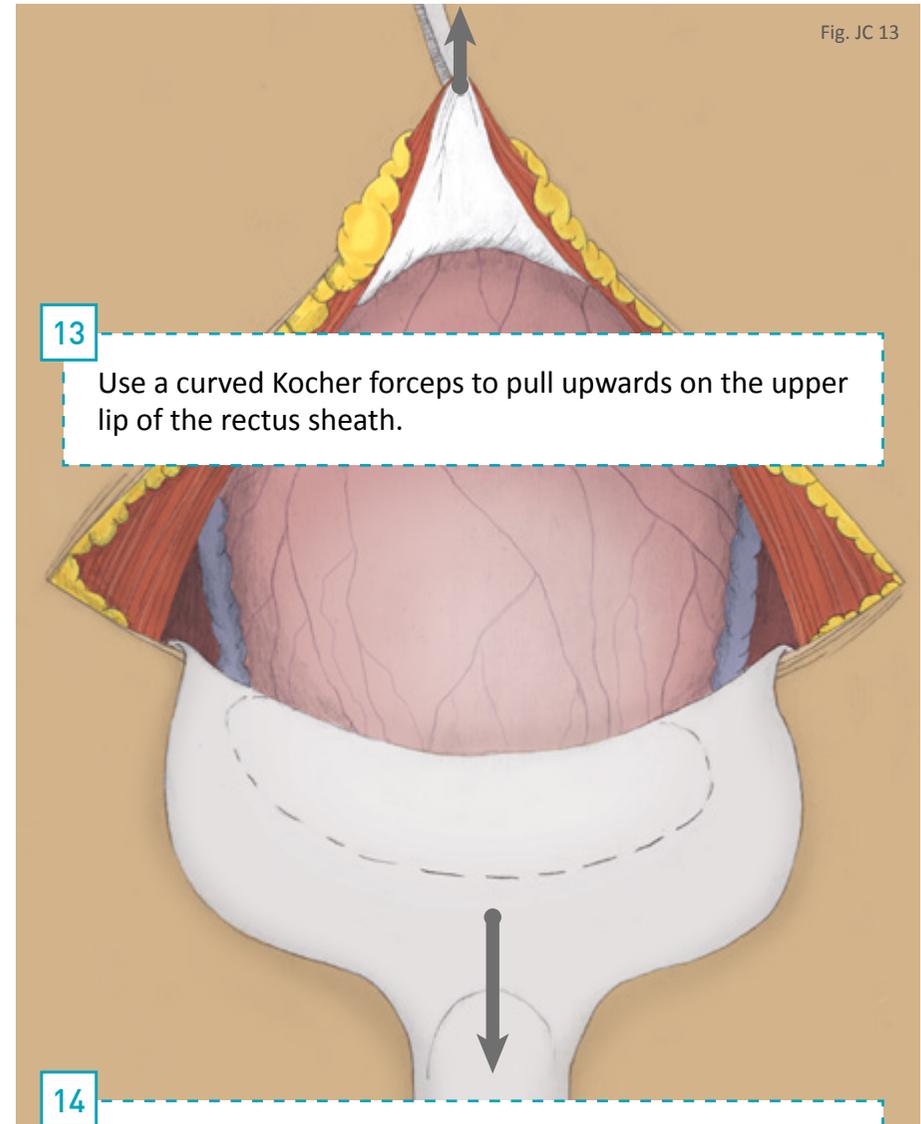


Fig. JC 13

13

Use a curved Kocher forceps to pull upwards on the upper lip of the rectus sheath.

14

Identify the bladder and uterine vascular pedicles
[to fix the level of the incision of the visceral peritoneum].

In the Misgav-Ladach technique, abdominal compresses are NOT placed on either side of the uterus before uterin incision

VERTICAL MIDLINE INCISION

1

Surgeon on the right handside :

Vertical midline incision starting 15cm above the pubis, extending towards the pubis, over a length of about 12cm

[stopping 3cm above the pubis].
Incise the subcutaneous tissue until the linea alba (whitish tissue) is reached.

Surgeon on the left handside :

Incise the midline from 3cm above the pubis over a length of about 12cm towards the umbilicus.

[Given the laxity of the abdominal wall during pregnancy, the size of this incision should be large enough for delivery of the child.]

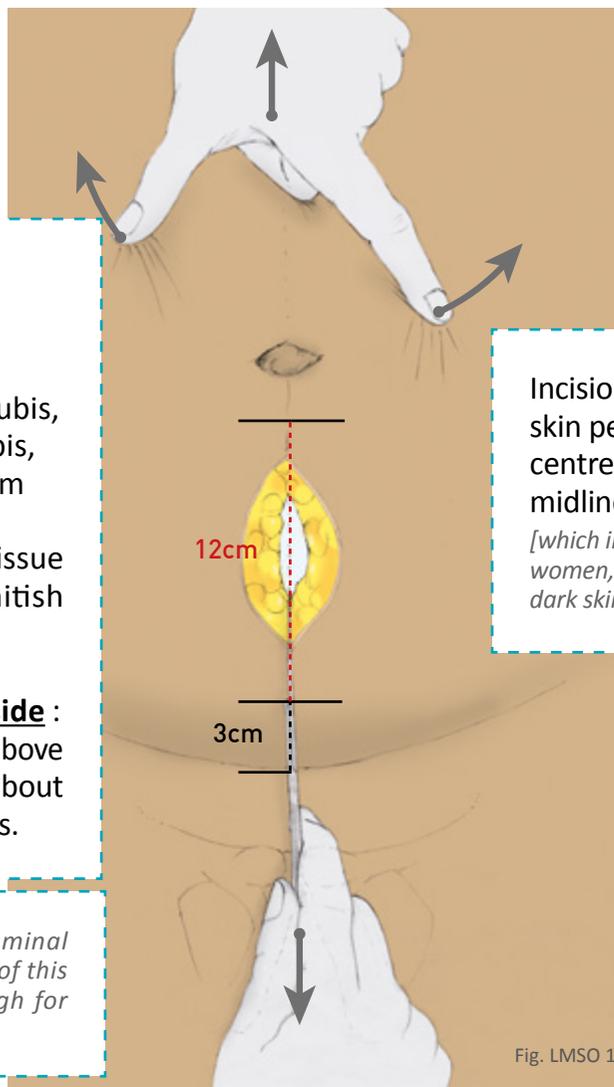


Fig. LMSO 1

Incision of the skin perfectly centred on the midline

[which in pregnant women, looks like a dark skin line].

2

Push back the subcutaneous fat with two compresses, or with two Farabeuf retractors.

Make a small (4cm) vertical incision in the linea alba in the medial part of the wound.

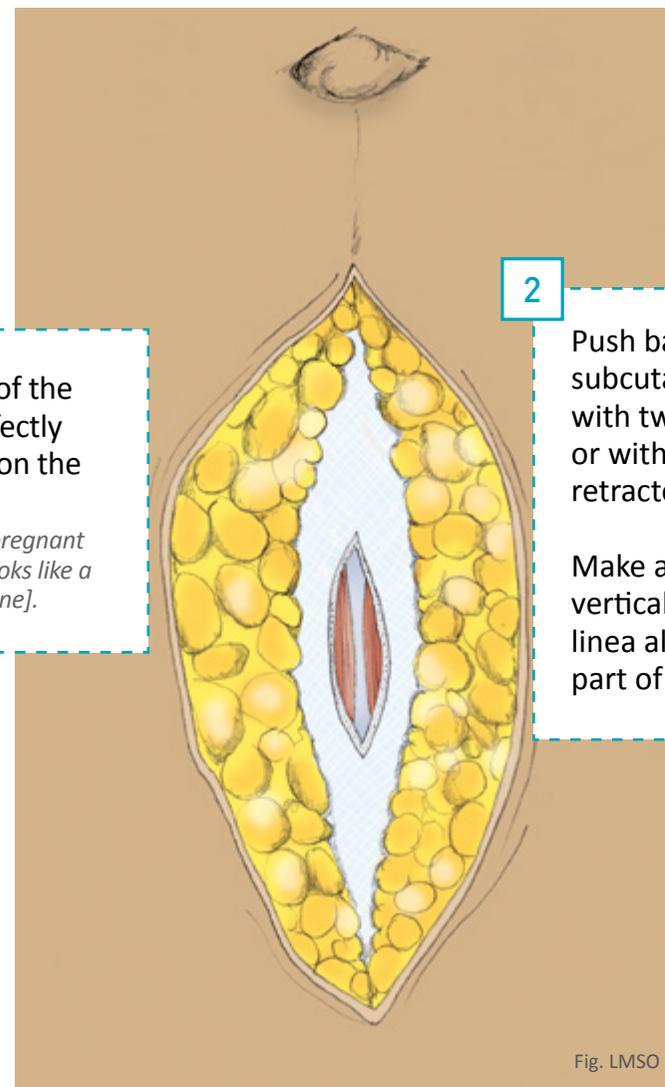


Fig. LMSO 2

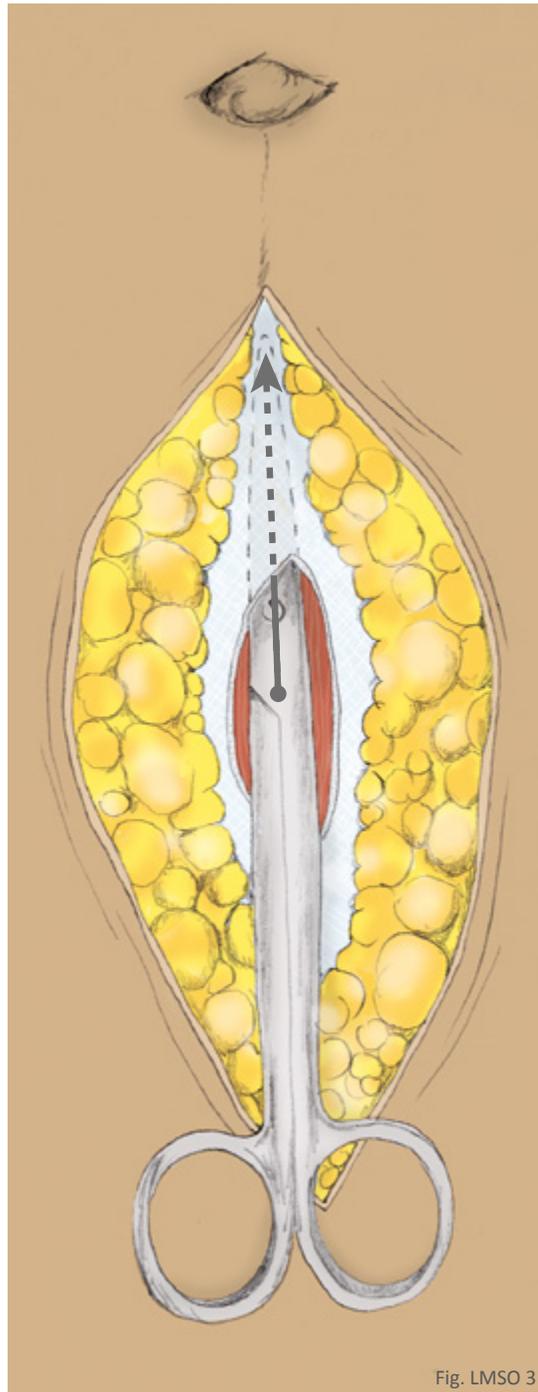


Fig. LMSO 3

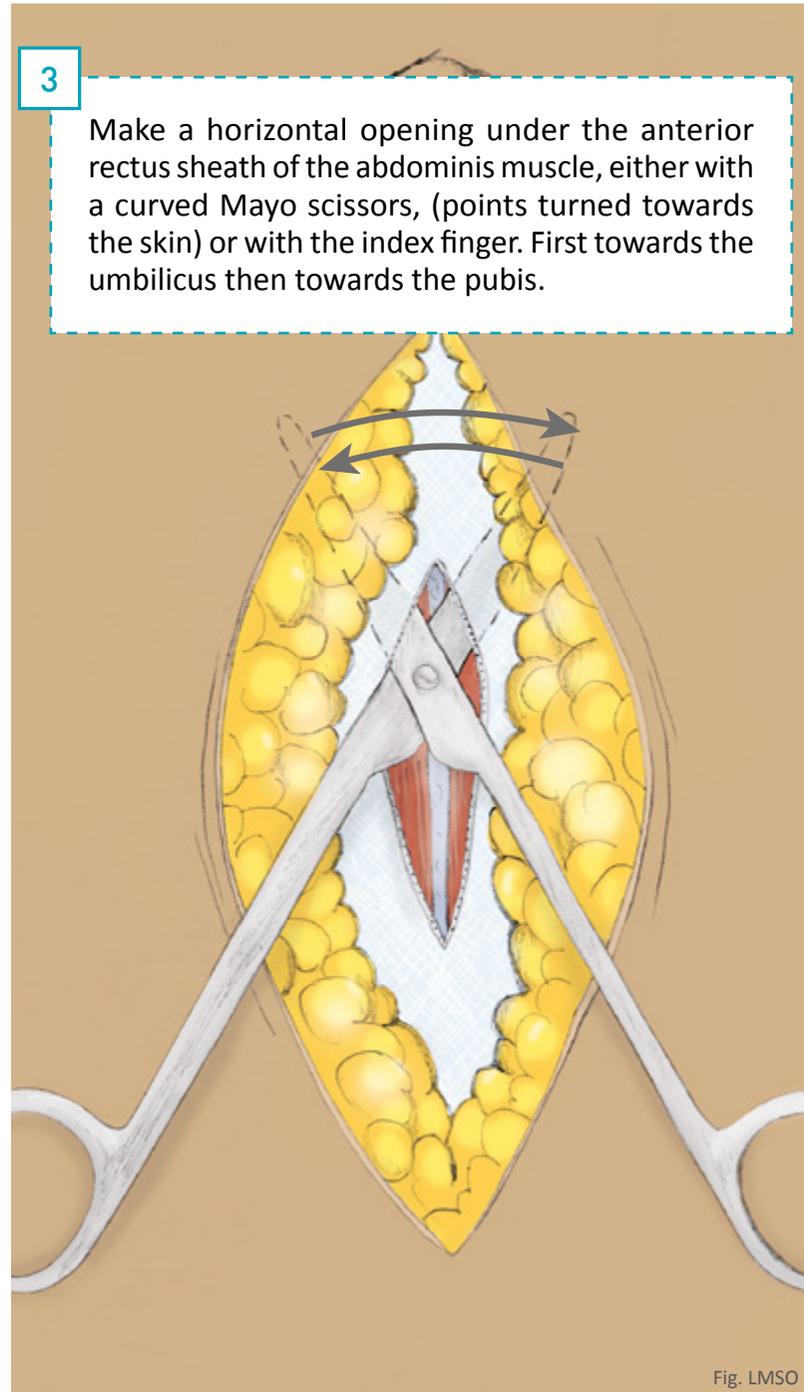


Fig. LMSO 4

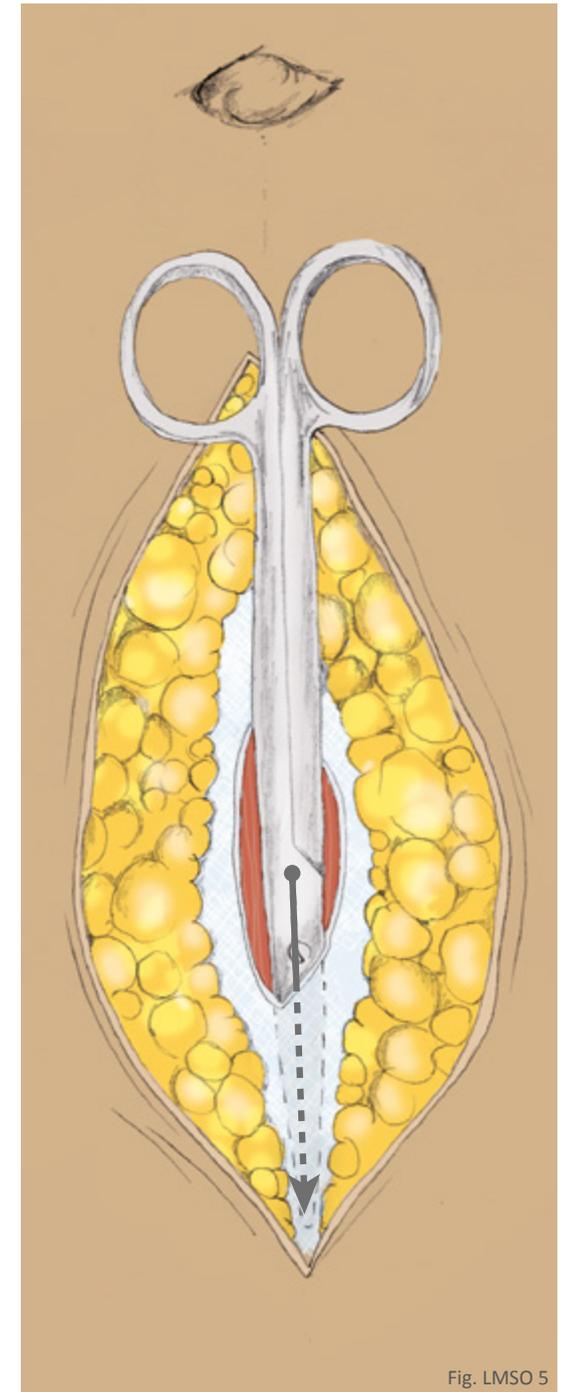


Fig. LMSO 5

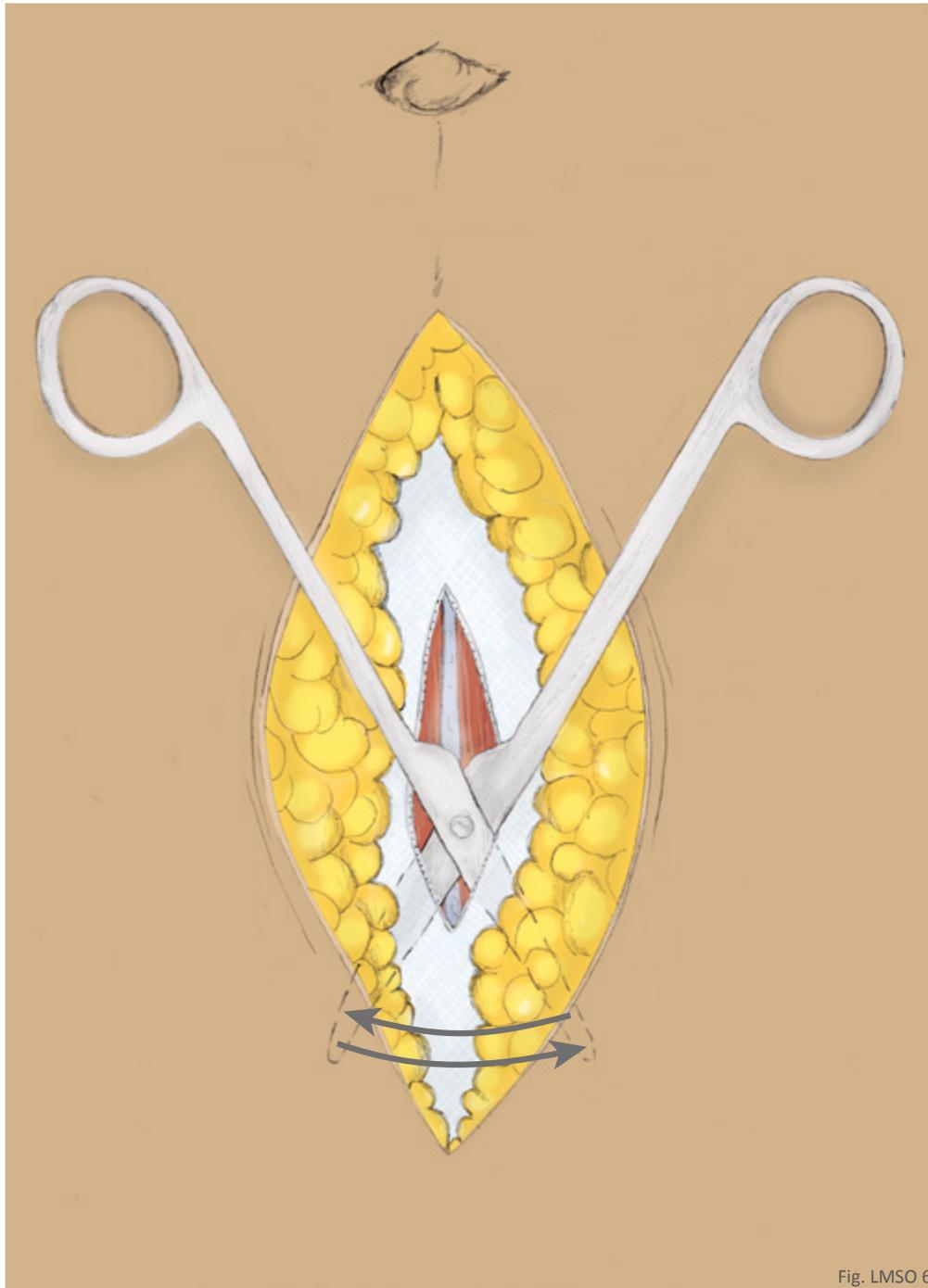
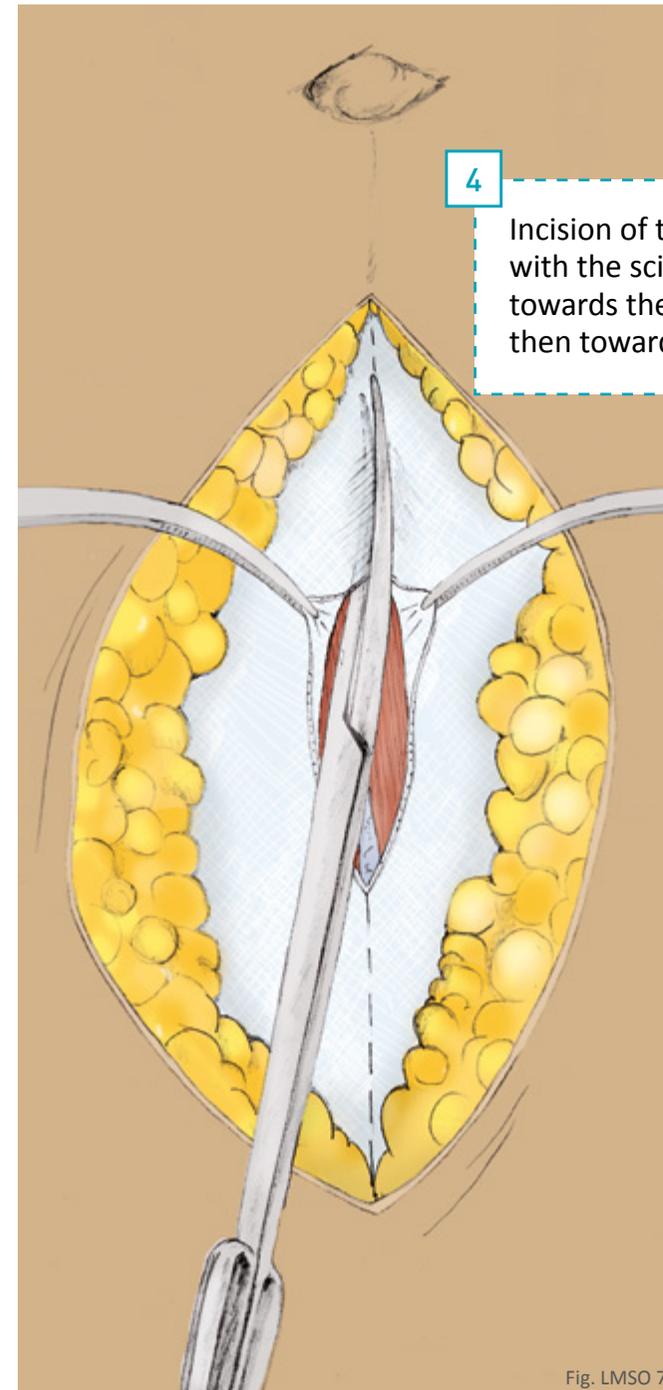


Fig. LMSO 6

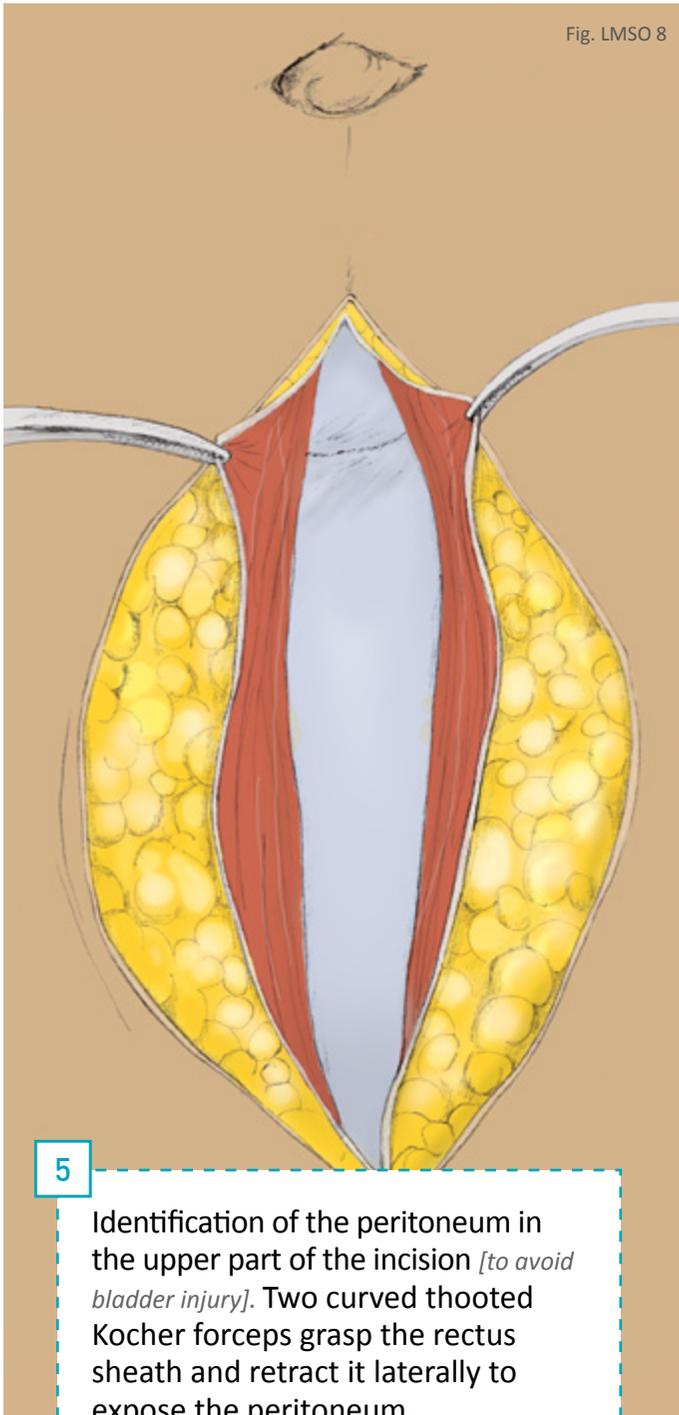


4

Incision of the aponeurosis with the scissors: first towards the umbilicus, then towards the pubis.

Fig. LMSO 7

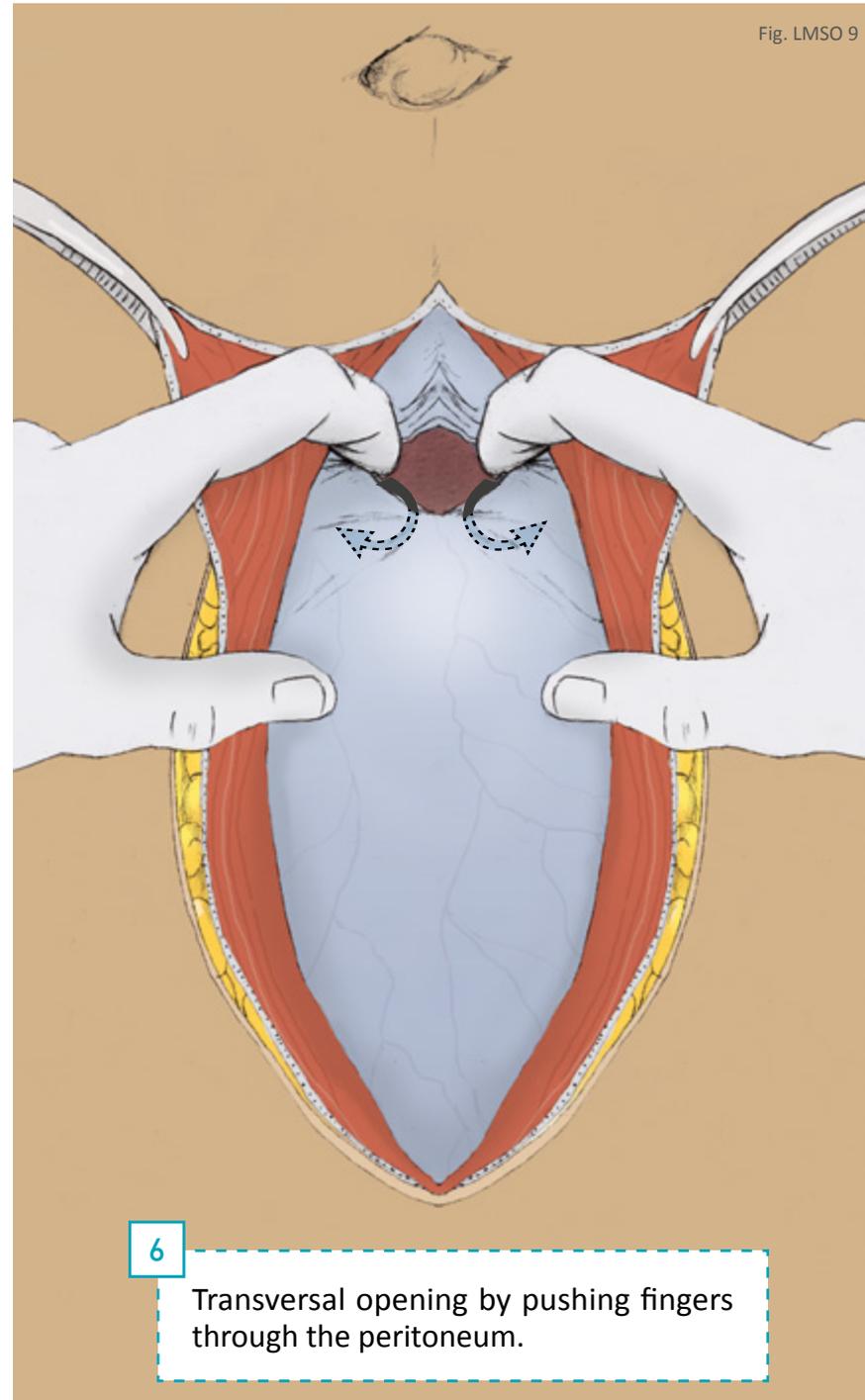
Fig. LMSO 8



5

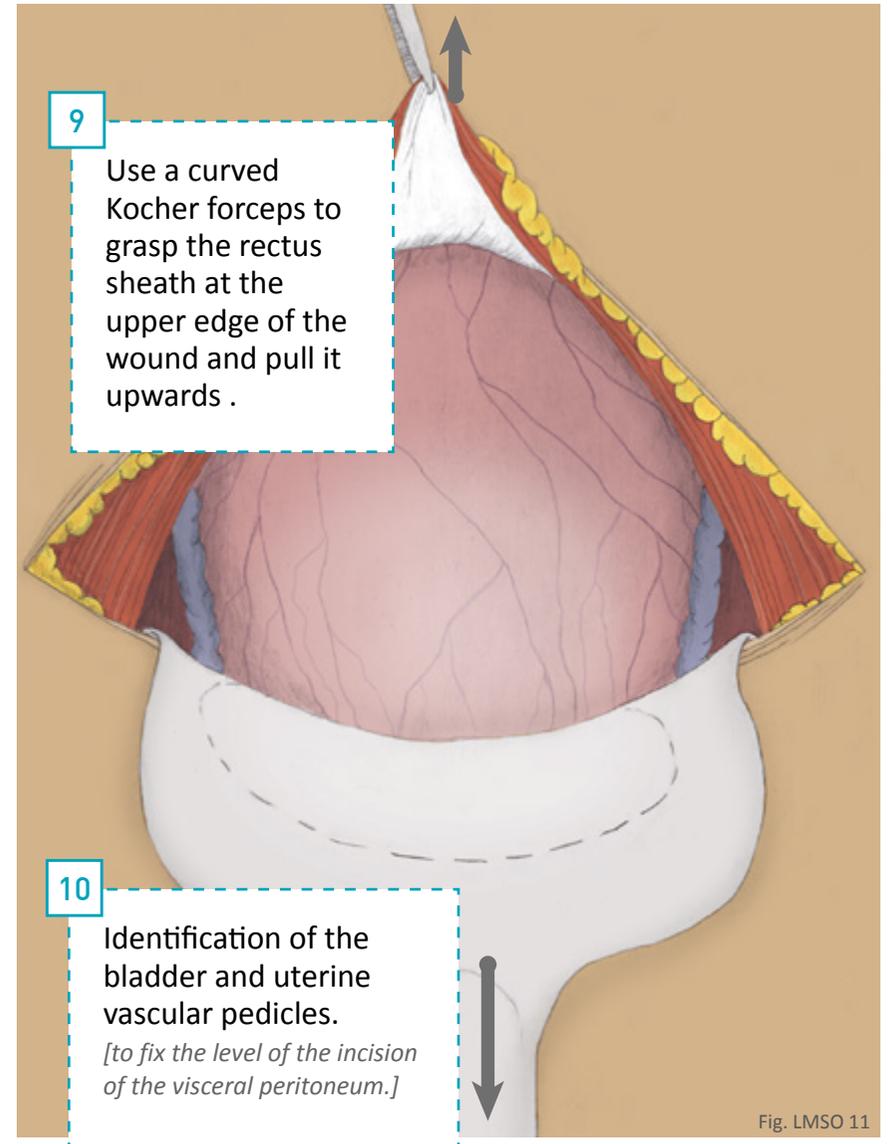
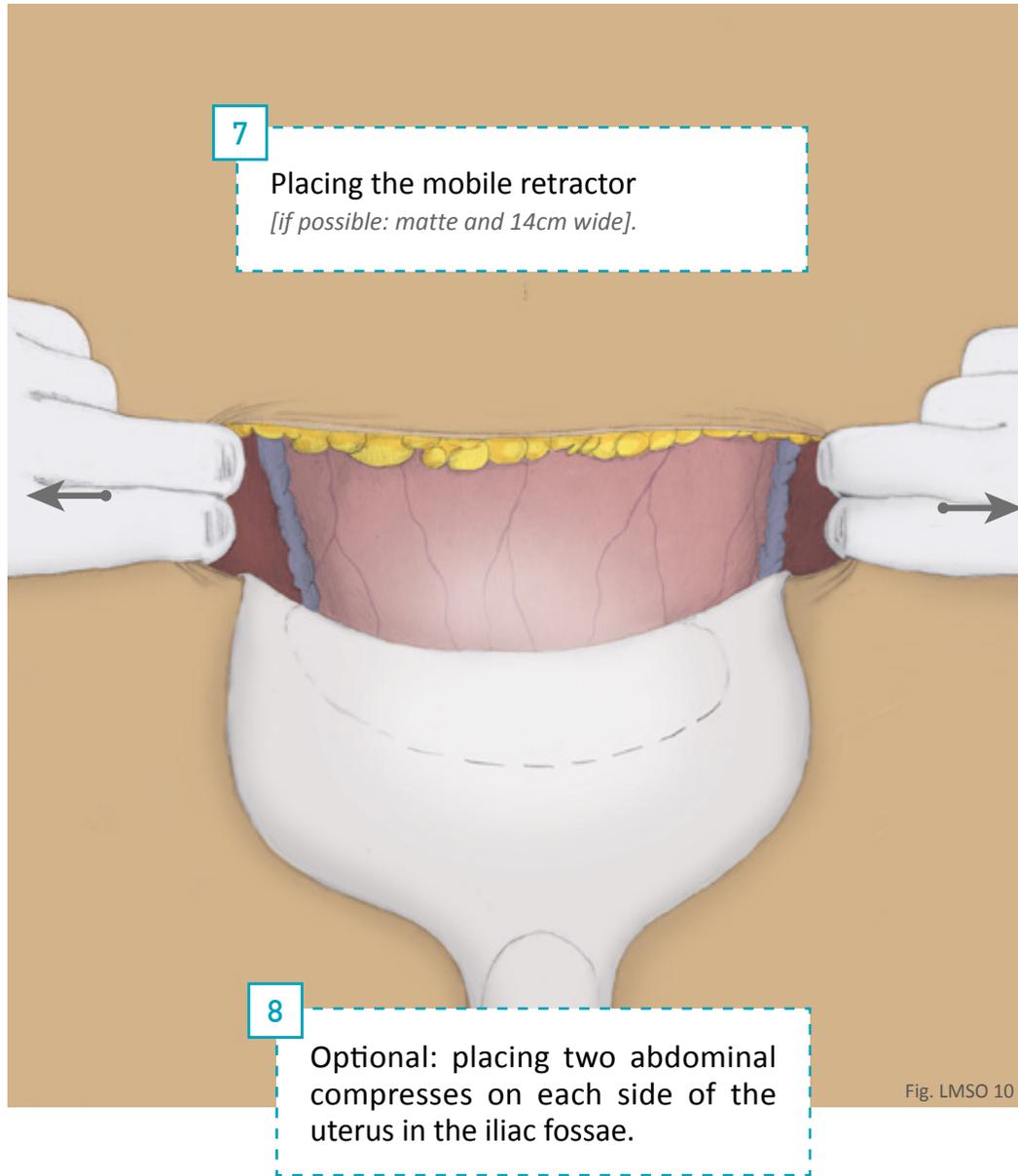
Identification of the peritoneum in the upper part of the incision [to avoid bladder injury]. Two curved thooted Kocher forceps grasp the rectus sheath and retract it laterally to expose the peritoneum.

Fig. LMSO 9



6

Transversal opening by pushing fingers through the peritoneum.



The choice not to place abdominal compresses in the abdomen (because of risk of forgetting them) is acceptable unless complications occur (rupture, bleeding, endometritis...).

PFANNENSTIEL INCISION

1 Skin incision with a cold blade slightly curved upwards, 1cm above the lower abdominal skin fold over a length of at least 14cm.

