**Mulago guideline for the use of vacuum extraction**

**Purpose**

The aim of this guideline is to provide up to date information on the use of vacuum extraction. It can help in decision making about when to do a vacuum extraction. Furthermore it describes the technical aspects of the procedure.

**Definition**

A vacuum extraction is aiding a vaginal delivery by traction on the fetus using a suction cup applied to the fetal head.

**Background**

Vacuum extraction is a valuable procedure in preventing complications of prolonged labour and fetal

distress1-3. According to the WHO, vacuum extraction is one of the seven critical functions of basic emergency obstetric care4. It can improve fetal and maternal outcome. And, by avoiding an emergency caesarean section (EMCS), the complications of an EMCS and those of a uterine scar can be prevented5-7. The decision to delivery interval is usually shorter for vacuum extraction than for EMCS. Vacuum extraction is a safe and reliable procedure if attention is paid to indications and contraindications8-11. However, complications do occur, mainly when too many tractions are applied9. Worldwide, more vacuum extractions are performed than forceps deliveries. While the indications and contraindications for the use of vacuum extraction and forceps delivery are mostly similar, research show that vacuum extraction is easier to learn than forceps delivery8,12. For situations in which there is no clear clinical indication for a specific instrument, the use of vacuum extraction as the first line method for assisted vaginal delivery is supported8. Use of vacuum extraction varies widely worldwide: In the Netherlands 10% of deliveries is by vacuum extraction, in the UK 6.0%, in the US 3%, in sub-Sahara-Africa < 1%5,13-15. For this guideline the A-J mnemonic, as used in the ALARM course is used11. It was adapted to the local situation in Mulago Hospital to form a Mulago Mnemonic for vacuum extraction.

**Indications and contraindications**11,12,16-20

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| **Indications** |
| 1 | Delay in the second stage of labour |
| 2 | Need to shorten the second stage of labour for maternal medical condition |
| 3 | Maternal exhaustion |
| 4 | Fetal distress in the second stage of labour |

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| **Absolute contraindications** |
| 1 | Breech, face or brow presentation, transverse lie |
| 2 | Incompletely dilated cervix in a prime gravida |
| 3 | Unengaged fetal head: 2/5th or more palpable per abdomen |
| 4 | Gestation < 34 weeks |
| 5 | Cephalo-pelvic disproportion |
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| **Relative contraindications** |
| 1 | Incompletely dilated cervix in a multiparous patient |
| 2 | HIV positive patient |
| 3 | Moulding grade 3 (irreducible overlapping skull bones) |

**Indications**

**1. Delay in the second stage of labour**

Definition: Duration of the second stage of labour > 2 hours in a prime gravida and > 1 hour in a parous patient (passive and active phase of second stage combined and without epidural analgesia). In case of epidural analgesia: > 3 hours in a prime gravida and > 2 hours in a parous patient17-19. This definition assumes that labour is monitored and that it is known when the second stage of labour started. As this is not always the case, the operator has to use his/her own judgment in deciding if a vacuum extraction is indicated or not. The definition can be used as guidance rather than as a strict criterion18,19. Progress of descent can be a helpful indicator. If there is progress, no fetal distress and adequate monitoring the patient may be allowed to push for a longer period. If there is no progress a vacuum extraction can be performed before the definition is met.

**2. Need to shorten the second the second stage of labour for maternal medical condition**

For example in certain cardiac or neurological diseases11,17-20. However, the mother should push as well. If the mother is not able to push at all, the vacuum extraction is likely to fail.

**3. Maternal exhaustion**11,17

**4. Fetal distress in the second stage of labour**11,17-20

If severe fetal distress is suspected during the second stage of labour, vacuum extraction can be a life saving procedure because of it’s short decision to delivery interval. However, if a difficult vacuum extraction with high risk of failure is anticipated and theatre space is available, EMCS might be a safer option.

**Absolute contraindications**

**1. Breech, face or brow presentation, transverse lie**11,12,18,20

**2. Incompletely dilated cervix in a prime gravida**11,12,16-20

In a prime gravida an incompletely dilated cervix is an absolute contraindication. In a parous patient it is a relative contraindication.

