

Chapter 1

Trends in Assisted Vaginal Birth and Future Practice

Stephen O'Brien, George Attilakos, Kim Hinshaw and
Dimitrios Siassakos

Introduction

In skilled hands, assisted vaginal birth (AVB) remains the most efficient and effective method of expediting birth in the second stage of labour. It is associated with fewer adverse maternal and neonatal outcomes compared to second stage emergency caesarean section. In this chapter we will focus on the history and role of AVB as it currently stands. We will review relevant literature, examine important areas of practice and suggest a way forward that aims to maintain AVB at the heart of obstetric practice in the twenty-first century. The need for such focus is clear – complications in the second stage of labour (fetal compromise, obstructed labour, maternal exhaustion, or maternal medical conditions exacerbated by the act of pushing) remain a major cause of maternal and neonatal mortality and morbidity across the world. Such complications are responsible for 4 to 13% of maternal deaths in Africa, Asia, Latin America and the Caribbean.¹ In 2013 obstructed labour alone accounted for 0.4 deaths per 100,000 women worldwide.²

Current Practice

Since its introduction to routine clinical practice, AVB has been the preferred approach used by the accoucheur seeking to reduce maternal and neonatal morbidity in the second stage of labour.³ In a matched cohort study, compared to assisted vaginal delivery, caesarean section (CS) at full cervical dilatation was associated with higher rates of major haemorrhage >1 L (RR 2.8; 95% CI 1.1 to 7.6) and extended hospital stay ≥6 days (RR 3.5; 95% CI 1.6 to 7.6). Neonatal

ROBuST: RCOG Assisted Birth Simulation Training

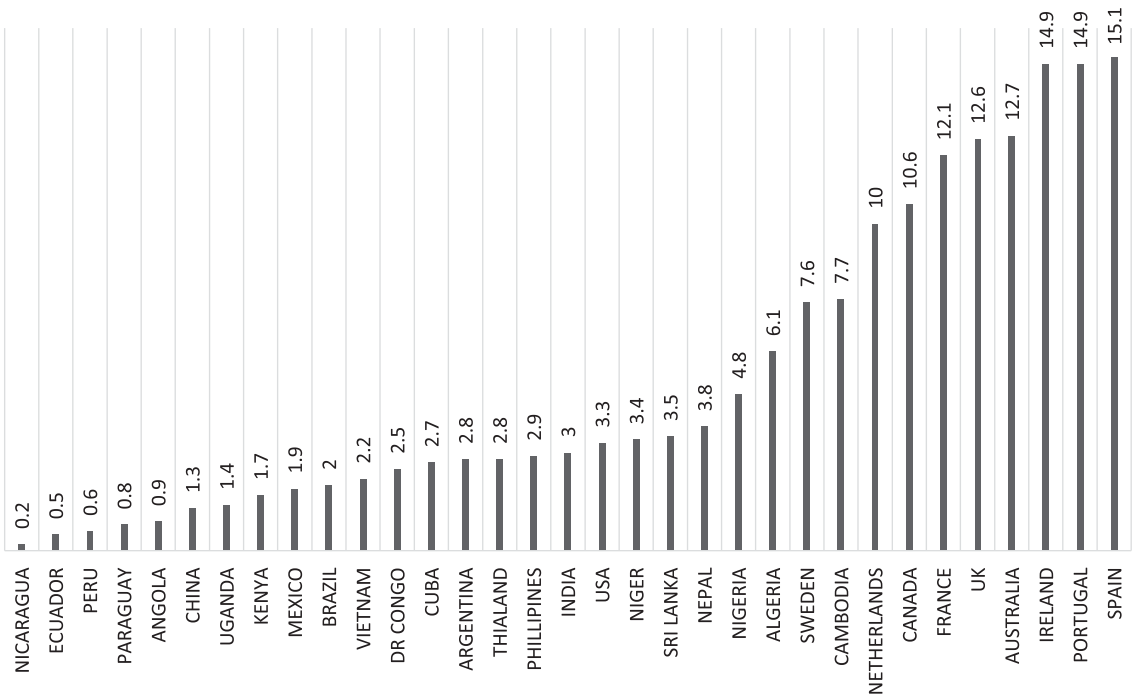


Figure 1.1 Percentage of births as AVBs in selected countries, 2008 to 2015.