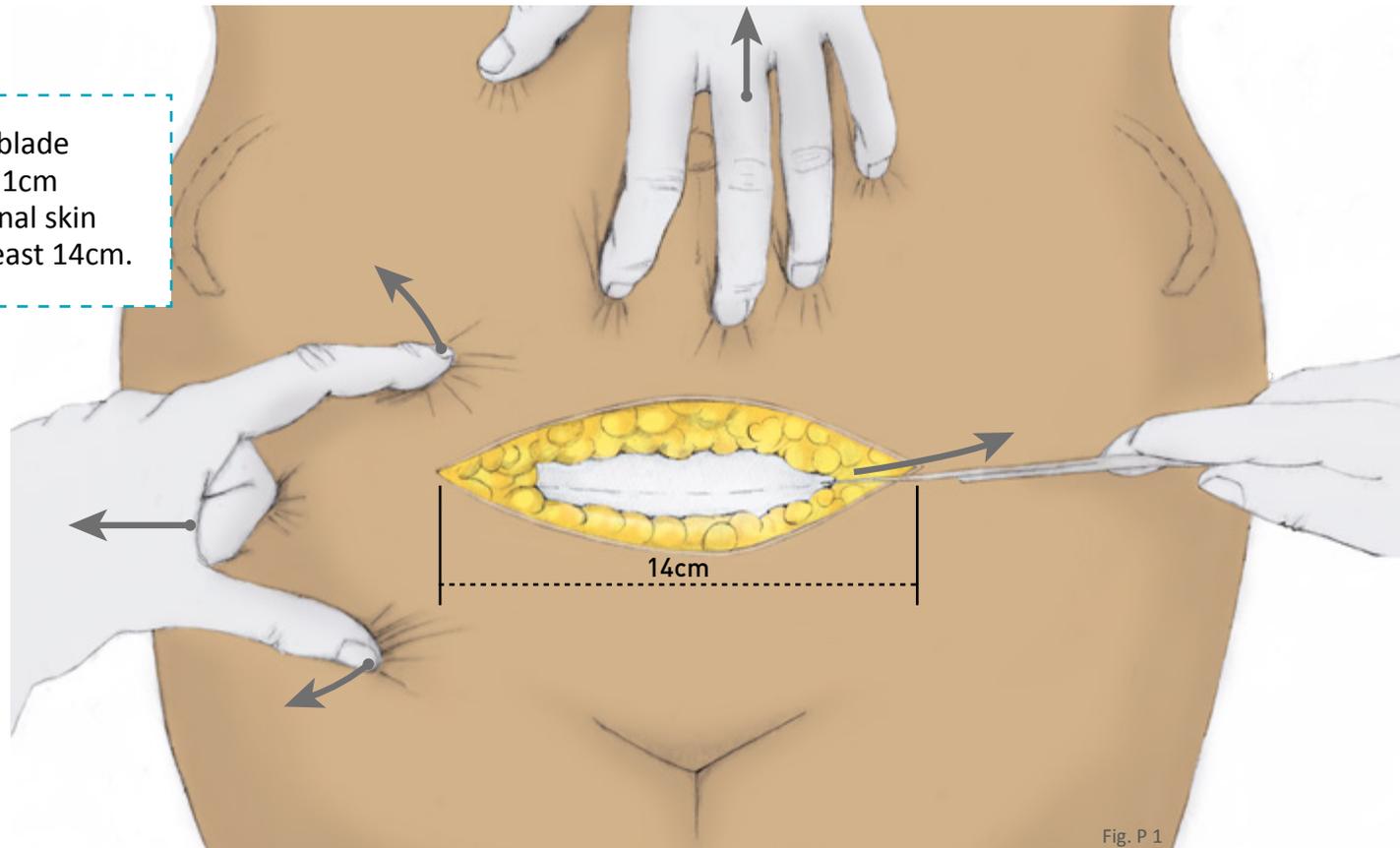
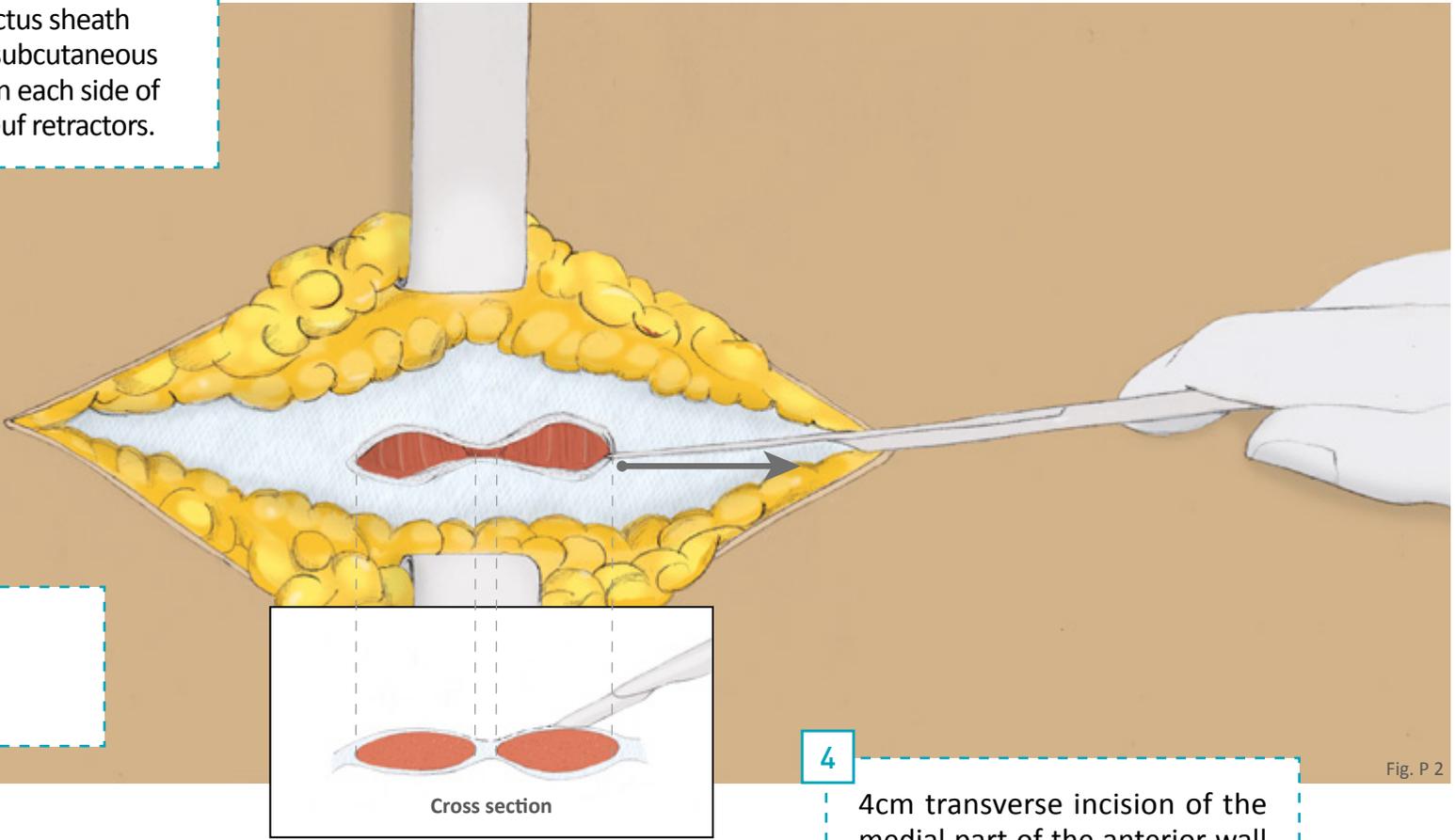


Fig. P 1

2 Incision of the subcutaneous tissue up to the anterior wall of the rectus sheath (whitish tissue). Retract the subcutaneous tissue with 2 swabs placed on each side of the incision, or with 2 Farabeuf retractors.

3 Clamping and section of the 2 superficial epigastric veins located laterally.



4 4cm transverse incision of the medial part of the anterior wall of the rectus sheath.

Fig. P 2

5 Horizontal sub aponeurotic separation +/- 10cm with scissors or fingers on each side of the midline.

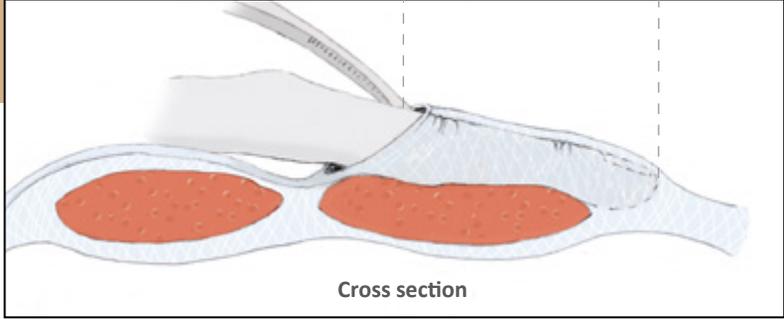
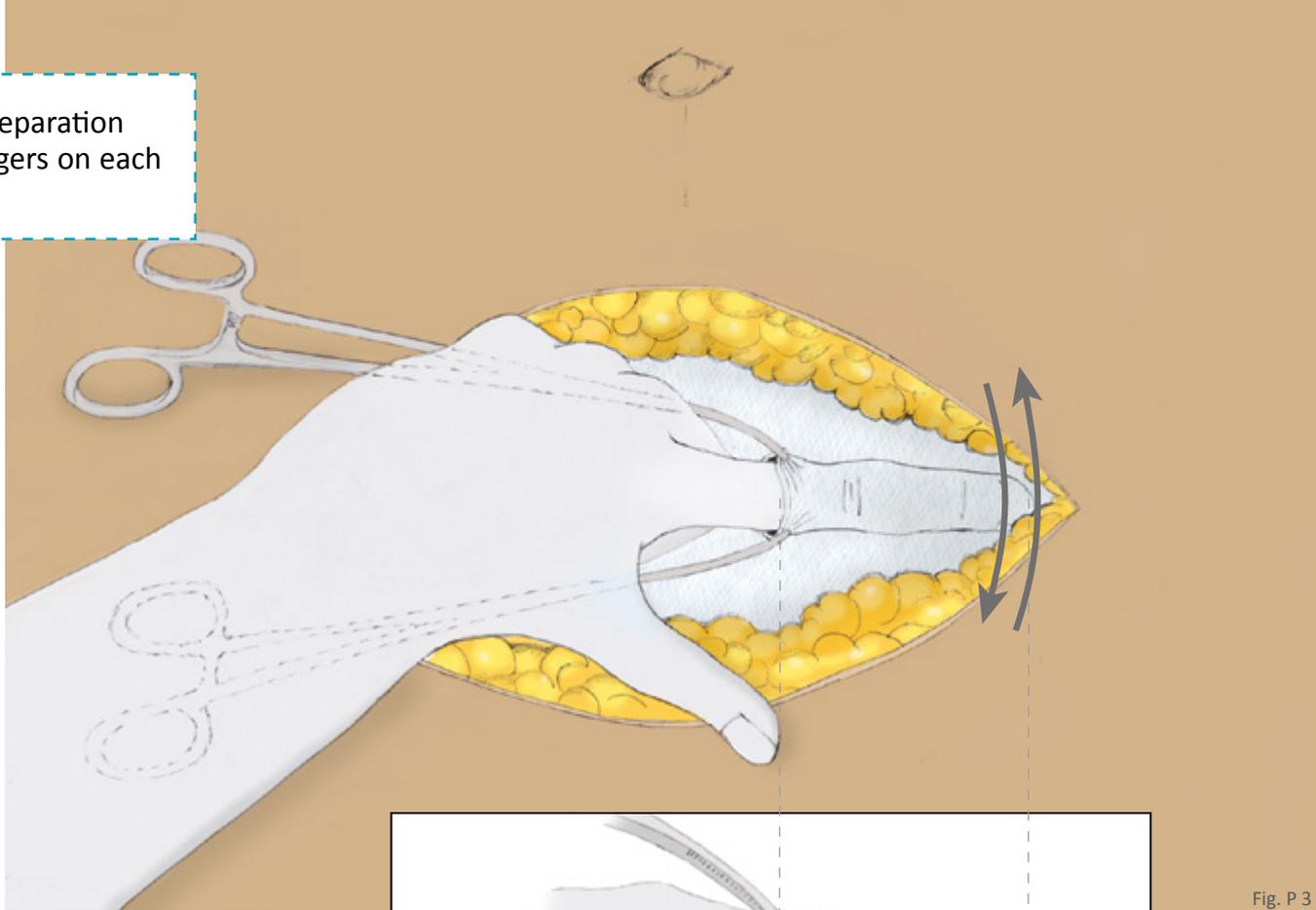
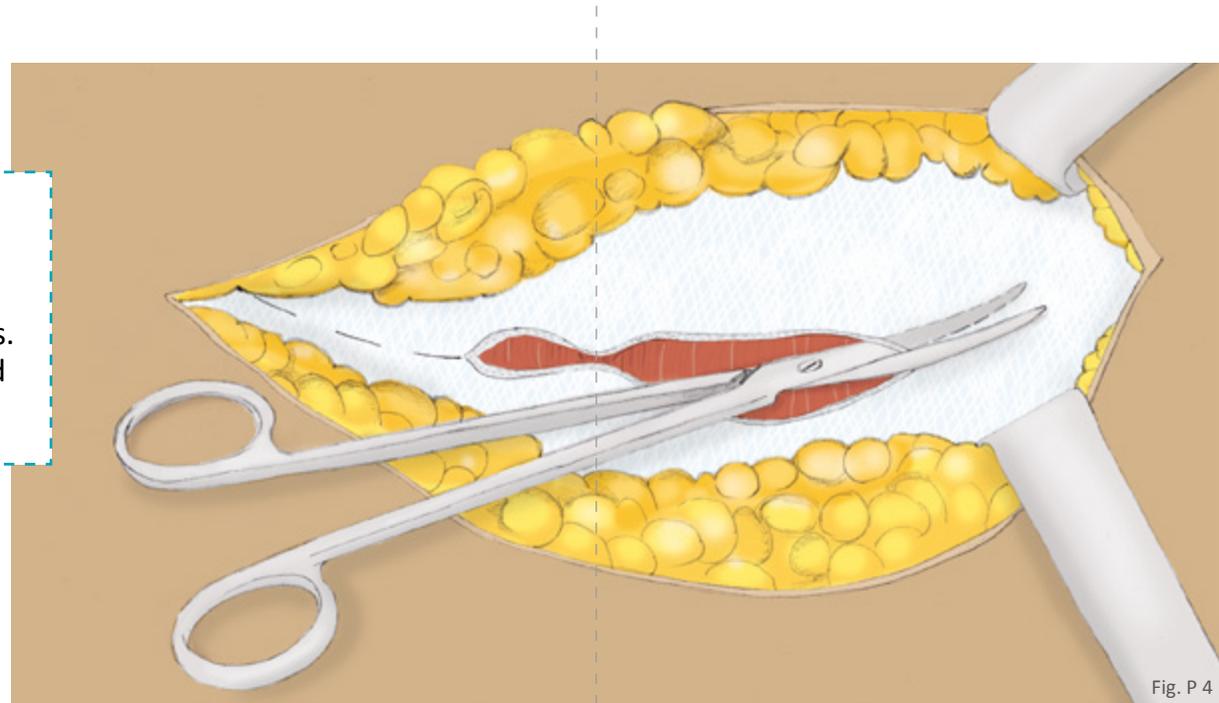


Fig. P 3

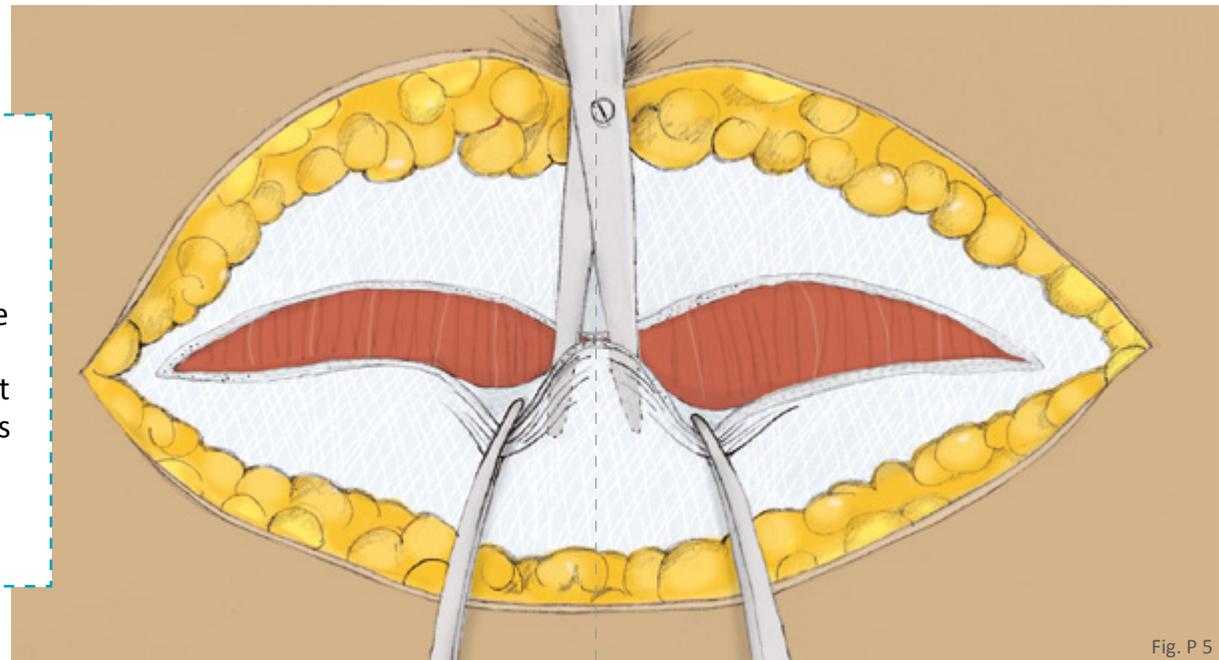
6

With scissors laterally extend the initial fascia incision of the anterior wall of rectus sheath slightly curving upwards. Width: 20cm (left +/- 10cm and right +/- 10cm).



7

Make a lower fascial flap while separating by cleaving with fingers from the external part (left and right) towards the medial part. There will be some adhesion at the medial part (linea alba), which has to be cut after being exposed by Kocher's forceps placed on the lower edge at either side of the linea alba and pulling downwards.



8

Make an upper fascial flap also by separating by finger cleavage from the external part (left and right) towards the medial part and up to the vicinity of the umbilical insertion, respecting or ligating the perforating arteries. The medial part (linea alba) must be cut after being exposed by Kocher's forceps placed on the upper edge at either side of the linea alba and pulling upwards.

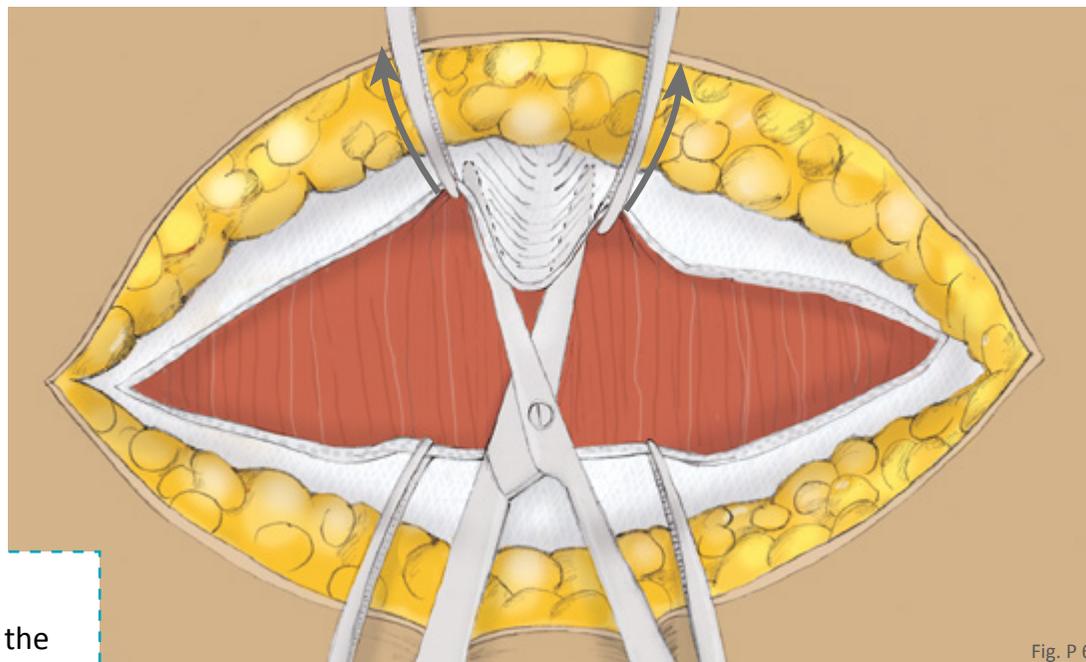


Fig. P 6

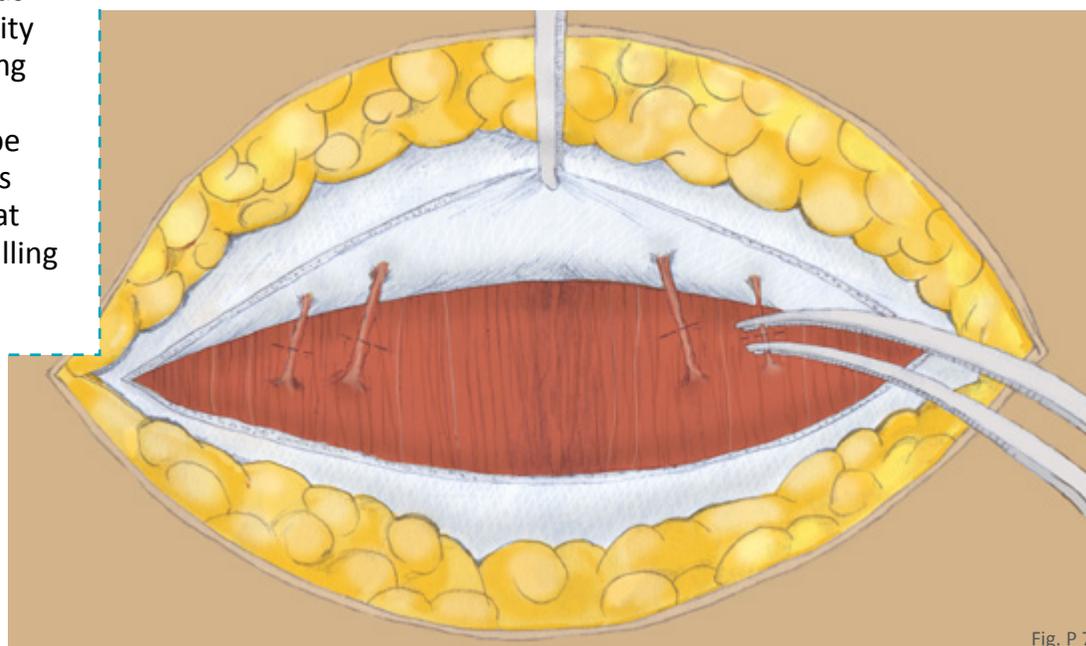


Fig. P 7

9

Identification of the peritoneum at the midline between the rectus abdominis muscles at the upper part of the incision.

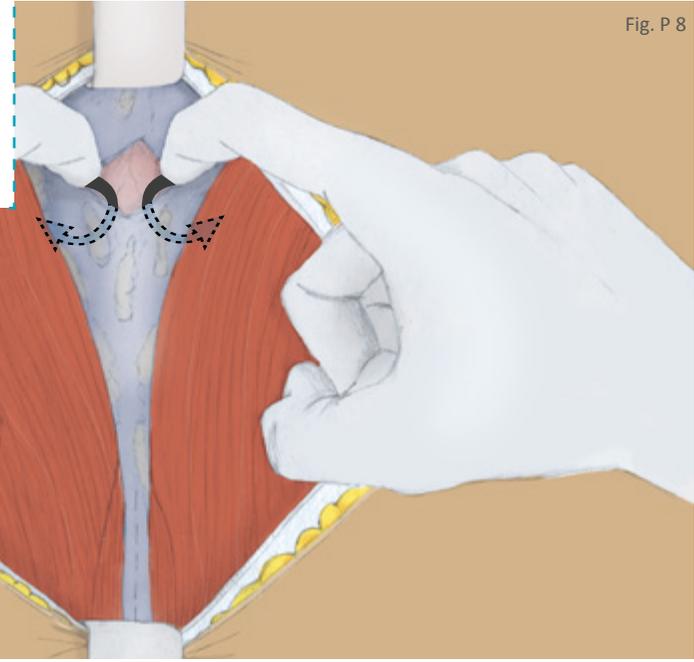


Fig. P 8

10

Transversal stretch and opening of the peritoneum, either with scissors or better fingers.

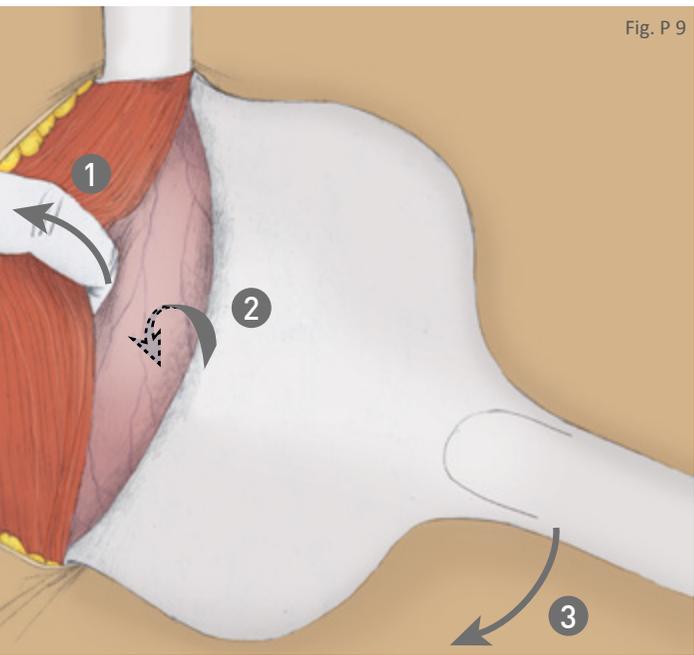


Fig. P 9

11

Placing the mobile retractor [if possible: matte and 14cm wide].

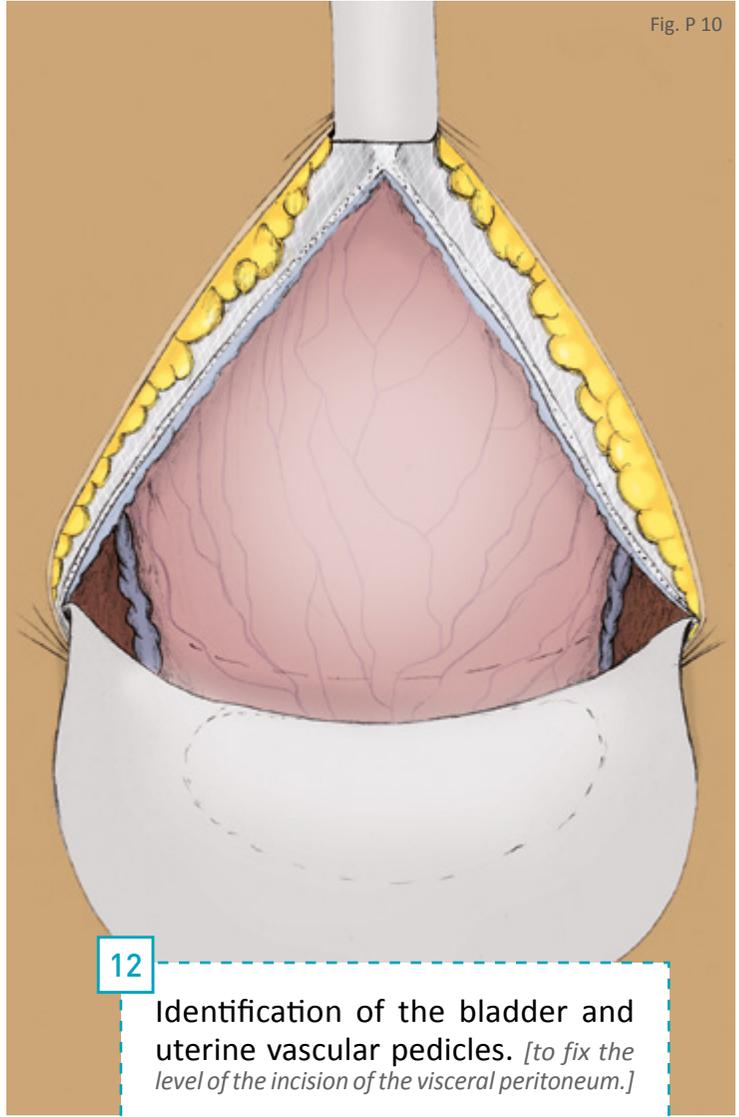


Fig. P 10

12

Identification of the bladder and uterine vascular pedicles. [to fix the level of the incision of the visceral peritoneum.]

The choice of not putting abdominal compresses in the abdomen (due to risk of forgetting them) is acceptable unless complications occur (rupture, bleeding, endometritis...).

3 UTERINE OPENING

A. OBJECTIVE

B. TECHNIQUE

INCISION (and possible detachment) OF THE PERITONEUM

UTERUS INCISION (AMNIOTOMY)

Avoid harming the child

Upwards concave uterine incision!

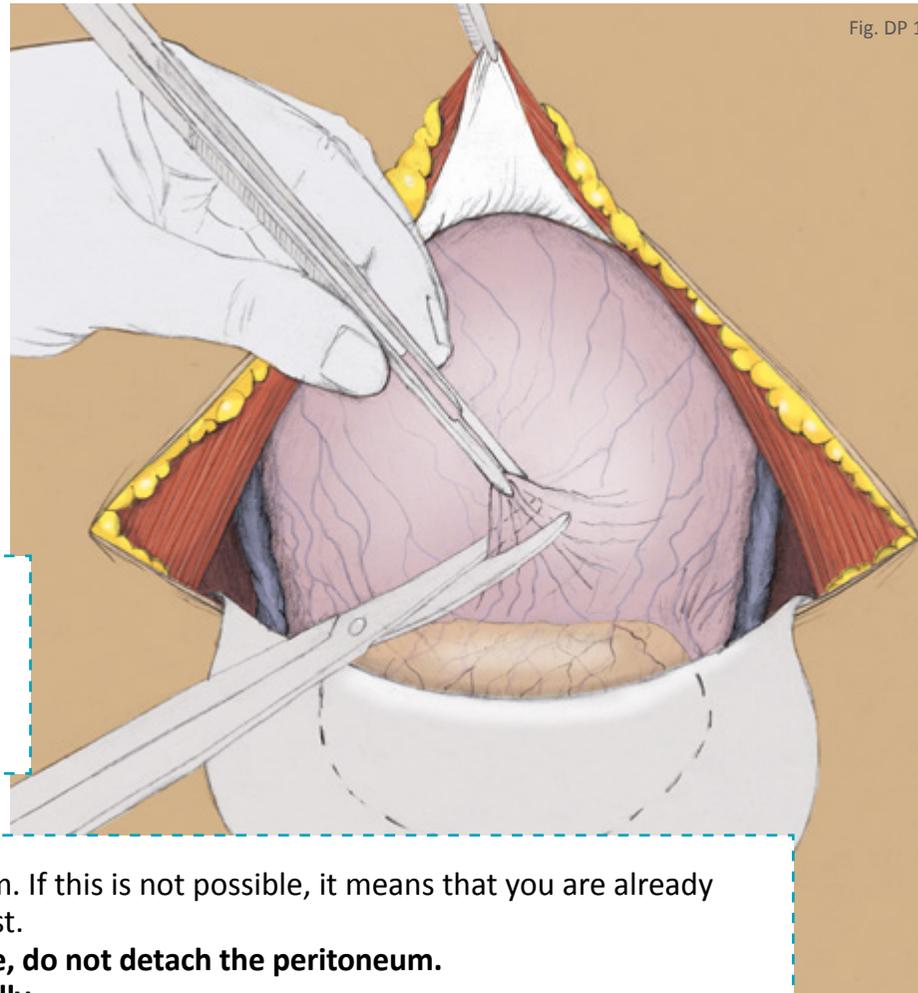
A. OBJECTIVE

To access the child without causing uterine bleeding and without injuring the child.

B. TECHNIQUE

Mobile retractor in place and under traction.

INCISION (AND POSSIBLE DETACHMENT) OF THE PERITONEUM



1

USUAL CASE :

Grasp the peritoneum 3cm above the upper edge of the bladder.

2

Pinch and lift up the peritoneum. If this is not possible, it means that you are already in the uterine body. Do not insist.

In the Misgav-Ladach technique, do not detach the peritoneum.

If you do so, only do so minimally

3

In case of difficulty in visualizing the anatomical plans, separate the peritoneum from the uterine wall approximately 6cm to the right and 6cm to the left of the initial opening of the peritoneum.

[During opening of the peritoneum with fingers or scissors, the mobile retractor follows the instrument movement.]

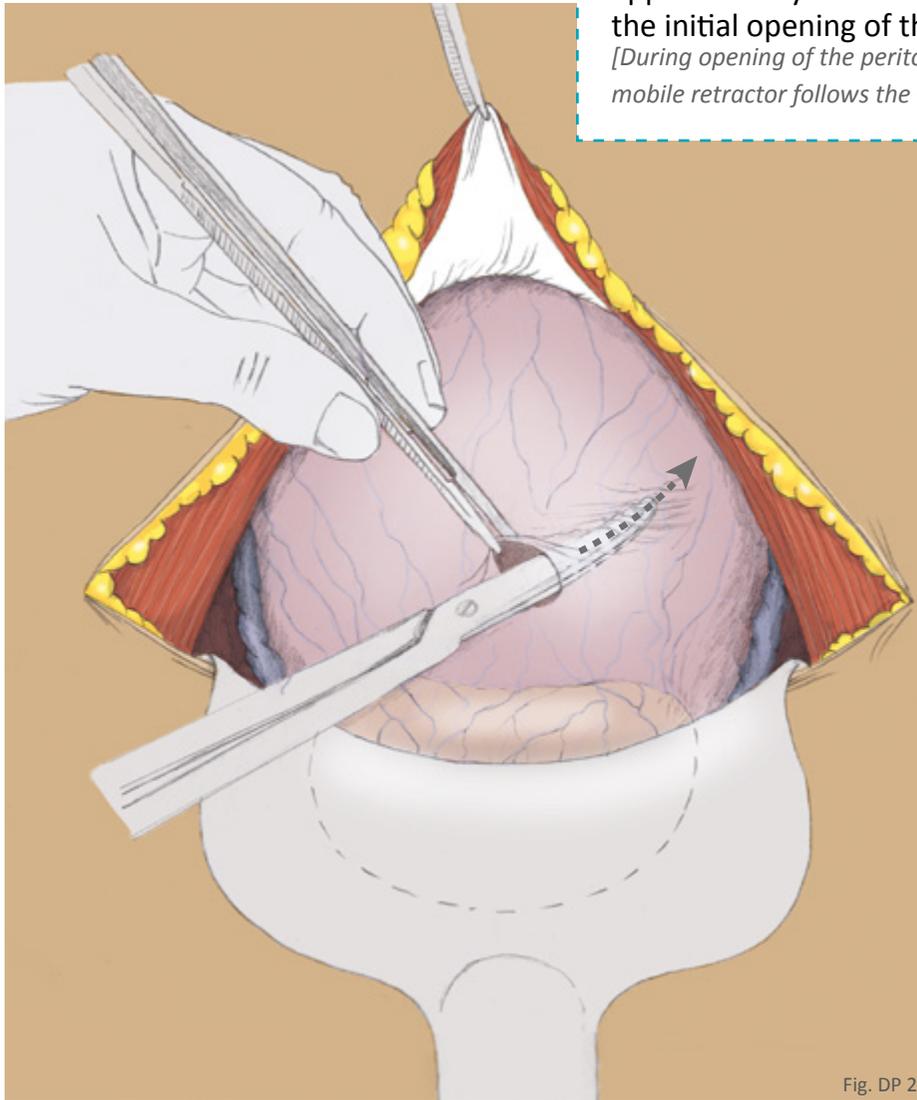


Fig. DP 2

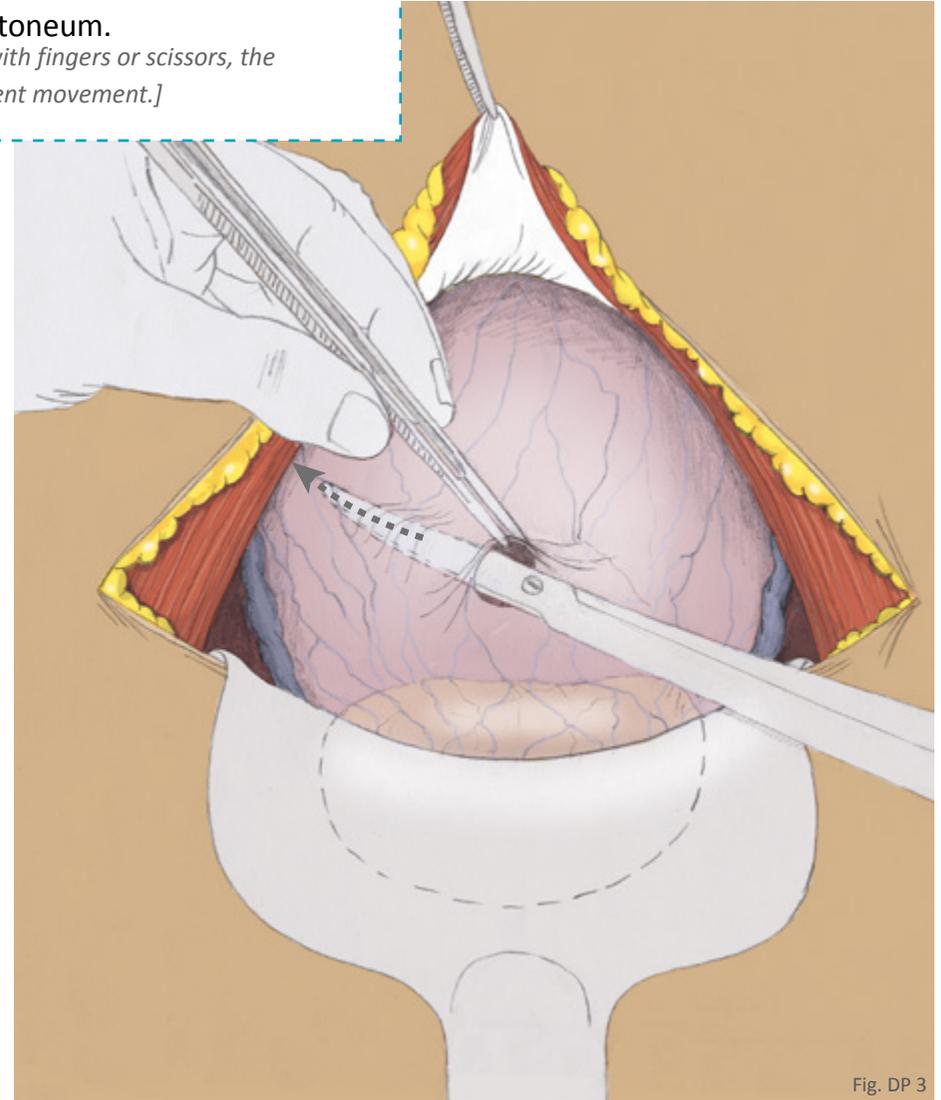
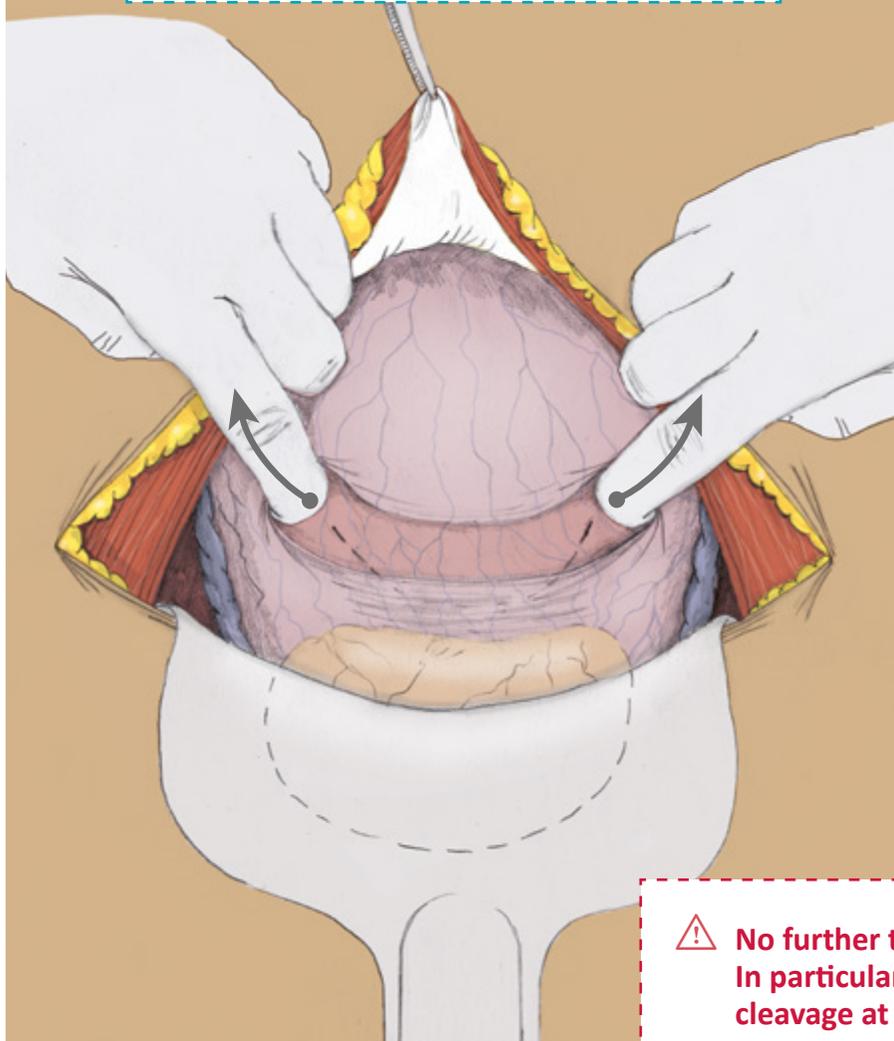


Fig. DP 3

4

If it is too difficult to visualize the anatomical layers, make 2 flaps with your finger, 1cm at upper edge, 1cm at lower edge along the entire incision.

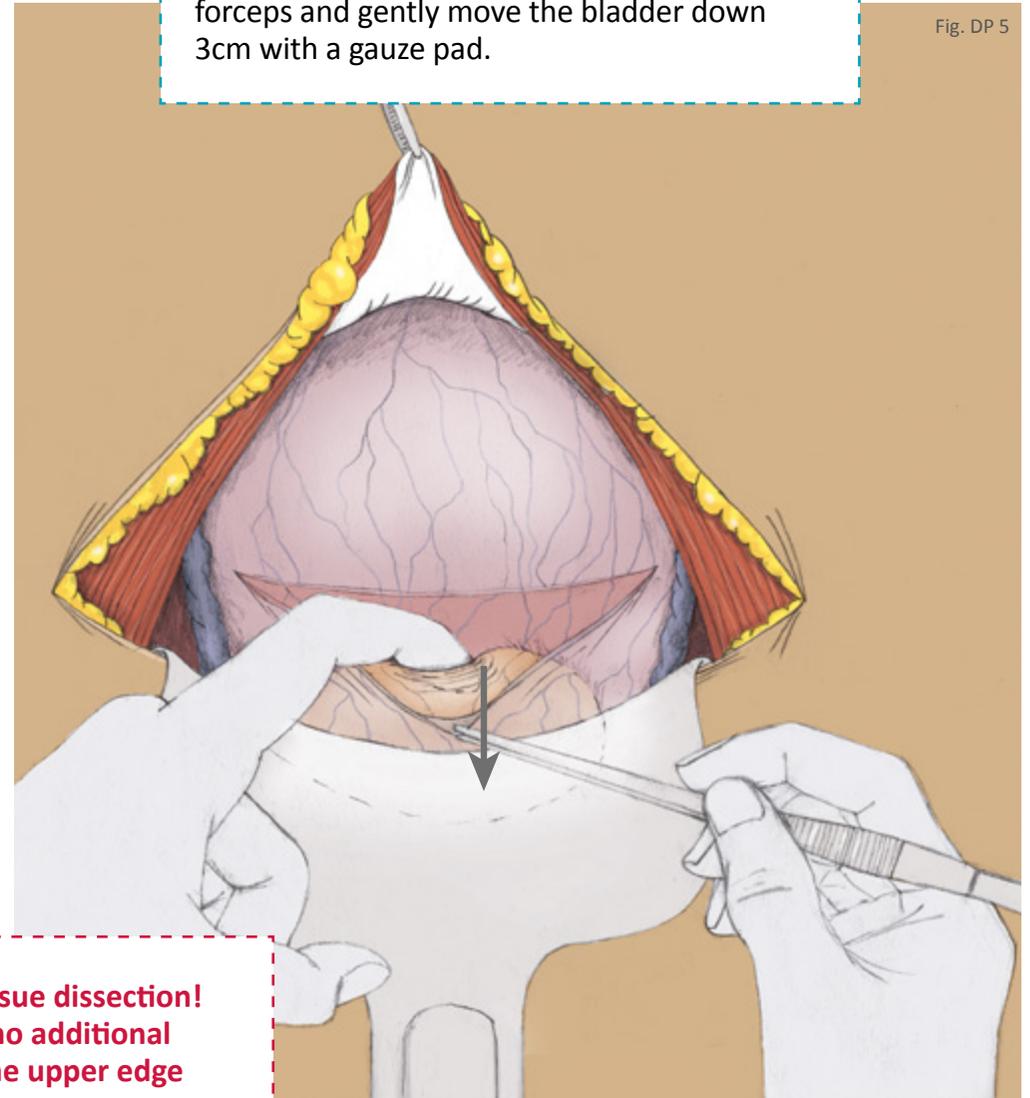
Fig. DP 4



5

In the event of iterative Caesarean section and presence of adhesions: grasp the lower edge of the peritoneum with anatomical forceps and gently move the bladder down 3cm with a gauze pad.