**3. Unengaged fetal head**

In literature there are different opinions about how deep the head should be engaged before a vacuum extraction can be considered: 2/5th or less palpable per abdomen16,20, 1/5th or less palpable per abdomen17 or 0/5th palpable per abdomen12. In Mulago Hospital we have reached consensus on: 1/5th or less palpable per abdomen. On vaginal examination the bony part of the fetal head has to be at least at the level of the spines, station 012,16,19. When there is a significant degree of caput succedaneum, or moulding, assessment by abdominal palpation using “fifths of head palpable” is more useful than assessment by vaginal examination11.

**4. Gestation < 34 weeks**

Most literature does not recommend a vacuum extraction before a gestational age of 34 weeks because of susceptibility of the preterm infant to cephalo-haematoma, intracranial haemorrhage, subgaleal haemorrhage and neonatal jaundice17-20. If an intervention is needed, forceps delivery or EMCS is the recommended mode of delivery. From 34 to 36 weeks of gestation a vacuum extraction should be carried out with caution17.

**5. Cephalo-pelvic disproportion**11,12,18,20

If cephalo-pelvic disproportion is suspected, a vacuum extraction is contra indicated. Malposition of the fetal head can mimic cephalo-pelvic disproportion. In malposition vacuum extraction may correct the position and is not contraindicated.

**Relative contraindications**

Depending on the clinical circumstances the following situations will be or not be contraindications for vacuum extraction.

**1. Incompletely dilated cervix in a parous patient**

Most literature states that a completely dilated cervix is a prerequisite for vacuum delivery11,12,16-20. In Mulago Hospital we have reached consensus on an incompletely dilated cervix in a prime gravida being a contraindication for vacuum extraction. In a parous patient with a cervical dilation of 8 cm or more a vacuum extraction may be performed. This should only be done by a specialist. After the procedure the operator must inspect the cervix for cervical tears.

**2. HIV positive patients**

There is only one meta-analysis about risk of HIV transmission in instrumental delivery (vacuum extraction and forceps delivery combined). In this meta-analysisthere is no statistically significant difference in HIV transmission between a group of mother-child pairs that had instrumental delivery (n=520) and the group that had non-elective caesarean section (n=895). The HIV transmission rate was 18,3% in the instrumental delivery group and 16.2% in the non-elective caesarean section group (p=0.3396)21. Studies included were conducted before 1999 and >70% of mother-child pairs did not use anti-retroviral therapy. In other literature used for this guideline, positive HIV status is not mentioned as a contraindication12,16-18,20. The RCOG guideline states: “Blood-borne viral infections of the mother are not a contraindication to operative vaginal delivery.”17 And a Cochrane review on instrumental delivery states: “For women who are infected or at high risk for infection with viral infections such as HIV and hepatitis, the risk of scalp injury with the metal vacuum cup is a particular cause for concern, and would favor the use of soft vacuum cup or forceps.”

In deciding if a HIV positive patient should have a vacuum extraction or an EMCS, the following should be taken into consideration:

It is unknown if vacuum extraction for delay in second stage of labour increases or decreases the risk of mother-to-child-transmission of HIV8. Delivery byelective caesarean section does reduce mother-to-child-transmission of HIV21,22. However, an EMCS for delay in the second stage of labour is a different situation. The fetus has been in the birth canal and membranes have been ruptured for a long period. Waiting for an EMCS might prolong this period and might therefore increase the risk of mother-to-child-transmission of HIV. Caesarean section is associated with increased maternal morbidity and mortality. In case of fetal distress the fetus might benefit from the short decision to delivery interval in vacuum extraction. Performing a vacuum extraction can cause laceration to the fetal scalp and hereby increase the risk of mother-to-child-transmission of HIV, especially when there is a high viral load. When an indication for vacuum extraction arises in a HIV positive mother, the health provider has to outweigh the risks and benefits of an EMCS versus a vacuum extraction for mother and fetus. In the case of a vacuum extraction, an episiotomy should be avoided and the best cup to use is a softcup8,11.

