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# Global perspectives on operative vaginal deliveries



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### A B S T R A C T

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Operative vaginal delivery (OVD) refers to the use of an instrument (forceps or vacuum device) to assist with the delivery of the fetus from the vagina. This can help improve maternal and fetal outcomes and has to be weighed up against the risks and benefits of performing second-stage cesarean deliveries. OVD forms an integral part of basic emergency obstetric care and a skilled birth attendant's duties. Outlet forceps and vacuum extraction should be used to shorten the second stage of labor and to improve maternal and fetal outcomes associated with delayed second stage. Despite the known benefit of OVD, available data on the use of OVDs in low- and middle-income countries show very low rates, mostly due to the lack of skilled healthcare workers and equipment shortages. Increased use of OVD can safely reduce the number of second-stage cesarean deliveries with its associated morbidity and mortality. We recommend implementing training programs to increase the number of skilled healthcare workers and strengthening health systems to provide birthing facilities with the equipment required to perform OVD.

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## Introduction and background

Operative vaginal delivery (OVD) refers to the use of an instrument (forceps or vacuum device) to assist with the delivery of the fetus from the vagina. This can be achieved with or without maternal pushing. The decision to perform an assisted delivery can improve maternal and fetal outcomes and has to be weighed up against the risks and benefits of performing cesarean delivery during the second stage of labor. Indications for performing an OVD include fetal distress, delay in the second stage, or maternal contraindications to Valsalva.

The fifth Millennium Development Goal established reducing maternal mortality as a priority for the international community [1]. More than half of the estimated 536,000 global annual maternal deaths occur in Sub-Saharan Africa. In certain regions, the maternal mortality ratio exceeds 900 per 100,000 live births [2,3]. Maximizing intrapartum care for pregnant women seems to be the most important intervention in reducing the high maternal mortality rate. Approximately 70% of deaths are due to hemorrhage, hypertensive diseases in pregnancy, sepsis, unsafe abortion, and obstructed labor [4].

The World Health Organization (WHO) defines seven basic services as prerequisites for emergency obstetric care [5]:

- Parenteral antibiotic administration
- Use of uterotonic drugs
- Magnesium sulfate administration to women with preeclampsia/eclampsia
- Manual removal of the placenta
- Removal of retained products of conception with the use of vacuum aspiration or by dilation and curettage
- Performing assisted vaginal delivery with the use of forceps or vacuum extraction
- Performing basic neonatal resuscitation with a bag and a mask

Assisted delivery rates vary greatly between settings and the ideal rate is not known. In developed countries, the rates vary from 10 to 15% in the UK to approximately 4.5% in the USA where its rate has halved in the last 20 years [6,7]. Lower rates are expected in low-resource settings because of the higher mean parity, the unavailability of epidural analgesia and electronic fetal monitoring, and lack of facilities providing OVD. The rate of OVD is also inversely proportional to the cesarean delivery rate. This leads to an unmet need and higher incidence of complications of obstructed second stage of labor, such as stillbirths, uterine rupture, and vesicovaginal fistulas.

## Fistulae, sphincter injuries, and female genital mutilation

In low- and middle-income countries (LMICs), especially in Sub-Saharan Africa, vesicovaginal fistulae are more common than in high-income countries. Obstructed labor caused by cephalopelvic disproportion (CPD) and prolonged second stage of labor can cause maternal injuries leading to vesicovaginal fistulae. Obstetric fistulae are a direct consequence of obstructed labor. The permanent leakage of urine and/or feces through the vagina can lead to the rejection of these women resulting in isolation. The MOMA study was a multicenter, population-based prospective study carried out in six major West African countries. More than 20,000 women were followed up during pregnancy and after delivery. Two women were diagnosed with a vesicovaginal fistula after delivery. The incidence rate was 10.3 per 100,000 deliveries and 0 per 100,000 deliveries in major cities [8]. In the rural areas involved in this study, the incidence of obstetric fistulae is approximately 123.9 per 100,000 deliveries, which is much higher than that previously thought [9]. These data stress the importance of timely diagnosis and intervention of obstructed labor and provision of good-quality emergency obstetric care including OVD.