Fig. DP 5



⚠ No further tissue dissection!
In particular no additional cleavage at the upper edge

UTERUS INCISION (AMNIOTOMY)

It should be performed in the lower segment of the uterus and in the center of the dissected space, not at the uterine body level.

The thickness of the lower segment wall is highly variable and should be carefully assessed before fully opening the uterine wall.

1

Start the U-shaped incision curving upwards. Incise gradually to a **depth of +/- 5mm** over a length of about 3cm. The lower extremity of the incision is +/- 3cm above the vesico uterine fold.

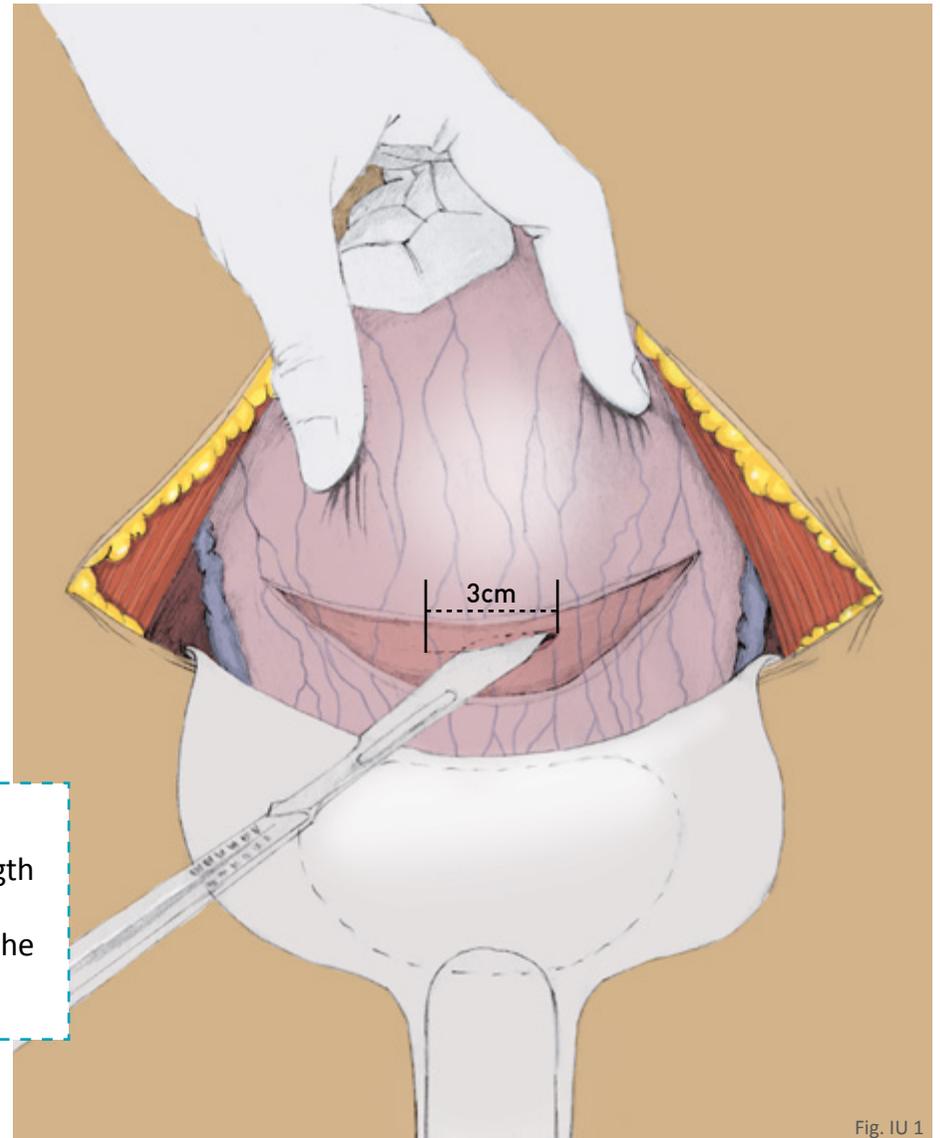


Fig. IU 1

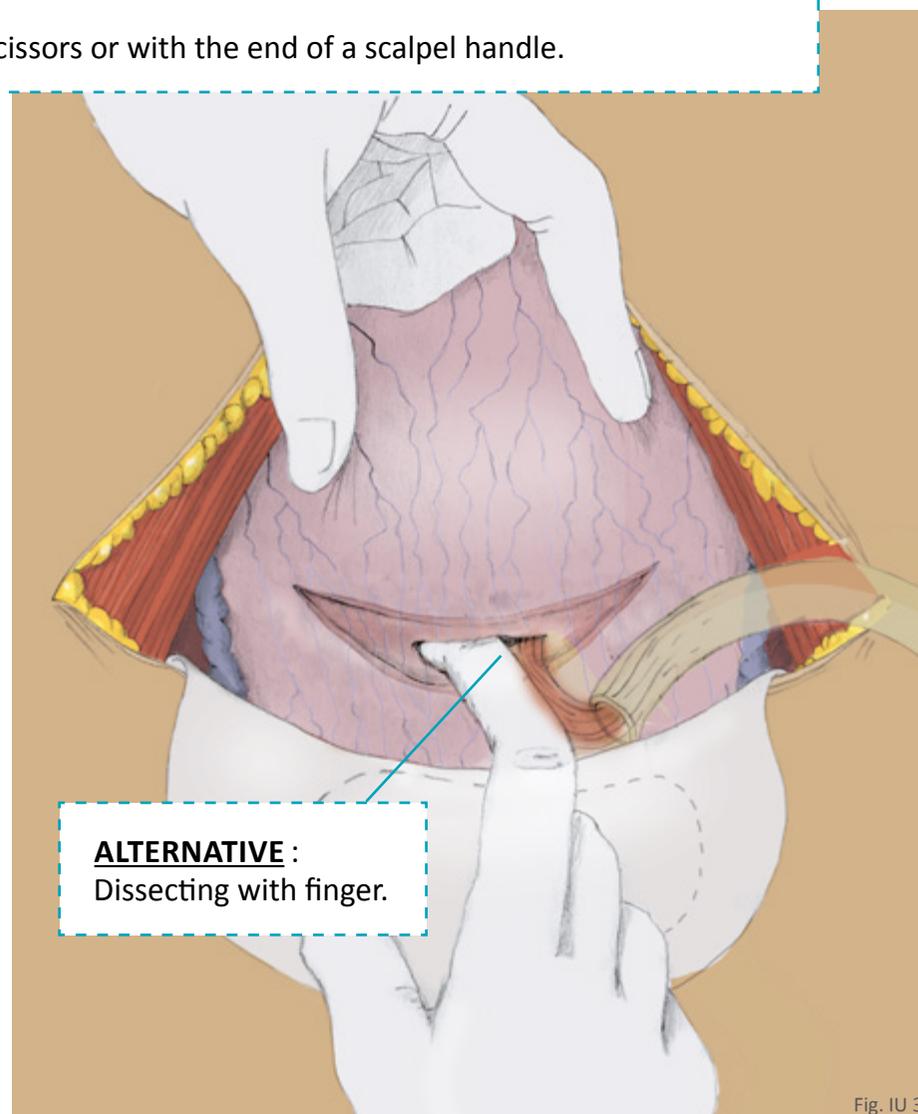
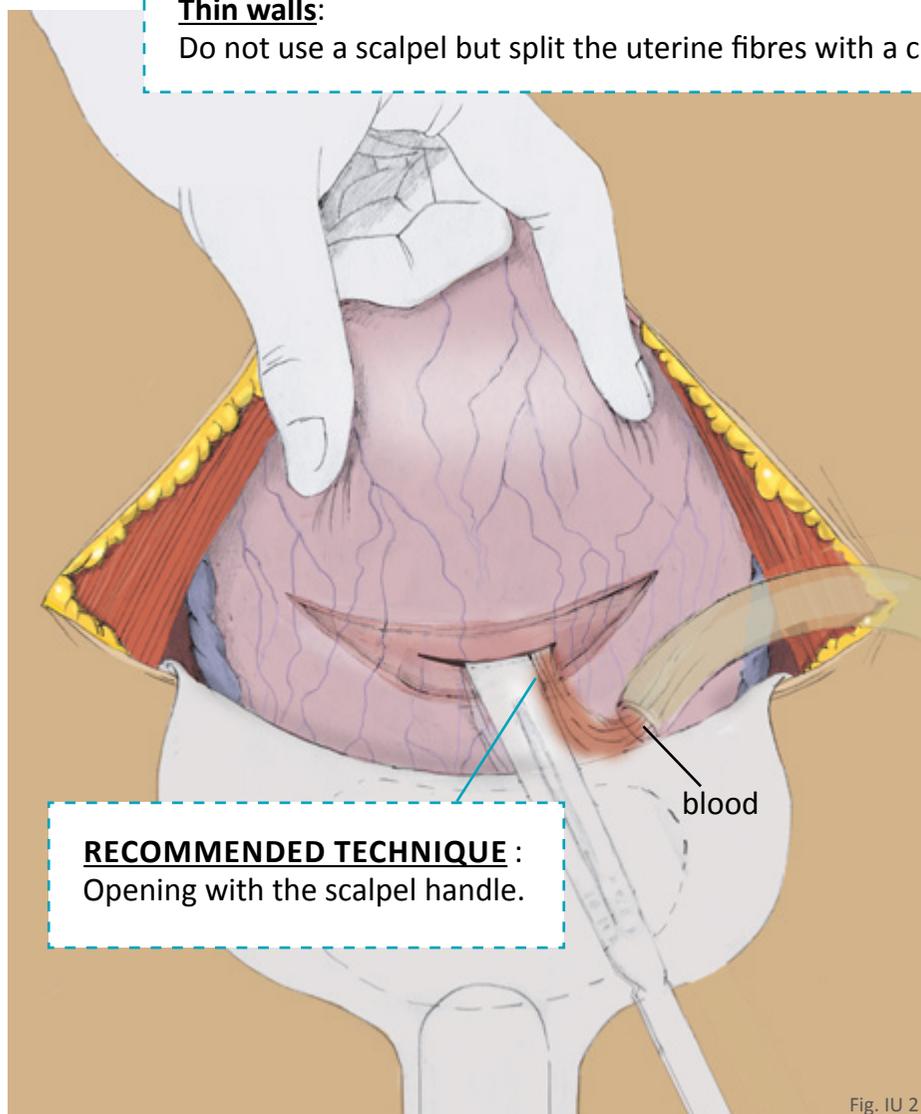
2

DEEPENING THE CENTRAL INCISION :**Thick uterine walls :** [*Elective Caesarean section*]

Continue to cut horizontally in repeated and careful sections at the centre of the first incision until it is possible to open the wall completely with the finger or with the end of a scalpel handle.

Thin walls:

Do not use a scalpel but split the uterine fibres with a closed scissors or with the end of a scalpel handle.



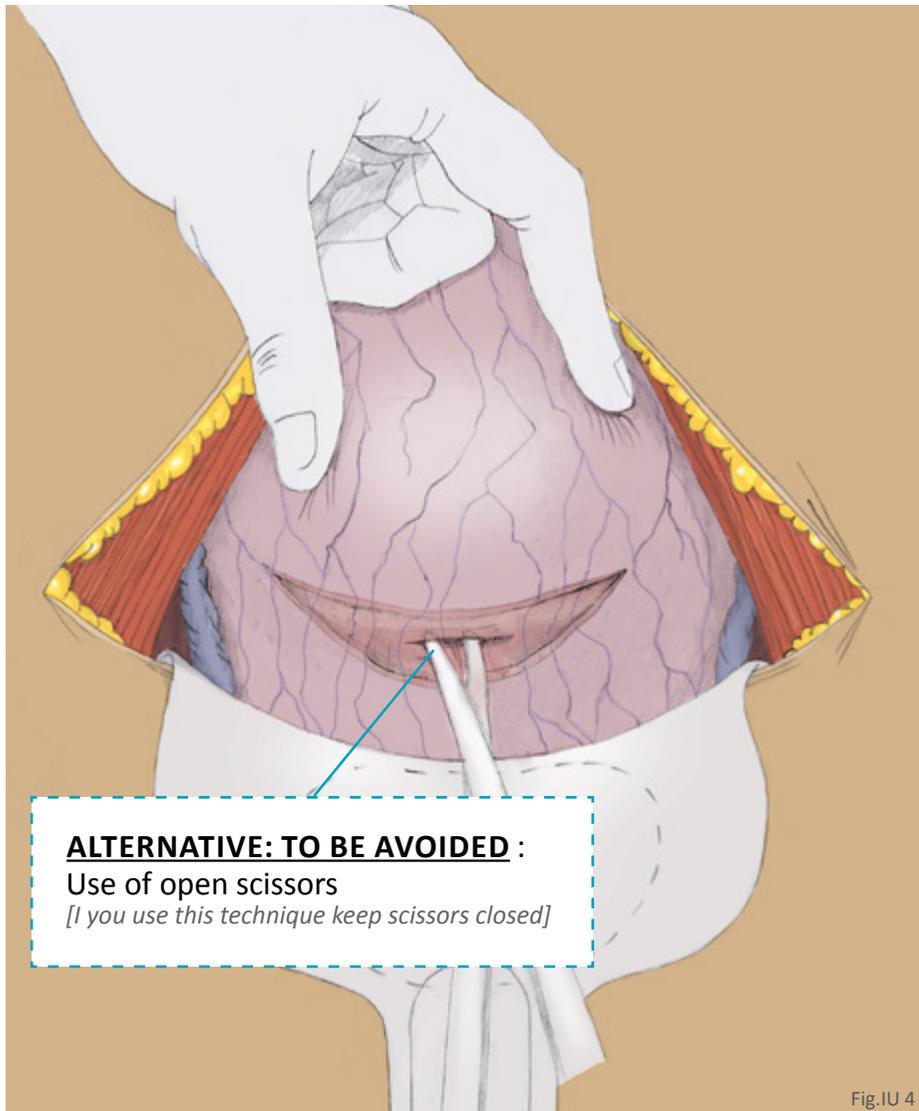


Fig.IU 4

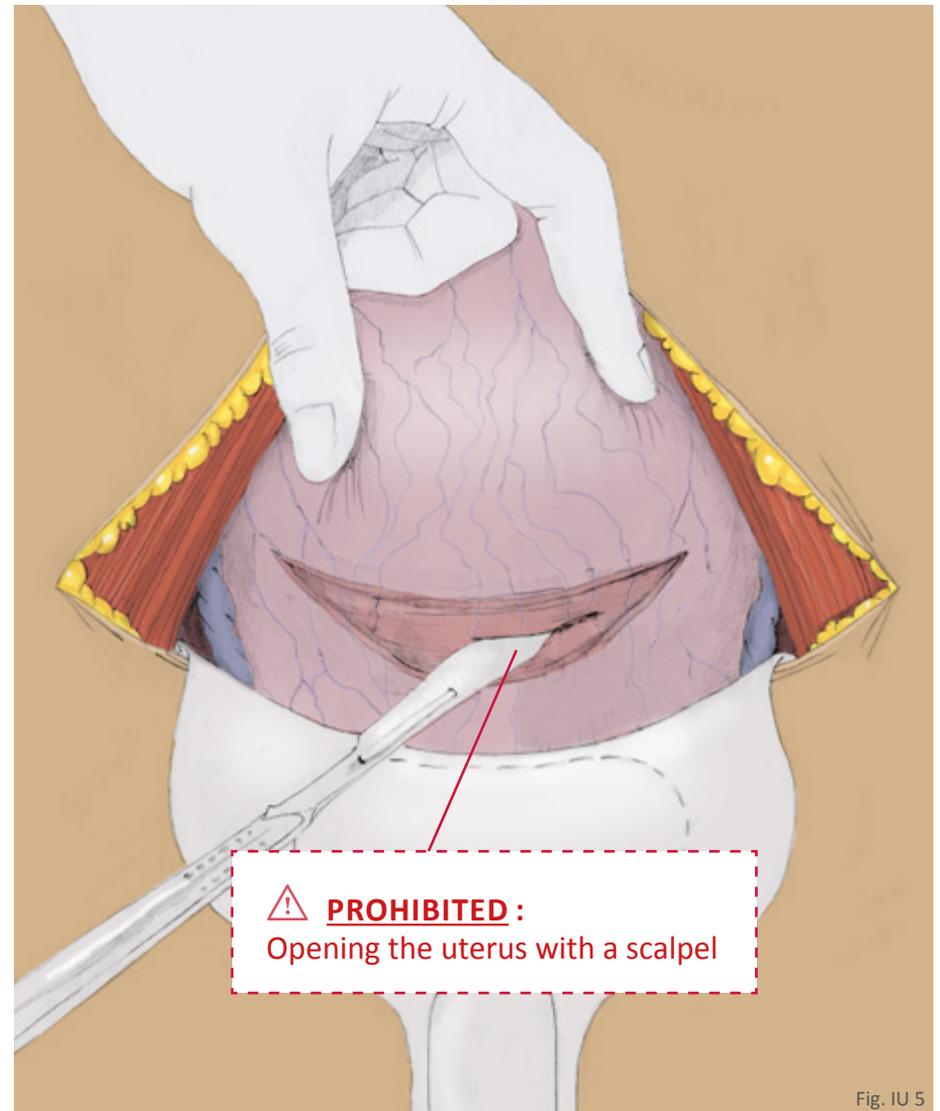


Fig. IU 5

3a

WIDENING OF THE UTERINE OPENING :

PREFERRED TECHNIQUE :

the surgeon's back is towards the mother's feet or back to head [58].
Hook the uterine wall with both index fingers, back to back at first and then pull both back laterally and upwards.

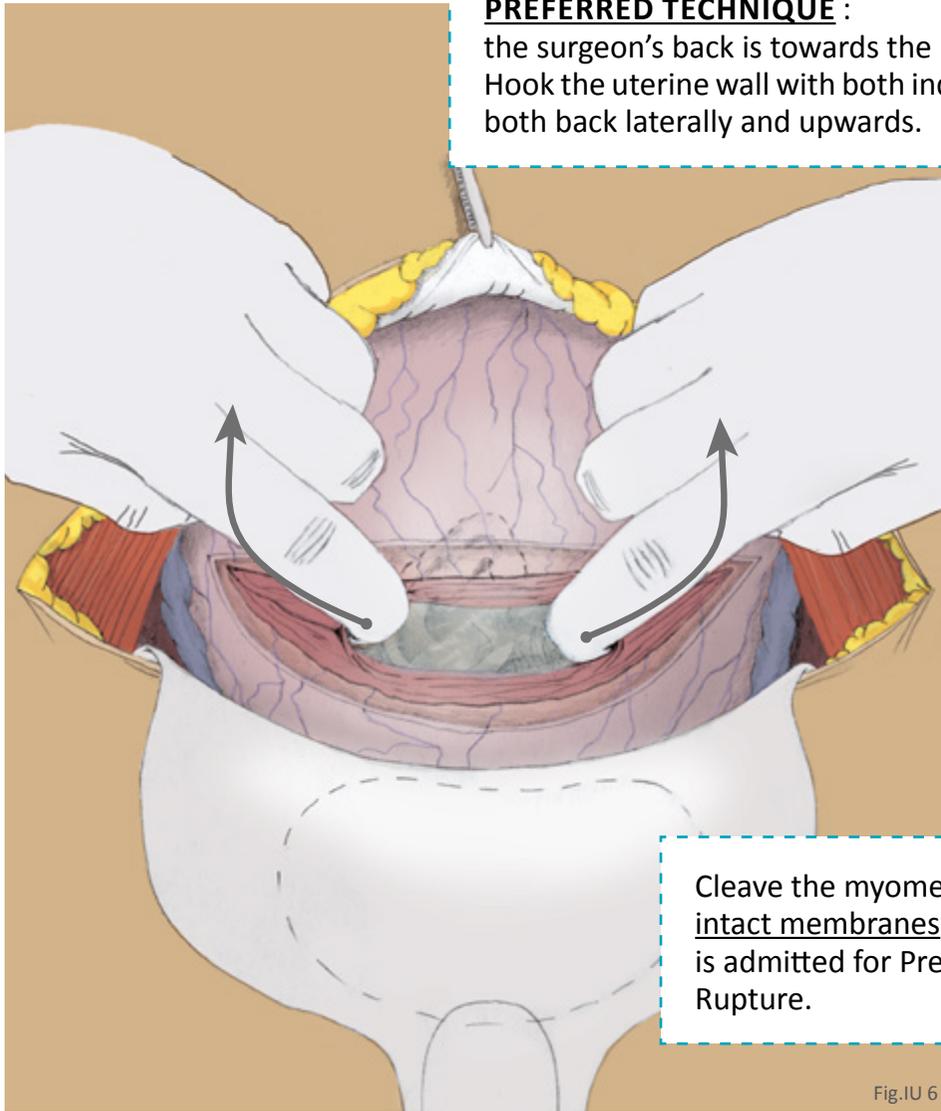


Fig.IU 6

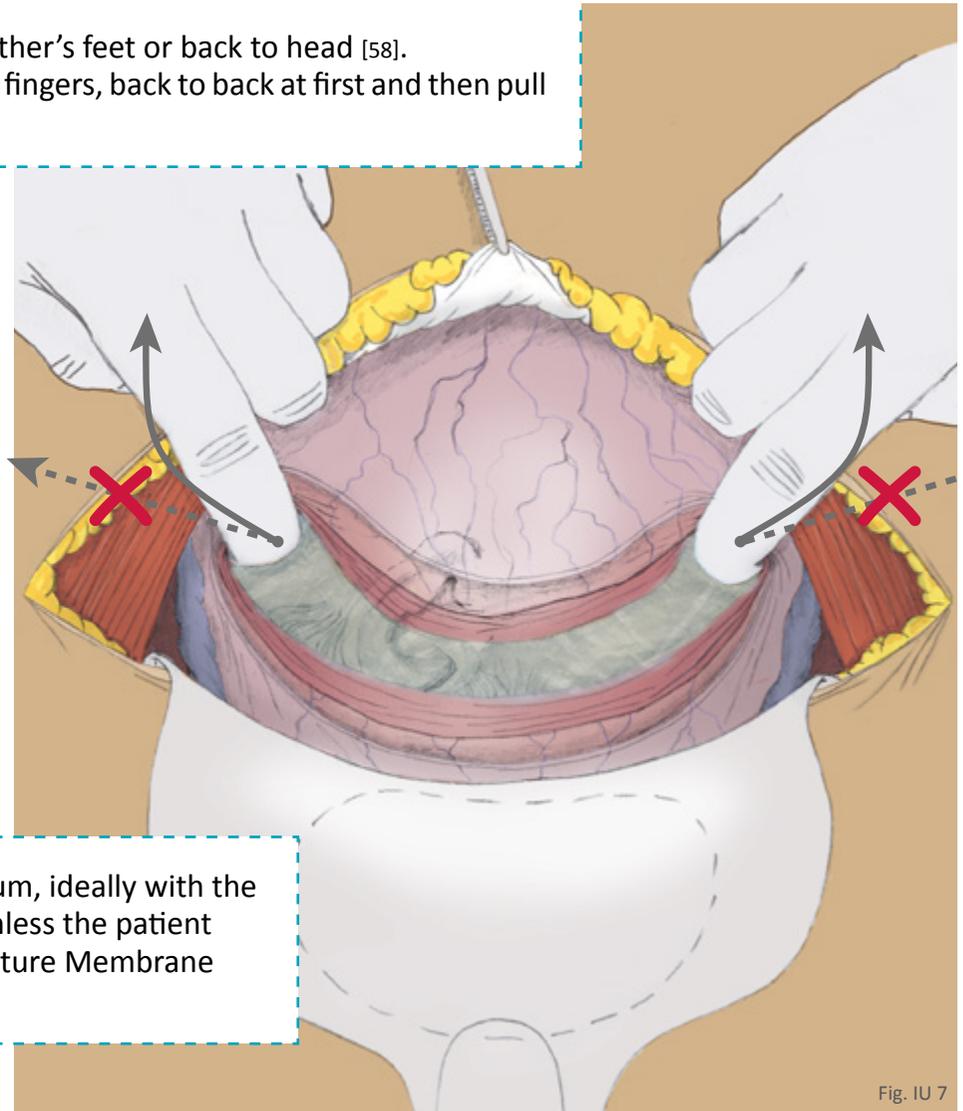
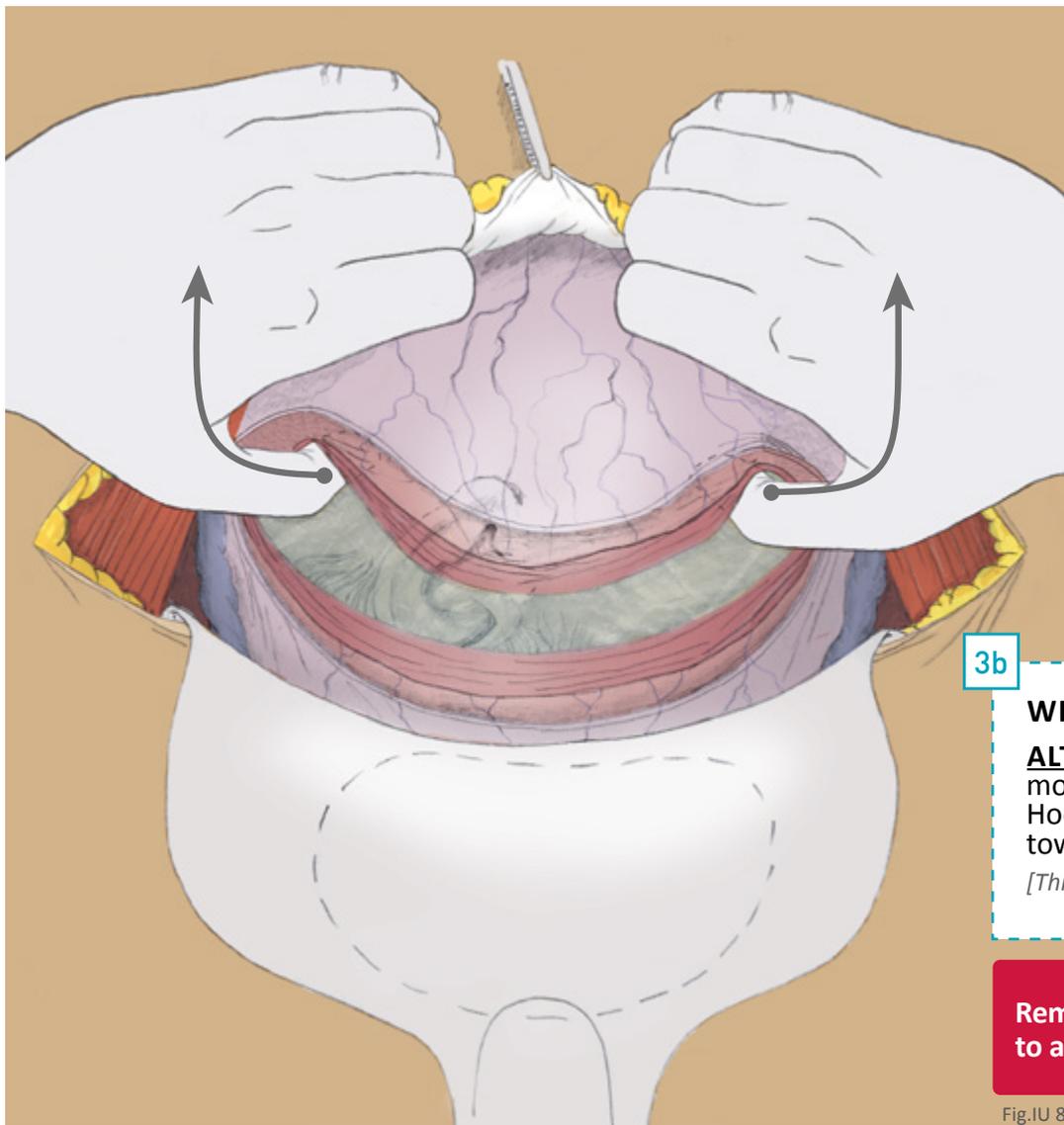


Fig. IU 7

Cleave the myometrium, ideally with the intact membranes, unless the patient is admitted for Premature Membrane Rupture.



3b

WIDENING THE UTERINE OPENING :

ALTERNATIVE : the surgeon's back is towards the mother's feet.
Hook the uterine wall with both thumbs, then pull towards the mother's head.

[This technique is considered more difficult.]

Remember: move your fingers sideways and upwards to avoid lateral vascular pedicles.

Fig.IU 8

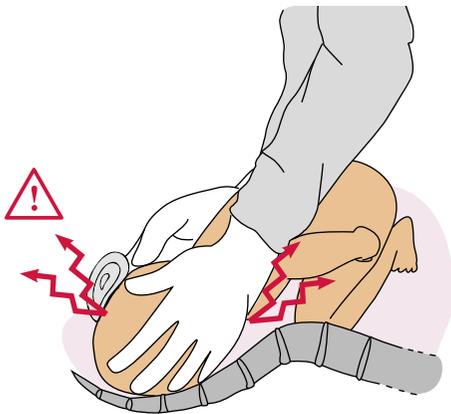
4 CHILD DELIVERY

- A. OBJECTIVE AND RISKS TO BE AVOIDED
- B. TECHNIQUE
- C. EXTRACTION COMPLICATIONS

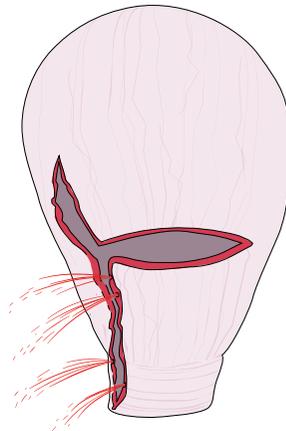
A. OBJECTIVES AND RISKS TO BE AVOIDED

To enable delivery of the child under the best possible conditions for mother and child.

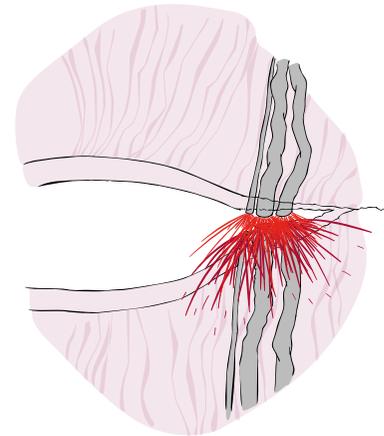
Risk of trauma to the child.



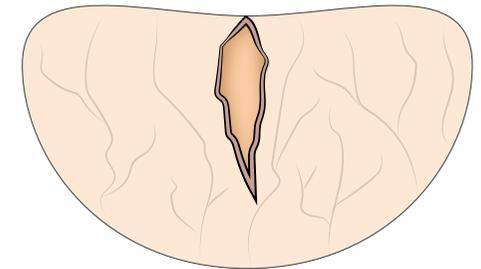
Risk of tearing the uterus.



Risk of uterine vessel injury.



Risk of bladder trauma.



B. TECHNIQUE

1 Identification of the presentation through the hysterotomy and evaluation of its degree of engagement :

Cephalic presentation (also called head first or vertex presentation) :

- **Occiput** : *Left Occipito Anterior (LOA) presentation: the most common position and lie (the child is delivered face down).
Right Occipito Anterior (ROA) presentation,
Left Occipito Posterior (LOP) presentation: Right occipitoposterior (ROP) presentation or occipitoposterior presentation (OP).
The child is delivered face up (brow, eyebrows, face, chin)*

Breech presentation : you can see a buttock or a foot

- **Frank breech** : *buttocks*
- **Footling breech** : *one foot*
- **Complete breech** : *two feet*

Shoulder presentation :

- **Arm** (*neglected shoulder*)
- **Shoulder**
- **Trunk**

 **If the placenta appears in the hysterotomy incision, remove it quickly and immediately deliver the child depending on the type of presentation. Find the membranes, break the pouch and quickly take the baby out.**

Placenta : placenta previa, regardless of the type of presentation

2 Amniotic fluid aspiration

Amniotic fluid [*use large suction tube, no nozzle*], whether clear or meconial, is sucked up to avoid contamination, which occurs when the fluid leaks onto the drapes [*usually tissue*].

EXCEPTION :

- if it is haemorrhagic [*to save time*]
- in the event of acute foetal distress

3 Delivery

A) CEPHALIC PRESENTATION HEAD FIRST

1. The head is not yet level with the hysterotomy

USUAL CASE

PROBLEM

2. The head is level with the hysterotomy

3. The head is out of the uterus

USUAL CASE

PROBLEM

B) BREECH PRESENTATION

1. Frank breech (buttocks)

USUAL CASE

PROBLEM

2. Footling or complete breech (buttocks and foot or feet)

C) TRANSVERSE LIE PRESENTATION

1. Back anterior
2. Back posterior
3. Back to side

D) SHOULDER (AND VAGINAL HAND) PRESENTATION

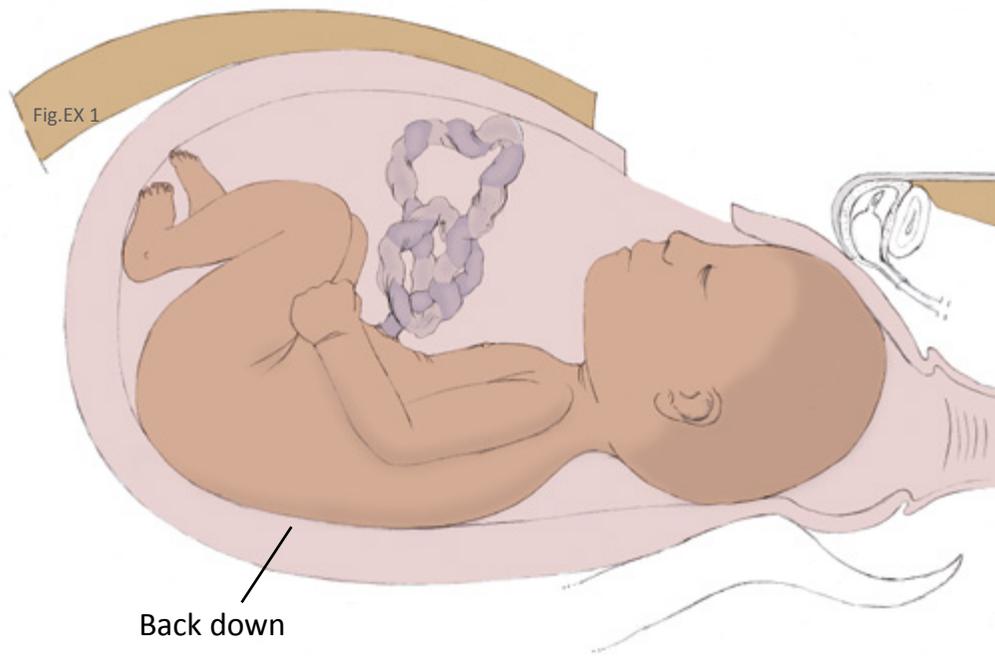
E) TWINS¹

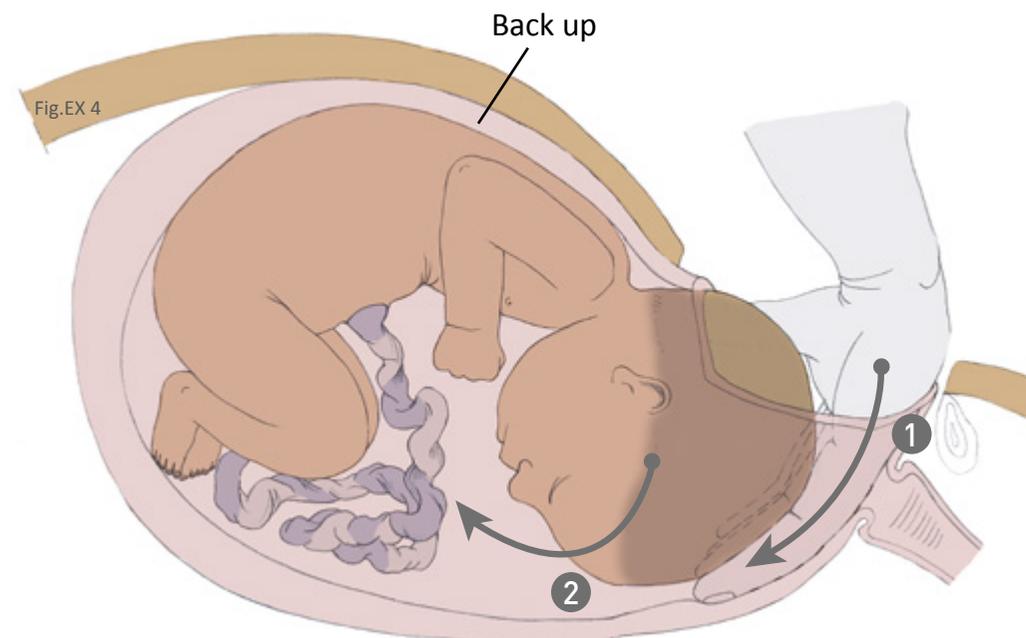
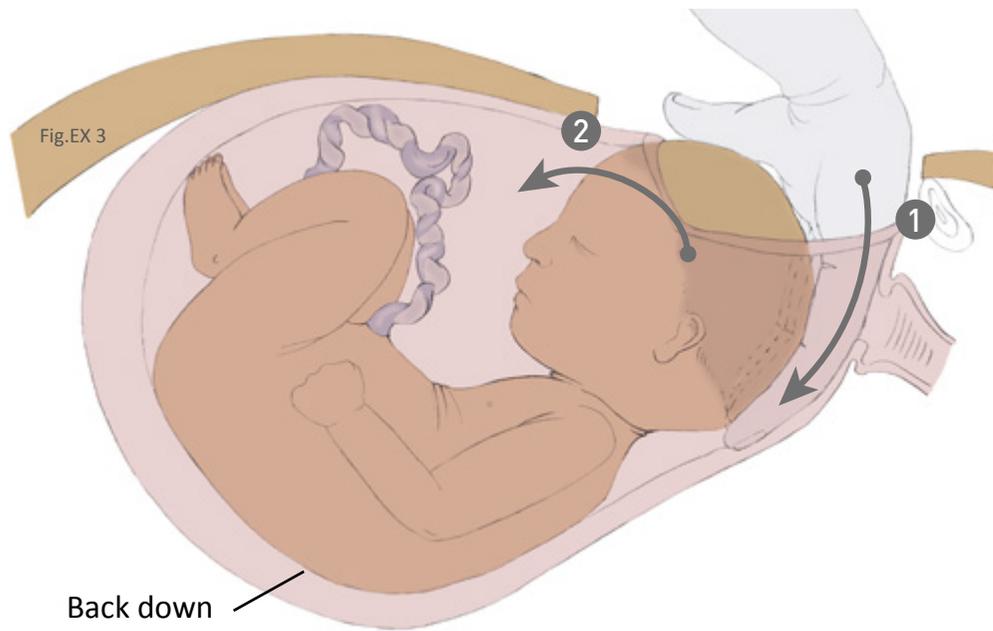
1. Vertex-Breech
2. Vertex-Vertex
3. Transverse-Transverse

1: Only the most common presentations are discussed

A) CEPHALIC PRESENTATION, HEAD FIRST

1. The head is not yet at the level with the hysterotomy





1a

USUAL CASE

Through hysterotomy, the surgeon's dominant hand (with fingers pressed tight) passes between the uterine wall and the baby's head.

The cupped hand lifts the head *[towards the maternal anterior wall]*. The traction must be smooth, gentle and progressive. The head may move only 10 to 20 seconds after the beginning of this traction.

1b

PROBLEM

Through hysterotomy, the surgeon's right hand (with fingers tightly together) cannot pass between the uterine wall and the baby's head.