outcomes with second stage CS showed higher rates of admission for intensive care (RR 2.6; 95% CI 1.2 to 6.0) but lower rates of neonatal trauma (RR 0.4; 95% CI 0.2 to 0.7) compared to forceps.⁴

Despite this evidence suggesting an overall benefit for AVB, rates and methods of AVB have remained highly variable over time and between countries. AVB is currently performed with varying frequency in both high- and low-income countries (see Figure 1.1).^{5–8}

In addition to widespread low levels of utilisation, some surveys found many areas where AVB was not used at all. In 2006 this was the case in 74% (17/23) of Latin American and Caribbean countries, 30% of countries in sub-Saharan Africa and 40% of countries in Asia.⁹

AVB in High-Income Countries

Rates of AVB appear to have remained broadly stable within many high-income countries, although the utilisation of forceps versus ventouse/vacuum delivery has changed over time, with forceps declining and the rate of ventouse/vacuum increasing in many settings. In the UK in 1980, the overall AVB rate was 12%, with 11.3% of all births being performed with forceps but only 0.7% being performed by ventouse/vacuum.¹⁰ By 2022 the overall rate of AVB was 11.4%, with 7% of all births performed by forceps and 4.4% performed

Trends in Assisted Vaginal Birth and Future Practice

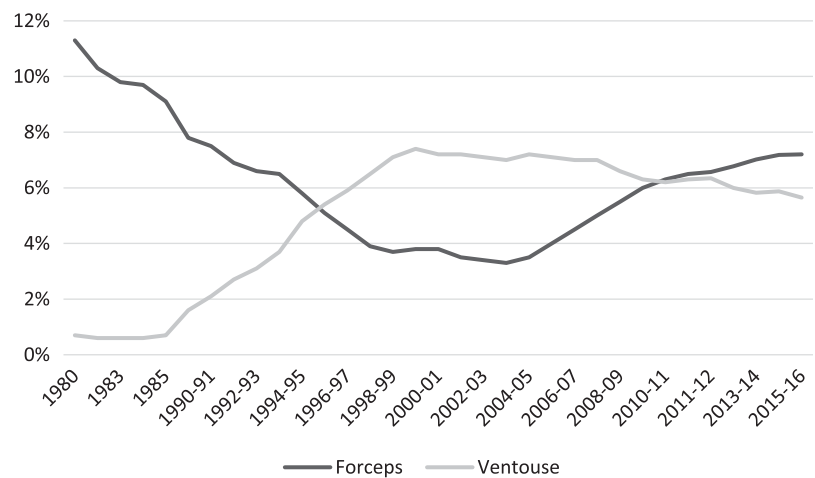


Figure 1.2 Percentage of births performed with forceps and ventouse in the UK, 1980 to 2016.

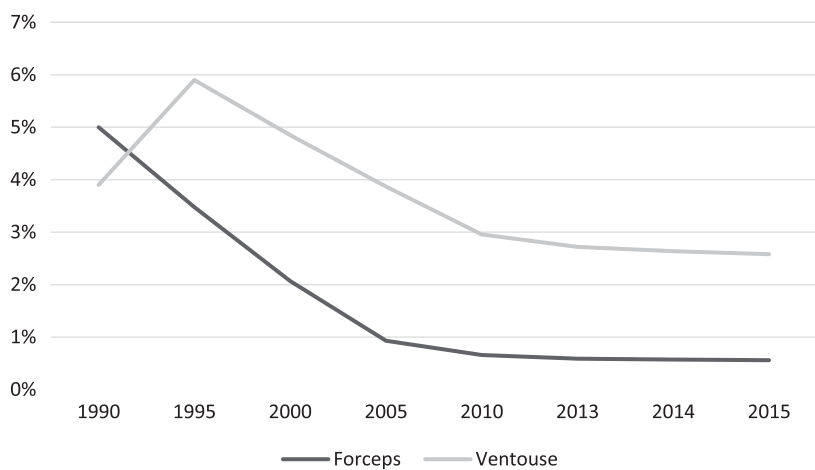


Figure 1.3 Percentage of births performed with forceps and ventouse in the USA, 1990 to 2015.

by ventouse/vacuum.¹¹ This trend is shown in Figure 1.2 (data adapted from NHS Maternity Statistics, annually from 1980 to 2016).