Obstetric anal sphincter injuries (OASIS) are a major cause of maternal morbidity and are a risk factor for the development of fistulae and fecal incontinence. Ramm et al. showed that OVD was complicated by OASIS in 24% of vacuum-assisted deliveries compared to 4% in normal vaginal deliveries

[10]. Data regarding the greater risk of OVD with forceps than with vacuum for OASIS are conflicting but seem to show more OASIS cases with forceps than with vacuum. Hehir et al. analyzed vaginal deliveries at two large obstetric hospitals during 8-year period [11]. Out of 100,307 vaginal deliveries, there were 2121 cases of OASIS (2.1% incidence): OASIS was more common in delivery with forceps than in normal vaginal delivery (NVD) (8.6% vs. 1.3%,  $p < 0.0001$ , odds ratio (OR): 7.1, confidence interval (CI): 6.4–7.9). Vacuum-assisted delivery also carried an increased risk of OASIS (3.7% vs. 1.3%,  $p < 0.0001$ , OR: 2.9, CI: 2–2.6). The Cochrane review on choice of instruments for assisted vaginal delivery mentions that sphincter injuries (third- and fourth-degree perineal tears) are more likely with forceps than with vacuum [12].

The WHO describes female genital mutilation (FGM) as all procedures that intentionally alter or cause injury to the female genital organs for nonmedical reasons (such as partial or total removal of the external female genitalia or other injuries to the female genital organs) [13]. FGM is classified as four types and is prevalent among some ethnic groups, with high concentration in Africa, the Middle East, and Asia. FGM is usually performed as a part of culture and tradition and carries no health benefit for the girl or woman. Type III FGM, also referred to as infibulation, is the narrowing of the vaginal opening through the creation of a covering seal. The seal is formed by cutting and repositioning the labia minora, or labia majora, sometimes through stitching, with or without removal of the clitoris (clitoridectomy). Deinfibulation refers to the practice of cutting open the sealed vaginal opening, which may be necessary to facilitate childbirth. Reinfibulation (restituting after deinfibulation) is not recommended.

FGM can lead to obstructed labor and is associated with an increased risk of OVD and perineal trauma. Therefore, given the causal relationship between obstructed labor and fistulae, FGM may lead to a higher risk of developing fistulae after delivery. Abdulcadir et al. performed a retrospective analysis of women with FGM who attended a specialized clinic at a tertiary center in Switzerland [14]. They found an OVD rate of 22% in all deliveries of women with FGM and 20% in women with type III FGM, which is higher than the average in Switzerland.

## Worldwide use of OVD

OVDs are more common in high-income countries than in LMICs. The rate of OVD ranges from 10 to 15% of all live births in the UK to as low as 1.5% in other countries. In the UK, the rates have remained fairly constant, but the preferred instrument has moved from forceps to vacuum extractor. Bailey et al. assessed the incidence of OVDs in LMICs [15]. They included hospital and nonhospital sites in 36 countries, 27 of which were located in Sub-Saharan Africa. They found that instrumental delivery was not widely practiced, but it was more likely to occur in hospitals than in clinics and health centers. Fifty-three percent of hospitals in Sub-Saharan Africa reported OVDs in the recent past compared to 6% of nonhospital sites. The total percentage of OVDs was approximately 1%. The reasons cited for not performing OVD were inadequate training, equipment shortages, and policies failing to support the use of OVD. Specialist obstetricians most often provided OVD in hospitals and midwives in nonhospital sites. Mozambique was an exception to the rule where midwives were trained in performing vacuum extraction as part of a government initiative.