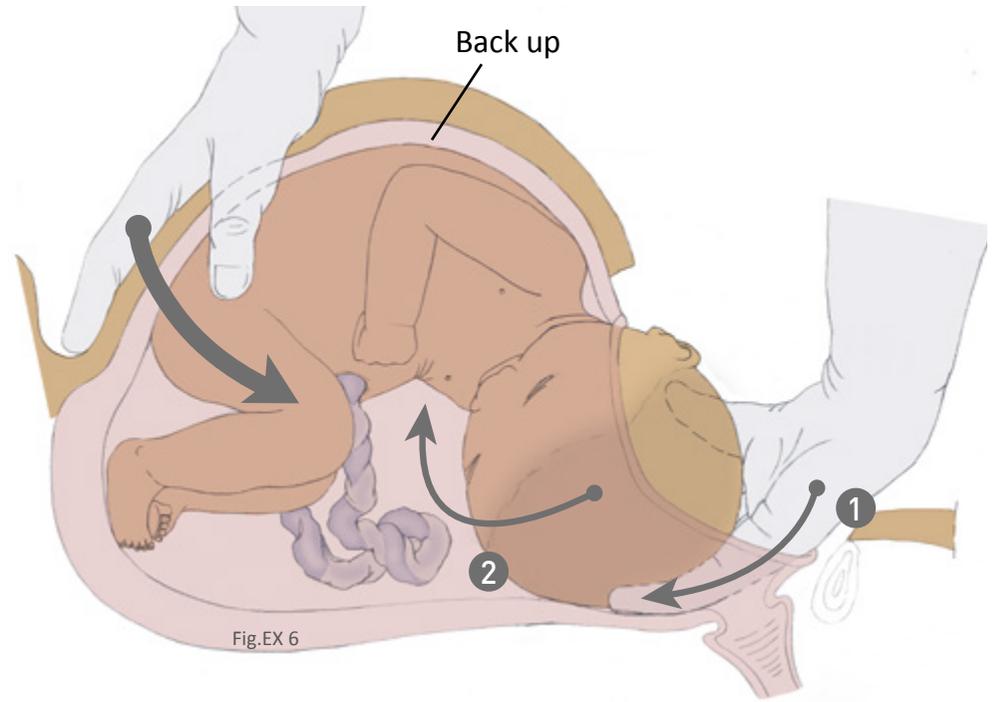
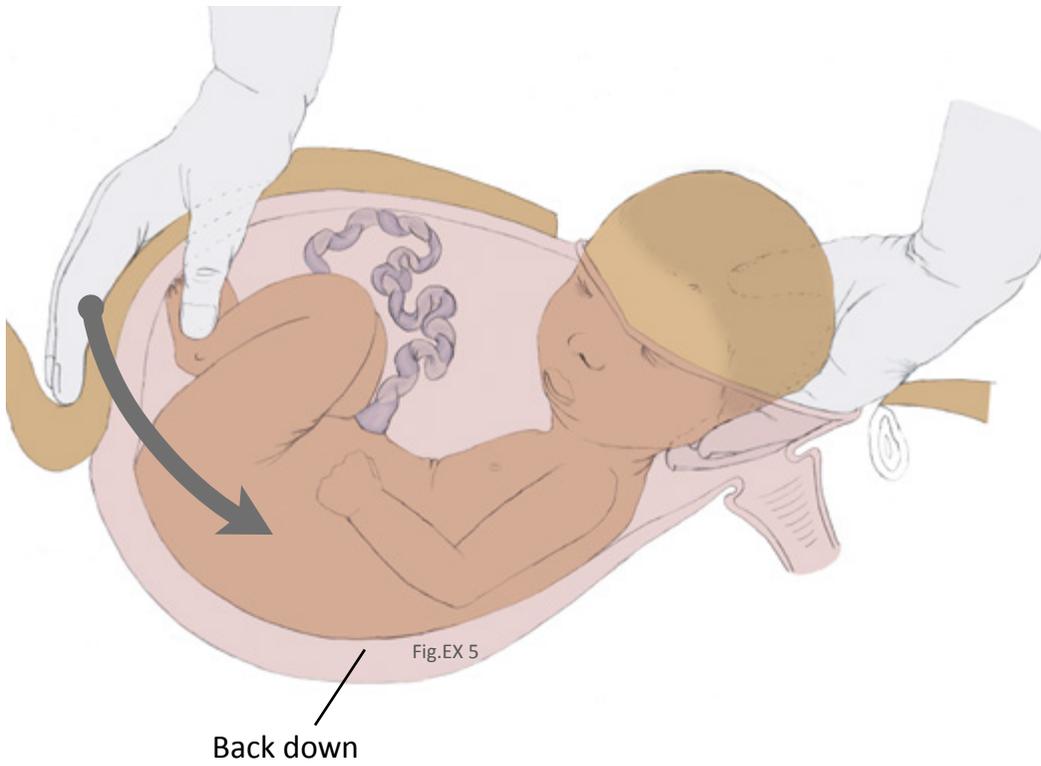
If the presentation does not move upwards, apply the other hand to the child's visible shoulder and push it back to the uterine fundus, then with the right-hand lift *[towards the maternal anterior wall]* the head that is now mobile. If this manoeuvre fails:

- 1) First try (if the head is still blocked) to move the entire uterus upwards *[towards the mother's head]*, by placing your hands on the uterine wall where you presume the child's shoulders should be.
- 2) If this technique fails, **the best thing to do**, is ask a second assistant to reach the baby's head under the back through the vagina in a sterile manner.

Keep the baby's head up

2. The head is at the level with the hysterotomy

1 **⚠ With the baby's head inclined on the surgeon's hand, turn spontaneously to the right or the left.**

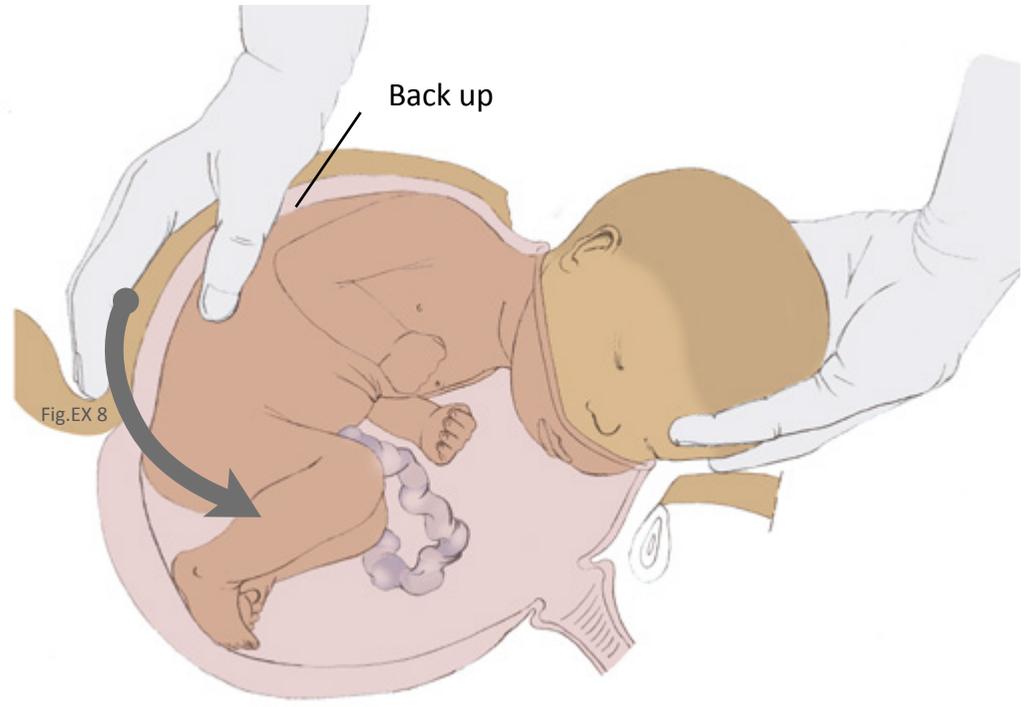
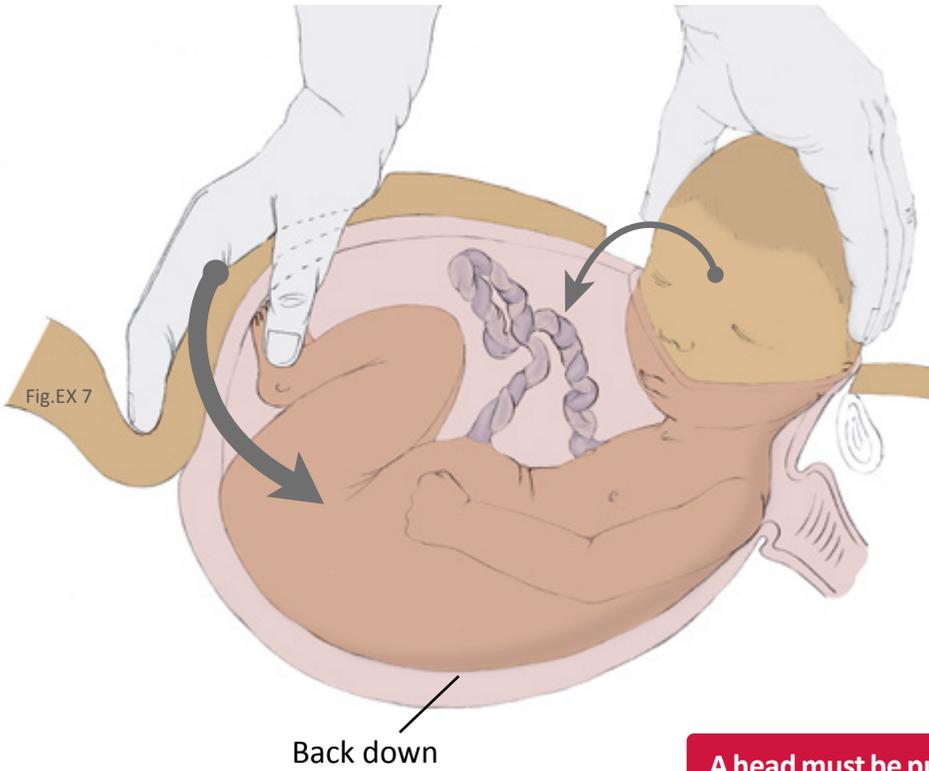


2

The assistant (usually) or the surgeon (sometimes) applies pressure to the **baby's seat** with their flat hand.

[The baby's seat doesn't necessarily correspond to the uterine fundus.]

[Use of the forearm is not recommended as this technique is more likely to cause sterility defects.]



A head must be pushed, but never pulled

3. The head is out of the uterus

1

Inject oxytocin:

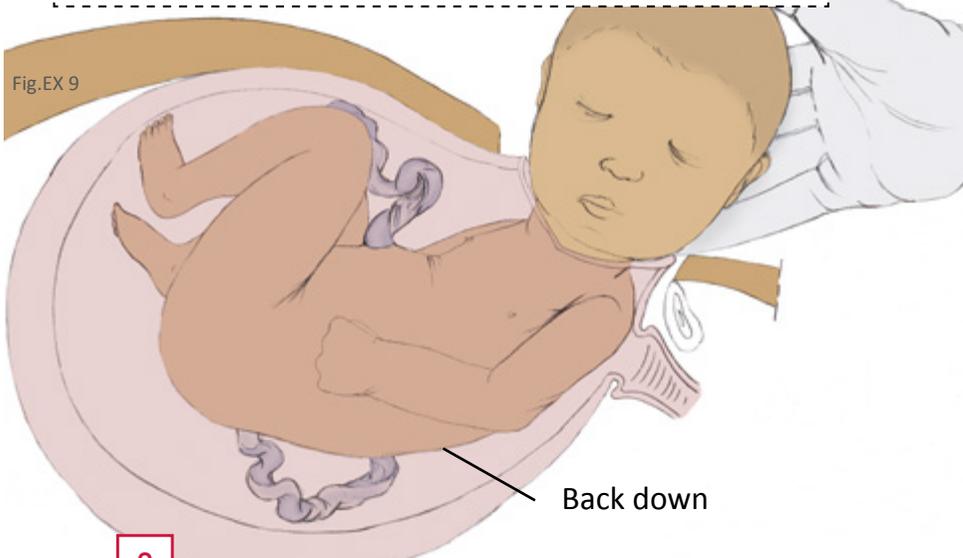
Either: 1) As soon as the head comes out of the uterus. Ask the anaesthetist to inject 5UI oxytocin IV:

- helps placental delivery
- reduces blood loss (from 250ml up to 500ml)

2) After delivery of the baby. Ask the anaesthetist to inject 5U.I. of oxytocin IV again.

Or later: Only when the baby is completely out of the uterus. Ask the anaesthetist to inject 10 IU of oxytocin IV in a single bolus.

Fig.EX 9



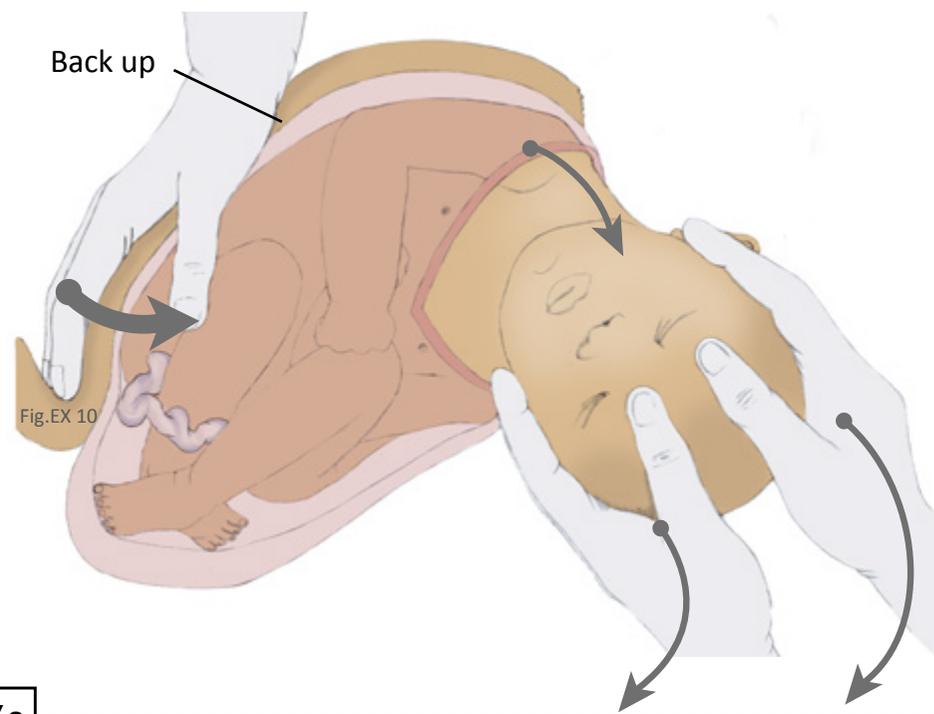
2

⚠ Let the baby's head inclined on the surgeon's hand, turn spontaneously to the right or the left.

3

- Hold the baby's head with both hands cupped around parietals or better with thumb and fingers of the right hand on either side of the neck below the mastoids.
- After the anterior shoulder is out assist the delivery of the foetus by letting it slide on to your left hand.

Fig.EX 10



4a

USUAL CASE

the anterior shoulder is released

- Pull the presentation towards the pubis.
- Stop pulling as soon as the anterior shoulder is out of the uterus.

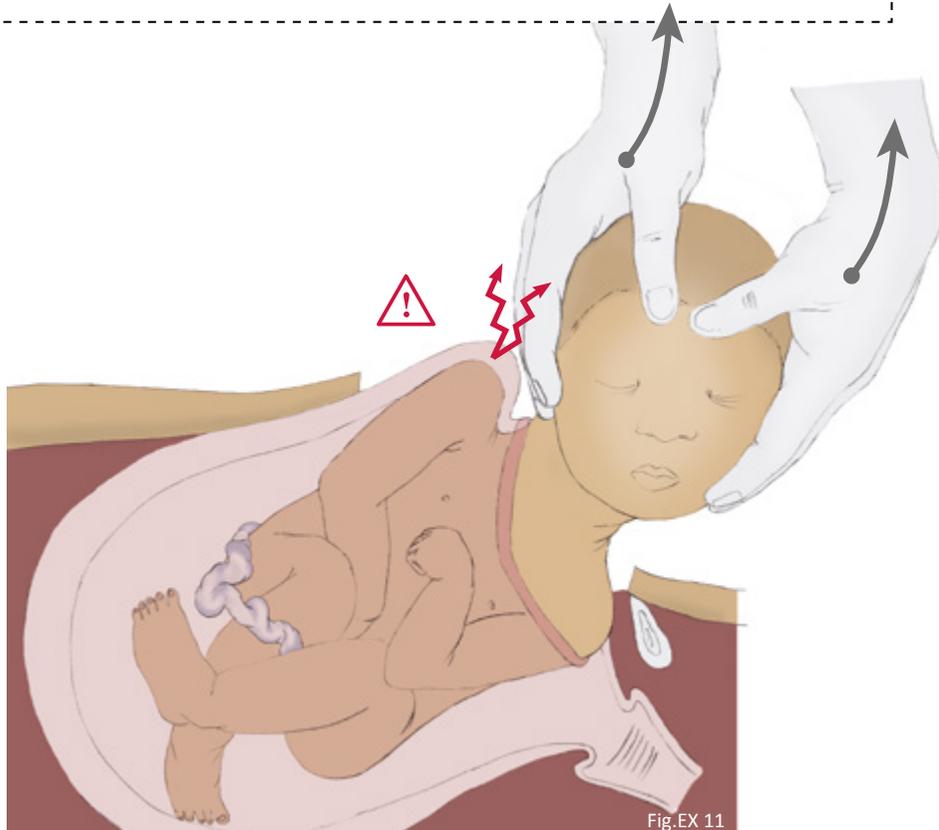
4b

PROBLEM

the anterior shoulder fails to come out.

SOLUTION

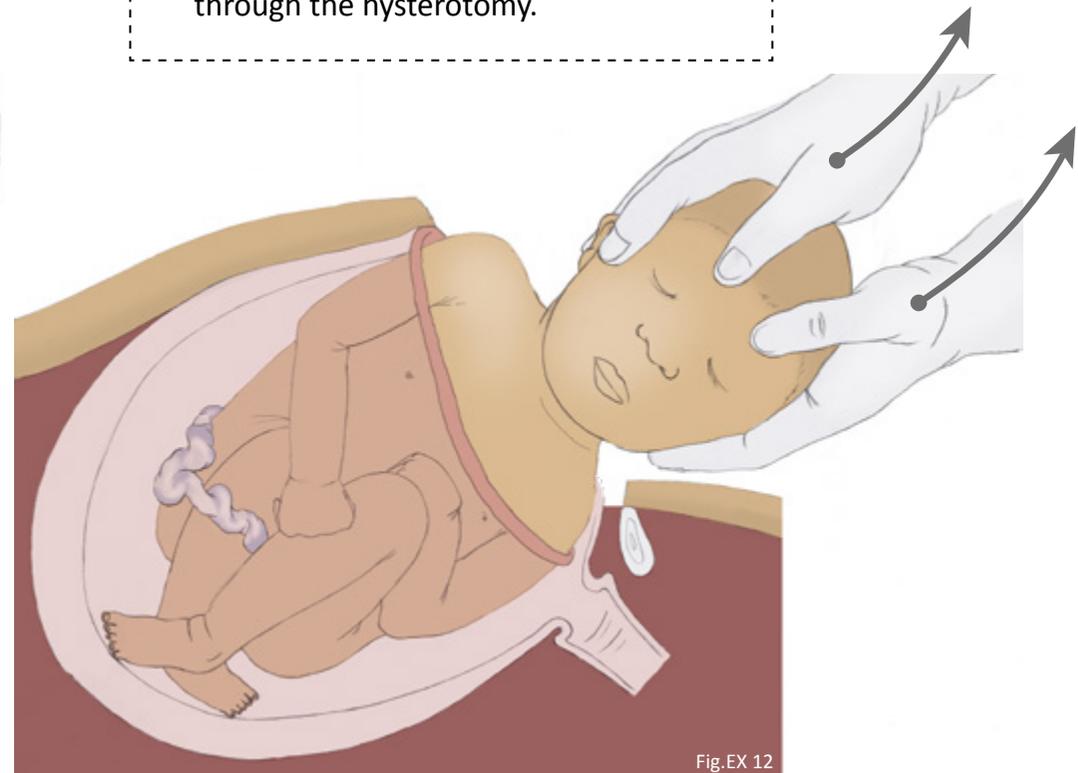
- Lift the head *[towards the maternal anterior wall]* obliquely *[rotate the head in a wide 180° movement]* to release the posterior shoulder.
- The anterior shoulder will usually be freed...
[Space found after the posterior shoulder was freed.]
- Then continue as in the **usual case**.



5

USUAL CASE

- Now lift the baby's head *[towards the maternal anterior wall]* to pass the posterior shoulder through the hysterotomy.



6

Move the shoulders obliquely **through** the hysterotomy.

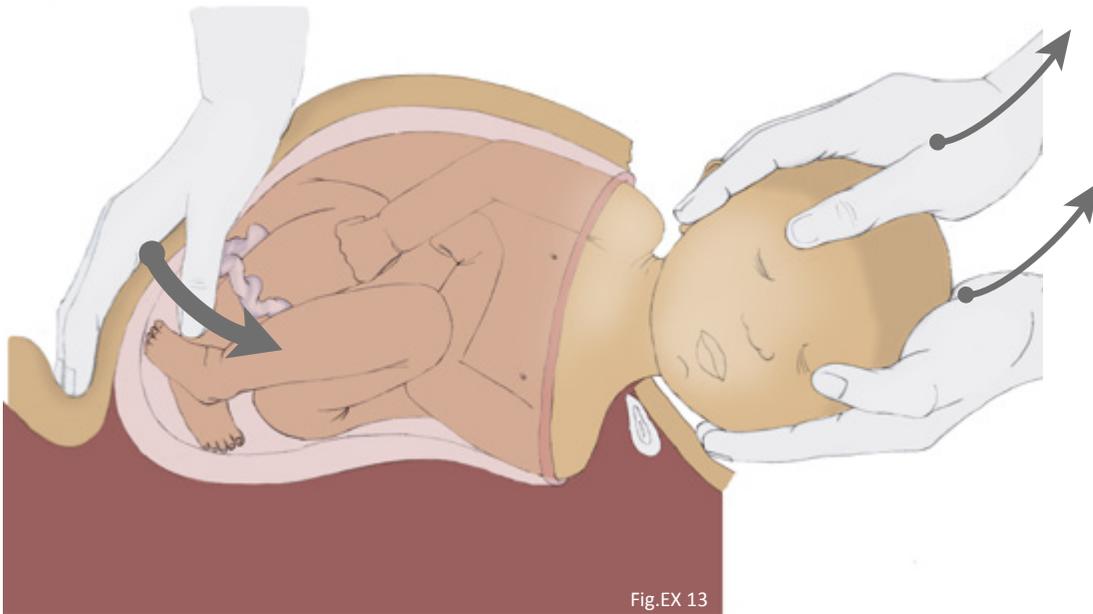


Fig.EX 13

Never extract both shoulders at the same time as there is a major risk of uterine tearing.

7

The child comes out **spontaneously.**
[Sometimes quickly!]

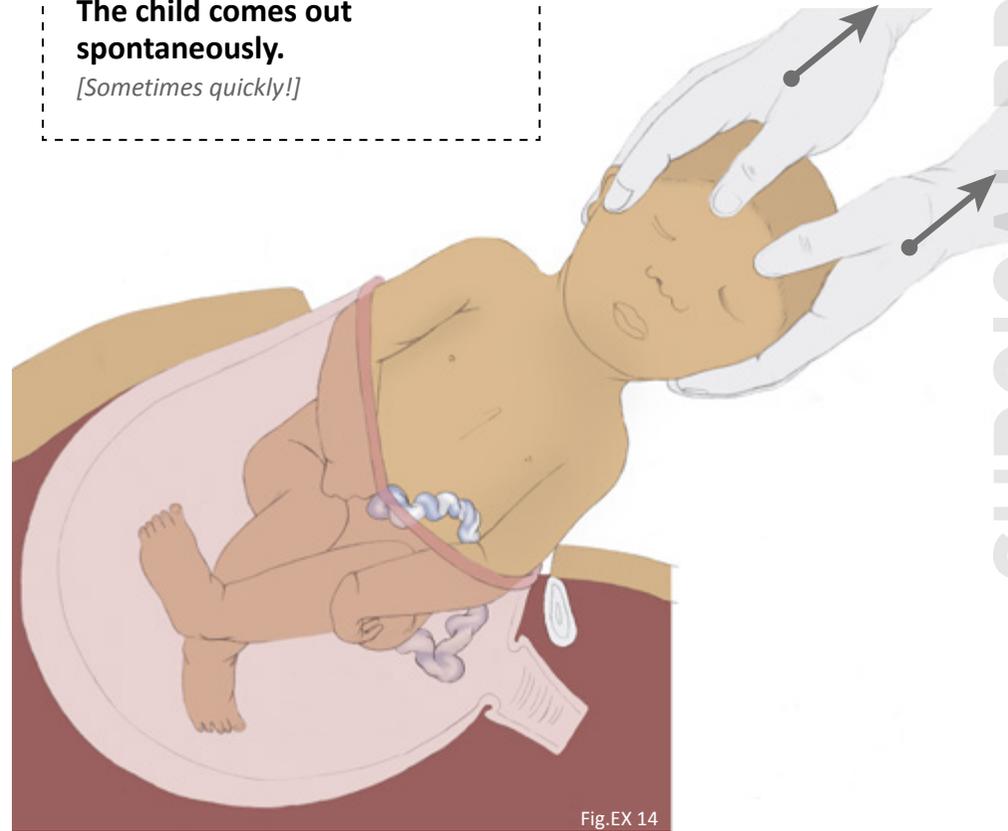


Fig.EX 14

B) BREECH PRESENTATION

Identify the type of breech presentation (frank, footling or complete).

A frank breech presentation (buttock) is the most common and is extracted in the same manner as head first.

Do not confuse hand and foot.

The assistant presses the head through the uterine fundus.

1. Frank breech :

the lower limbs lie along the child's abdomen (you only feel the buttocks).

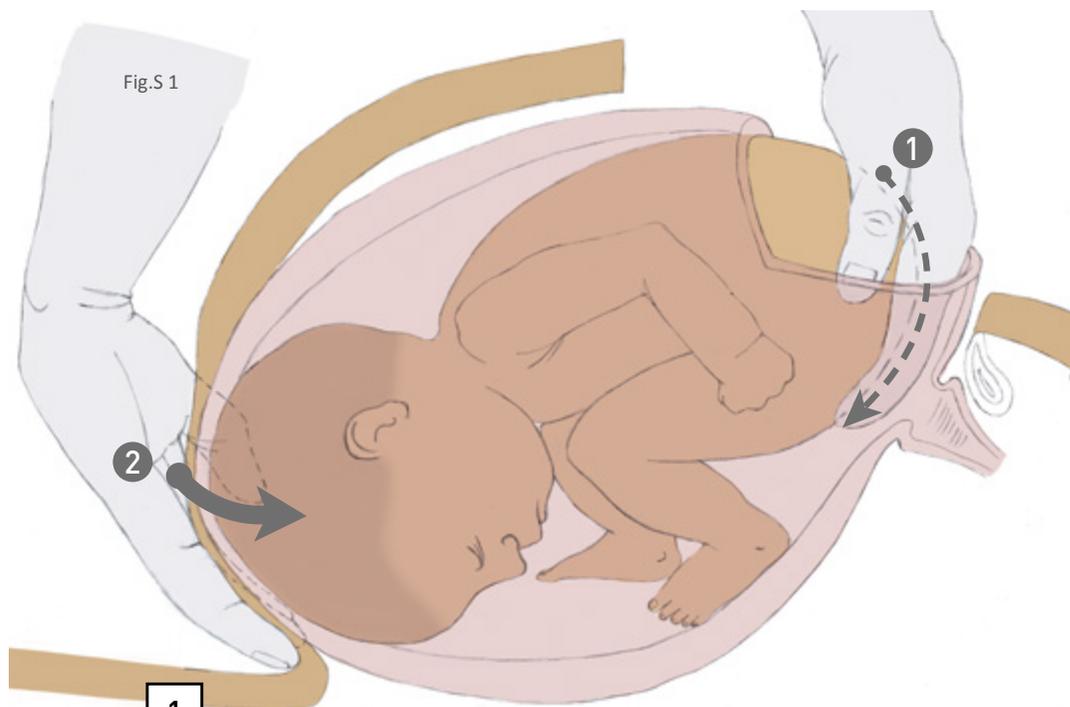


Fig.S.1

1

Lift the presentation (buttocks) with cupped hand under the buttocks.

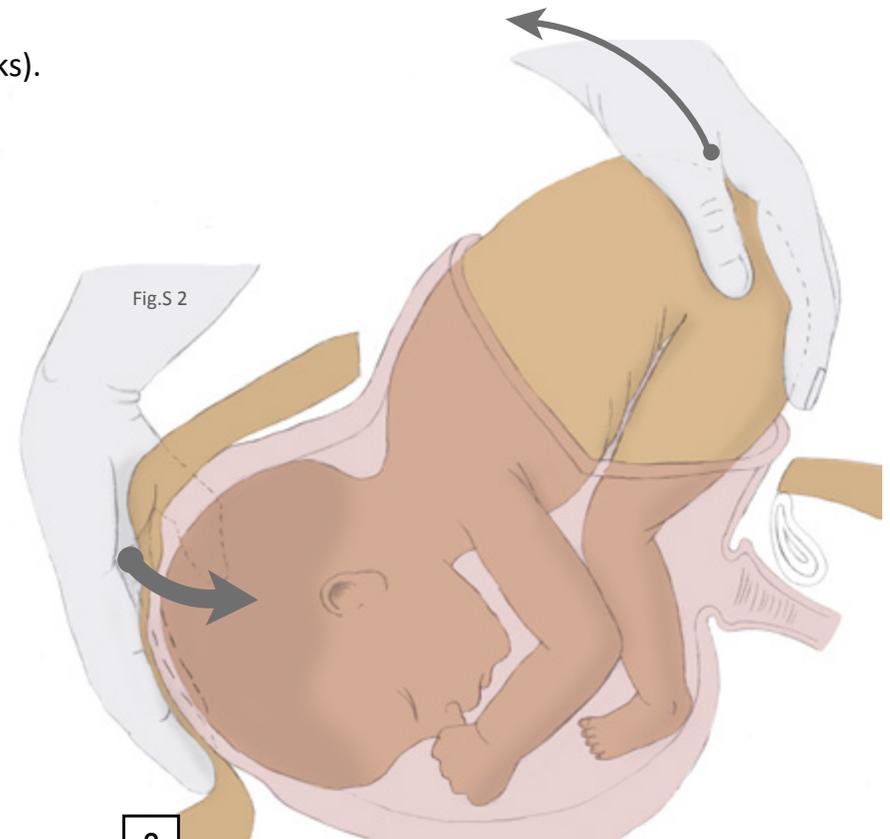
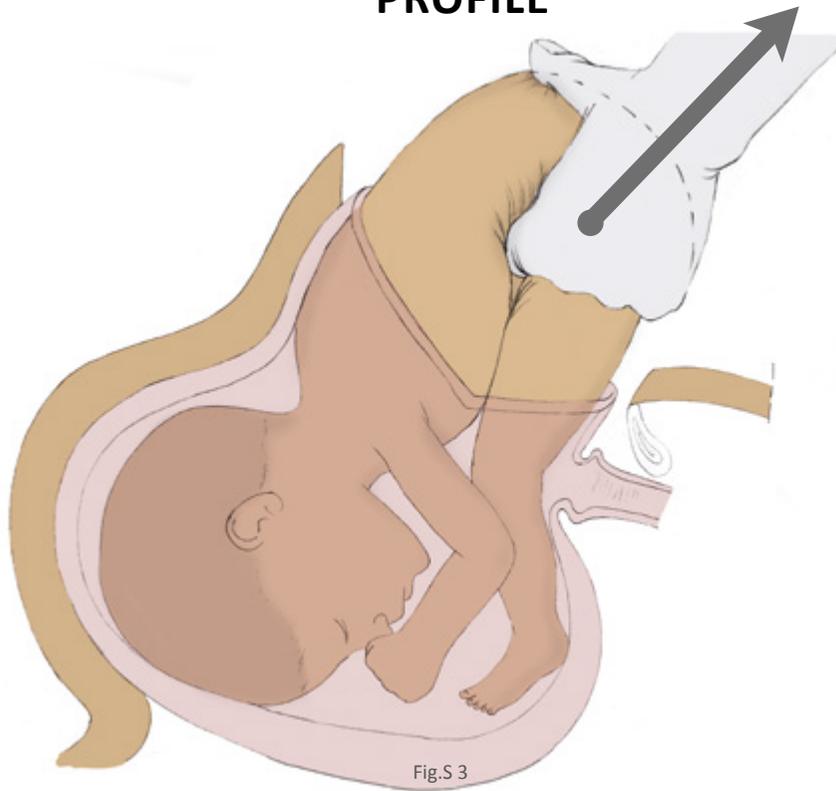


Fig.S.2

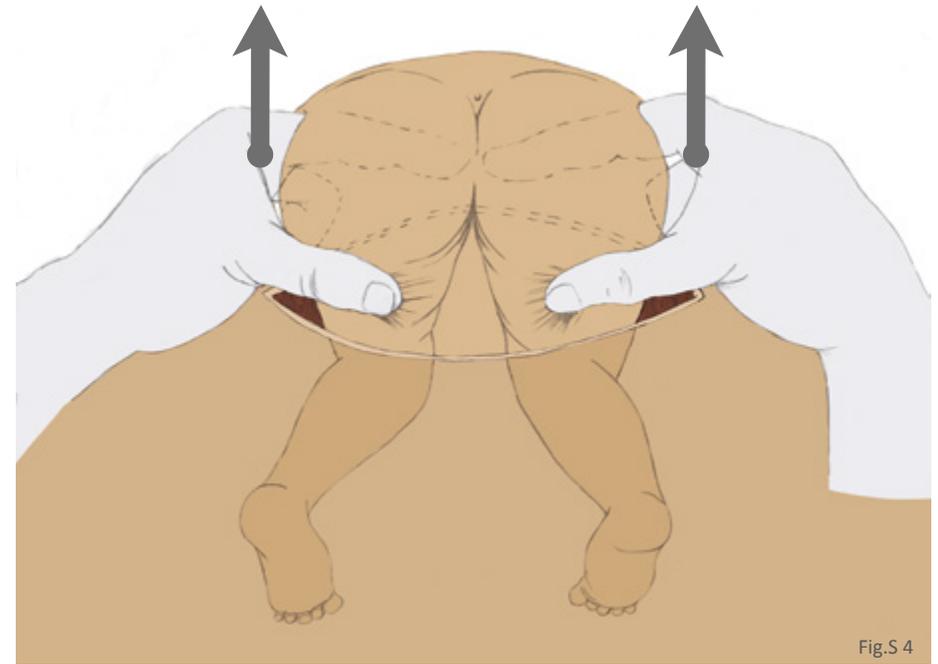
2

Push the presentation out of the uterus with the assistant's hand on the uterine fundus.

PROFILE



FACING MOTHER'S ABDOMEN



3

Grasp the hips with both hands:
Either: the index fingers are on the iliac crest and the thumbs are in the groin area
Or: the thumbs are on the iliac crest and the index are in the groin area (Fig. S.3)
Or: the thumbs are on the upper end of the thigh and the index in the groin area (Fig. S.4)

4

Pull the hips upwards [*towards the mother's anterior wall*] until the feet are completely out of the uterus.

5 Identify the emergence of the child's umbilical cord as an abdomen marker

6 If the abdomen is anterior, turn the child so that its BACK is ANTERIOR.

PROFILE

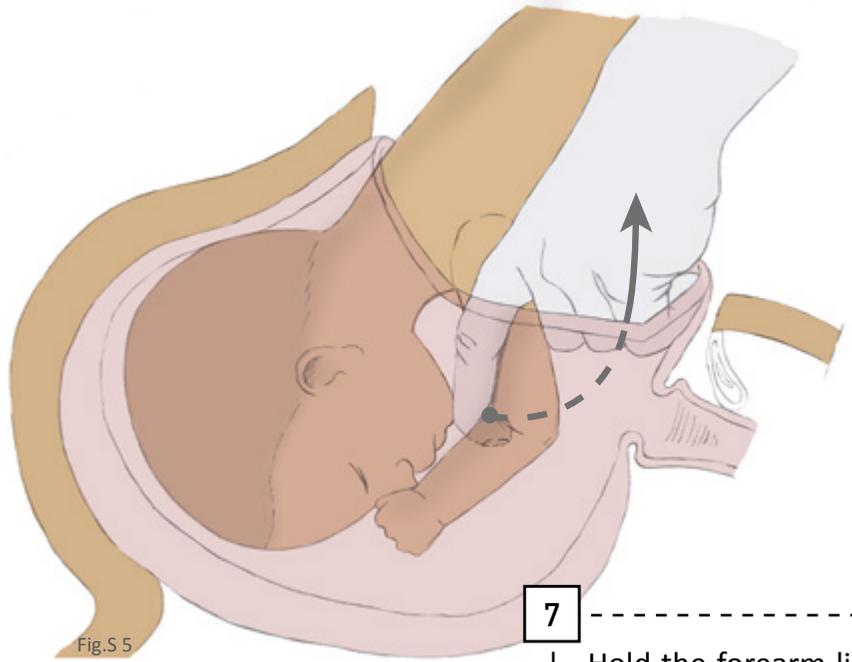


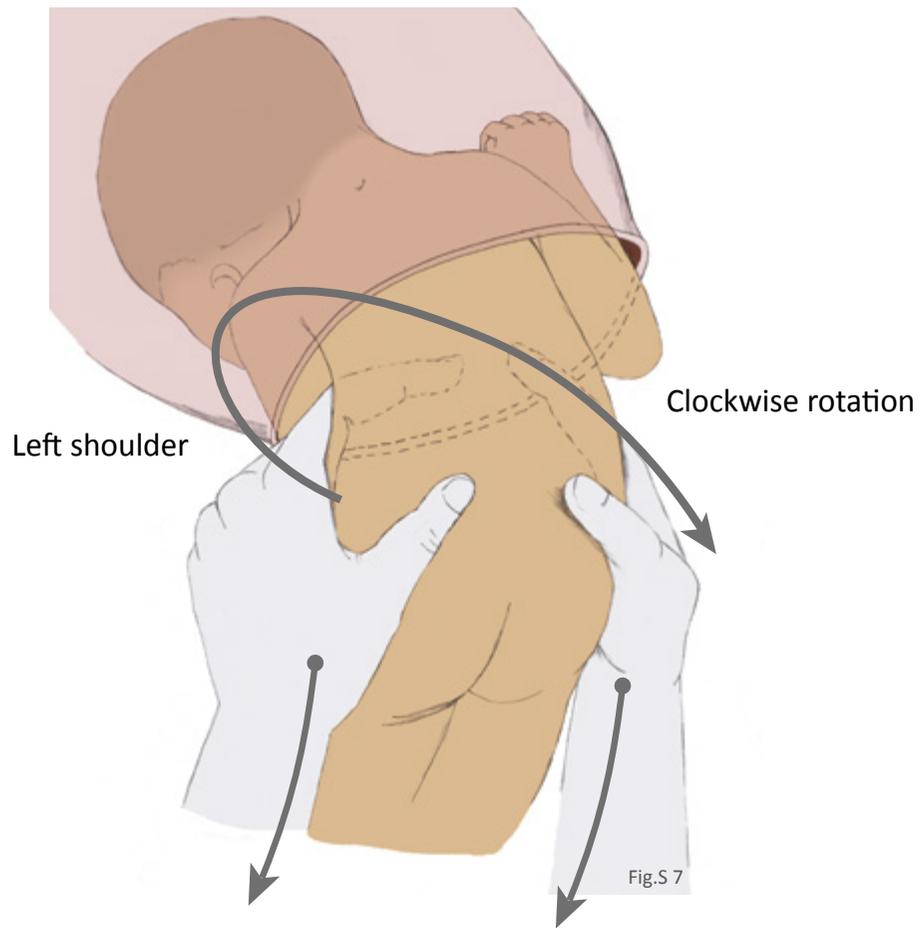
Fig.S 5

FACE

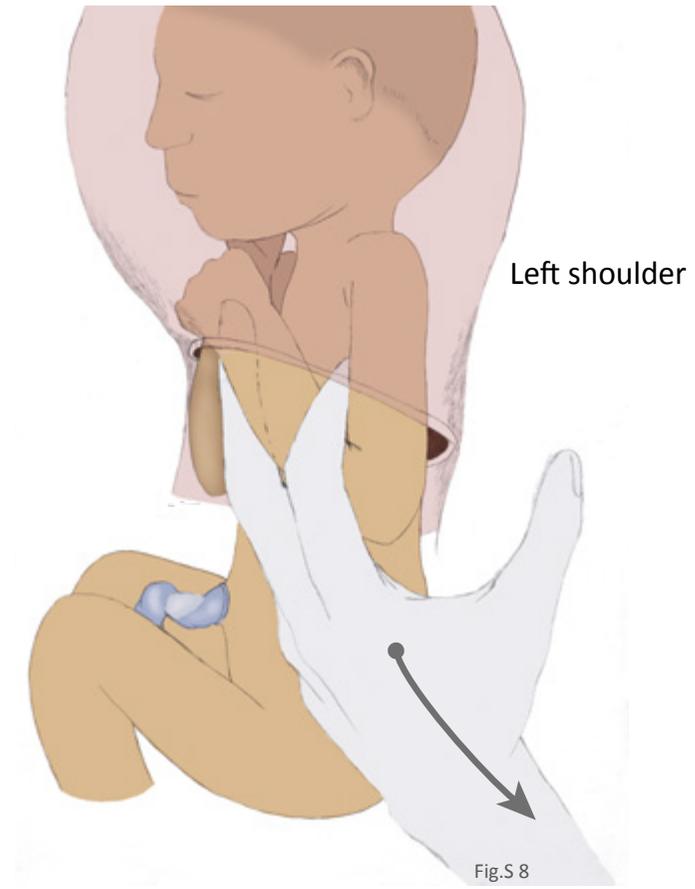


Fig.S 6

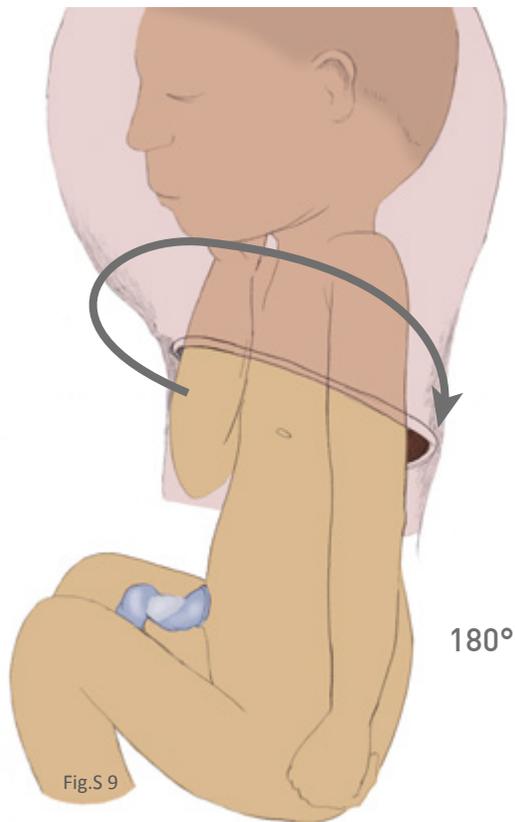
7 Hold the forearm like a splint. Hook the child's elbow between the surgeon's index finger and middle finger with the arm also in a splint with your thumb.