There has been a similar change in Australia, where from 1991 to 2013 the overall AVB rate increased from 12.5% to 18%, with forceps deliveries reducing from 10% of births to 7%, while ventouse/vacuum increased from 2.5% to 11%.^{5,12} In the USA, AVB rates for both forceps and ventouse/ vacuum have consistently declined in the past 30 years, from a level broadly comparable with European countries (9% of all births in 1990) to a current low of 3.12% in 2015, of which forceps were only 0.56% – see Figure 1.3 (data adapted from CDC, National Vital Statistics Reports, 2017).¹³

ROBuST: RCOG Assisted Birth Simulation Training

Since 2015, the CDC no longer makes assisted vaginal birth data routinely available, given its infrequent nature within the USA.

Current Instruments for AVB and Associated Outcomes

Non-rotational forceps (Simpson, Rhodes, Neville-Barnes, Anderson, Wrigleys, etc.), manual rotation (usually completed with non-rotational forceps), solid mushroom cup ventouse/vacuum (Malström, Bird and Kiwi) and rotational forceps (Kielland's forceps) are the obstetric instruments currently in use. Bell cup ventouse/vacuum (silastic/silicone) are used less frequently. Other instruments (e.g. Odon) are still being developed and tested with uncertain applicability. The instruments are associated with different relative benefits and adverse outcomes. These depend not only on specific differences between devices, but also on the different clinical presentations in which the instrument is used (e.g. non-rotational versus rotational births). The different risk/benefit profile for each device, and variable experience in their use, impact on the utilisation rates of individual instruments, as well as the decision whether to attempt AVB or proceed directly to caesarean section.

Non-rotational Instrumental Births

A non-rotational birth is an AVB where the fetal head is not rotated (or rotated $<45^\circ$) by the accoucheur (either actively – i.e. rotational forceps/manual rotation, or passively – i.e. rotational ventouse/vacuum). Non-rotational births can be performed using non-rotational forceps, solid mushroom cup or bell ventouse/vacuum. Of these, forceps tend to be more successful and associated with less harm to the baby, but are potentially associated with higher maternal morbidity. The most recent Cochrane Review of 10 randomised trials involving 2,923 women showed that the use of forceps was associated with a lower risk of failure as the primary instrument (RR 0.58; CI 0.39 to 0.88) compared to ventouse/vacuum.¹⁴ While this is an important finding given the significantly higher rates of maternal and neonatal adverse outcomes associated with the use of sequential instruments, other significant differences need to be considered; thus relative to ventouse/vacuum, forceps is:

- Less likely to be associated with a low Apgar score at 5 minutes (<7) (RR 1.71, CI 0.59 to 4.95)
- More likely to be associated with an umbilical arterial pH < 7.2 (RR 1.33, CI 0.91 to 1.93)

Trends in Assisted Vaginal Birth and Future Practice

- More likely to be associated with third/fourth degree anal sphincter injury (RR 1.83, CI 1.32 to 2.55)
- More likely to be associated with post-partum haemorrhage (>500ml) (RR 1.7, CI 0.59 to 4.95)¹⁴
- Possibly less likely to be associated with higher long-term morbidity as a result of pelvic organ prolapse, although this association has not been shown in recent population-level studies.^{15,16}

Despite the apparent superiority of forceps in non-rotational birth for most maternal and neonatal outcomes, their use is generally lower worldwide than ventouse/vacuum.¹⁷

Rotational Births

A rotational birth is an AVB where the fetal head is rotated by the accoucheur **by >45°** (either actively – i.e. rotational forceps/manual rotation, or passively – i.e. rotational ventouse/vacuum). Rotational births can be performed using mushroom cup ventouse/vacuum (Bird or Kiwi cup), manual rotation followed by direct forceps (or ventouse/vacuum) or rotational forceps.