## OVD rates in LMICs

Nolens et al. conducted a prospective study in Uganda including 13,152 deliveries, with 358 vacuum extraction OVDs [16]. There were no maternal deaths reported in the vacuum extraction group compared to five maternal deaths attributed to complications during or after second-stage cesarean delivery. In terms of fetal outcome, the perinatal mortality rate was similar in the two groups (8.4% in the OVD group vs. 11% in the second-stage cesarean delivery group). This study highlighted the improved maternal outcomes and similar perinatal outcomes when OVD is compared to second-stage cesarean delivery. Their conclusion was that vacuum-assisted deliveries can help improve maternal outcomes and reduce complications related to second-stage cesarean deliveries.

Cesarean deliveries performed during the second stage of labor are associated with an increased risk of maternal morbidity such as prolonged hospital stay, hemorrhage, risk of bladder trauma, and unintended extensions of the uterine incision [17,18]. Several studies analyzing perinatal outcomes after second-stage cesarean delivery compared to OVD found no difference or worse outcomes in the cesarean-delivery group [19,20].

There are limited data about the use of OVD in different countries and regions. Levine et al. conducted a study analyzing emergency obstetric care in Zambia [21]. In terms of OVD, only 6.1% of health centers had vacuum extractors and 9.1% of health centers had forceps available. Only 5.7% of healthcare workers felt comfortable performing assisted vaginal deliveries (forceps or vacuum). Adaji et al. found an OVD rate of 3.6% with prevalence rates of 1.0–3% for forceps delivery and 1.4–1.5% for vacuum extraction in Nigeria [22]. The paper by Duysburgh et al. reporting preintervention measurements of quality of routine antenatal and childbirth care in rural districts in Burkina Faso, Ghana, and Tanzania showed that, even though quality scores for childbirth care were reasonably high, none of the sites performed OVD; equipment to perform OVD was absent in the sites [23]. A facility-based cross-sectional study reported by Echoka et al. collected data on emergency obstetric care from 40 health facilities in Malindi District in Kenya [24]. None of the assessed facilities provided OVD, neither by vacuum nor by forceps. Pattinson et al. reported that the assisted delivery rate in South Africa (reported in 2010–2011) was 0.52% for vacuum and 0.15% for forceps, whereas the cesarean delivery rate was 21% [25]. The study found a negative correlation between the use of OVD and perinatal deaths secondary to intrapartum asphyxia and trauma. They hypothesized that increasing the use of OVD in South Africa will likely help reduce perinatal morbidity and mortality due to intrapartum asphyxia. It is also thought to reduce maternal morbidity and mortality related to second-stage cesarean deliveries. An increase in the use of OVD can be achieved through a unified effort by managers, educators, trainers, and supervisors working in obstetrics.

Chang et al. mentioned the scarcity of available data on the use of vacuum extraction in South America [26]. Their prospective study in Ecuador analyzed increasing cesarean delivery rates, which were linked to increasing costs and maternal morbidity. OVD was not performed routinely at their institution: they reported a 1.9% incidence of vacuum extraction in one hospital in Ecuador; the lack of skilled healthcare workers and absence of an established training program being the main reasons for the low rates. Vacuum-assisted delivery was shown to be a cost-effective and safe alternative to cesarean delivery, and the investigators suggested that adequate training programs in OVD can help reduce cesarean delivery rates with the associated complications thereof.

### **Cultural beliefs and HIV infection**

We have found no data on cultural beliefs around OVD such as declining, performing, or undergoing assisted delivery for religious or cultural reasons. Healthcare workers might be hesitant to perform OVD in HIV-positive women. The Cochrane review on choice of instrument for assisted vaginal delivery and the RCOG guideline on OVD suggest a theoretically increased risk of mother-to-child transmission during OVD due to scalp injury; however, there are very little data available [6,12]. The National Study of HIV in Pregnancy and Childhood in the UK and Ireland collected data of 9072 live births in HIV-positive women since 2008 [27]. OVD was performed in 251 women; one infant was reported to be HIV positive. The RCOG states that blood-borne viral infections of the mother are no contraindications to performing OVD, but one should avoid scalp trauma.

