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REVIEW ARTICLE

Is it Time to Rejuvenate the Forceps?

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Abstract The obstetric forceps was designed to assist extraction of the foetal head and thereby accomplish delivery of the foetus in the second stage of labour. More than 700 types of obstetric forceps have been described. An understanding of the anatomy of the birth canal and the foetal head is a prerequisite to becoming a skilled and safe user of forceps. Operative vaginal delivery rates have remained stable at between 10 and 13 %. The last few decades has seen a rise in caesarean section, along with the introduction and safe use of the vacuum extractor. This has resulted in a decline both in the use of the obstetric forceps as well as in the training for the same. The forceps is less likely to fail when used as the primary instrument thereby reducing the need for the sequential use of two instruments which increase the morbidity of the neonate. Perineal trauma is more likely to occur with the use of the forceps but the evidence is that the maternal concern is less when compared to the ventouse. Simulation training is an important part of obstetric training. Application of forceps blades in the simulation setting can improve the skill level of obstetricians. The use of the forceps should not be decreasing and more senior involvement in training is necessary so that juniors develop the proper skills to perform forceps delivery in a competent and safe manner. It is vital that the art of the forceps is not lost to future generations of obstetricians and the women they care for.

Keywords Obstetric forceps · Kjellands forceps · Vacuum extractor · Caesarean section

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Introduction

The obstetric forceps was designed to assist extraction of the foetal head and thereby accomplish delivery of the foetus in the second stage of labour. It was invented by the Chamberlain family surgeons. The Chamberlain's were French Huguenots. William Chamberlain was most likely a surgeon, who specialized in midwifery [1]. The inventor was probably the eldest brother Pierre, who became the obstetrician–surgeon of Queen Henrietta of England. Each forceps had two branches. Each branch had a blade, a handle and a shank. The two branches were connected by a lock. Each blade had a cephalic curve for accommodation of the foetal head and a pelvic curve which lay along the curve of Carus on application of the forceps. The Kjellands forceps is used for the rotation of foetal head and has

almost no pelvic curve. The obstetric forceps were kept secret by the Chamberlain family but gradually appeared in England and Scotland in 1735. In 1747, the French obstetrician Andre Levret, published 'Observations sur les causes et accidents de plusieurs accouchements laborieux' (Observations on the Causes and Accidents of Several difficult Deliveries), in which he described his modification of the instrument to follow the curvature of the maternal pelvis. This 'pelvic curve' allowed a grip on the foetal head still high in the pelvic cavity, which could assist in more difficult cases. This improvement also was published in 1751 in England by William Smellie. More than 700 types of obstetric forceps have been described [2]. Another instrument called the Ventouse (derived from the French word 'von-toose' meaning, suction) which assists in delivery of the foetus in the second stage of labour was invented first in Sweden from a bicycle pump. Since then more sophisticated types (both metal and plastic) have been designed. An understanding of the anatomy of the birth canal and the foetal head is a prerequisite to becoming a skilled and safe user of forceps or the vacuum extractor. It is strongly recommended that obstetricians achieve experience in spontaneous vaginal delivery prior to commencing training in forceps delivery.

Change in Use of Forceps Worldwide

Operative vaginal delivery rates have remained stable at between 10 and 13 % in the United Kingdom over the last decade, yielding safe and satisfactory outcomes for the majority of mothers and babies [3, 4]. There has been an increasing awareness of the potential for morbidity for both the mother and the baby. The increased risk of neonatal morbidity in relation to operative vaginal delivery has long been established, although with careful practice and skill, overall rates of morbidity remain low [5]. Continuous support for women during childbirth can reduce the incidence of operative vaginal delivery (15 trials; $n = 13{,}357$; RR 0.82; 95 % CI 0.82–0.96), particularly when the carer was not a member of staff [6]. The last few decades have seen a rise in caesarean section rates which is due to multiple factors. This along with the introduction and safe use of the vacuum extractor has seen a decline both in the use of the obstetric forceps as well as in the training for the same. This is not only true for developed nations but also for developing countries.