Rotational births have long been perceived as being proportionately more risky than non-rotational AVBs.¹⁸ Reflecting this, the most recent RCOG guideline specifies that rotational deliveries should be conducted in the presence of an experienced operator and in a setting with immediate recourse to caesarean section.¹⁹ Although some small studies in previous decades have shown poorer neonatal outcomes following attempted rotational forceps births (relative to caesarean section),²⁰ more recent, larger studies suggest that attempted rotational birth (using any of the three approaches) is not inherently more risky than the alternative of second stage caesarean section,²¹ and generates comparable outcomes to non-rotational AVB.^{22,23} This has generated a renewed interest in rotational AVB for the management of malposition of the fetal head at full cervical dilatation.^{24–26}

Debate continues about the most effective instrument for rotation and delivery of the fetal head. Whilst the relative efficacy of all three approaches has only been compared in one retrospective cohort study,²² other studies have examined outcomes of various combinations of two of the three approaches.^{23–25}

A large prospective randomised trial is under way in the UK (ROTATE) to examine the outcome of different rotational methods (manual, rotational forceps, rotational ventouse).

ROBuST: RCOG Assisted Birth Simulation Training

Rotational Forceps versus Rotational Ventouse/Vacuum

In single centre trials, rotational forceps appear to be more effective compared to rotational ventouse/vacuum in terms of successful vaginal delivery. A meta-analysis in 2015 analysed eight studies (seven retrospective cohort studies and one prospective cohort study, total 2,399 patients) and reported a statistically significant reduction in the risk of failure to deliver with the intended instrument using rotational forceps compared to rotational ventouse/vacuum (RR 0.32; 95% CI 0.14 to 0.76; $p = 0.009$), with no significant differences found in any adverse maternal or neonatal outcomes.²⁶ However, a national audit in the UK showed the same success rate with either rotational forceps or rotational ventouse/vacuum (79%, REDEFINE, unpublished data).

Rotational Forceps versus Manual Rotation Followed by Direct Forceps

Two UK-based retrospective cohort studies have directly compared rotational forceps with manual rotation followed by direct forceps, but they reached different conclusions: Bahl et al. found no differences in any maternal or neonatal outcomes,²² whilst the study published by O'Brien et al. found a significantly higher chance of vaginal birth using rotational forceps than with manual rotation followed by direct forceps (RR 1.17; CI 1.04 to 1.31, $p = 0.017$). Additionally, birth by rotational forceps was associated with a significantly higher rate of shoulder dystocia (RR 2.35; CI 1.23 to 4.47, $p = 0.012$), but with no other differences in maternal or neonatal injuries.²⁴ Both of these studies were limited by their design (retrospective cohort) and the setting (both studies were restricted to one unit in the same city (Bristol, UK)). Moreover, the number of accoucheurs performing the rotational forceps births in each study was low (three accoucheurs in O'Brien et al.)²⁴ and this may limit the generalisability of the study findings.

Manual Rotation Followed by Direct Forceps versus Rotational Ventouse/Vacuum

In 2013, in a retrospective study of 263 women, Bahl et al. compared success rates of manual rotation (followed by direct forceps) with rotational ventouse/vacuum and found no significant differences in any outcomes.²²

Despite renewed interest, the performance of rotational AVB remains relatively specialised.

Trends in Assisted Vaginal Birth and Future Practice

The Way Forward for AVB

In skilled hands and in the majority of cases, AVB remains the safest and most effective means of expediting delivery in the second stage of labour. Multiple pressures, including availability of training, women's perceptions and concerns surrounding long-term complications, have acted as negative drivers on rates of AVB in many settings, across many countries. Multiple efforts by national and international bodies have not succeeded in preventing the continued rise in caesarean sections in the second stage of labour, and substantial changes to training schedules for junior obstetricians appear unlikely.

Outwith new technologies and large trials, there are approaches which can be used to promote competent and confident use of AVB. For AVB to be used regularly, both individual practitioners and healthcare units need to be confident that the techniques are being deployed safely and effectively. Women and their families need to be active participants in the decision-making, ideally through ample provision of antenatal information, well in advance of labour, as to the options to deliver a baby with malposition. Regular positive feedback, when appropriate, can be a driver that helps to both develop and maintain skills. Real time reporting and collation of outcomes can be useful. This approach, using statistical control charts of simple 'success' or 'failure' outcomes for attempted ventouse/vacuum deliveries, has been demonstrated to be a useful tool with which to target training within a large teaching unit in the UK.²⁷ Reporting and active review of real time outcomes has been practised routinely in surgical specialties in the UK since 2013,²⁸ and large population-based studies have found that this did not lead to a change in surgical patient selection or 'gaming' of the system.²⁹

In a similar way, it may be useful to encourage real time open reporting of selected outcomes following attempted AVB. Trainees would benefit from confirmation of developing or continued competence, allowing them to grow in confidence and become more assured of their skills. Trainers and hosting hospitals would be able to use the data generated to pick up early when individuals are not meeting expected thresholds of competence. This would allow for focused, targeted training, and correction of 'less than ideal' practices at an early stage.