**3. Moulding**

Grade 3 moulding (irreducible overlapping skull bones) can be a sign of cephalo-pelvic disproportion17.

**Preparations and procedure: The Mulago Mnemonic for vacuum extraction**11,23

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| **A** | ADDRESSANAESTHESIAASSISTANCEANTICIPATEACCESS | - address patient, explain, get verbal informed consent- adequate pain relief- for neonatal support- shoulder dystocia, PPH, low Apgar Score- give IV line |
| **B** | BLADDERBACK UP PLAN | - empty bladder- have a plan in case vacuum extraction fails |
| **C** | CERVIX | - fully dilated- membranes ruptured |
| **D** | DELIVERY BEDDERTERMINEDRUGS | - lithotomy position with buttocks at edge of bed- position, station, pelvis adequacy- have oxytocine ready, give antibiotics after delivery |
| **E** | EQUIPMENT | - check vacuum cup, pump, tubing and pressure |
| **F** | FONTANELLE | - position the cup over flexion point- sweep finger around cup to clear maternal tissue |
| **G** | GENTLE TRACTION | - pull with contractions only- the woman should push during contractions- traction in axis of birth canal  |
| **H** | HALT | - no progress with 2-3 traction aided contractions- vacuum pops off 3 times- 20 minutes after application of cup- baby not (about to be) born after 3 traction aided contractions |
| **I** | INCISION | - consider episiotomy  |
| **J** | JAW | - remove vacuum when jaw is reachable  |

**A: Address**

Address the patient. Explain the indication and the procedure to her and obtain verbal informed consent17.

**A: Anaesthesia**

Anaesthesia can be by pudendal block or infiltration of the perineum with lidocaine, as for an episiotomy.

**A: Assistance**

Ensure that at least 1 assistant is available. The assistant should stand by the woman’s head to reassure her and encourage her to push during contractions. The assistant should note the time of application of the cup.

Ensure that staff trained in neonatal resuscitation is present.

The vacuum extraction must be performed by, or under supervision of a competent operator.

**A: Anticipate**

Anticipate on complications that may arise (shoulder dystocia, PPH, low Apgar Score)

Ensure oxytocic drug for management of the third stage is prepared, drawn up in syringe ready for injection.

Make sure that umbilical cord clamps or kochers are present, so that the neonate can be taken to the

resuscitation area promptly.

**A: Access**

Make sure there is IV-access, so that if needed, iv drugs or fluids can be given promptly.

**B: Bladder**

Make sure the woman has emptied her bladder (or use a catheter to empty bladder).

An in-dwelling catheter should be removed or deflated.

**B: Back up plan**

Make a back-up plan in case of failure to deliver (is theatre ready for caesarean section?)

**C: Cervix**

The cervix must be fully dilated and membranes ruptured. In a parous patient a vacuum extraction may be considered when the cervix is 8 cm or more dilated but only by a specialist.



**D: Delivery bed**

The woman must be in lithotomy position on a delivery bed or transverse on a normal bed, with her buttocks at the edge, so that traction in the axis of the birth canal (downwards) is possible. Vacuum extraction can be done in labour suite. If a difficult vacuum extraction is expected, it can be done in theatre, so that if the vacuum extraction fails, an EMCS can be done promptly.

**D: Determine**

Do a vaginal examination and determine:

Position of the head:

A vacuum extraction can be done for all vertex presentations (not face or brow presentation) as long as the cup is placed over the flexion point, which is 3 cm anterior to the posterior fontanelle along the sagittal suture (see F: Fontanelle).

Station:

The bony part of the skull must be at least at station 0. On abdominal palpation less than 2/5th of the fetal head should be palpable above the pubic bone. A vacuum extraction from station 0 to station +2 can be difficult and must only be done by an experienced operator.