Figure 1 highlights the change in trend in the caesarean section and instrumental delivery rates at the Rotunda Hospital over a 50-year period from 1960 to 2010. The Rotunda hospital is the oldest maternity hospital in Europe, providing unbroken service since 1745. In 1960 the hospital delivered around 4,400 babies. By 2010 it was delivering twice as many babies each year. In 1960 the caesarean section rate

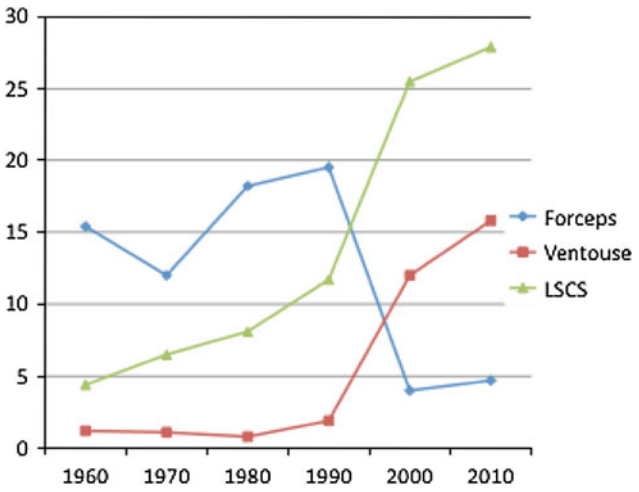

Fig. 1 Changing rates of assisted deliveries from 1960 to 2010 at the Rotunda Hospital, Dublin (data collected from the Hospital Annual Reports for the years: 1960, 1970, 1980, 1990, 2000 and 2010)

was 4.4 %, this increased to 6.5 % in 1970, 8.1 % in 1980, 11.7 % in 1990, 25.5 % in 2000 and 27.9 % in 2010. In 1960 only around 1 % of babies were delivered by the vacuum extractor, which remained fairly constant until the 1990's. Between 1990 and the year 2000 there was a sudden increase in the use of the vacuum extractor. In 1990 1.9 % of deliveries involved the use of the vacuum and by the year 2000, 12 % of all deliveries were by the vacuum extractor (Annual Reports, Rotunda Hospital, 1960–2010).

The overall instrumental delivery rate has remained much the same. In 1960, 16.8 % of all deliveries were by the instrumental route, and though it was slightly lower (13.1 %) in the year 1970, overall it has consistently remained around 18–22 %. In the year 1980 the instrumental delivery rate was 19 %, in 1990 it was 21.4 % and in 2010 it was 20.5 %. In contrast to this, the use of forceps has declined significantly over the same time frame, having reduced to only a third of what it was 50 years ago. In 1960 15.4 % of all deliveries were by the forceps with a reduction by 1970 to 12 %. In 1980 there was an increase to 18.2 % and in 1990 a further increase to 19.5 %. This meant that 1 in 5 babies were delivered by the forceps. Things changed dramatically within that decade, where by the year 2000, only 4 % (1 in 25) were delivered by the forceps at a time when the vacuum extractor was more in vogue. In the year 2010 the incidence of forceps use remained around 4 % while the vacuum became more popular.

Safety of Forceps and Ventouse

Forceps is a safe instrument if used correctly and a standard classification of operative vaginal delivery should be used to assess the level of difficulty with the delivery. The American College of Obstetricians and Gynecologists