### **Analgesia and OVD in LMICs**

We did not find any data on the use of regional versus local analgesia for performing OVD in LMICs. In general, adequate analgesia is recommended. Epidural analgesia is often not available, as only trained doctors can perform the procedure and many (rural) birthing facilities only have midwives and nurses on site. For local anesthesia, local infiltration or a pudendal block can be used. However, in settings with high HIV prevalence, a pudendal block is not commonly performed due to the risk of needle pricks for the birth attendant.

## Improved training can increase OVD rates

Improved training in OVDs can help to increase rates of vacuum- and forceps-assisted deliveries. The Advanced Life Support in Obstetrics (ALSO) provider course, a 2-day training course, was developed to teach birth attendants evidence-based management of emergencies in obstetrics. The goals are to improve patient care and increase healthcare providers' skills level in emergency obstetric care. The results from Colombia, Guatemala, Honduras, and Tanzania showed improved obstetric outcomes after the training has been completed [28]. Two hospitals in Colombia and Guatemala had a reduction in maternal mortality after implementation of the training.

Vacuum-assisted delivery can help reduce the need for cesarean deliveries. The results from Honduras showed increased vacuum-assisted deliveries after the introduction of ALSO. In Tanzania, assisted vaginal deliveries increased the year after the introduction of ALSO. The results at 6 and 12 months showed that more than 90% of providers who used OVD felt that ALSO improved their skills as well as maternal and fetal outcomes. At the study hospital, vacuum-assisted deliveries were never performed and forceps-assisted deliveries were only rarely performed before ALSO training. By contrast, 6 months after training, 13 (24.1%) of the 54 participants had used a vacuum extractor and 18 (33.3%) had used forceps. Twelve months after ALSO training, 18 (33.3%) reported vacuum use and 20 (37.0%) forceps use.

One concern to be raised may be the increased risk of failed OVD in birthing facilities without immediate access to cesarean delivery if OVD is more widely used. To avoid this complication, we suggest that birth attendants in remote facilities without theater access should only perform OVD when the head is on the perineum (in case of suspected fetal compromise or failure to progress). Training programs should include topics such as assessing the position of the fetal head and assessing cephalo-pelvic disproportion to avoid further complications.

One clinical innovation, the Odon Device, is currently under development as a new instrument for OVD where a plastic sleeve is inserted around the fetus' head and a cuff is inflated to subsequently assist the operator in delivering the baby. One pilot clinical study was performed (and early terminated): the results suggest the Odon Device is feasible as a device to assist delivery [29]. This could be promising, especially for LMICs. However, as this was a feasibility study where the device was applied under nonemergency conditions, more research is needed before this device can be implemented.

## Conclusion

As shown above, OVD forms an integral part of basic emergency obstetric care and a skilled birth attendant's duties. Outlet forceps and vacuum extraction should be used to shorten the second stage of labor and to improve maternal and fetal outcomes associated with delayed second stage. Increased use of OVD can safely reduce the number of second-stage cesarean deliveries with its associated morbidity and mortality. We recommend the implementation of training programs in LMICs for all skilled birth attendants to provide high-quality emergency obstetric care as well as support from health systems to provide all birthing facilities with the equipment required to perform OVD.

### Practice points

- The indications and benefits of operative vaginal deliveries (OVDs) are well established.
- The rates of OVDs are significantly lower in low- and middle-income countries than in high-income countries.
- Lack of skilled healthcare workers and lack of resources are the main reasons for the low rates of OVDs.
- To be able to provide OVDs at all birthing facilities as part of high-quality emergency obstetric care, training programs for all skilled birth attendants need to be established.

### Research agenda

- Operative vaginal delivery and mother-to-child transmission of HIV.
- Implementation strategies in low- and middle-income countries.

### Conflict of interest

None.

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