8 Pull down by the hips while rotating the child **clockwise** to completely anteriorize the shoulder.



9 Lower the anterior shoulder and deliver the forearm from the uterus.



10

Perform a 180° **clockwise** rotation of the child. [*Lovset manoeuvre*]

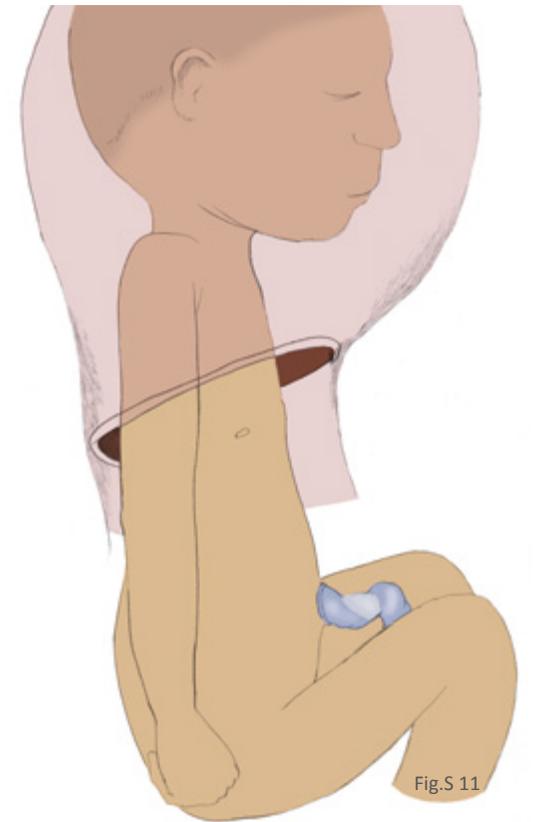


11

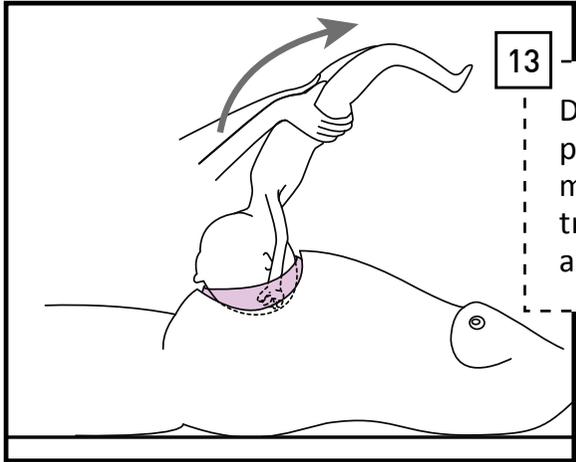
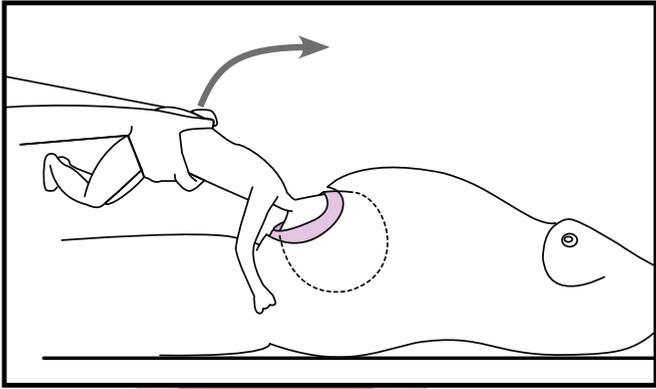
The former posterior shoulder becomes anterior. Take this arm like in a splint. With the index finger hook the elbow (kept bent) and exert downwards traction.

12

Lower and deliver the arm **AFTER** having lowered the child's head as far as possible by pulling the child down (i.e. along the axis of the maternal legs).



USUAL CASE



13

Deliver the child's head by pivoting (possibly Bracht manoeuvre). Lay the child's trunk on the mother's abdomen.

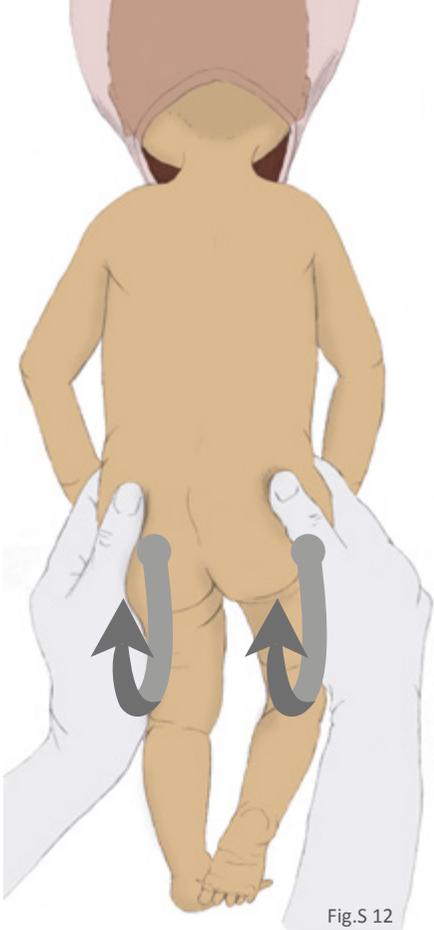


Fig.S 12

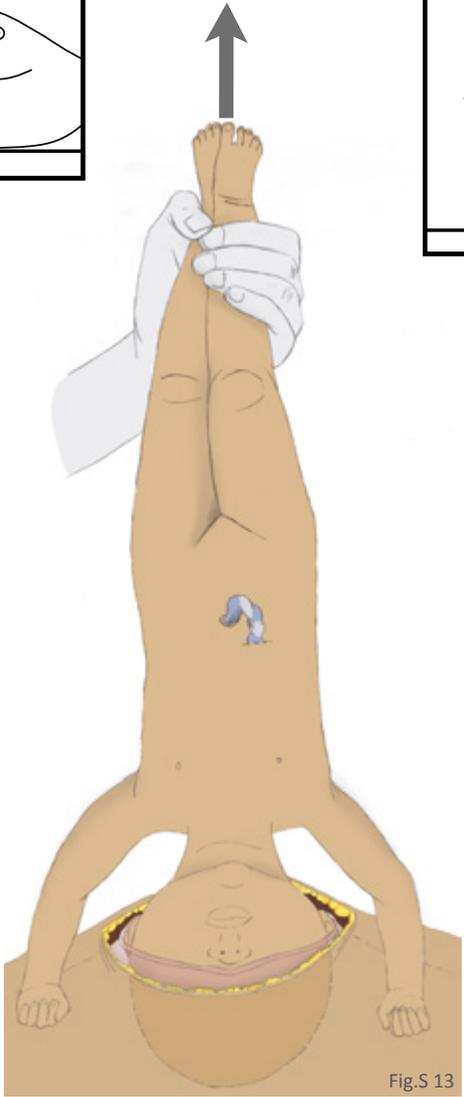


Fig.S 13

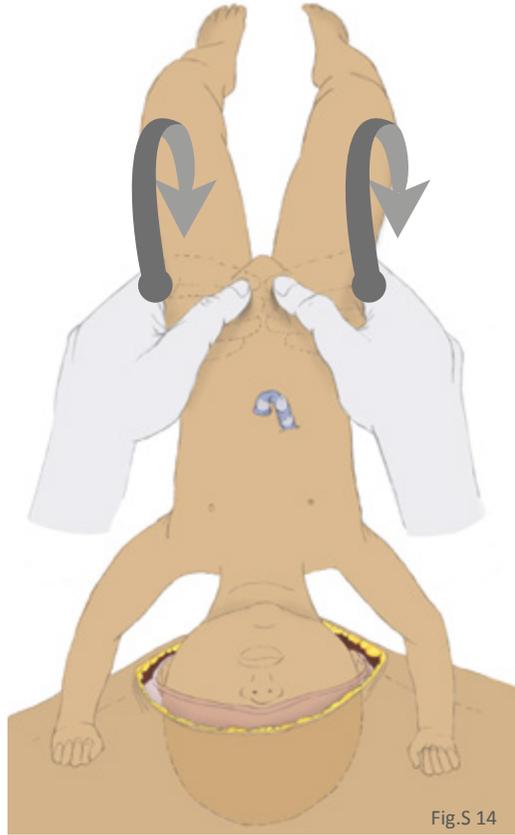
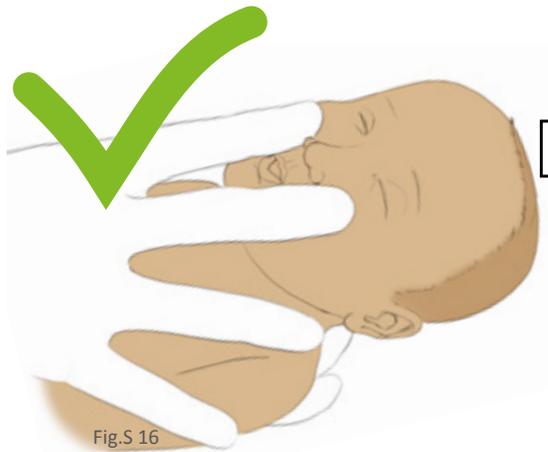


Fig.S 14

PROBLEM

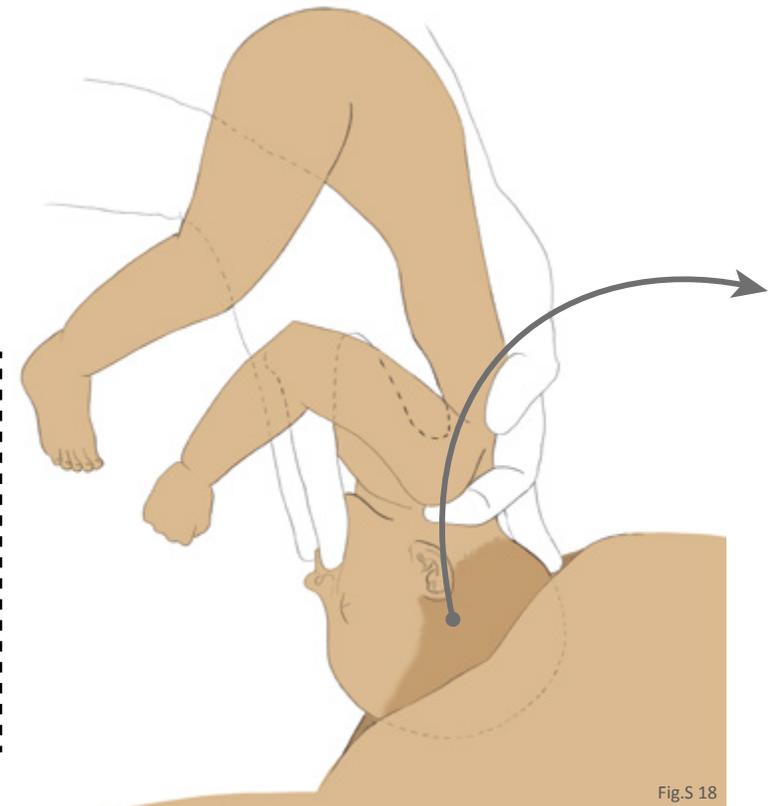
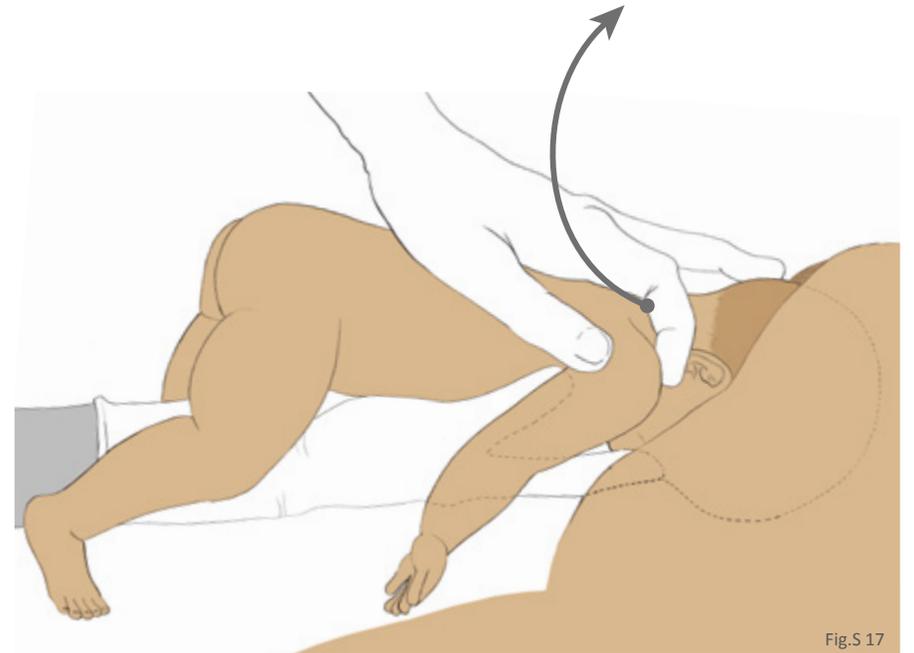


The classic MauriceauSmellie manoeuvre may no longer be performed: the child was laid on its back on the mother's stomach and the surgeon introduced their index and middle finger into the child's mouth to bend the child's head onto its chest (contamination risk)



14

In the event of failure, perform a **modified MauriceauSmellie manoeuvre**, with one hand bending the child's head on to its chest by pushing on the upper jaws [remember: no finger in the mouth] and the other hand pushing back, the upper lip of the hysterotomy.



2. Footling or complete breech :

buttocks and foot or feet

NEVER take out a hand in the first place.
If this happens: reintroduce it into the uterus !



1

Look for a foot or both feet, ideally with amniotic membranes still intact and rupture them only once the foot or both feet are grasped in your hand.

2

Take the feet out.

3

Turn child's back to the anterior position.

4

Continue the breech extraction as a frank breech (buttocks only).

C) TRANSVERSE LIE PRESENTATION

The intrauterine hand must identify :

- back anterior
- or
- back posterior

1. Back anterior

Differentiate between upper and lower limbs.

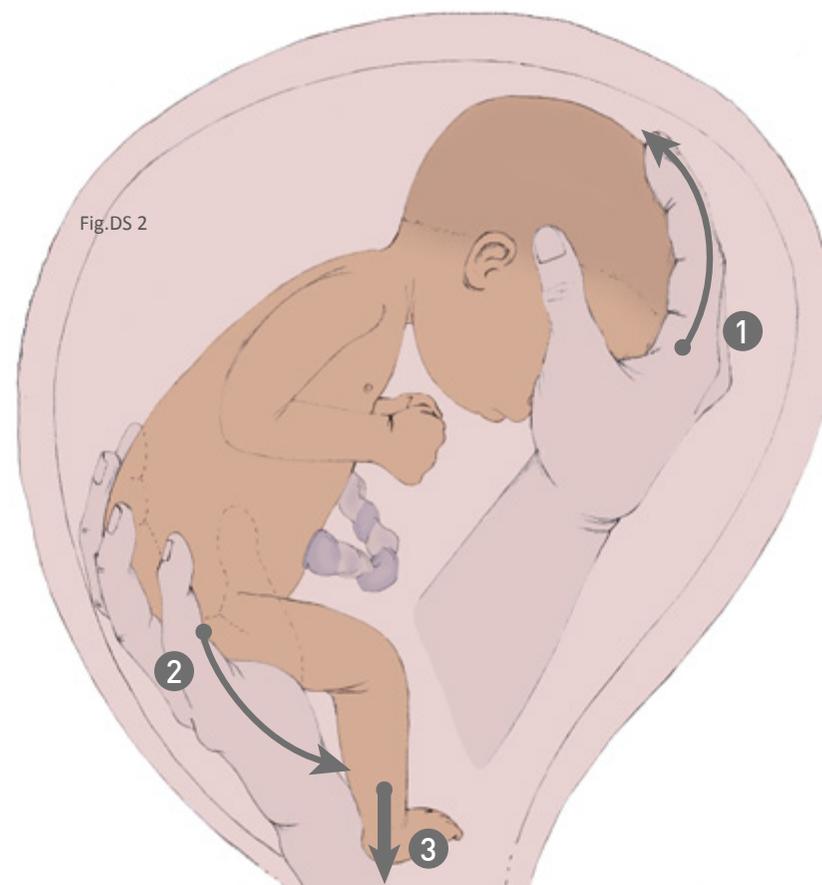
If child's hand should come out of the uterus (or is inadvertently grasped by the surgeon), put it back into the uterus



- 1 Feel the insertion of the cord at the umbilicus, feet, hands.

⚠ Beware of foot and hand confusion!

Ideally, in all cases of internal version and/or extraction, the feet must be found and grasped with amniotic membranes intact. These are ruptured at the beginning of extraction.



- 2 Perform the version/ extraction :
 - 1 First locate and raise the head (the cupped hand presses on the head (face or occiput)
 - 2 Then lower the hips with your hand on the buttocks
 - 3 Take BOTH feet in one hand, deliver them and then turn the back to the anterior position (proceed as for complete breech)

2. Back posterior

A flat surface is felt.
Beware of mistaking the head!



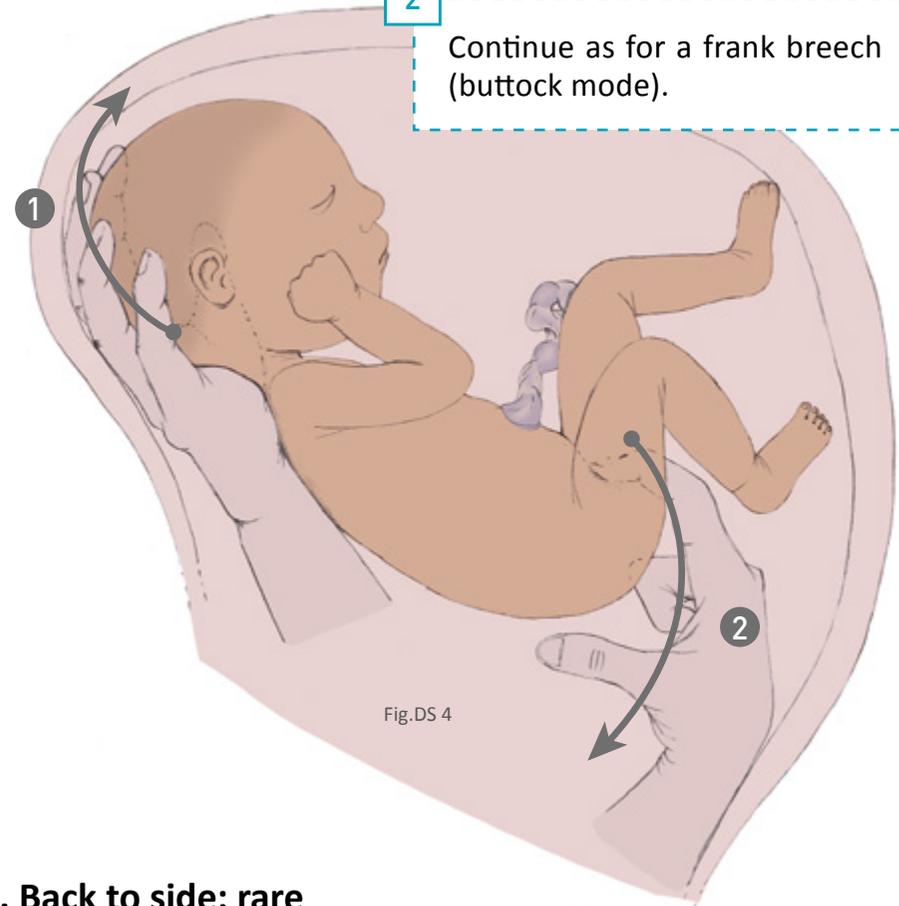
Be sure to locate where the head and seat are respectively!

1

- 1 Raise the head upwards, the cupped hand presses on the back and head (occiput).
- 2 Hook the crotch with the index finger and lower the seat towards the hysterotomy.

2

Continue as for a frank breech (buttock mode).

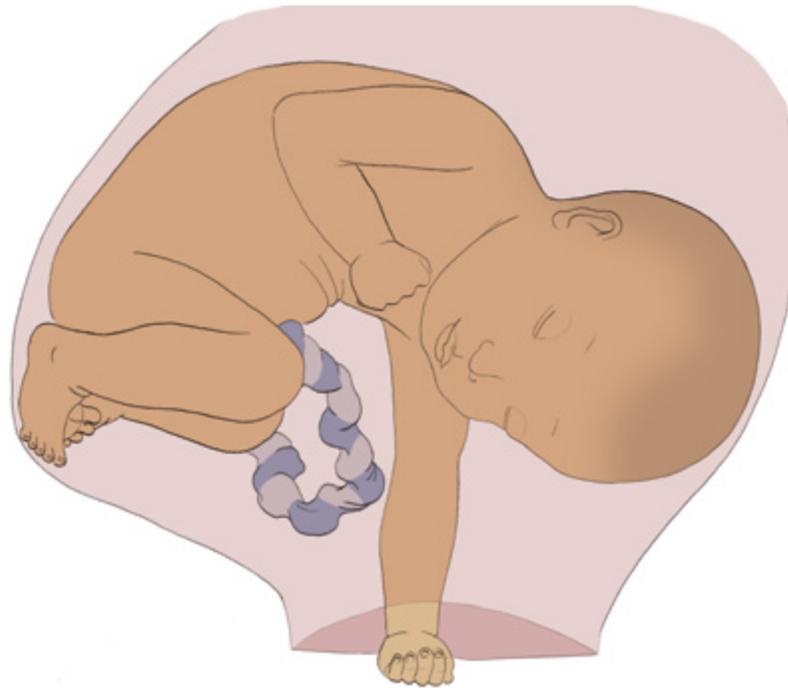


3. Back to side: rare

You feel both back AND limbs.
Turn the child to back down or back up

D) SHOULDER (AND VAGINAL HAND) PRESENTATION

Reach up, hand on the occiput, head towards the top of the uterus, which raises the shoulder (and the hand).
Continue as a frank breech presentation.



E) TWINS

Preoperative ultrasound localization.

Ideally, in all cases of internal version and/or extraction, one must find and grasp the feet with intact amniotic membranes. These are ruptured at the beginning of the extraction.

Vertex-vertex	40%
Vertex-Breech	21%
Breech-vertex [59]	14%
Breech-Breech	10%
Vertex or Breech or Transverse-Transverse	15%

1. Breech-Vertex

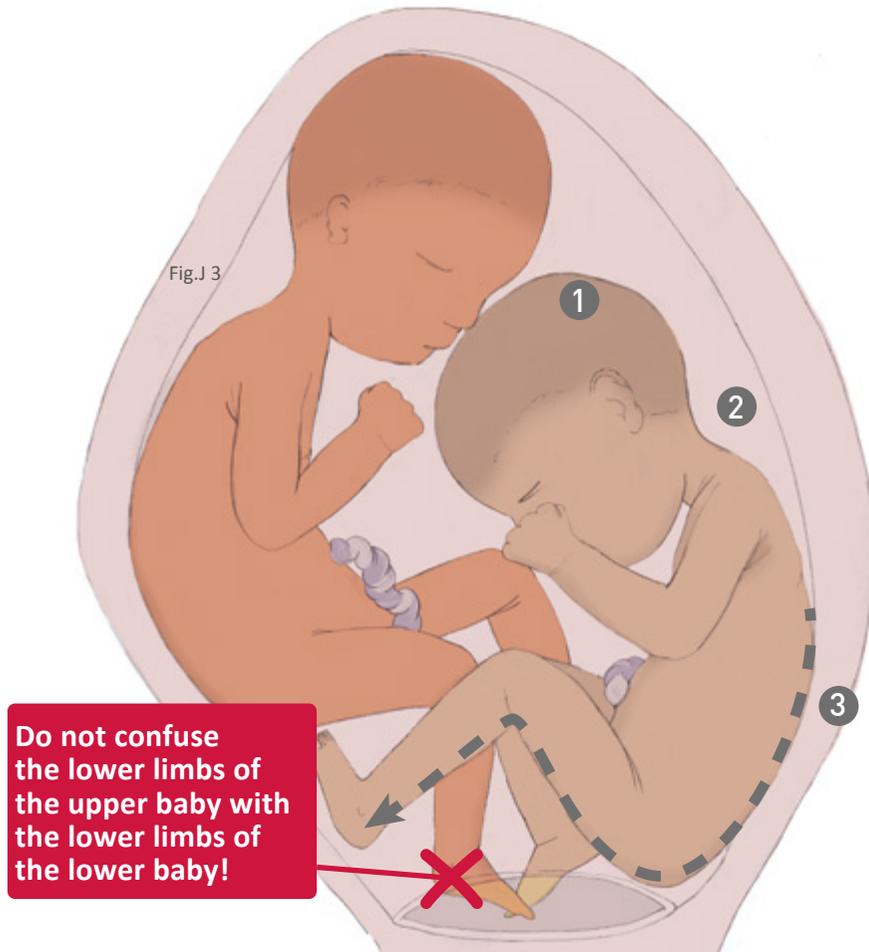


2

Locate the presentation of the second baby, intact amniotic membranes: extract it as a singleton after amniotic membrane rupture.



2. Breech-Breech



1

- 1 Locate the presentation of the 2 heads starting from the back.
- 2 Identify the lower foetus with the lowest head.
- 3 Slide along their back, buttocks, lower limbs.

2a

Try to deliver the lower baby by breech extraction.

3a

Extract the breech by the feet.

[If the feet of the second foetus come out through the hysterotomy put them back into the uterus BEFORE proceeding with the extraction of the first foetus.]

4a

Second child: proceed as for a single (singleton) breech.

3. Transverse lie -Transverse lie

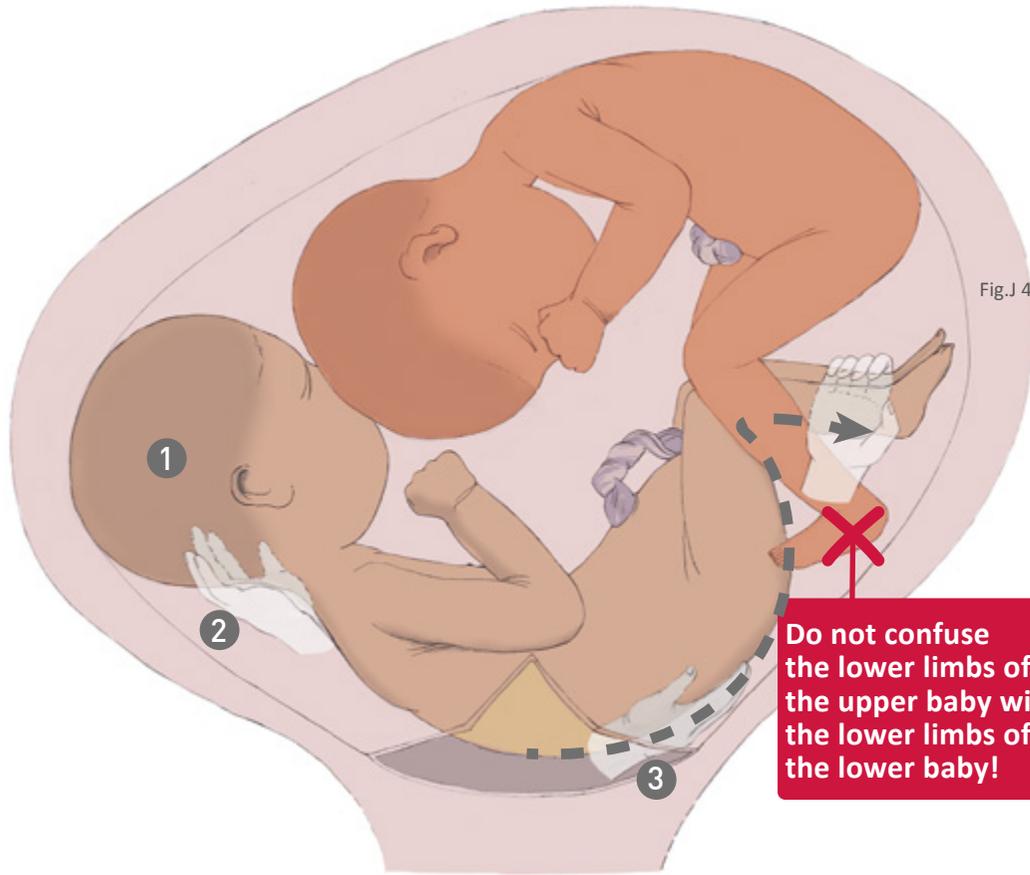


Fig.J 4

- 1
- ① Locate the presentation of the 2 heads starting from the back.
 - ② Identify the lower foetus with the lowest head.
 - ③ Slide along their back, buttocks, lower limbs.

2b

In case of transverse presentation: try the intrauterine version, with intact amniotic membranes.

- 3b
- **If the version succeeds :** extract the child as a singleton.
 - **If the version fails :** proceed with amniotic membrane rupture followed by extraction version (see: singleton extraction in transverse presentation).

Do not confuse the lower limbs of the upper baby with the lower limbs of the lower baby!

If the second baby presents transversely, turn them to a longitudinal lie with still intact amniotic membranes (do not perform amniotic membrane rupture before this)

If a T-incision has to be performed it requires careful monitoring of subsequent pregnancies.

C. COMPLICATIONS

1. Impossible to extract the foetus through the lower segment incision

Cause :

- Immature uterus: < 32 weeks
- Transverse lie presentation
- Uterine malformation (rare)

Treatment :

1) Use of small sterile intraoperative suction cups.

[In conditions of limited resources, in case of difficult extraction, the suction cup and in particular small manual vacuum cups are very easy to use.]

2) In the case of an immature uterus <30-32 weeks, longitudinal cervical hysterotomy and sometimes corporeal hysterotomy is preferred if it is estimated before incising that there is not enough space for a transverse hysterotomy.

3) Inverted T-incision

[over 5cm for the vertical branch]

alternative in case of extraction failure by suction cups or if cups are not available or if you have already performed a transverse hysterotomy on the patient.

2. Rupture of the uterine pedicles

→ see *Rupture of uterine pedicles*

5 PLACENTAL DELIVERY

A. OBJECTIVE

B. TECHNIQUE

USUAL CASES

COMPLICATIONS

A. OBJECTIVE

To ensure complete delivery of the placenta with minimal blood loss:

- Through haemostasis of the uterine placental wound
- By removal of any membrane, source of infection or dehiscence of the uterine wound (isthmocele).

1) After fetal birth inject the mother with 5 IU oxytocin IV and 5 IU after placenta expulsion

[Alternative: 10 IU of oxytocin in one bolus after delivery.]

[Methergine 0.2mg IV can be given as an alternative to oxytocin.]

[Methergine is contraindicated in the event of gestational hypertension due to the risk of maternal vascular spasms.]

2) Check that there is no active bleeding of large vessels.

3) Ensure haemostasis of the uterine wound edges with abdominal compresses.

4) Check the integrity of the placenta and membranes.

5) Perform systematic uterine cleaning.

[Risk of membrane or cotyledon retention] [60]

Spontaneous delivery of the placenta must be the rule.

[In spontaneous delivery blood loss is on average 200ml lower than in manual delivery.]

B. TECHNIQUE

USUAL CASES

When delivering the foetus, it is highly recommended **NOT TO CLAMP THE CORD IMMEDIATELY** [61-63].

Wait 1 to 3 minutes (especially in premature babies) unless resuscitation is required

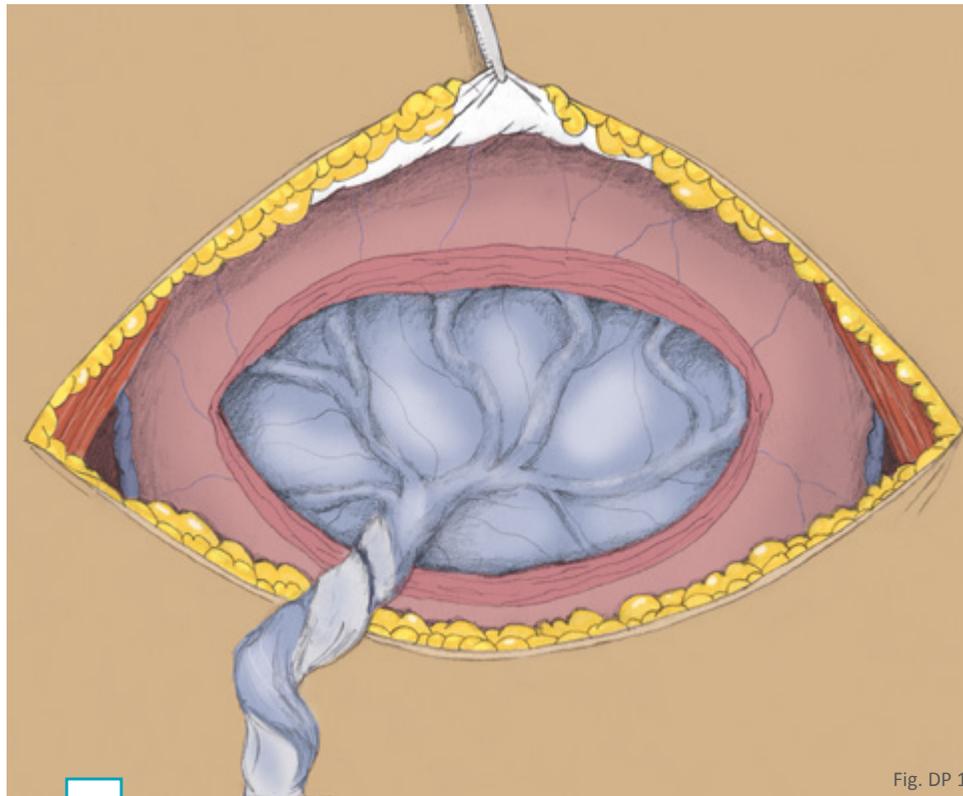


Fig. DP 1

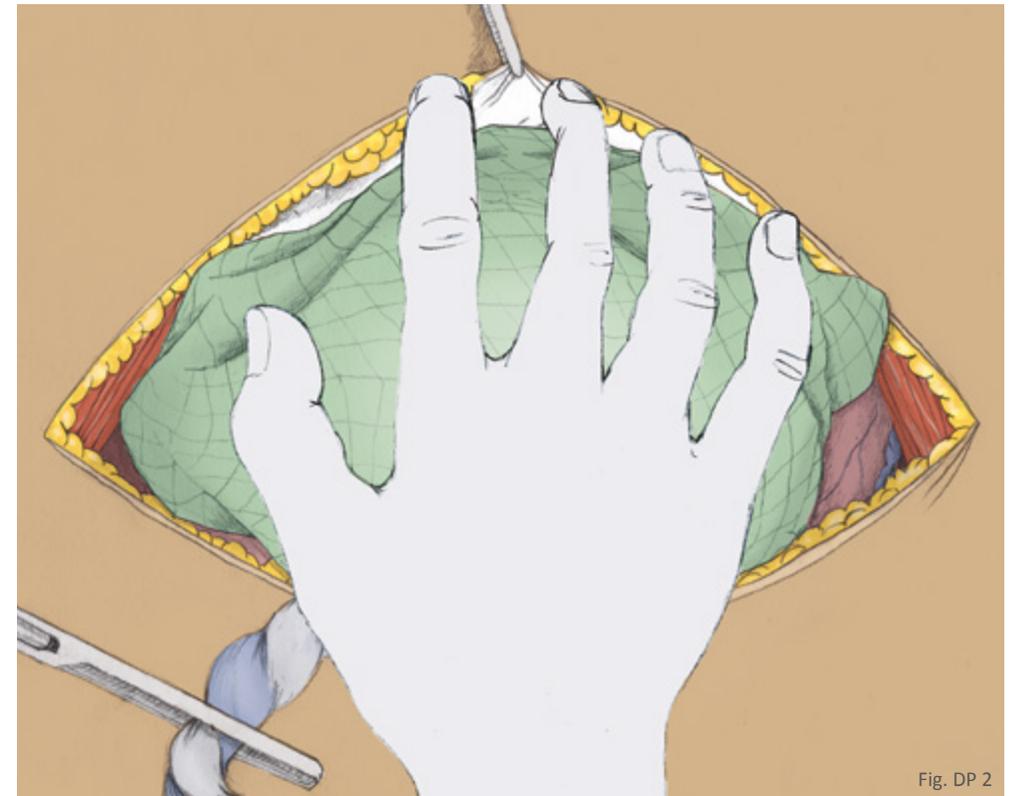


Fig. DP 2

1

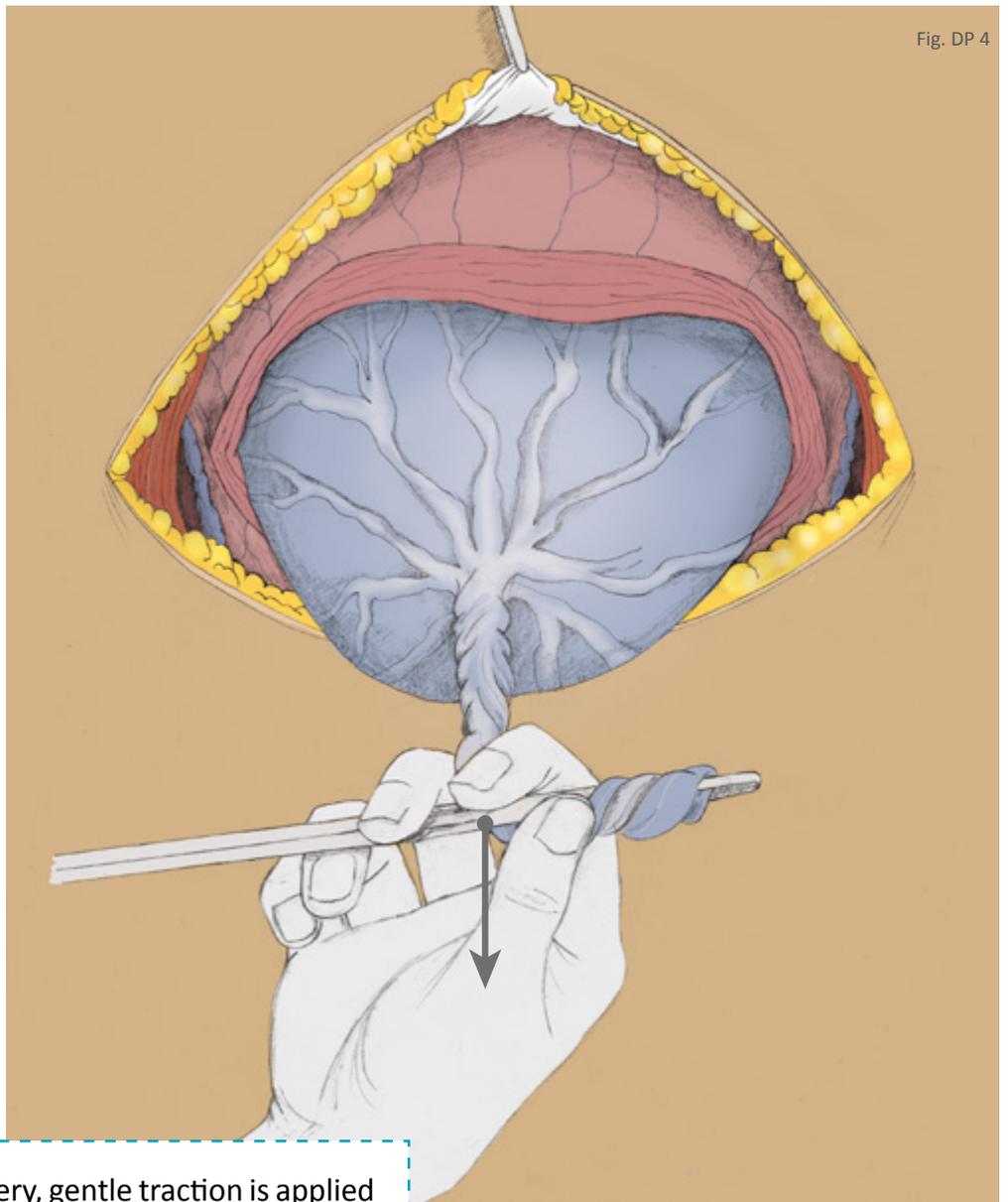
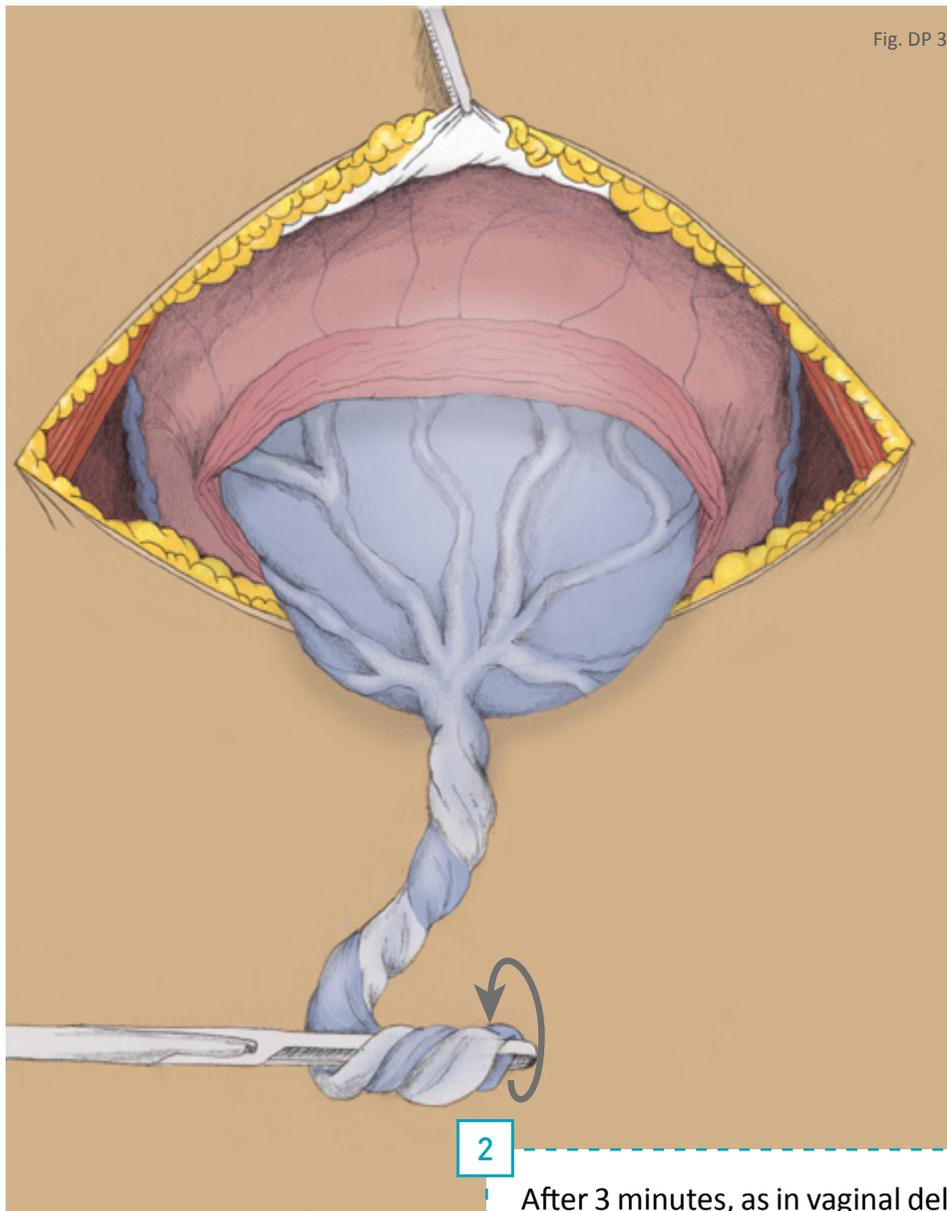
After sectioning the cord, an abdominal compress is placed on the hysterotomy edges. Manual pressure ensures haemostasis.