Pelvis adequacy:

Caput succedaneum and moulding are normal in prolonged second stage of labour and not a contraindication for vacuum extraction. However irreducible moulding can be a sign of cephalo-pelvic disproportion17. If cephalo-pelvic disproportion is suspected, an EMCS must be done.

**D: Drugs**

Give 10 IU of oxytocine directly after delivery of the neonate.

There is not enough evidence to support the use of antibiotic prophylaxis for operative vaginal delivery24. This is based on only one trial, involving 393 women undergoing instrumental deliveries. It reported seven women with endomyometritis in the group given no antibiotic and none in prophylactic antibiotic group. This difference did not reach statistical significance24,25. In the setting of Mulago Hospital there is an increased risk of infection. We will therefore give profylactic antibiotics after vacuum extraction. First choice is a single dose of intravenous ampicillin or cephalosporins (ceftriaxone) after cord clamping. If there was obstructed labour: See protocol obstructed labour for antibiotic regimen.

**E: Equipment**

The equipment for vacuum extraction consists of:

A kiwi vacuum extractor or a reusable vacuum extractor with hand pump. Check the equipment before use on a gloved hand. Is a vacuum created?

**F: Fontanelle**

The centre of the cup should be placed over the flexion point, 3 cm anterior to the posterior fontanelle. The edge of the cup will be 3 cm from the anterior fontanelle and just in front of the posterior fontanell. This placement will promote flexion, descent and autorotation with traction. Correct application of the vacuum cup is essential for successful outcome. Sweep a finger around the cup to clear maternal tissue.





**G: Gentle traction**

Create a vacuum of 0.8 kg/cm (600mg Hg), using the rapid method rather than the stepwise method26. The rapid method reduces duration of the procedure whilst there is no evidence of differences in failure rate or maternal and neonatal outcomes. Pull with contractions only. Do not release the vacuum in between pulls. Prompt the woman to push during contractions. Do not try to rotate the fetal head. It will rotate by itself with descent. Traction should be in the direction of the pelvic curve, initially downward and finally upward.

**H: Halt**

If there is insufficient progress, it is important to stop the procedure and perform an EMCS immediately. 1-34% of vacuum extractions are not successful8,26-28. Continuing tractions without descent of the fetal head, can cause serious complications to mother and fetus.

**Stop the procedure when11:**

* No descent of the bony part of the fetal head is during 2-3 tractions\*
* The vacuum pops off 3 times
* 20 minutes have passed after application of the cup
* The fetus is not born after 3 traction aided contractions and the head is not crowning. Only if the head is crowning and the baby will very likely be born during the next contraction, a 4th traction may be performed

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| *\* Note: 1 traction is defined as 1 traction aided contraction, even if there are multiple pulls during the contraction.* |

**I: Incision**

Restrictive use of episiotomy, using the operator’s individual judgment, is supported11,17. Delay episiotomy until the head stretches the perineum. This will avoid unnecessary blood loss. Avoid episiotomy in HIV positive patients11.

**J: Jaw**

When the jaw is reachable the vacuum is released, the cup removed, and delivery of the neonate completed.

**Post-procedural care**

Direct post delivery care is the same as for spontaneous delivery. After vacuum extraction it is recommended to monitor the mother and neonate for 24 hours.

**Mother**: Fundal height, vaginal bleeding, urinary output (be cautious for urine retention) and vital signs including temperature. If there was obstructed labour, give a urinary catheter (see protocol obstructed labour).

**Neonate**: Vital signs and examination of scalp at 1 and 2 hours after birth. Thereafter 6 hourly. If there is a swelling of the scalp that increases, suspect cephalo-haematoma or subgaleal haemorrhage. Check if neonate is feeding well. On discharge, instruct the parents to come back when the neonate becomes jaundiced or does not feed well.