Feedback from women and their families is also necessary and will increase both the perceived and the actual safety of AVB.

AVB has long been considered to be the essential core skill that every obstetrician should be able to confidently offer. Developing and maintaining relevant skills in AVB should continue, supported by an ongoing research base and continuous audit of practice. This will ensure safe, effective and appropriate use of all available AVB techniques.

ROBuST: RCOG Assisted Birth Simulation Training

References

1. Khan KS, Wojdyla D, Say L, Gülmezoglu AM, Look PFV. WHO analysis of causes of maternal death: a systematic review. *The Lancet*. 2006;367(9516):1066–74.
2. GBD 2013 Mortality and Causes of Death Collaborators. Global, regional, and national age-sex specific all-cause and cause-specific mortality for 240 causes of death, 1990–2013: a systematic analysis for the Global Burden of Disease Study 2013. *The Lancet*. 2015;385(9963):117–71.
3. Arulkumaran S, Robson M. *Munro Kerr's Operative Obstetrics*. 13th ed. Arulkumaran S, Robson M, editors. London: Elsevier; 2019.
4. Murphy DJ, Liebling RE, Verity L, Swingler R, Patel R. Early maternal and neonatal morbidity associated with operative delivery in second stage of labour: a cohort study. *The Lancet*. 2001; 358(9289):1203–7.
5. AIHW. Australian mothers and babies 2015 – in brief. 2017; p. 1–72.
6. Macfarlane AJ, Blondel B, Mohangoo AD et al. Wide differences in mode of delivery within Europe: risk-stratified analyses of aggregated routine data from the Euro-Peristat study. *BJOG: An International Journal of Obstetrics & Gynaecology*. 2016;123(4):559–68.
7. National Centre for Health Statistics. Births: Final Data for 2013. 2015;64(1):1–68.
8. Souza JP, Gülmezoglu A, Lumbiganon P et al. caesarean section without medical indications is associated with an increased risk of adverse short-term maternal outcomes: the 2004–2008 WHO Global Survey on Maternal and Perinatal Health. *BMC Medicine*. 2010;8:71.
9. Fauveau V. Is vacuum extraction still known, taught and practiced? A worldwide KAP survey. *International Journal of Gynecology and Obstetrics*. 2006;94(2):185–9.
10. General Statistical Service, NHS Maternity Statistics, England: 1980–1994. 1998; p. 1–43.
11. NHS Digital. NHS Maternity Statistics, England – 2021–22 [Internet]. London: NHS Digital; 2022 [accessed 15 March 2023]. <https://digital.nhs.uk/data-and-information/publications/statistical/nhs-maternity-statistics/2021-22>
12. AIHW. Australia's Mothers and Babies 1991. 1994; p. 1–84.
13. CDC. National Vital Statistics Reports, Volume 66, Number 1, January 5, 2017. Dec p. 1–70.
14. Verma GL, Spalding JJ, Wilkinson MD et al. Instruments for assisted vaginal birth. *Cochrane Db Syst Rev*. 2021;2021(9):CD005455.
15. Barber M. Pervasive impacts of mode of delivery across multiple measures of prolapse severity. *BJOG: An International Journal of Obstetrics & Gynaecology*. 2015;123(9):1557.
16. Volløyhaug I, Mørkved S, Salvesen Ø, Salvesen K. Pelvic organ prolapse and incontinence 15–23 years after first delivery: a cross-sectional study. *BJOG: An International Journal of Obstetrics & Gynaecology*. 2015;122(7):964–71.
17. Deering S. Forceps, simulation, and social media. *Obstetrics & Gynecology*. 2016 Sep;128(3):425–6.
18. Patel RR. Forceps delivery in modern obstetric practice. *BMJ (Clinical research ed.)*. 2004;328(7451):1302–5.
19. Murphy DJ, Strachan BK, Bahl R. . Assisted Vaginal Birth: Green-top Guideline No. 26. *BJOG: An International Journal of Obstetrics & Gynaecology*. 2020.
20. Chiswick ML, James DK. Kielland's forceps: association with neonatal morbidity and mortality. *BMJ (Clinical research ed.)*. 1979;1(6155):7–9.
21. Aiken AR, Aiken CE, Alberry MS, Brockelsby JC, Scott JG. Management of fetal malposition in the second stage of labor: a propensity score analysis. *American Journal of Obstetrics and Gynecology [Internet]*. 2015 ;212(3):355.e1–355.e7.
22. Bahl R, Venne MV de, Macleod M, Strachan B, Murphy DJ. Maternal and neonatal morbidity in relation to the instrument used for mid-cavity rotational operative vaginal delivery: a prospective