Table 1 Classification for operative vaginal delivery

Outlet	Foetal scalp visible without separating the labia
	Foetal skull has reached the pelvic floor
	Sagittal suture is in the anterio-posterior diameter or right or left occiput
	Anterior or posterior position (rotation does not exceed 45°)
	Foetal head is at or on the perineum
Low	Leading point of the skull (not caput) is at station plus 2 cm or more and not on the pelvic floor
	Two subdivisions:
	Rotation of 45° or less from the occipito-anterior position
	Rotation of more than 45° including the occipito-posterior position
Mid	Foetal head is no more than 1/5th palpable per abdomen
	Leading point of the skull is above station plus 2 cm but not above the ischial spines
	Two subdivisions:
	Rotation of 45° or less from the occipito-anterior position
	Rotation of more than 45° including the occipito-posterior position
High	Not included in the classification as operative vaginal delivery is not recommended in this situation where the head is 2/5th or more palpable abdominally and the presenting part is above the level of the ischial spines

criteria are adapted in Table 1 and define the delivery by station and position [7].

In 1998, the US Food and Drug Administration issued a warning about the potential dangers of delivery with vacuum extractor [8]. In addition, there has been a growing awareness of the short-term and long-term morbidity of pelvic floor injury as well as neuro-developmental outcomes for children following operative vaginal delivery [9, 10]. Forceps can be used at any gestation but use of the ventouse traditionally has been restricted before 36 weeks of gestation and absolutely contraindicated before 34 weeks of gestation. The risk of subgaleal and intracranial haemorrhage increases at gestations under 36 weeks [11, 12]. However, there is a real paucity of data with respect to neonatal and paediatric outcomes after instrumental delivery in very preterm gestations. Some recent data suggest that ventouse may not be a higher risk than forceps in the very preterm setting [13]. At the very least, further research is warranted in this area.

Perineal trauma is more likely to occur with the use of the forceps but the evidence is that the maternal concern about the neonate is less when compared to the ventouse (odds ratio 2.2; 95 % confidence interval 1.2–3.9) [14]. Vacuum extractors are contraindicated with a face presentation and are more likely to be associated with retinal haemorrhages compared to the forceps. Two case studies reported a minimal risk of foetal haemorrhage if the extractor is applied following foetal blood sampling or application of a spiral scalp electrode [15, 16]. Forceps and vacuum extractor deliveries prior to full dilatation of the cervix are contraindicated. Forceps can be used for the after-coming head of the breech and in situations where maternal effort is impossible or contraindicated. In case of infectious disease such as HIV and Hepatitis C one should avoid foetal scalp lacerations to reduce the incidence of mother to child transmission of disease. Every clinician should be trained and know when to abandon the procedure and resort to caesarean section. Also adequate traction should be given before carrying out caesarean section at full dilatation as there may be difficulty with delivery of the baby. There is a significant risk of uterine extension and post partum haemorrhage with full dilatation caesarean sections.

Operative vaginal births that have a higher risk of failure should be considered as a 'trial' and should be conducted in a place where immediate recourse to caesarean section can be undertaken, such as in an operating theatre. The non-technical skills are generally divided into seven main categories; four of the categories like situational awareness, decision making, task management, and team work and communication are similar to the skills identified in any surgery. The other three categories unique to obstetrics are professional relationship with the woman, maintaining professional behaviour and cross-monitoring of performance. This explicitly defines the skills taxonomy that can aid trainees' understanding of the non-technical skills to be considered when conducting an operative vaginal delivery and may potentially reduce morbidity and improve the experience for the mother [17].

For a trial of instrumental delivery in theatre, the consultant should attend in person or should be immediately available if the trainee on duty has not been assessed and 'signed off' as competent [18]. When used as a primary instrument the ventouse is more likely to fail than the forceps but the ventouse is no more likely to be associated with delivery by caesarean section (OR 0.6; 95 % CI 0.3–1.0), no more likely to be associated with low 5-min Apgar scores (OR 1.7; 95 % CI 1.0–2.8) and no more likely to be associated with the need for phototherapy (OR 1.1; 95 % CI 0.7–1.8). There is an increased risk of neonatal trauma with the sequential use of instruments and some studies have shown that the risk of intracranial haemorrhage is 1 in 256 for vacuum-assisted forceps deliveries, versus 1 in 860 for a vacuum extraction and 1 in 664 for a forceps compared to 1 in 954 for a caesarean only [19–22]. The use of sequential instruments significantly increases maternal morbidity as well. Obstetricians need training in the appropriate selection