**Documentation**

1. Date and time of delivery
2. Indication for vacuum extraction
3. Operator
4. Fetal condition prior to procedure
5. Findings on abdominal and vaginal examination prior to procedure
6. Number of tractions and pop off’s (1 contraction with several pulls is documented as 1 traction)
7. Mother: Blood loss, lacerations of genital tract, complications
8. Neonate: AS, weight, inspection of scalp, resuscitation, admission to SCU, complications
9. Post procedural instructions

**Complications (Appendix A)**8,9

To prevent complications, a vacuum extraction should be performed or supervised by an experienced person. The most important maternal complication is anal sphincter rupture (in 7.5% of vacuum extractions).

Neonatal complications are:

**Cephalhaematoma** (in 9.4% of vacuum extractions) is usually not present at birth, but appears within a few hours. The swelling is characterized by being confined to the skull bone (it does not cross suture lines). It may take 1 - 4 weeks to resolve but almost never requires specific treatment.

**Intracranial injury** (in 0.08-0.9% of vacuum extractions) Research shows that neonates delivered by vacuum extraction do not have more intracranial complications than neonates delivered by EMCS. This suggests that abnormal labour may contribute more to intracranial hemorrhage than does the method of delivery.

**Subgaleal haemorrhage** (in 0.5% of vacuum extractions) causes a generalized fluctuant scalp swelling. In contrast to a caput succedaneum, which starts to decrease within an hour after birth, it increases in size. Neonates can lose 50% of their blood volume in this compartment and will show signs of hypovolaemic shock.

**Neonatal jaundice** (9%) might occur 1-3 days after birth. On discharge, instruct the parents to come back when the neonate becomes jaundiced or does not feed well. Other neonatal complications are **retinal haemorrhage** which disappears without treatment and **scalp injury** that should be kept clean and dry and will heal spontaneously. When cephalhaematoma, intracranial injury, subgaleal haemorrhage or neonatal jaundice is suspected, refer to the special care unit.

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**Appendix A: Complications**

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| **Maternal complications** | **FE %** | **VE %** | **OR** | **95%CI** | **significant** |
| lacerations of vaginal wall  | 26 | 12 | 2.48 | 1.59-3.87 | yes |
| episiotomy or perineal tear that needs suturing | 65 | 68 | 0.95 | 0.91-1.00 | no |
| anal sphincter rupture | 14 | 7.5 | 1.89 | 1.51-2.37 | yes |
| **Neonatal complications** |  |  |  |  |  |
| cephalhaematoma | 5.2 | 9.4 | 0.64 | 0.37-1.11 | no |
| Apgar score at 5 min of < 7  | 2.4 | 2.9 | 0.82 | 0.44-1.54 | no |
| death | 0.9 | 0.5 | 1.75 | 0.46-6.68 | no |
| scalp injury | 3 | 2 | 1.36 | 0.75-2.48 | no |
| retinal haemorrhage | 5.3 | 7.6 | 0.68 | 0.43-1.06 | no |
| jaundice | 7.3 | 9.0 | 0.79 | 0.59-1.06 | no |
| intracranial injury | 0.9 (1/115) | 0.0 (0/143) | - | - | no |
| failed delivery | 9.3 | 14.1 | 0.65 | 0.45-0.94 | yes |

Ref. 8: O’Mahony F, Hofmeyr GJ, Menon V. Choice of instruments for assisted vaginal delivery. Cochrane Database of Systematic Reviews 2010, Issue 11. Art. No.: CD005455. DOI: 10.1002/14651858.CD005455.pub2.

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| **Neonatal complications in 583,340 births** | **SVD %** | **VE %** | **FE %** | **EMCS %** |
| Subdural or intra cerebral haemorrhage | 0.03 | 0.08 | 0.10 | 0.07 |
| Convulsions | 0.06 | 0.12 | 0.10 | 0.21 |
| Feeding difficulties | 0.69 | 0.72 | 0.75 | 1.17 |
| Mechanical ventilation | 0.26 | 0.39 | 0.45 | 1.03 |

Ref. 9: Towner D, Castro MA, Eby-Wilkens E, Gilbert WH. Effect of mode of delivery in nulliparous women on neonatal intracranial injury. N Eng J Med 1999; 341: 1709.

**Anatomy of intracranial and extra cranial haemorrhage**

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