[Use this time to check mother and child vital signs]

Haemostatic FOERSTER clamps are only used in cases of uterine tears or for localized bleeding.

[Giving 10 IU of oxytocin as soon as the foetus is delivered does not prevent surgeon from waiting before cord clamping]

The contraction of the uterus allows spontaneous placental delivery with minimal blood loss.



2

After 3 minutes, as in vaginal delivery, gentle traction is applied to the cord. The membranes then detach spontaneously. Placenta and membranes are checked on their foetal and maternal sides.



3

Finalize extraction of the placenta and membranes, possibly with surgical artery forceps.

Fig. DP 5

COMPLICATIONS

1. EXTENDED DELAY OF PLACENTAL DELIVERY
2. UTERINE CONTRACTION (PLACENTAL RETENTION)
3. PLACENTA ACCRETA

1. Extended delay of placental delivery :

Placenta not delivered after 5 minutes (most frequent case!)

CONTRIBUTING FACTORS :

- a) Prolonged labour > 24 hours
- b) Large multigravida
- c) Selective Caesarean section (immature uterus)
- d) Caesarean section before 37 weeks

1

Manual delivery of placenta :

Move the fingers of one hand laterally until you locate the edge of the placenta, the other hand gently pulls the cord using a Kocher's forceps.

[Fingers on maternal side, do not push through the amniotic sac]

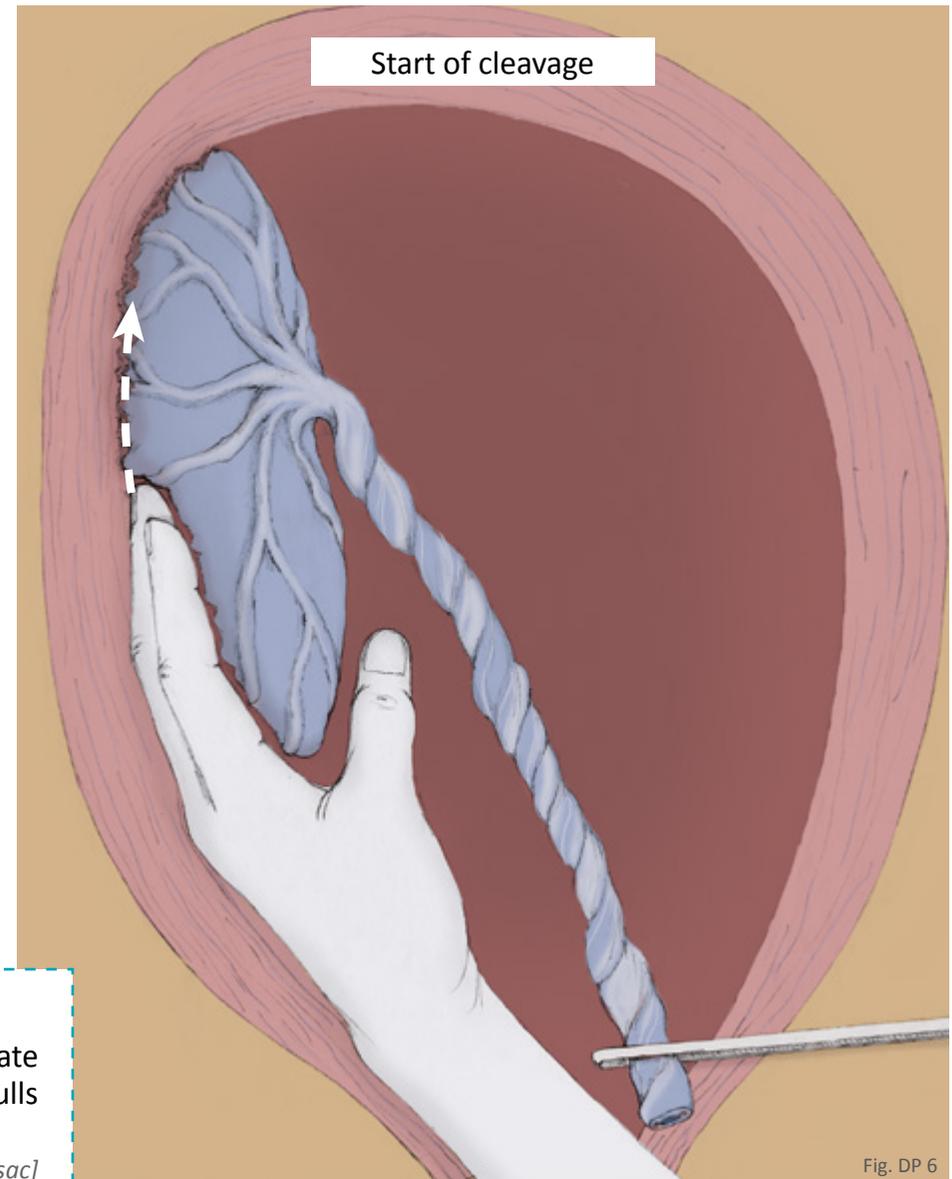
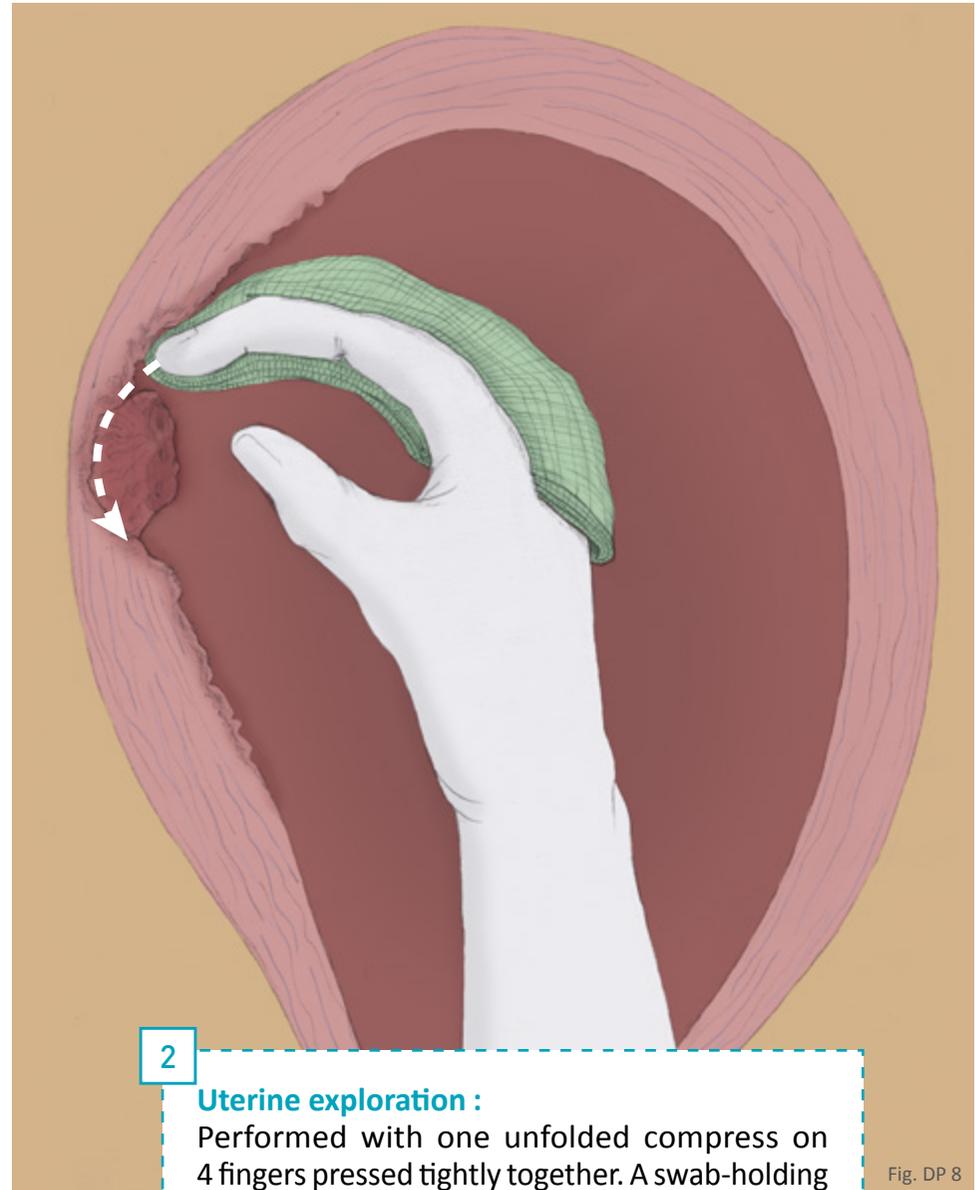
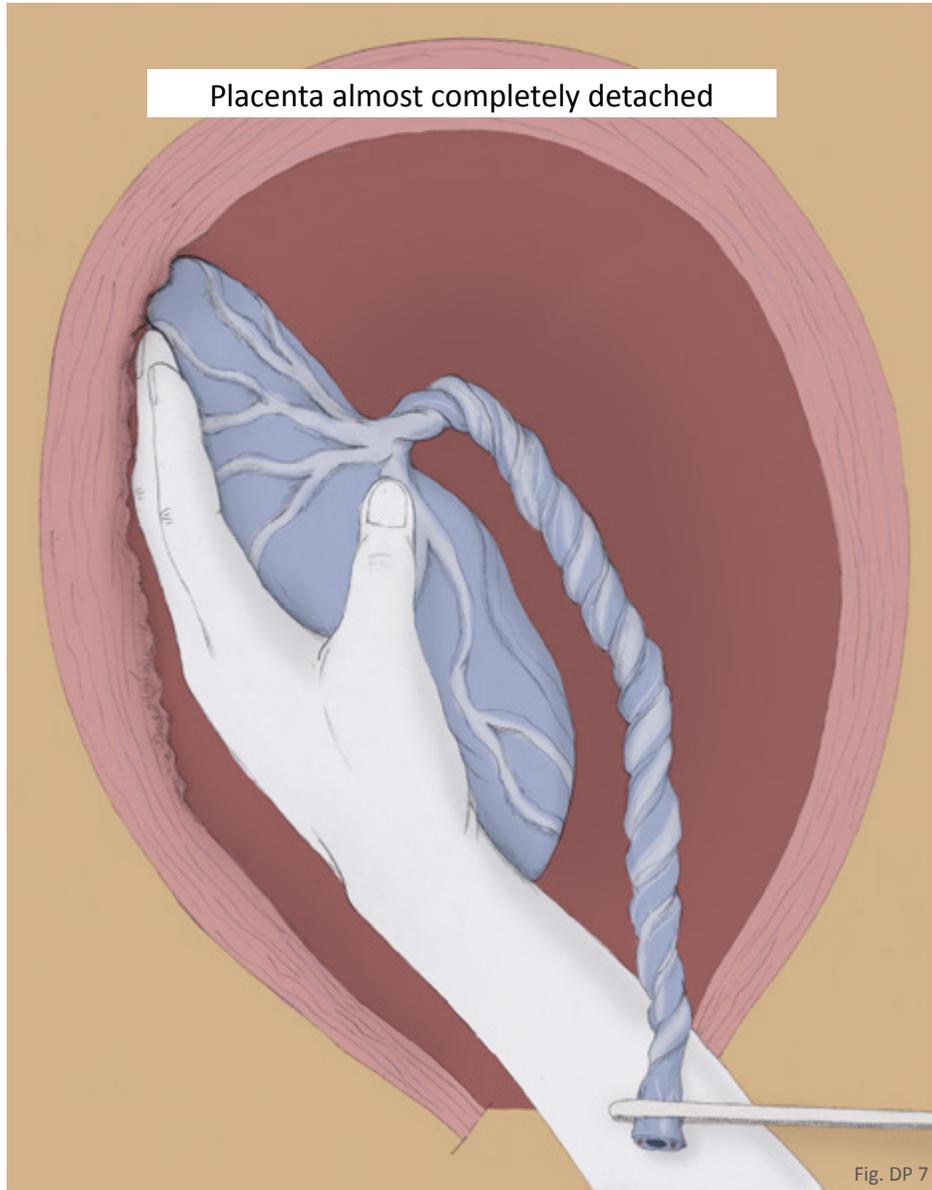


Fig. DP 6



2. Uterine contraction (placental retention)

FAVOURABLE FACTORS :

- a) Incision too low on the lower segment
[In case the lower segment is poorly formed]
- b) Caesarean section before 37 weeks
[because the lower segment is poorly formed]
- c) Oxytocic hyperstimulation [64-65]
[the lower segment is poorly formed and placental cleavage is more difficult]

1

Perform a careful two finger manual delivery.

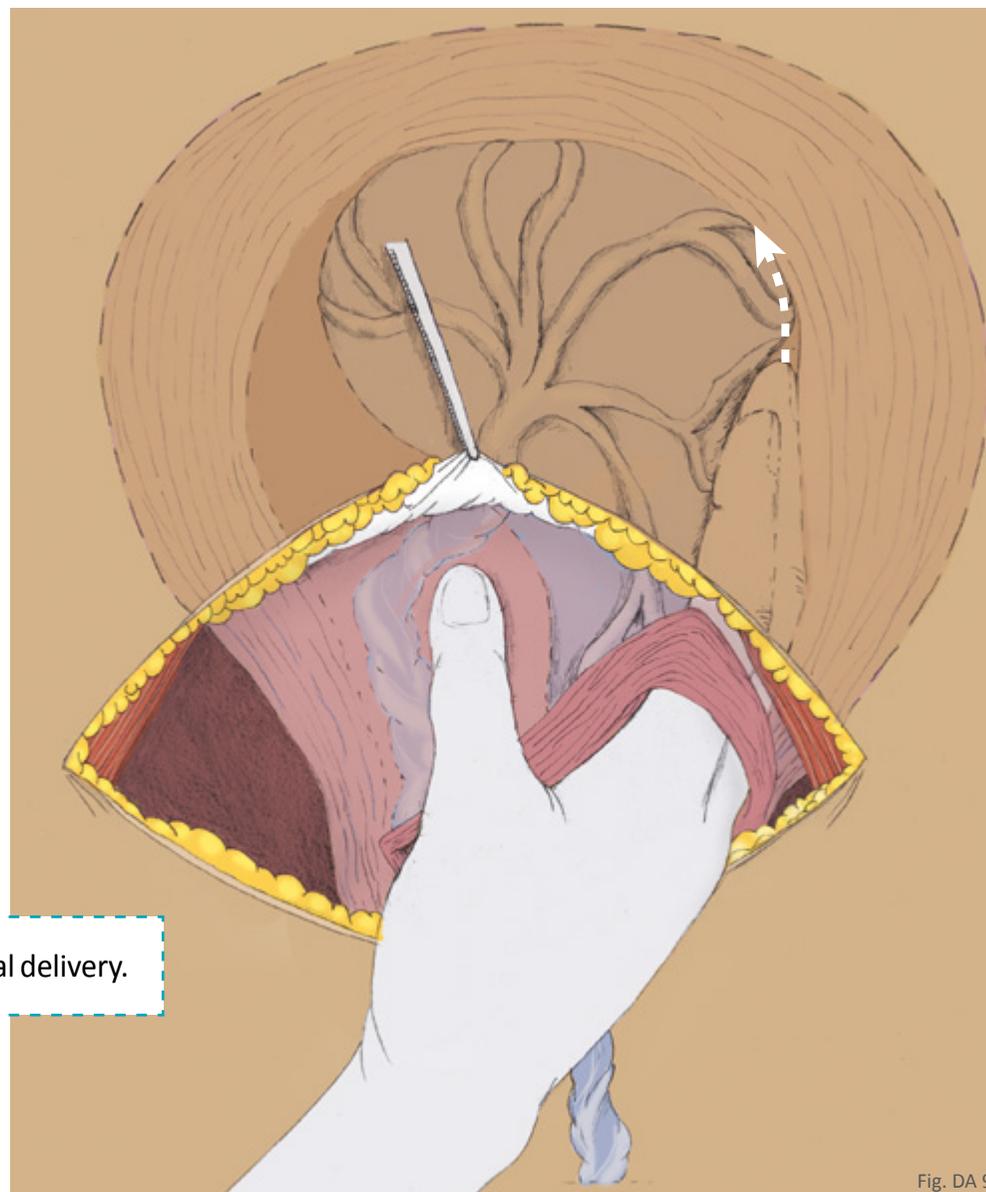


Fig. DA 9

Fig. DA 10

2

If manual exploration is unsuccessful, use two ring forceps to alternately pull the placenta.

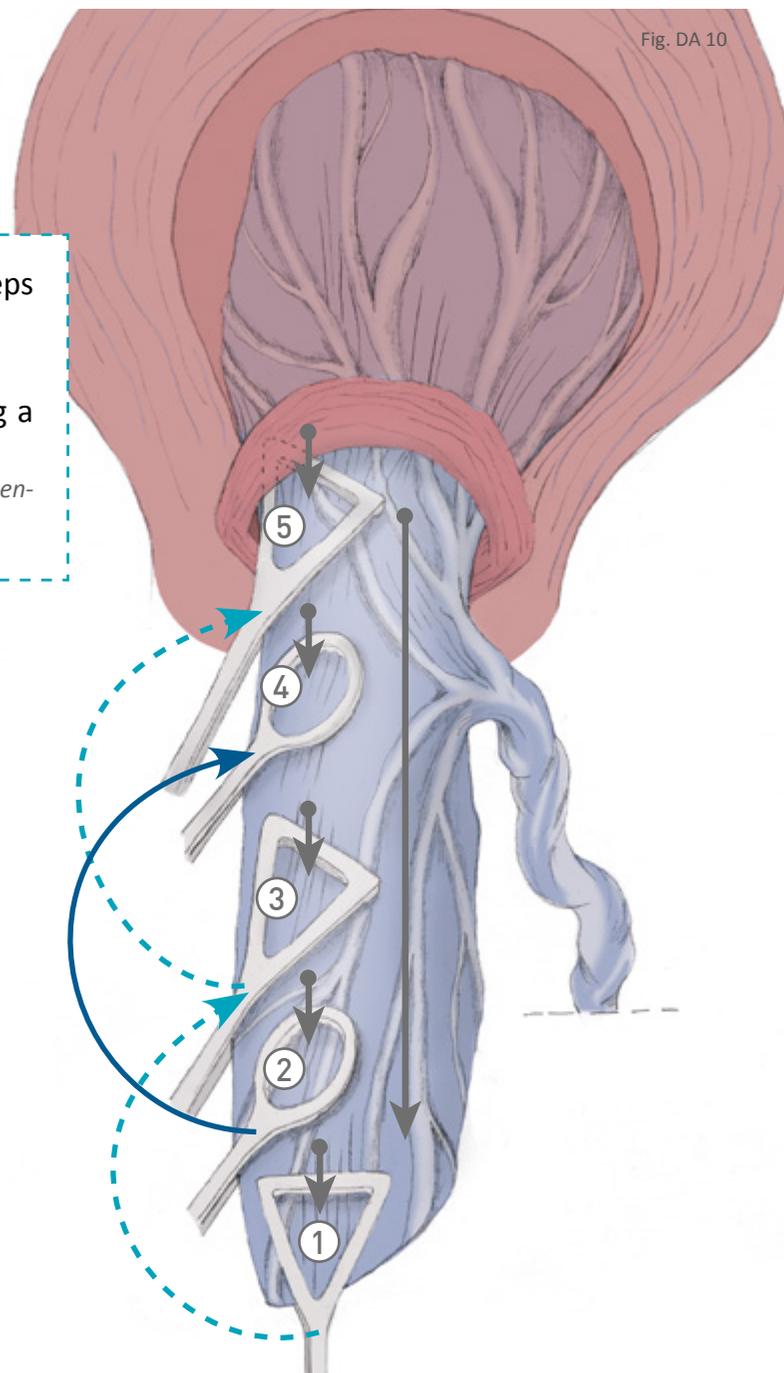
Then systematically perform uterine exploration (using a swab-holding forceps).

[Given the fragmentation of the placenta, it is necessary to verify no placental tissue is missing.]

3. Placenta accreta [66]

This should be considered if manual cleavage is difficult.

- Try to manually find the most appropriate cleavage plane.
- Complete the extraction by systematic removal of any placental lobe or tissue.
- Finish up with uterine exploration with compress
- In the event of placenta increta, discuss the indication for a subsequent hysterectomy *[after the c-section intervention]*.



6 UTERINE CLOSURE

A. OBJECTIVE

B. TECHNIQUE

USUAL CASES

COMPLICATIONS

Attention should be given to exposure of the operating site.
This point is too often neglected, the quality of the suture depends on it.

A. OBJECTIVE

Perform a suture that is:

- Quickly completed to limit blood loss
- Strong in order to reduce the risk of uterine scar rupture during a subsequent pregnancy

Two continuous over-and-over stitch layers are recommended.

⚠ Numerous well-designed methodological studies [71-80] give conflicting results with regard to closure of the uterine incision in one or two layers, with continuous locking suture or continuous over-and-over suture.

However, the two layer continuous over-and-over suture appears superior to the one-layer continuous stitch and continuous over-and-over suture appears superior to the locked stitch:

- *Two-layer repair gives less risk of scar rupture during subsequent pregnancies.*
- *Continuous stitch is quicker to perform and more economical in terms of suture material than suture with interrupted stitches, it allows better exposure while suturing, thanks to traction on the suture.*

The locking stitch is currently only used in thick uterine walls (outside labour) or in the case of a severe myometrial hemorrhage.

- *The benefits of including the endometrium when stitching the first layer is under investigation*
- *Suturing the second layer with the horizontal mattress technique is an excellent option.*

B. TECHNIQUE

- Uterine suturing is usually performed with the uterus in intra-abdominal position [67-69].
 **However, do not hesitate to lift the uterus out of the pelvis**
- Externalization of the uterus in extra-abdominal position is justified in case of insufficient exposure of the hysterotomy [70], in order to note the extent of injuries and examine both the front and back of the uterus.

A) Exposure

A 14cm wide mobile retractor, if possible, matte, is appropriate for simple cases.

A 4-blade retractor (Sebrechts-Kirschner type) gives excellent exposure for intra-abdominal suture of the uterus.

B) Inspection

The bladder must be located so that it is not caught in the suture.

After removal of the compress applied to the uterine wound :

- **Check the uterine wound**
 - > for possible tears
 - > for active bleeding
- **Locate the bladder!**

C) Uterine suture

Remember: the bladder must be located so that it is not caught in the suture.

Beware of confusing the swollen posterior wall of the cervix with the lower edge of the uterine wound!

USUAL CASES

1

Use Green Armitage clamps or ring forceps

- TO SYSTEMATICALLY
 - a) grasp the bottom edge
 - b) grasp the right corner
 - c) grasp the left corner
 - d) grasp the site of persistent active bleeding
- POSSIBLY
 - e) grasp the upper edge

[possibly: because the handle of this forceps often drops downwards, if there is only one assistant, it can interfere with the suturing process.]

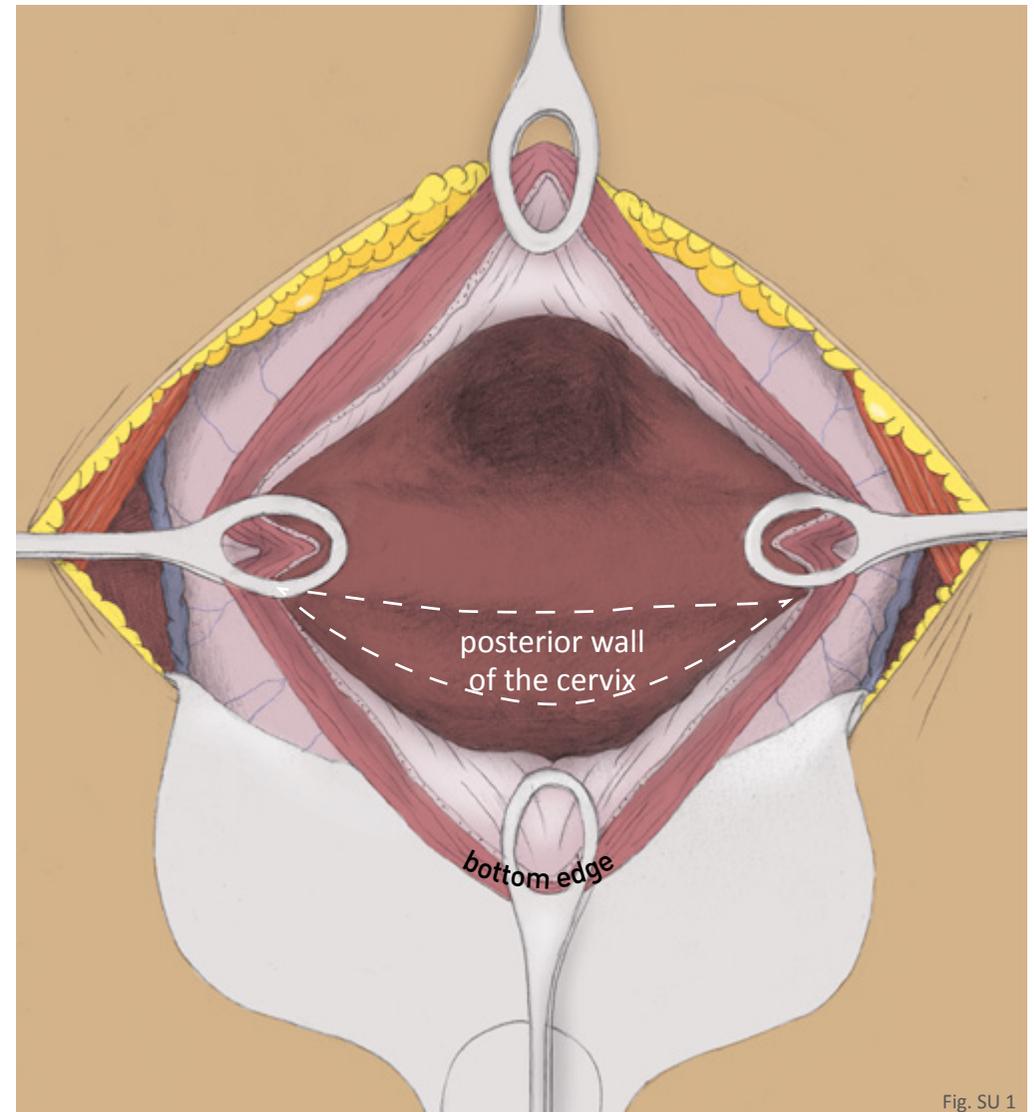


Fig. SU 1

Type of suture: slow absorbable (polyglactin, polyglycolic) #1 or #2, if they are not available, #0 is second choice
 Use 30 to 40mm half-circle or 3/8 round bodied surgical needles

RECOMMENDED TECHNIQUE: DOUBLE CONTINUOUS OVER-AND-OVER SUTURE [71-80]

USUAL CASES (indications)

- uncomplicated caesarean section
- non-haemorrhagic uterine wall
- thin uterine wall

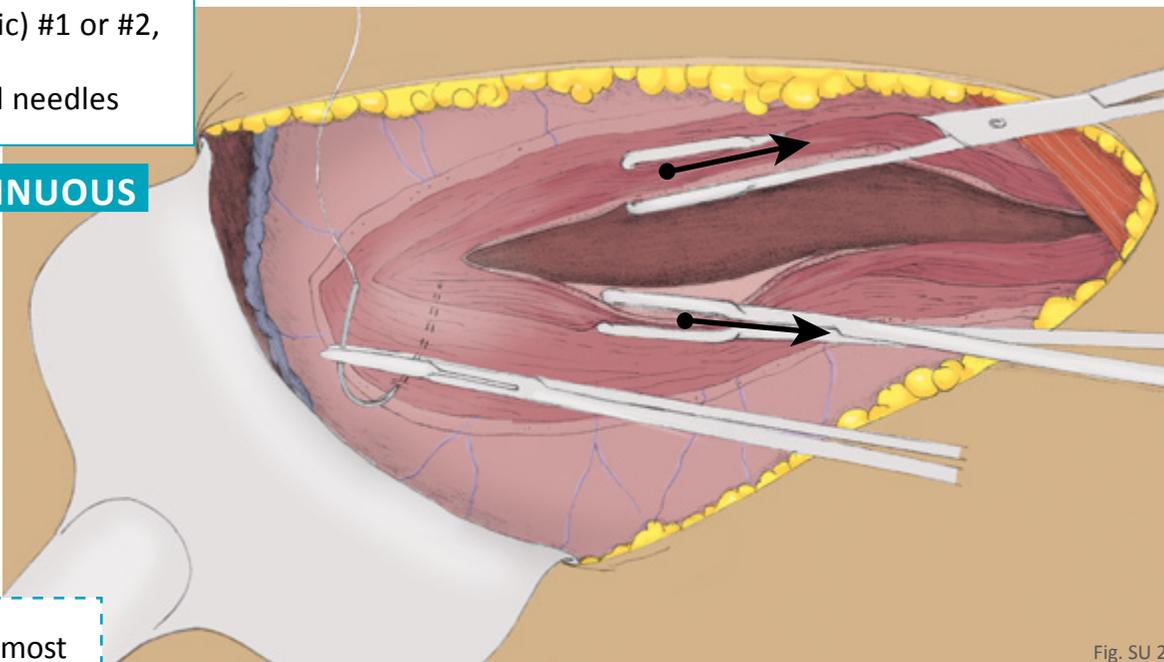
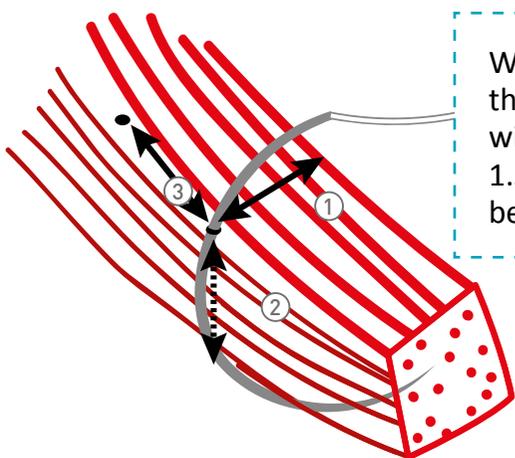


Fig. SU 2

1
First suture : quickly pass a figure-of-8 suture at the most haemorrhagic angle [choose a thick suture #1 or #2 which shears the uterine muscle less, especially if the lower segment is not formed].



With the needle, bite into the muscle at about 1.5cm width from the wound ①, 1.5cm deep ②, and 1.5cm between 2 stitches ③.

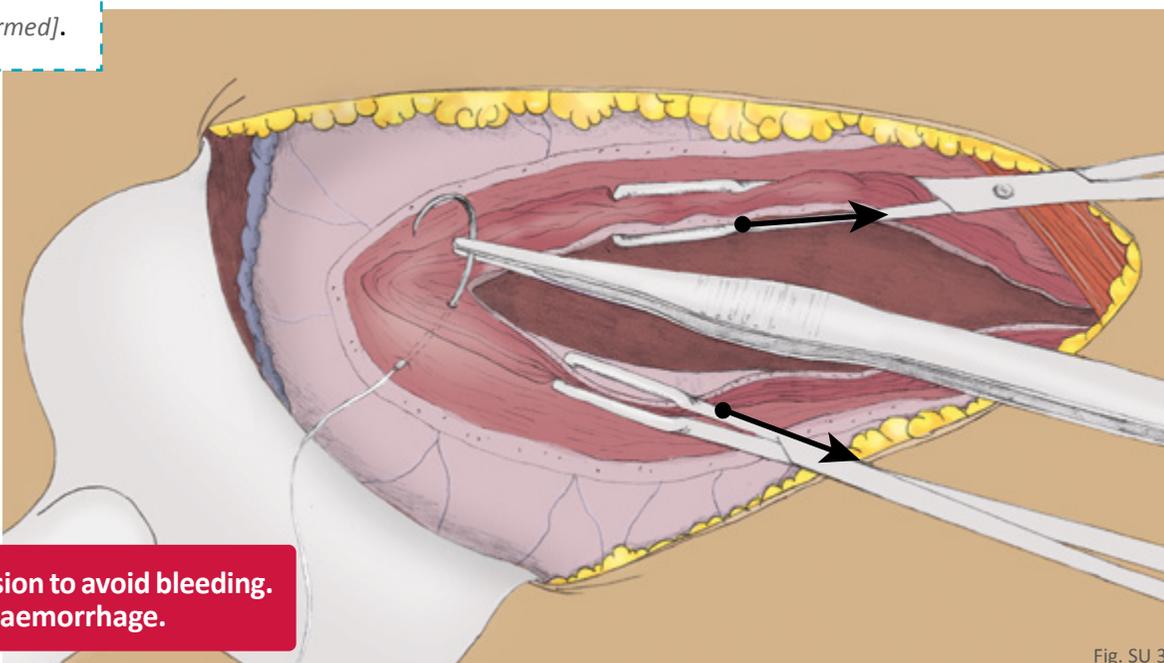


Fig. SU 3

Use a careful figure-of-8 suture at each corner of the uterine incision to avoid bleeding. This bleeding is often responsible for post-operative internal haemorrhage.

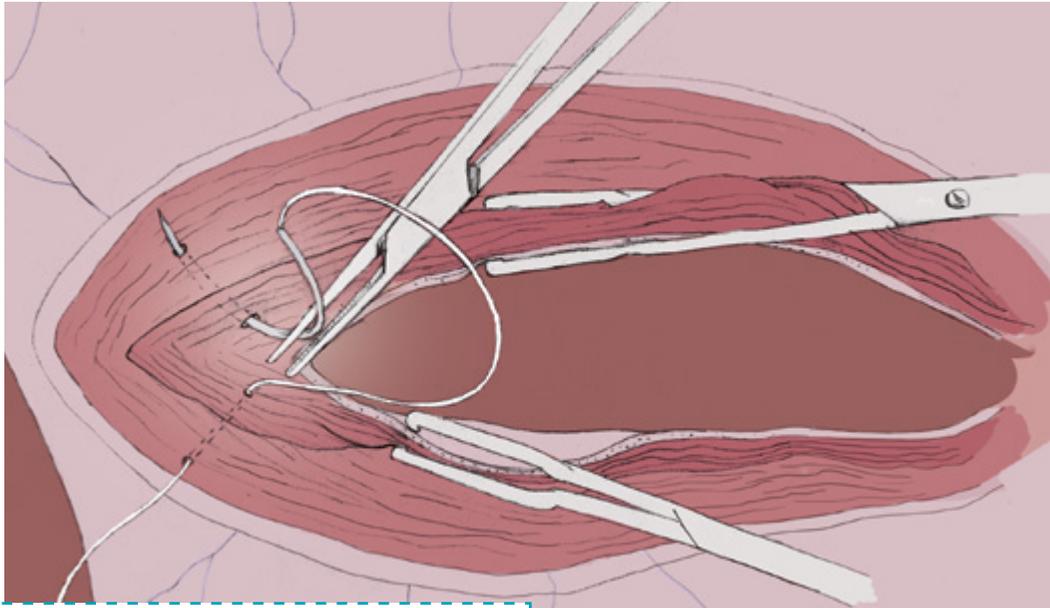


Fig. SU 4

2 Making the figure-of-8 suture (continued)

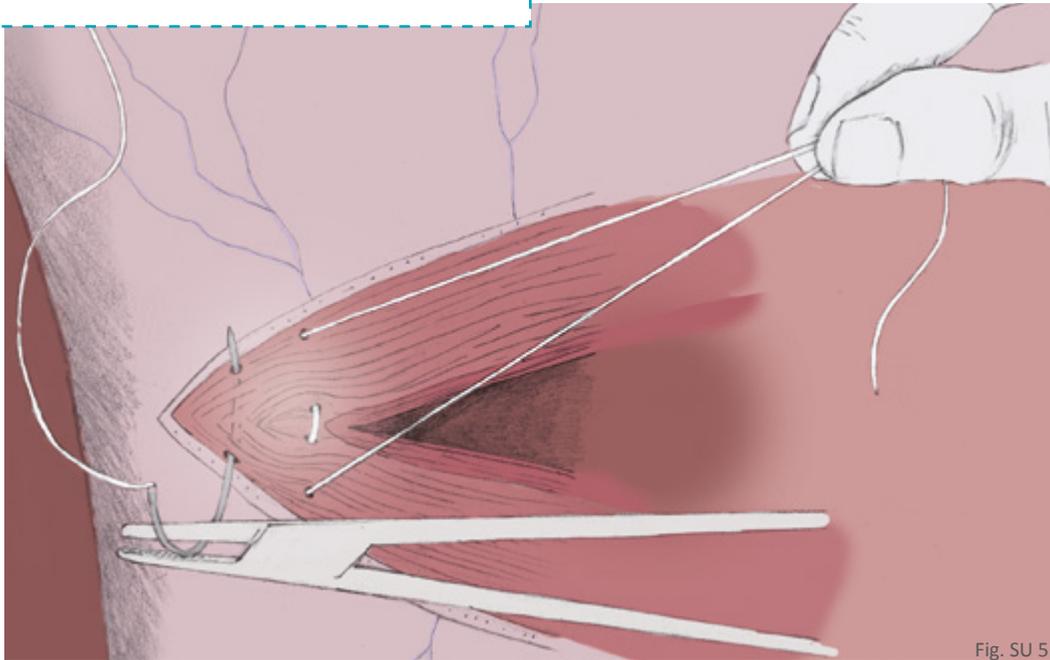


Fig. SU 5

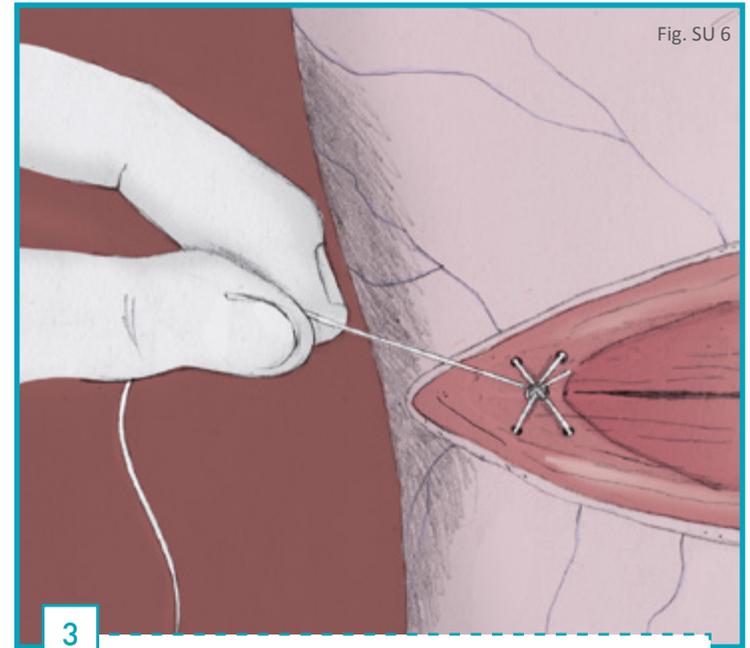


Fig. SU 6

3 After tightening the knot, leave the suture

4

Second suture : after the first stitch, you usually start the suture from left to right (for the right-handed operator) or from right to left (for the left-handed operator) in continuous over-and-over single running suture biting into the muscle (1.5cm wide, 1.5cm deep, 1.5cm between 2 stitches) to the opposite angle.

4a

FIRST LAYER (alternative 1)
Technique not including the endometrium in the suture:
simple extra-endometrial continuous over-and-over suture.