and use of instruments with the aim of completing delivery safely with one instrument [23]. In a randomised trial setting, the forceps has been shown to have a greater risk of faecal incontinence but in a 5-year follow-up study from another randomised controlled trial there was no difference in long-term effects [24, 25]. Routine use of episiotomy has not been shown to significantly decrease or increase anal sphincter tears but is associated with greater maternal and neonatal morbidity [26]. The failure rate when using forceps has been reported at 4.4 % and this increased when the biparietal diameter measured more than 9.5 cm, when the station was higher than +2 and also with occipitoposterior position [27].

Higher rates of failure with instrumental delivery are associated with:

- Maternal body mass index over 30.
- Estimated foetal weight over 4,000 g or clinically 'big baby'.
- Occipito-posterior position.
- Mid-cavity delivery or when 1/5th of the head palpable per abdomen.

Role of Forceps in Modern Obstetrics

The role of the obstetrics forceps has declined over the last 50 years and in some countries it is further declining. This may be due to fear of litigation and in some centres there may be no trained midwifery support in the room. Simulation training is an important part of obstetric training. Application of forceps blades in the simulation setting can improve the skill level of obstetricians [28]. The US National Center for Health Statistics reported that the caesarean section rate in 2001 had increased to almost 25 % which is the highest level since 1989, not dissimilar to the rate which was observed in England, Wales and Northern Ireland in 2000 [29].

Litigation has increased over recent years in all areas of obstetrics and gynaecology and is often related to care and management issues on the labour ward. Issues of litigation and practice guidelines has raised concerns over the training of obstetricians, and may have had a significant influence in how training is now carried out. Most residency training programmes in North America no longer expect proficiency in mid-cavity forceps delivery, and in one residency programme 14 % of the institutions surveyed were no longer performing such deliveries [30]. Metal Cup ventouse is rarely used now in the USA [31]. It is true that in the hands of an untrained accoucher the forceps is potentially a dangerous instrument.

In a Cochrane meta-analysis it has been shown that women who have experienced a vaginal delivery are less anxious about their babies and more satisfied with the birth than women who have had a caesarean section [32]. The rate of pregnancies conceived by assisted reproductive techniques is increasing worldwide and this can also have an influence on mode of delivery. The reasons behind caesarean section by maternal request must be evaluated in detail as a recent study found a delay in subsequent conception among women who had caesarean section compared with women who delivered vaginally [33]. Although an Australian study reported good neonatal outcomes, no perinatal deaths and only minor cases of trauma with Kjellands forceps when used correctly [34], the use of the Kjellands forceps has died out in most institutions worldwide due to concerns about its safe use. High rates of psychological morbidity have been reported in women who undergo instrumental delivery in theatre, in women who experience caesarean section in the second stage of labour and in women who have poor understanding of the whole event [35, 36]. In some cases this is sufficient to deter them from further pregnancies. It is imperative that trainees should have proper teaching sessions on debriefing and stress management strategies for women who have had complicated instrumental deliveries either in the labour room or in theatre and also for women who have a caesarean section after a failed instrumental delivery.

Conclusion

The obstetric forceps is an effective instrument which may help to avoid an unnecessary caesarean section and to avoid its associated complications. Appropriate training is required before carrying out forceps delivery. Simulation training is a critical component in obstetrics training as it allows trainees to practice a skill prior to performing a procedure on labouring women. It is essential that trainees become skilled in using both the forceps as well as the vacuum, as both have a place in modern obstetric care. The use of the forceps should not be decreasing and more senior involvement in training is necessary so that trainees develop the proper skills to perform forceps deliveries in a competent and safe manner. It is vital that the art of the forceps is not lost to future generations of obstetricians and the women they care for.

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