Trends in Assisted Vaginal Birth and Future Practice

cohort study. BJOG: An International Journal of Obstetrics & Gynaecology. 2013 Aug 7;120(12):1526–33.

23. Tempest N, Hart A, Walkinshaw S, Hapangama DK. A re-evaluation of the role of rotational forceps: retrospective comparison of maternal and perinatal outcomes following different methods of birth for malposition in the second stage of labour. BJOG: An International Journal of Obstetrics & Gynaecology [Internet]. 2013;120(10):1277–84.
24. O'Brien S, Day F, Lenguerrand E et al. Rotational forceps versus manual rotation and direct forceps: a retrospective cohort study. European Journal of Obstetrics, Gynecology, and Reproductive Biology. 2017;212:119–25.
25. Al-Suhel R, Gill S, Robson S, Shadbolt B. Kielland's forceps in the new millennium. Maternal and neonatal outcomes of attempted rotational forceps delivery. Australian and New Zealand Journal of Obstetrics and Gynaecology. 2009 ;49(5):510–4.
26. Wattar BHA, Wattar BA, Gallos I, Pirie AM. Rotational vaginal delivery with Kielland's forceps. Current Opinion in Obstetrics and Gynaecology. 2015;27(6):438–44.
27. Lane S, Weeks A, Scholefield H. Monitoring obstetricians' performance with statistical process control charts. BJOG: An International Journal of Obstetrics & Gynaecology. 2007;114(5):614–8.
28. NHS England. Everyone Counts: Planning for Patients 2013/14 [Internet]. 2012
29. Vallance AE, Fearnhead NS, Kuryba A et al. Effect of public reporting of surgeons' outcomes on patient selection, 'gaming,' and mortality in colorectal cancer surgery in England: population based cohort study. BMJ (Clinical research ed.). 2018;361:k1581.

Chapter 2

Indications and Assessment for Assisted Vaginal Birth

Deirdre Murphy and Meenakshi Ramphul

Introduction

The decision whether or not to recommend an assisted vaginal birth (AVB) is a complex one. Decision-making about the most appropriate mode of birth needs to take account of the key elements for a safe AVB which are that it needs to be conducted under optimal circumstances, in the most appropriate place and by a competent operator. Safety issues need to be balanced with the aim of providing a positive birth experience for the mother and her partner. The risks of maternal and neonatal morbidity are increased with AVBs, although with appropriate case selection and careful practice these risks are low.¹ Careful attention needs to be paid to the indication for AVB and to clinical assessment prior to any attempt at a procedure.

There are two alternatives to AVB. The first, continued pushing aiming for a spontaneous vaginal birth, may be preferred by women when progress is being made and the fetal status is satisfactory. However, an expectant approach may be unwise if there is evidence of fetal compromise (meconium, abnormal fetal heart rate, low pH) or diminished maternal reserve (exhaustion and absence of progress). The second approach, a caesarean section at full dilatation, is a complex surgical procedure associated with increased risks of maternal morbidity (major haemorrhage, extended hospital stay) and neonatal morbidity (higher rates of admission to the neonatal unit).² Overall, women who have vaginal births (even with assistance) tend to be more satisfied with the birth than those who have emergency caesarean sections. The risk of intrapartum complications in subsequent pregnancies is greatly reduced if a vacuum or forceps-assisted delivery can be completed safely.^{3,4}