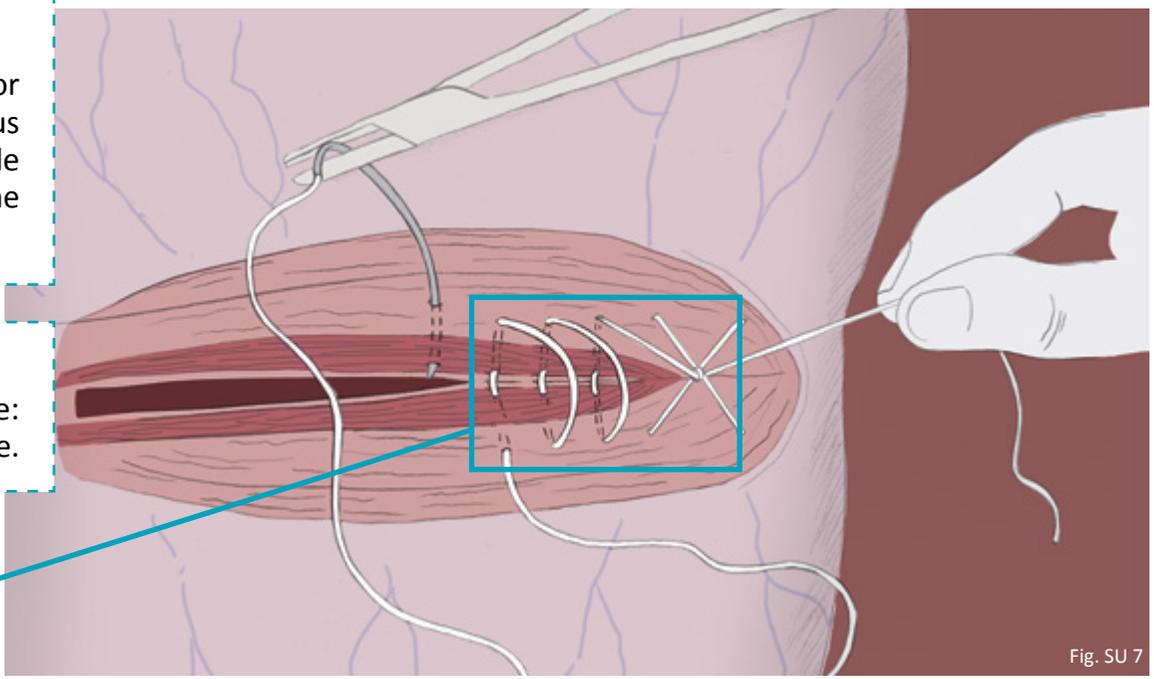
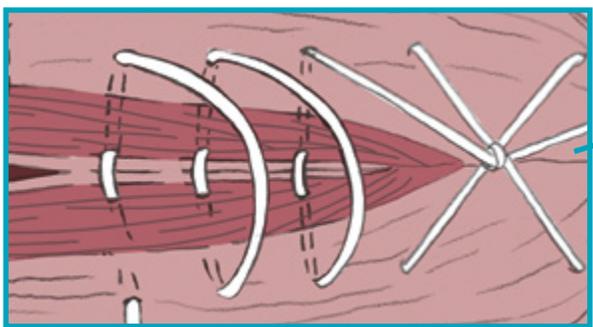
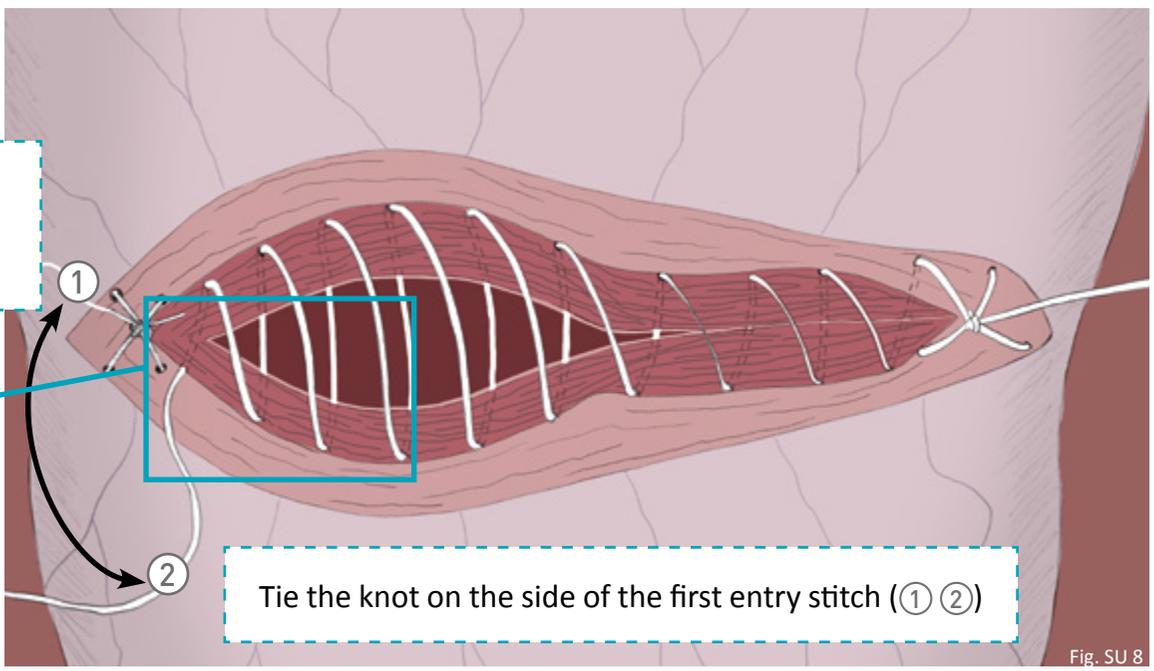
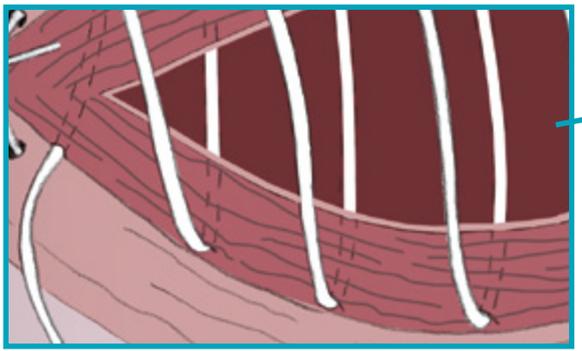


Fig. SU 7

4b

FIRST LAYER (alternative 2)
Technique including the endometrium in the suture.
[Including the endometrium in the suture is now under investigation.]



Tie the knot on the side of the first entry stitch (① ②)

Fig. SU 8

4

SECOND LAYER

continuous over-and-over single running suture or buried horizontal mattress suture

It must bury the first suture layer. Pull the peritoneum away from the upper and lower edges, watch out for the bladder at the lower edge. Bite the muscle (1.5cm width, 1.5cm deep, 1.5cm between 2 stitches)



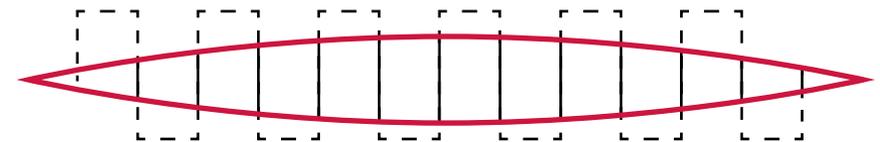
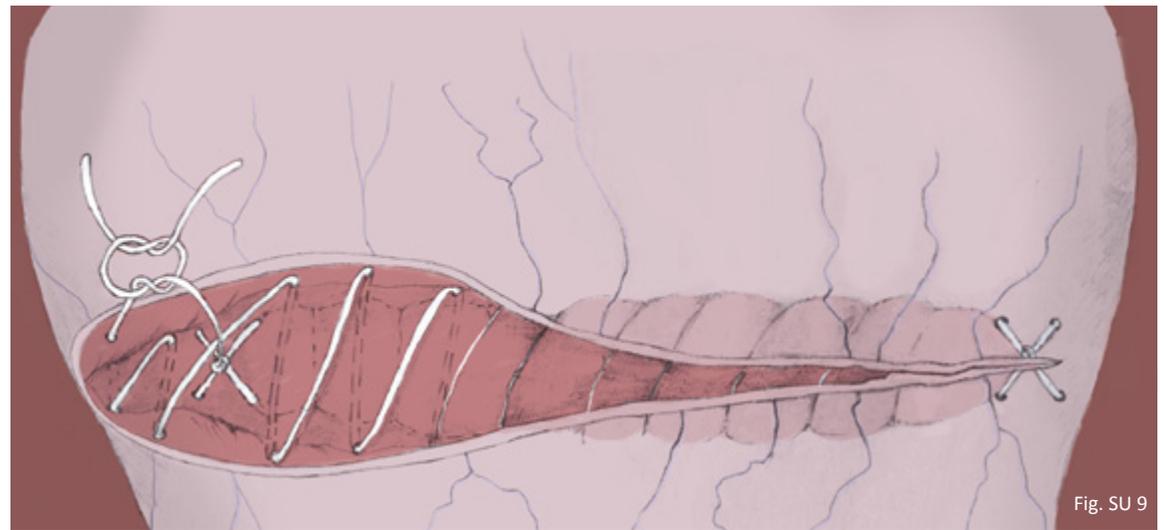
Do not stitch the visceral peritoneum!

[Peritoneal suture increases the risk of retrovesical collection, cystitis, pain, infection and extended hospital stay.]

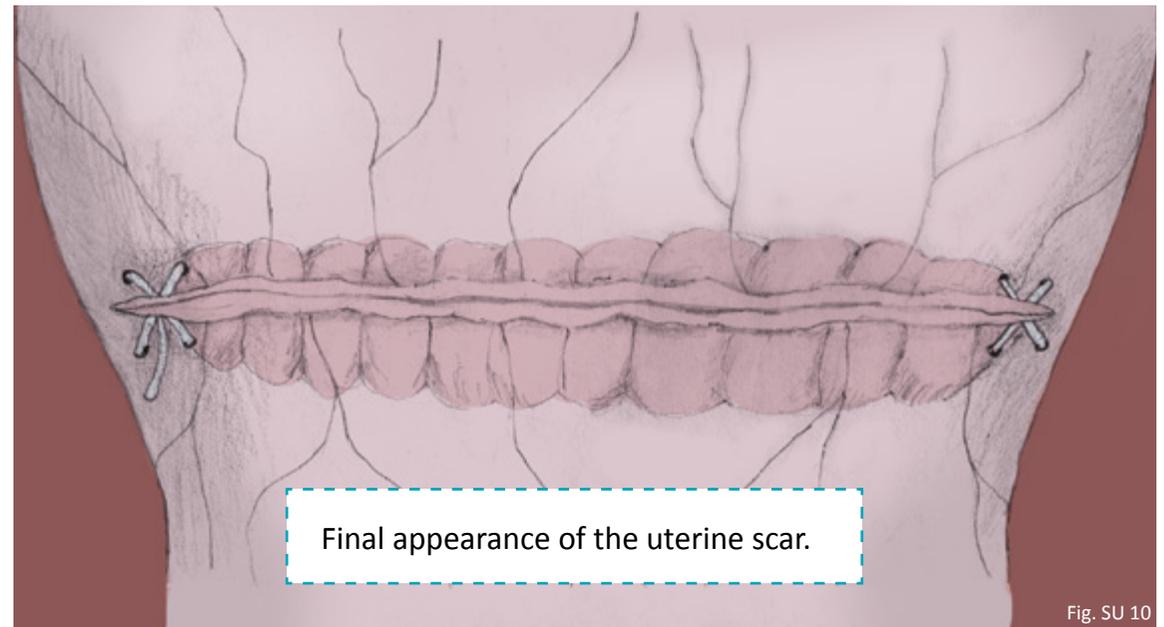
5

Compress the scar for 30seconds and check for haemostasis.

Watch out for the bladder while suturing the second uterine layer !



Buried horizontal mattress suture



ALTERNATIVE: locking and over-and-over first layer continuous suture (not routinely recommended) [81-83]

INDICATIONS

- thick uterine wall
- myometrial haemorrhage

1

First layer: quickly pass a figure-of-8 suture at the most haemorrhagic corner.

[choose a thick suture #1 or #2 which shears the uterine muscle less, especially if the lower segment is not formed.]

2

Tie the knot and leave a suture long enough in standby.

3

Carry out 2 locking and over-and-over continuous sutures starting at each corner with slowly absorbable suture (#0/#1/#2) 30 to 40mm half-circle or 3/8 round bodied needles taking the muscle 1.5cm wide, 1.5cm deep and 1.5cm between 2 stitches).

4

Tie the 2 ends of the suture together at the centre of the wound.

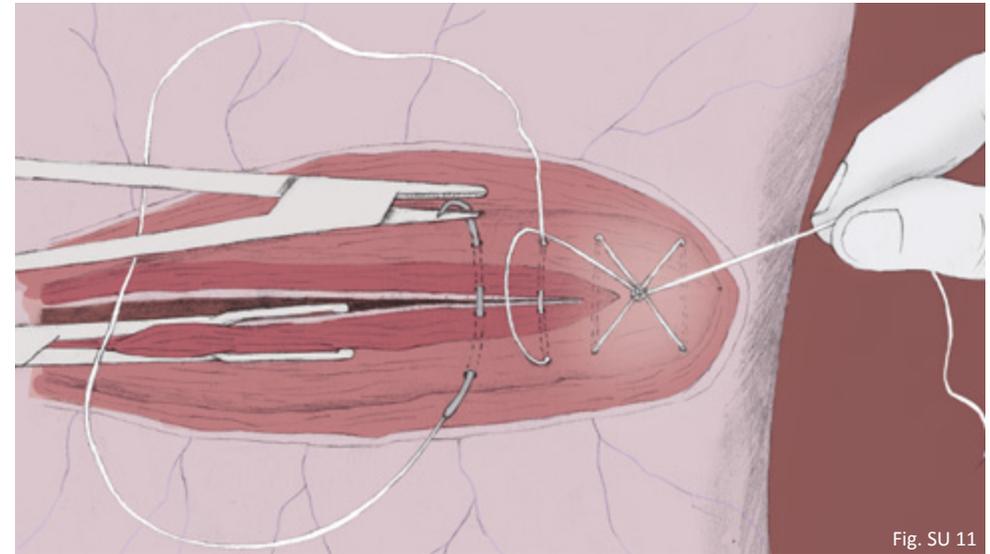


Fig. SU 11

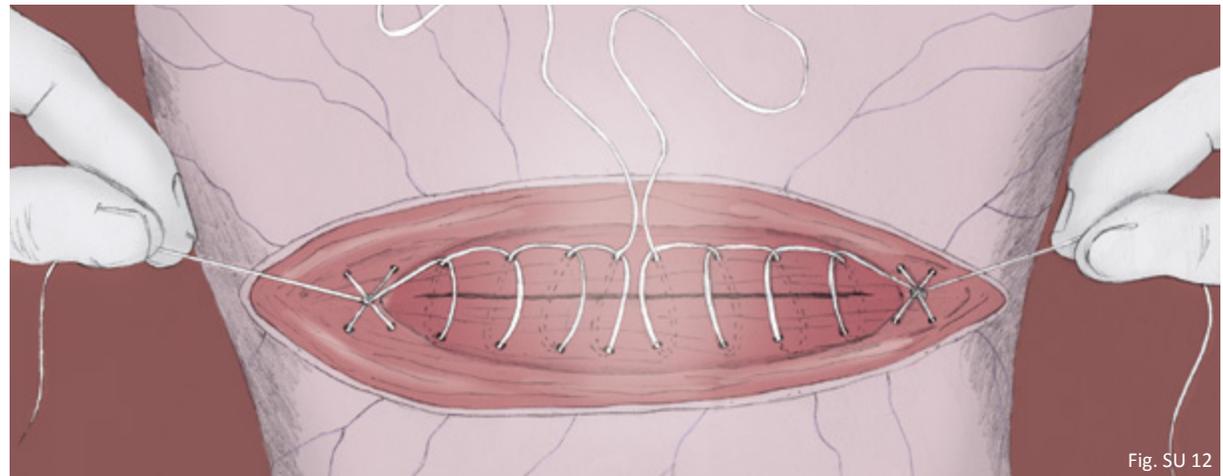
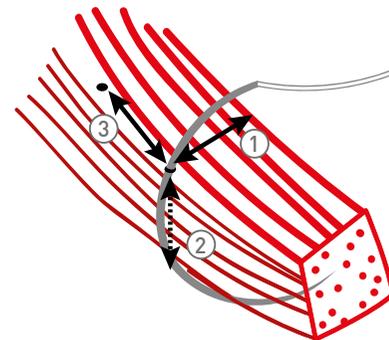


Fig. SU 12



Watch out for the bladder while suturing the second uterine layer!

5

Second layer: ALTERNATIVE 1

Carry out a second layer suture with single **buried horizontal mattress suture**.

It must bury the first suture layer. Pull the peritoneum away from the upper and lower edges, **watch out for the bladder** at the lower edge. Bite the muscle (1.5cm wide, 1.5cm deep, 1.5cm between 2 stitches).

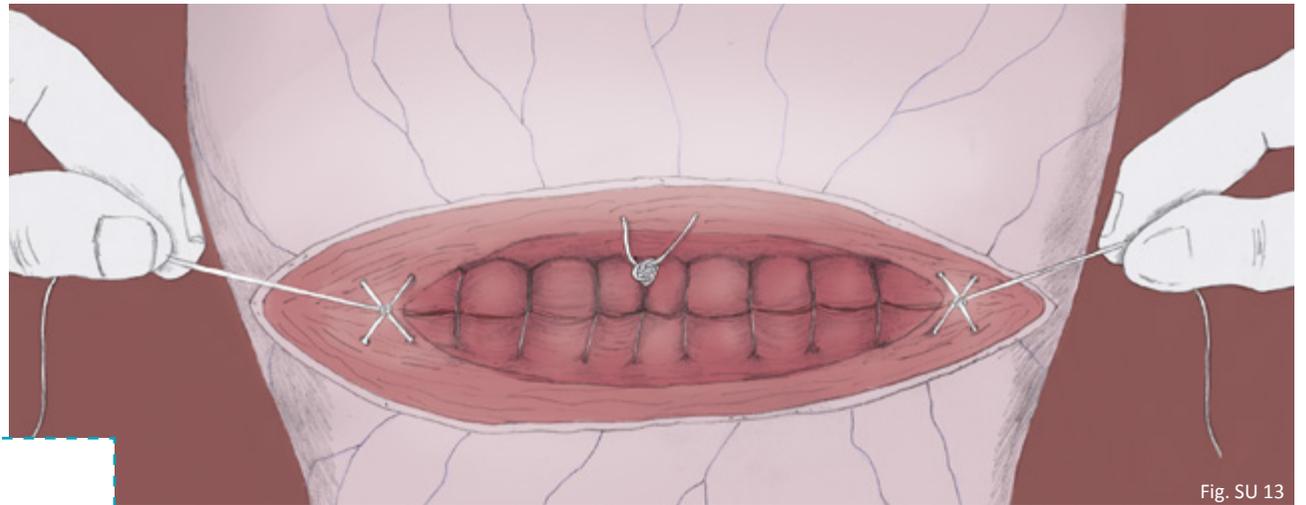
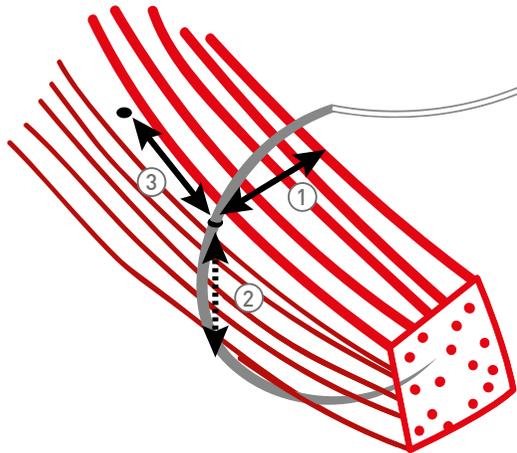
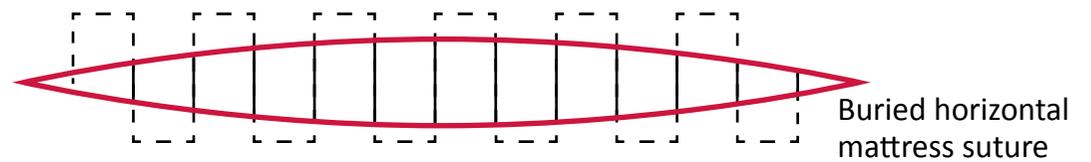


Fig. SU 13



Buried horizontal mattress suture

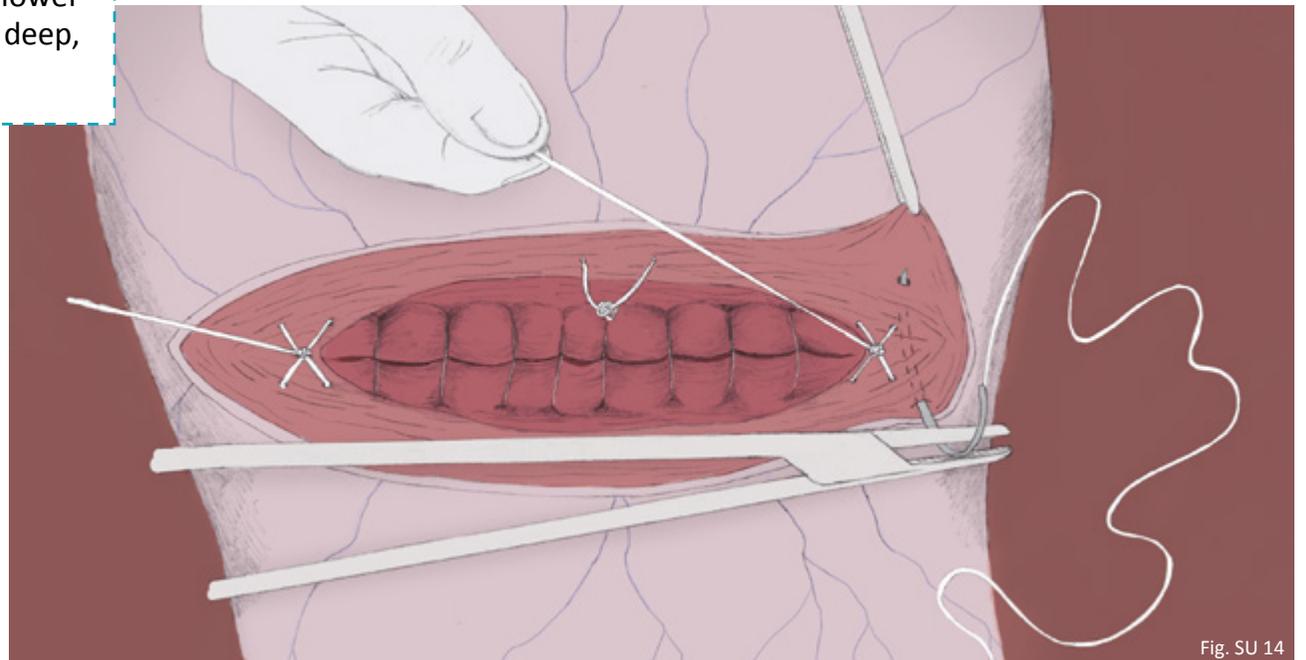


Fig. SU 14

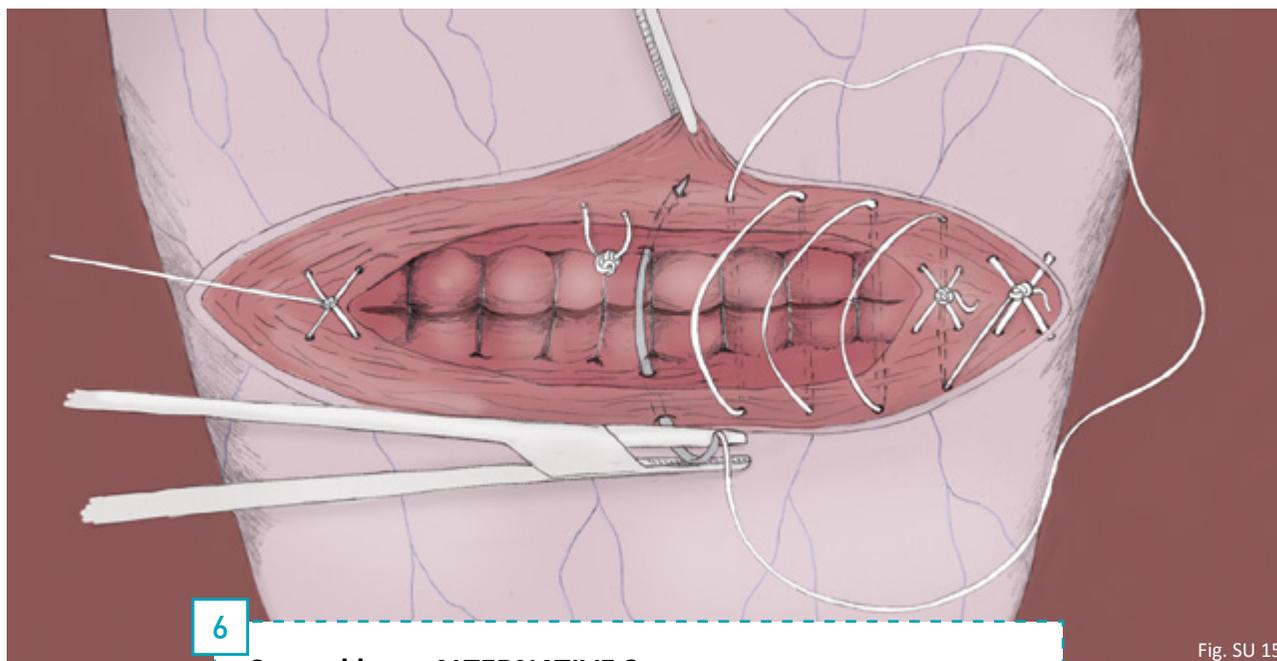


Fig. SU 15

6

Second layer ALTERNATIVE 2

This level must bury the first layer suture
 Pull the peritoneum away from the upper and lower edges,
 watch out for the bladder at the lower edge. Carry out a
 continuous over-and-over single running suture. Bite the
 muscle (1.5cm wide, 1.5cm deep, 1.5cm between 2 stitches).

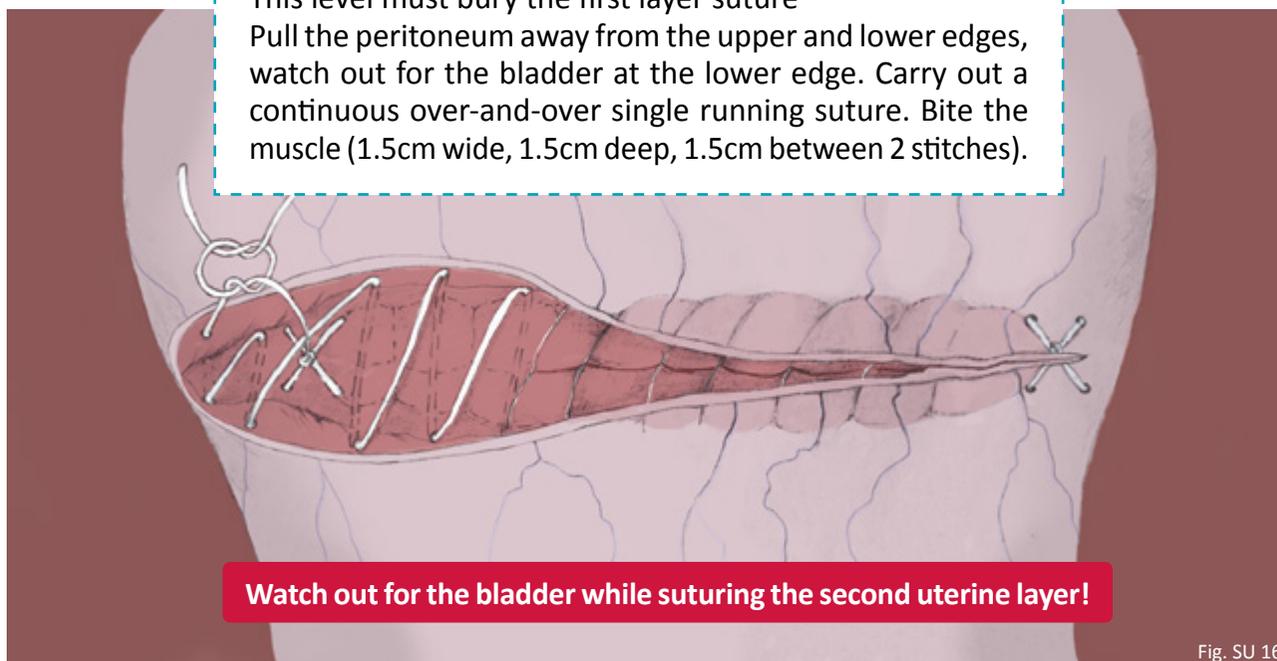


Fig. SU 16

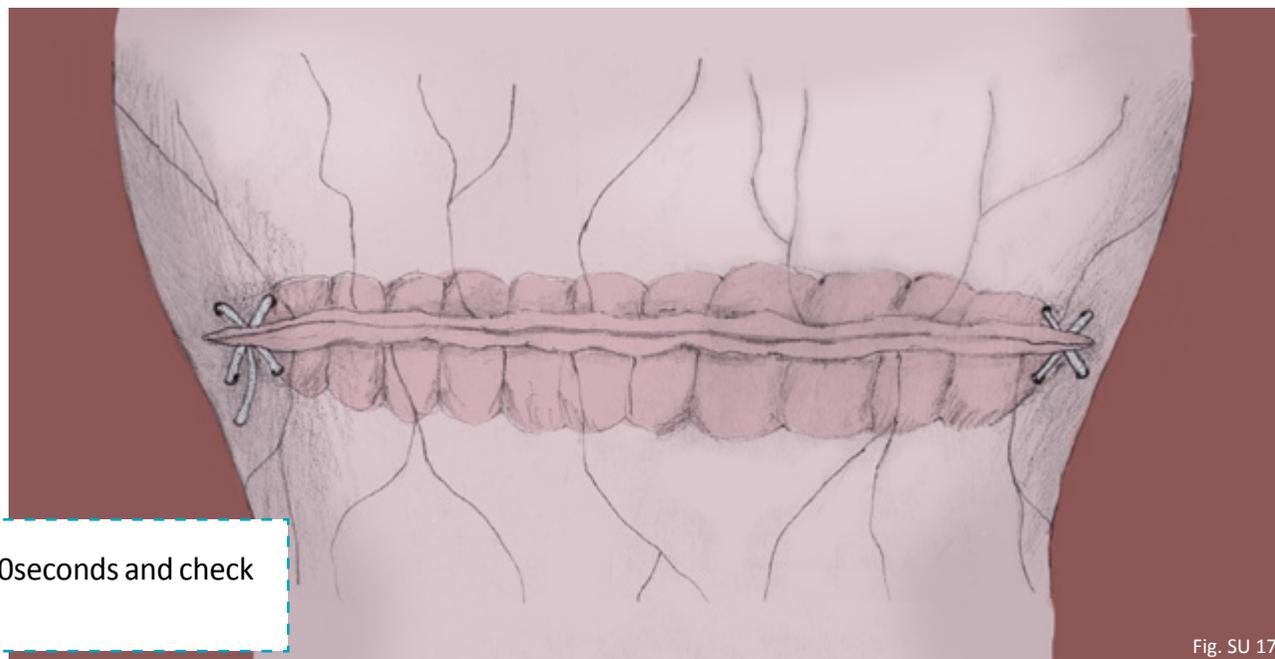


Fig. SU 17

7

Compress the scar for 30seconds and check for haemostasis.

⚠ Don't stitch the visceral peritoneum!

[Peritoneal suture increases the risk of retrovesical collection, cystitis, pain, infection and a longer hospital stay]

If the uterus was lifted out of the abdominal cavity check carefully for bleeding AFTER the uterus is reintegrated into the abdomen.

COMPLICATIONS

1. Uterine tear
2. Rupture of uterine pedicles
3. Abnormal bleeding of the uterine wound after suturing
4. Uterine atony
5. Bladder wound

1. Uterine tear

- a) Apply an abdominal compress to the bleeding site.
- b) Place the ring forceps first at the bleeding site and then on either side of the tear.
- c) Expose the tear by pulling on the edges of the wound, if necessary, apply long artery forceps
- d) Stitch the tear with continuous over-and-over sutures or figure-of-8 sutures.
- e) Ensure good haemostasis.

Expose the tear properly !

**In case of lateral tear: watch out for the ureter.
Identify the arteries and ureter before ligating the uterine vessels
In case of lower cervix tear, be careful with the bladder.**

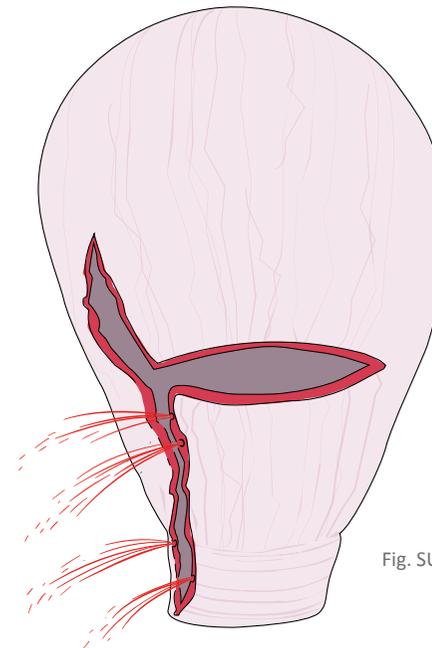
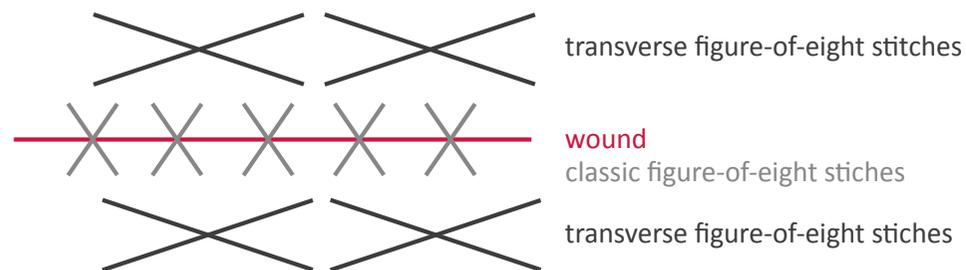


Fig. SU 18

2. Rupture of uterine pedicles

- Lift the uterus out of the pelvis.
[This gives better vision and allows the uterine pedicle to be moved away from the ureter]
- Compress with an abdominal swab rather than suction.
- Identify major lateral bleeding that doesn't originate from the uterine incision.
- Place Bengolea artery forceps on either side of the bleeding after identifying the arteries and the ureter.
- If necessary, suture with a figure-of-eight, tie with a slowly absorbable 2.0 suture.
- After ligation, place an artery forceps on the suture and maintain traction to expose the vessels.
- Slowly remove the Bengolea artery forceps from the bleeding site.
- Release the traction on the suture and check for bleeding.
- If hemostasis is incomplete, resume traction on the first stitch and make a second stitch, with a figure-of-eight if necessary, at the bleeding site.

⚠ In case of lateral tear: be careful with the ureter. Identify the arteries and ureter before ligating the uterine vessels.



3. Abnormal bleeding of the uterine wound after suturing

- After removing the compress, bleeding may persist, located at the level of the sutured hysterotomy.
- Expose the bleeding vessel and tie with a stitch, if necessary, a figure-of-eight.

4. Uterine atony

In case of persistent bleeding and swollen uterus :

- Vigorously massage the uterus
- Inject 10 I.U. oxytocin into the uterine fundus
- Repeat these procedures if necessary
- Assess uterine discharge, check vital signs
- Place an intrauterine balloon tamponade ([see chapter 5: complications](#))
- Place hemostatic artery forceps or clamps on the uterine and utero-ovarian pedicles: if bleeding persists, consider hysterectomy
- If, despite several well performed attempts, there is persistence of soft uterus and/or loss of more than 2000ml of blood and no possibility of transfusion and if vital signs are compromised: perform the interadnexal hysterectomy (leave the cervix).

5. Bladder wound

Suture of the bladder wall in 2 layers with Foley catheter

- First layer: use extra mucosal slowly absorbable 2.0 /3.0 continuous over-and-over suture biting the deep layer of muscles
- Second layer: use 2.0 seromuscular interrupted stitches

Alternative: suture of the wall in 1 single layer (not recommended)

- Single layer with slowly absorbable 2.0 continuous locking suture including the bladder mucosa.

7 WALL CLOSURE

A. TECHNIQUE

1. Cavity inspection :

- Check annexes.
- Check the uterine pedicles (anterior and posterior).
- Check the suture of the uterine hysterotomy.
- Express uterine clots by massage.
- Aspiration of secretions and amniotic fluid, removal of clots with a compress, rinse if necessary.

There is a current trend to suture the parietal peritoneum after transverse incisions. [84-96]

[Concerning transverse incisions, the conclusions of numerous studies comparing parietal peritoneum suture versus non-suture, tend to favour closing the parietal peritoneum in order to avoid post-operative adhesions.

Concerning median laparotomies, correct closure of the fascia spontaneously drawing towards the edges of the peritoneum, should eliminate the need for suturing.]

2. Swab count!!

3. Wall closure

AFTER PFANNENSTIEL INCISION OR JOEL-COHEN INCISION (MIS GAV-LADACH)

1

Installation of a peritoneal drain in the pouch of Douglas only if there is a risk of collection or infection.

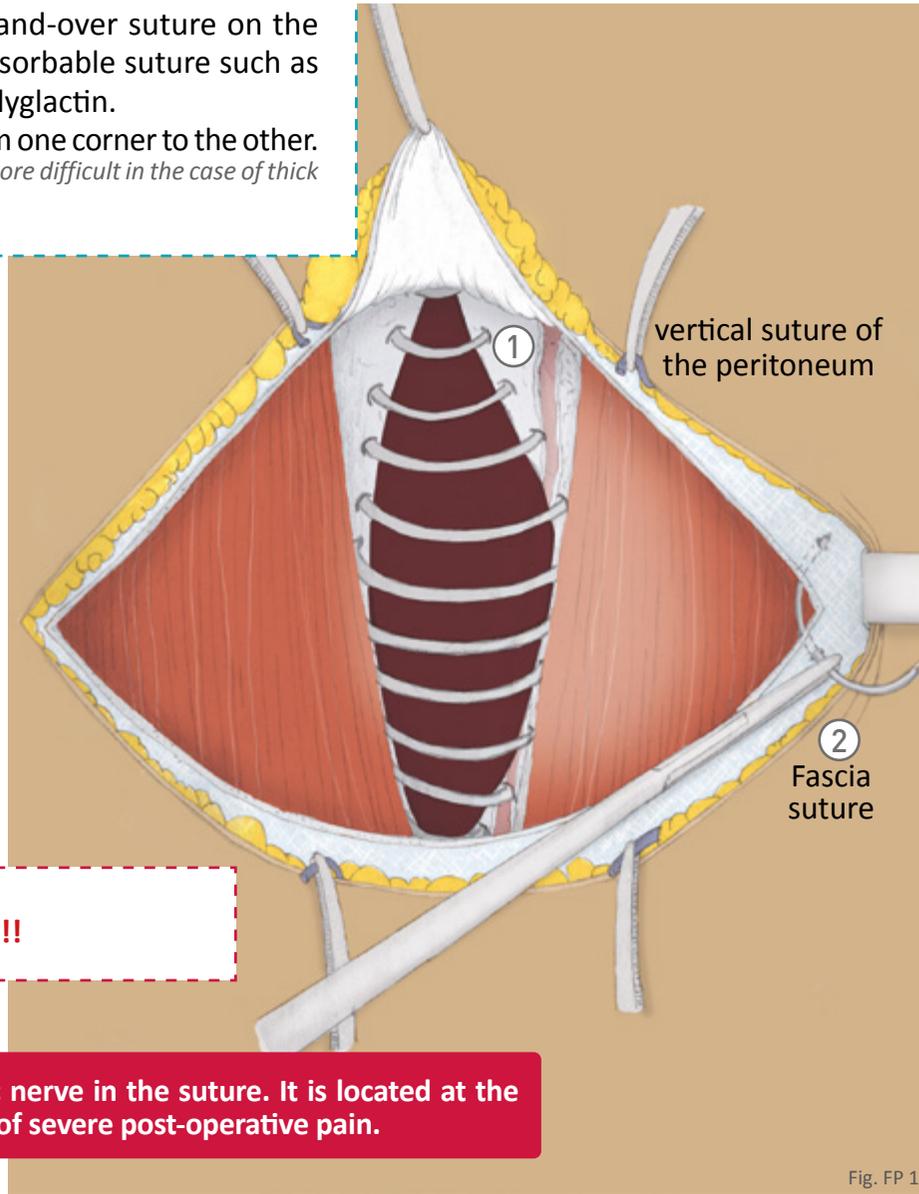
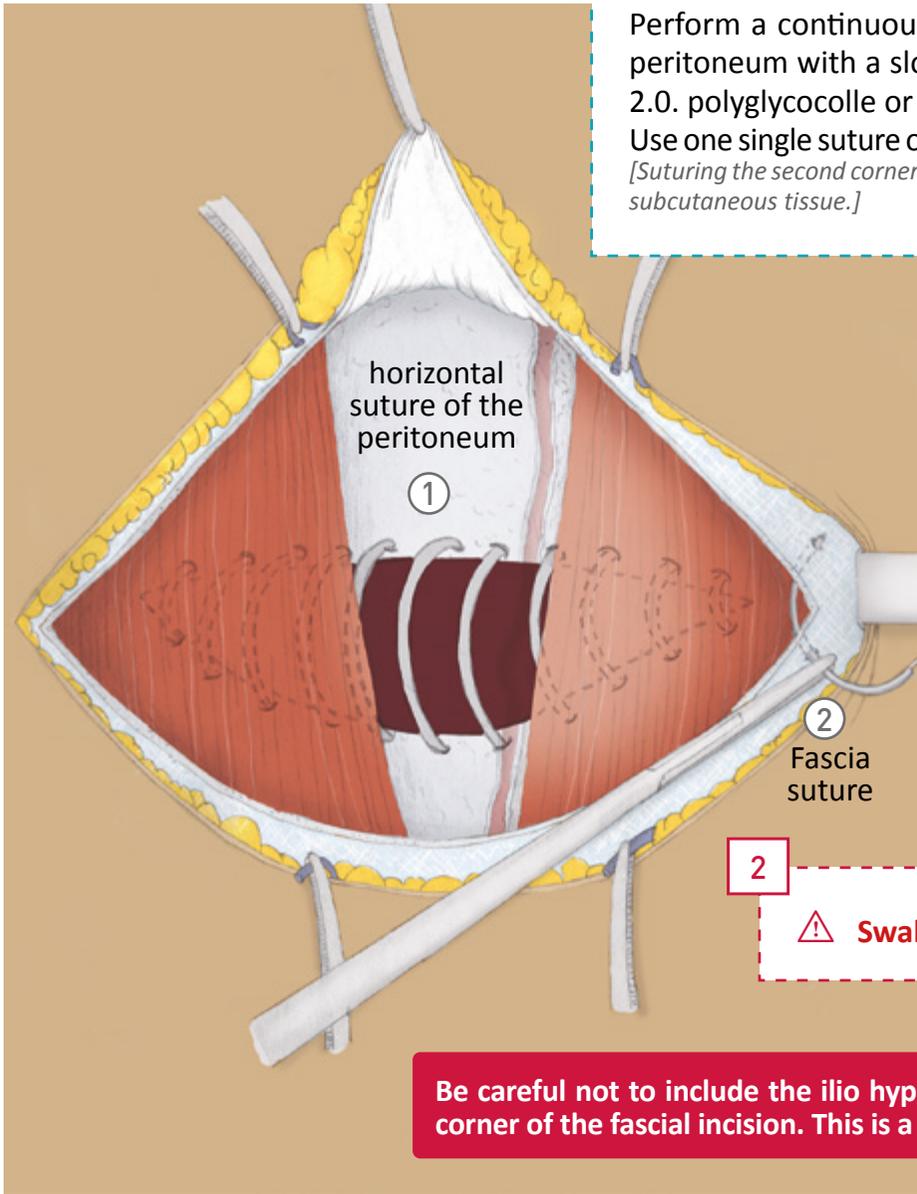
2

In the event of major diastasis of the rectus muscles (> 8cm):
1) Suture the two pyramidalis muscles at their upper end.
2) If diastasis persists in the upper part of the wound, bring the two rectus abdominis muscles closer by suturing together the edges of the posterior wall of the rectus sheath.

[No stitches in the muscle itself: risk of injuring the inferior epigastric vessels.]

RECOMMENDED TECHNIQUE: single continuous over-and-over suture

1
 Perform a continuous over-and-over suture on the peritoneum with a slowly absorbable suture such as 2.0. polyglycolle or 2.0. polyglactin.
 Use one single suture only from one corner to the other.
[Suturing the second corner will be more difficult in the case of thick subcutaneous tissue.]



2
 ⚠ Swab count!!

Be careful not to include the ilio hypogastric nerve in the suture. It is located at the corner of the fascial incision. This is a source of severe post-operative pain.

Fig. FP 1

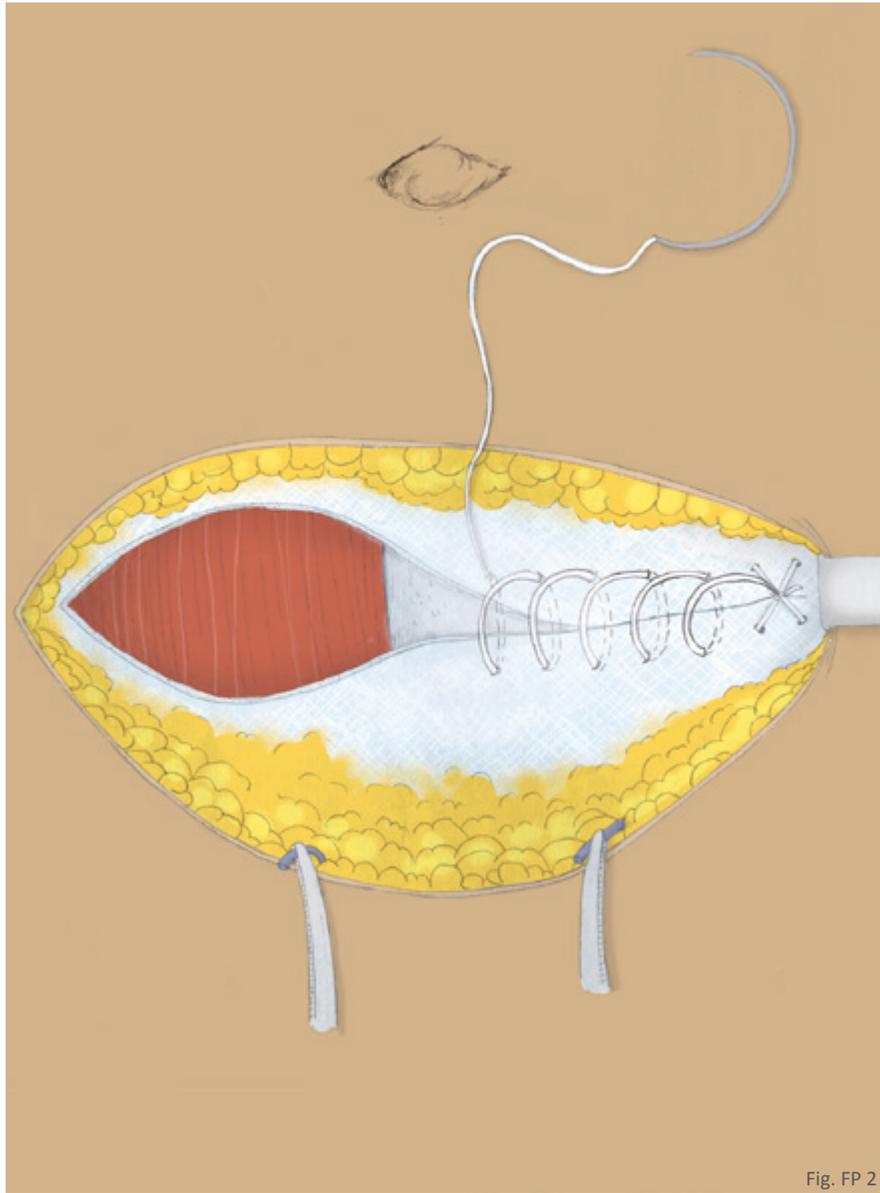


Fig. FP 2

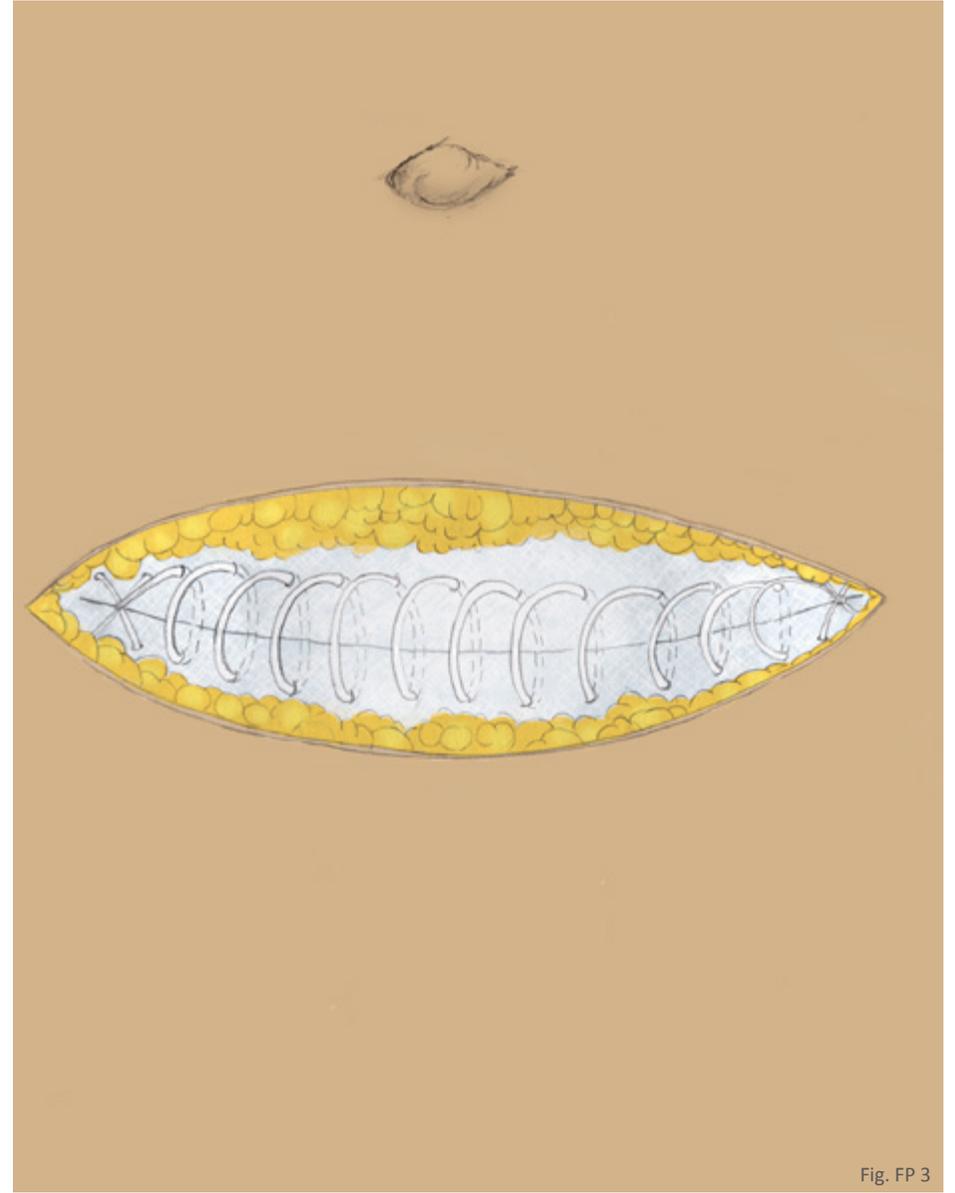


Fig. FP 3

ALTERNATIVE: two continuous locking over-and-over sutures

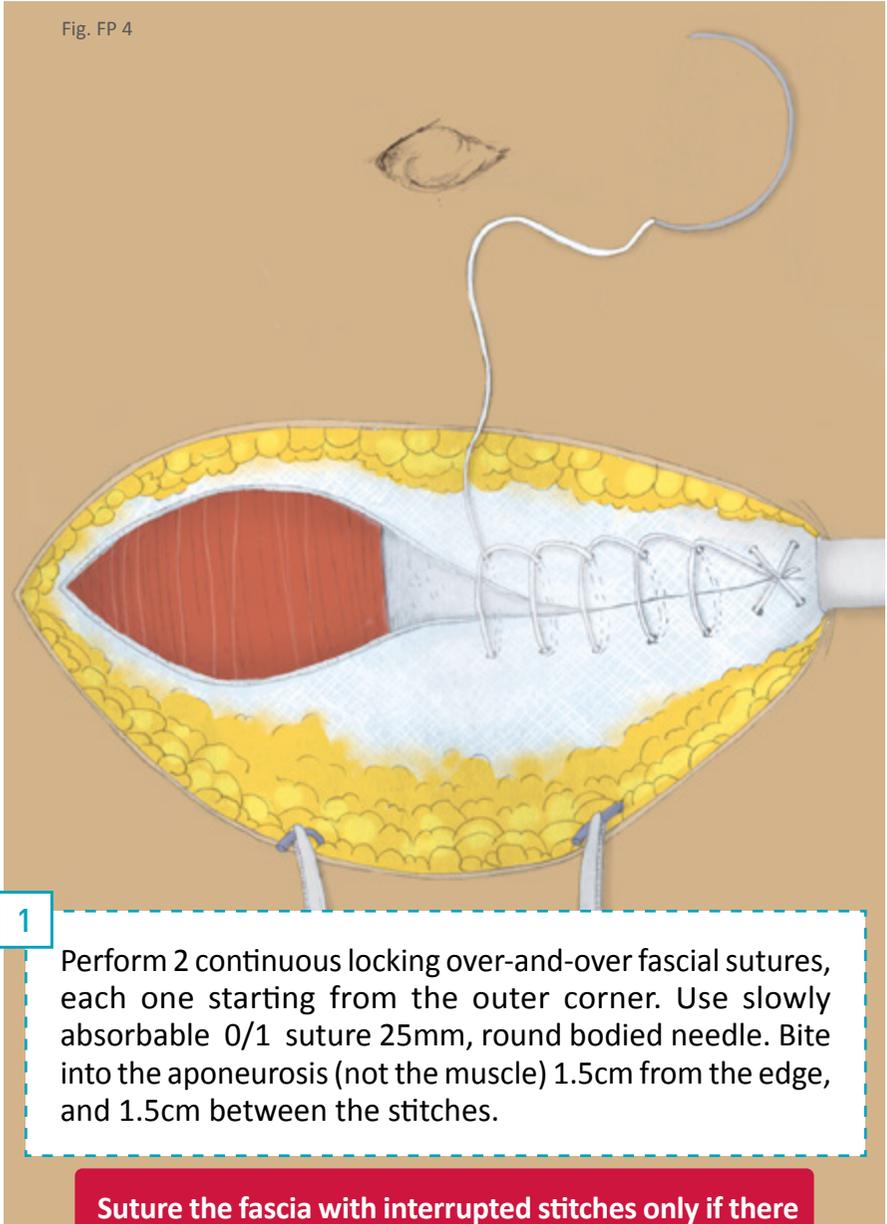


Fig. FP 4

1 Perform 2 continuous locking over-and-over fascial sutures, each one starting from the outer corner. Use slowly absorbable 0/1 suture 25mm, round bodied needle. Bite into the aponeurosis (not the muscle) 1.5cm from the edge, and 1.5cm between the stitches.

Suture the fascia with interrupted stitches only if there is a major risk of bleeding or infection.

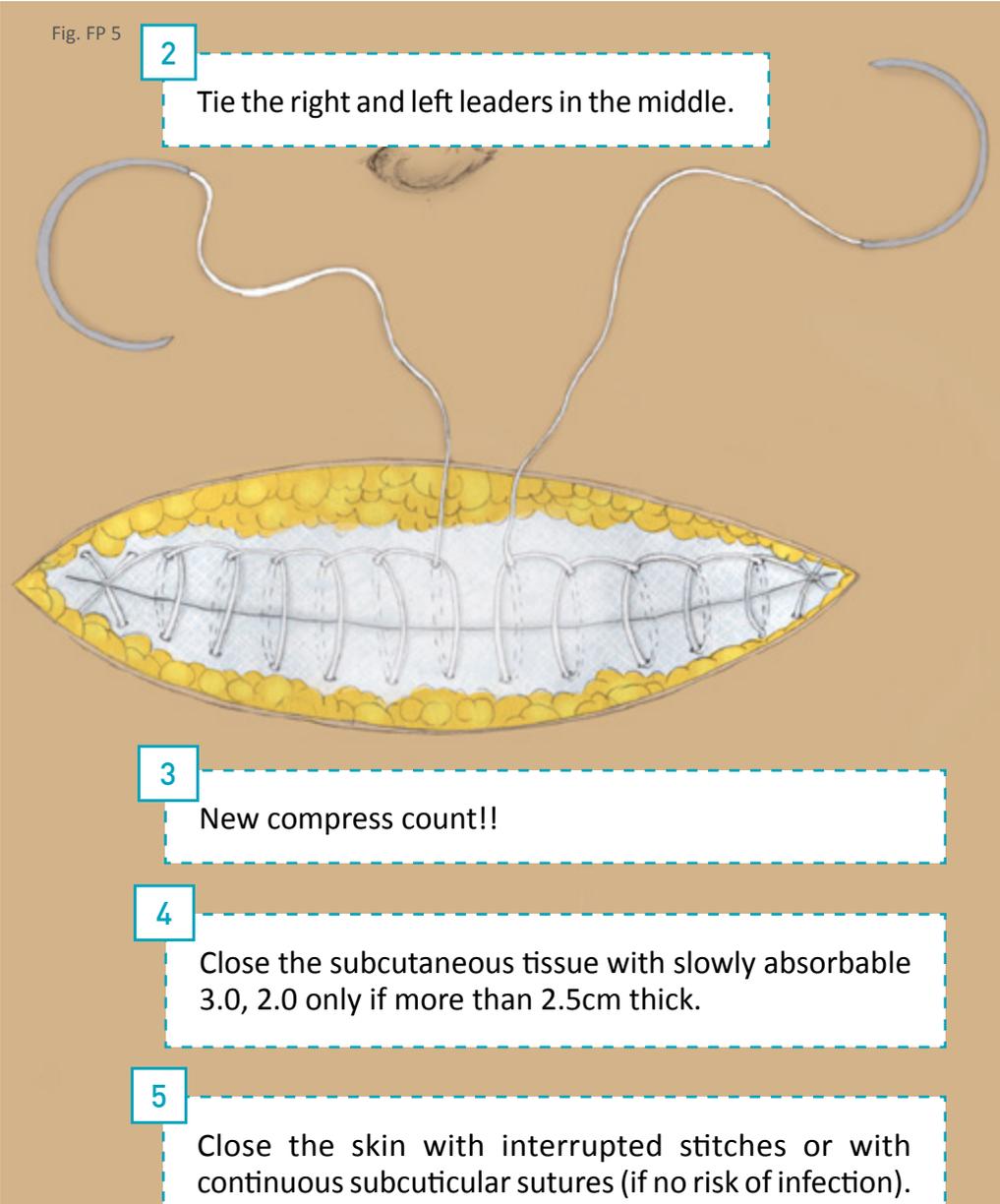


Fig. FP 5

2 Tie the right and left leaders in the middle.

3 New compress count!!

4 Close the subcutaneous tissue with slowly absorbable 3.0, 2.0 only if more than 2.5cm thick.

5 Close the skin with interrupted stitches or with continuous subcuticular sutures (if no risk of infection).

AFTER MIDLINE VERTICAL INCISION

RECOMMENDED TECHNIQUE : continuous over-and-over suture

USUAL CASE (indications)

- uncomplicated cases
- thin patient

1

Optional: suture of the parietal peritoneum with absorbable suture such as 2.0 polyglycolic or polyglactin with a continuous over-and-over suture.

2

Suture of the aponeurosis: use a single continuous over-and-over suture, preferably not locking, from the upper corner to the lower corner. Use slowly absorbable suture (0 or 1), 25mm round bodied needle gripping the two aponeurosis sheets (not the muscle) at 1.5cm from the edge and 1.5cm from the previous stitch.

Suture of the parietal peritoneum in a midline vertical incision is not routinely recommended given the effective rapprochement of its edges made possible by the suture of the fascia.

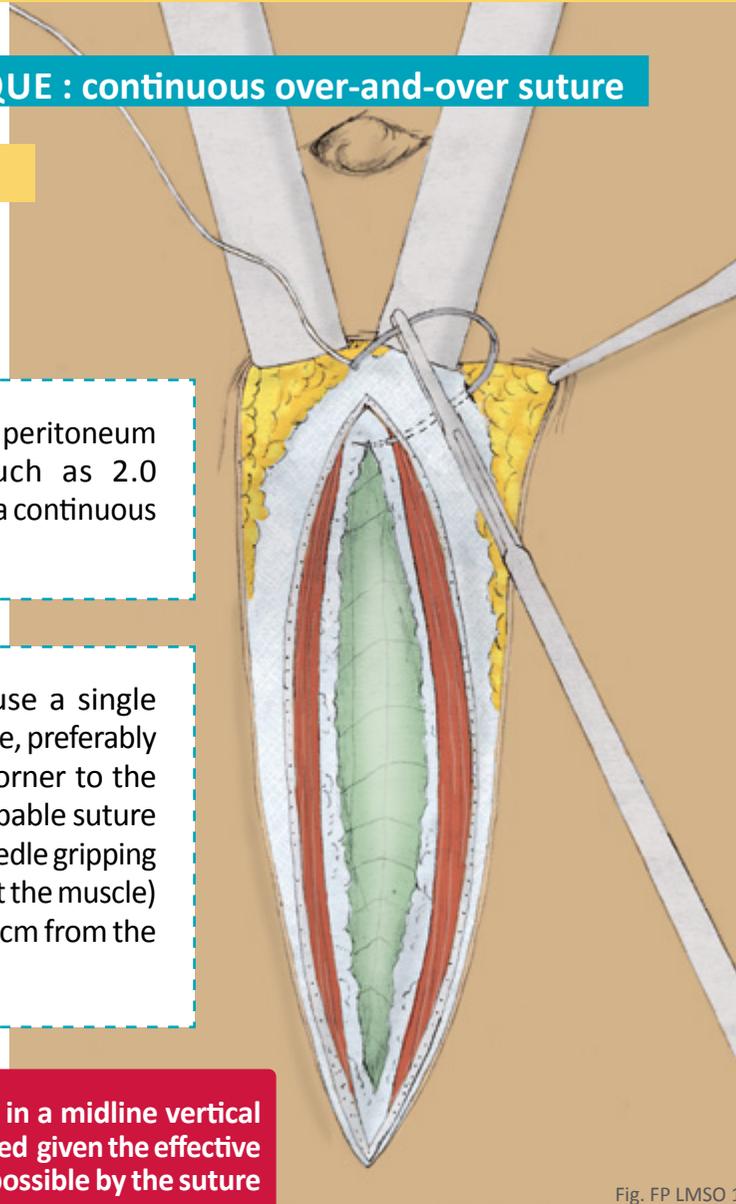


Fig. FP LMSO 1

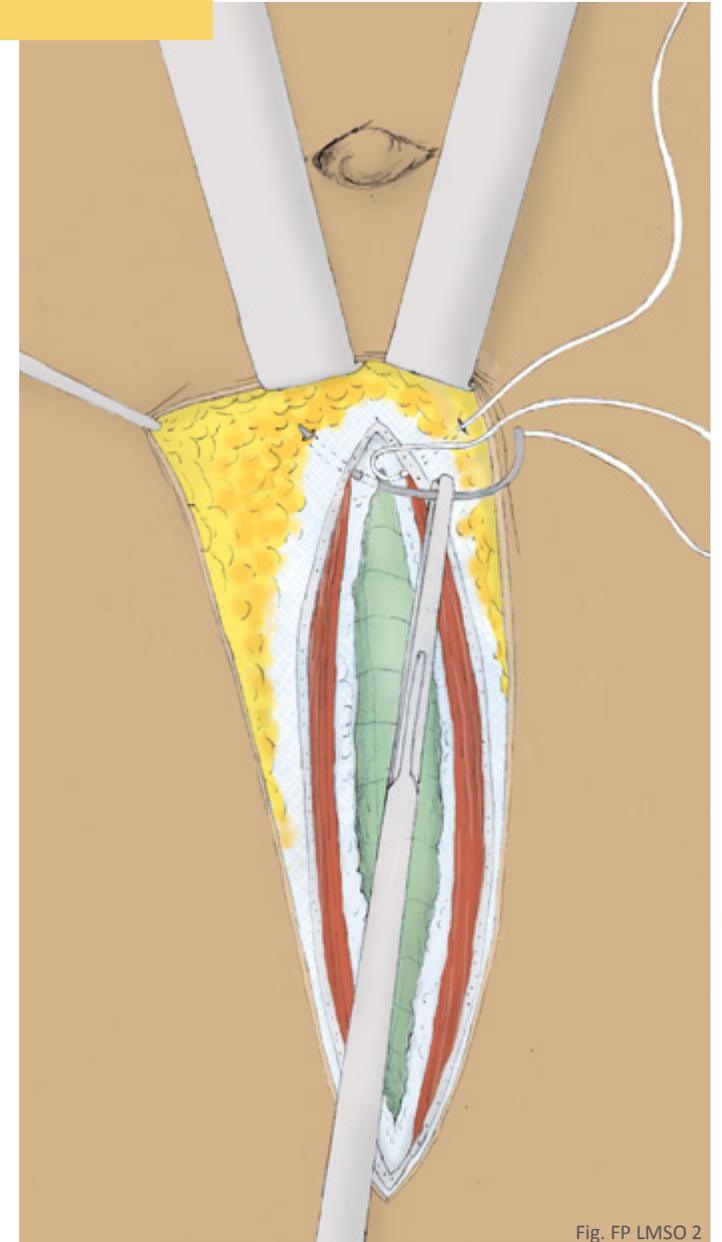


Fig. FP LMSO 2

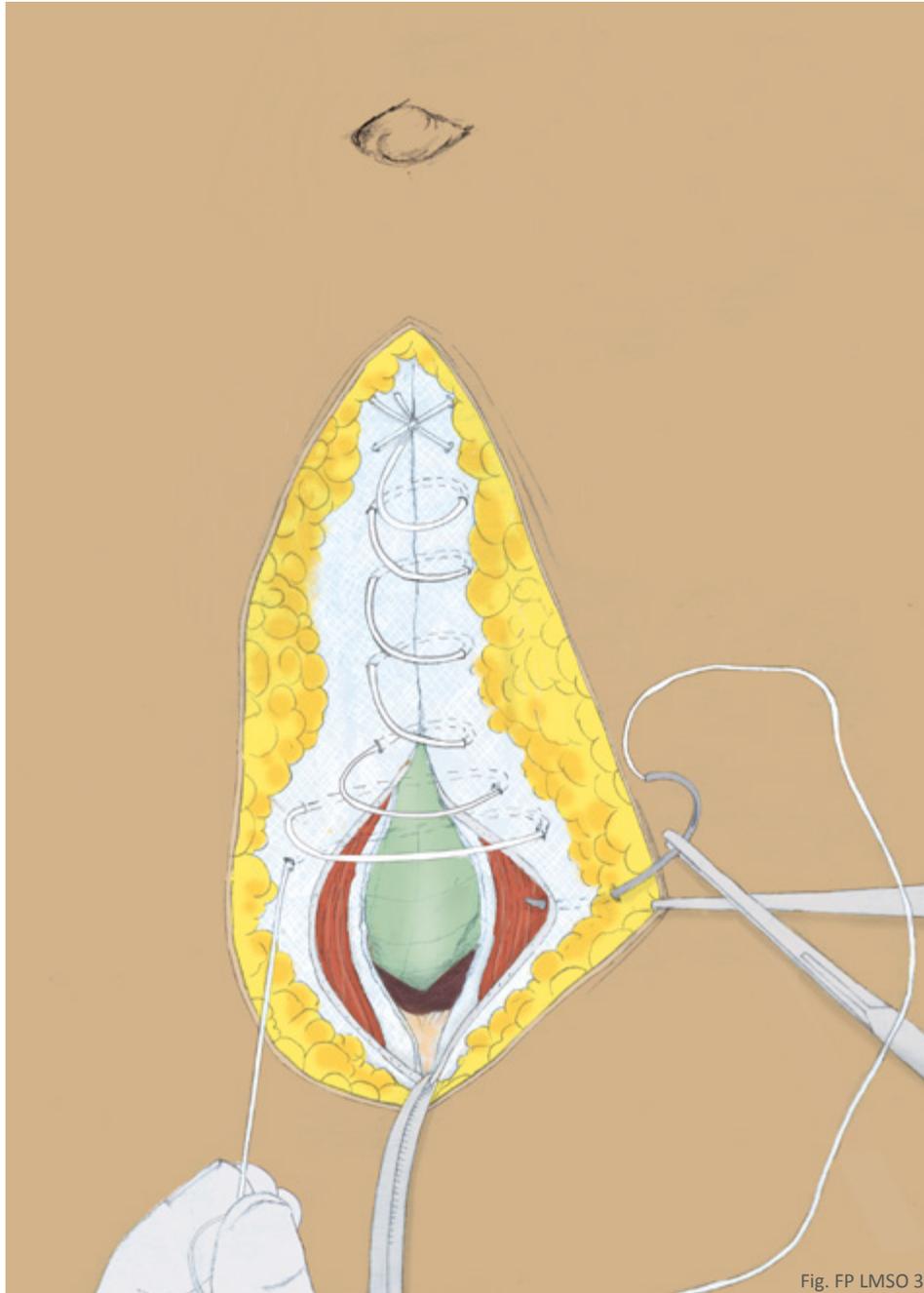


Fig. FP LMSO 3

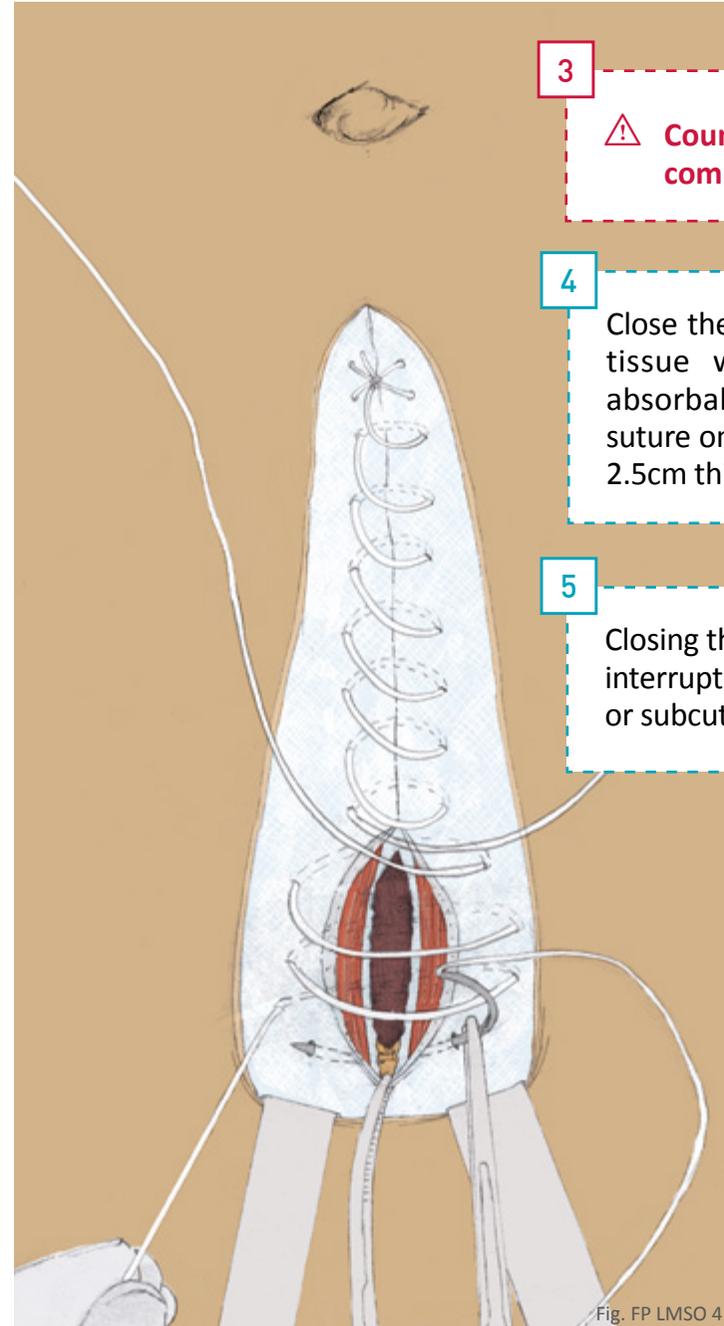


Fig. FP LMSO 4

3

⚠ **Count the compresses again!**

4

Close the subcutaneous tissue with a slowly absorbable 3.0 or 2.0 suture only if more than 2.5cm thick.

5

Closing the skin by interrupted stitches or subcuticular sutures.



VARIATION : double interrupted continuous sutures

PROBLEMS (indications)

- Complicated cases
- Obese patient

1

The first preferably locking over-and-over suture starts at the upper corner of the wound and stops at the centre.

2

The second preferably locking over-and-over suture starts at the lower corner of the wound.

3

Tie both ends of the two sutures at the center of the wound.

Interrupted stitches can be placed in the event of an infected wound or intra-abdominal complication.

8 OPERATING PROCEDURE REPORT [97-103]

In limited resource conditions, the hospital generally does not have a computer system to encode surgical reports. A log book with Robson classification will be used.

N° of the intervention - month - year .../....	Date	Name of the mother	First name of the mother	Age	Address : Location	Indication of the caesarean section	Summary : -Misgav-Ladach -Pfannenstiel -Vertical Midline Incision Classification according to Robson	Detail of the intervention 1. Wall incision - Joël Cohen, Pfannenstiel, Midline vertical incision - Particularities of the uterine approach; possible bladder detachment 2. Uterine incision - Type: low or high transverse segment, corporal - Explain any difficulties. - Amniotic fluid: > Appearance: clear, stained, meconium, bloody. > Quantity: normal, oligoahydramnios 3. Extraction of the child - Presentation: vertex, breech, transverse lie - Possible difficulties and manual manoeuvres - Gender: male, female, indeterminate - Apgar at 1 min, 5 min and 10 min 4. Placental delivery - Spontaneous; manual; uterine exploration. - Oxytocin: product, dose, route of administration - Macroscopic aspect of the placenta and cord 5. Uterine suture - Type of suture on hysterotomy (and on any tears): continuous over-and-over (locking), figure of eight stitches, interrupted, one or two layers - Type of sutures used and size. - Closure or not of the vesicouterine fold of peritoneum, if yes type of suture and size of suture - Quality of haemostasis at the end of the procedure - Uterine fundus 6. Wall closure - Possible intra-abdominal drainage - Peritoneal closure if applicable - Aponeurotic closure: type and size of suture - Supra-aponeurotic drain if applicable - Subcutaneous closure (if applicable: type and size of suture) - Skin closure (type and size of suture) 7 Compress count 8 Colour of urine at the end of the procedure 9 Estimated blood loss 10 Possible transfusion	- Name of the operator - Assistant name	- Anaesthetist name - Assistant name - Type of anaesthesia (general or regional) - Anaesthesia protocol reference number	- Remarks - Recommendations for action in future pregnancy

5. POST-OPERATIVE CARE [104]

Emergency treatment of post-partum haemorrhage (PPH).

Close monitoring of vital signs.

USUAL CONDITIONS: < 24 HOURS

- **Close monitoring of vital signs during the first 2 hours**
 - Pulse, blood pressure, temperature, pallor
 - Uterine fundus and blood loss
 - Urine colour and output
 - Pain
- **IV infusion :**
 - 12- 24 hours (for security reasons)
- **Post-operative analgesia** [105-107] :
 - First-line treatment:**
 - Paracetamol 1g three times daily for 48 hours
 - Other possibilities:**
 - Diclofenac 50mg three times daily for 48 hours
 - Paracetamol/Diclofenac alternately for 48 hours
[Recommended]
 - Ibuprofen 400mg three times daily for 48 hours
- **Resume feeding** [108-112] :
 - [It must be conducted early, whether after general or regional anaesthesia.]*
 - Drinks allowed after six hours (even after 3 hours)
 - Light meal allowed after 12 hours
- **Dressing** [113-114] :
 - Remove on Day 3 *[change before if soiled]*
 - Then leave the wound undressed
 - Remove the stiches, if not subcuticular, on Day 9
- **Prevention of thromboembolic risks**
 - Early out of bed mobilization, with help, the next day (or even earlier at the 12th hour)
 - Elastic support stockings ideally for 7 days
[often financially unaffordable]
 - Low molecular weight heparins (LMWHs): for at-risk patients (obese, history of thrombophlebitis, etc.)
[often financially unaffordable]
- **Removal of the bladder catheter**
 - Before the twelfth hour
 - or when the initially bloody urine becomes clear
 - or after 7 days, if there is any doubt concerning a bladder injury
[for example long-lasting compression of the bladder by the foetal head]
- **Monitor the resumption of urination**
- **Discharge from hospital :**
 - Possible after 1 or 2 days [115]

COMPLICATIONS

1 Complications: <24 hr (1st day) [116-117]

Postpartum haemorrhage (PPH) : [incidence 3-15%]

- Definition :**
- Continuous vaginal blood flow persisting for 15 to 30 minutes after the procedure.
 - Vaginal bleeding \geq 500ml within 24 hours following the intervention.

[After Caesarean section: 500ml = threshold for triggering active management] [Haemorrhage is considered severe if blood loss exceeds 1000ml.]

Treatment [118-120] :

1. Large venous catheters (14G/16G) and transfusion
2. Uterine massage to expel clots
3. Two-hand uterine compression (with one hand vaginal route)
4. Oxytocin 10 I.U. IV repeat 1X/20 minutes if bleeding persists or
5. Oxytocin 20 I.U./litre IV: 60 drops/minute (no more than 3 litres with oxytocin)
6. Misoprostol 4 tablets of 200micrograms (800micrograms) administered sublingually or rectally (more effective), if oxytocin failure or as a first-line treatment [121-124]
7. Insertion of an intrauterine tamponade balloon (see diagram opposite)
8. Ergometrine IM/IV 0.2mg, slowly, repeat IM after 15 min, if significant bleeding occurs. Maximum 5 doses (total of 1.0mg) in case of oxytocin and misoprostol failure

[Do not give if retained placenta or hypertension]

2 Complications : > 24hr (2nd to 21st day)

- Urinary infection
- Endometritis
- Thrombophlebitis of the lower limbs (and pelvis)
- Vesico-uterine fistula [125]

[Their diagnostic investigation and treatment will not be detailed in this guide.]

3 Long-term complications

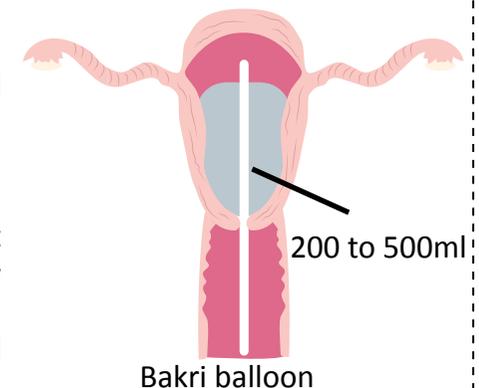
- Placenta Previa
- Placenta Accreta, Increta, Percreta
- Uterine rupture
- Secondary infertility due to infection

[Their diagnostic investigation and treatment will not be detailed in this guide.]

Intrauterine tamponade :

First choice: Insert the Bakri balloon vaginally and inflate it with 200 to 500ml of normal saline solution. Leave in place for 24 hours.

Second choice: If this is not available, use the largest Foley balloon available and inflate it with 50 to 60ml of normal saline solution.



6. BREASTFEEDING

Ideally, the newborn should be breastfed from the first hour after birth, whether vaginal or by caesarean section. [126]

In the case of a caesarean section, the health care staff routine often leads to an unnecessary and frequent delay in breastfeeding. [127]

Health care staff should be informed of the importance of early initiation in breastfeeding and its implications for children's health.

The earlier and more efficiently and repeatedly the newborn suckles, the more prolactin receptors increase resulting in increased milk production in the short and long term. [128]

Colostrum is the ideal food for the newborn baby who must start feeding from the first hour after birth.

Exclusive breastfeeding is recommended until the age of six months. From six months to the age of two years, or even more, breastfeeding must be supplemented with another diet.

Breastfeeding drastically reduces deaths from acute respiratory infection and diarrhoea [*two major causes of infant mortality*] as well as other infectious diseases [129].

For any vaginal or caesarean delivery, the first feeding or early manual breast stimulation optimizes milk production in the short and long term and is predictive of breastfeeding duration. Early breast stimulation reduces newborn morbidity and mortality in the short and long term.

In difficult situations, a proactive attitude enables a quick start to breastfeeding [130].

Breastfeeding assistance after a caesarean section significantly increases the percentage of exclusive breastfeeding at the end of the maternity period and at 2 weeks and 6 weeks of baby's life.

IN PRACTICE :

- 1** If safety conditions are ensured for the mother and newborn, place the newborn (one to three hours) in skin-to-skin contact with their mother for the first feeding, immediately after birth [131-134].
[Spinal anesthesia, anti-inflammatory drugs, paracetamol or antibiotics are not a contraindication for early breastfeeding.]
In case of general anaesthesia, feeding or colostrum expression is possible, as soon as the mother is fully awake [135].
- 2** If the mother or child's condition does not allow for safe skin-to-skin contact and first feeding, it is recommended to proceed to manual expression of colostrum. It should be given to the baby with a clean spoon as soon as possible and at best within the first hour after birth.
- 3** Thereafter, and as soon as the mother's situation permits, suggest that she give the first and subsequent feedings each time the baby wakes up.
- 4** If the baby is weakened or separated from the mother (no suction possible), manual breast stimulation should be continued 8 times a day until the baby sucks the breast. All the colostrum/ breast milk collected in this way will be given to the baby.

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Despite all our efforts to provide relevant and complete information, and in particular due to the rapid evolution in care strategies, materials and more generally the complexity of the topics dealt with, we cannot guarantee the completeness, accuracy, precision and quality of the information contained in this manual.

Consequently, we strongly advise practitioners to exercise the utmost vigilance. The information contained in this manual in no way relieves them from the obligation to check whether the information is suitable for the intended purpose and the environment and conditions in which it may be used. Practitioners are therefore solely responsible for all risks and dangers that arise or may arise from the use of the information contained in this manual. Neither the authors nor the publisher of this manual can be held liable for any material damage and/or personal injury resulting from its use.

The caesarean section is the most commonly performed procedure in the world. However, in regions with limited resources, it is still too often associated with unacceptable mother-child morbidity and mortality.

The main causes of this morbidity and mortality are the lack of pregnancy monitoring, insufficient screening of the mother and child, lack of information about the pregnancy itself, delays in referring the patient to hospital and **poor Caesarean section management in hospitals**, which this manual aims to improve.

This guide is mainly aimed at **young doctors working, often alone**, in sometimes poorly equipped **peripheral first referral hospitals**.

The objective of this manual is to increase the knowledge and practice of Caesarean section mainly with regard to:

1. Well-defined operating instructions adapted to the context.
2. Effective anaesthesia and resuscitation, which even today remains a challenge for pregnant women.
3. A well-established, abundantly illustrated and proven surgical technique.
4. Rigorous post-operative monitoring.

This manual, updated on in June 2020, is designed to be a clear and simple teaching tool, both **for young doctors and for the trainers who supervise them**.

The aim is that these practitioners, even if they are isolated and alone, will be able to carry out their work with confidence and in the best possible conditions for **a safe, comfortable and quality caesarean section for both mother and child**.
