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How safe is preterm operative vaginal delivery and which is the instrument of choice?

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Abstract

Objective: The objective of this study was to determine neonatal outcomes in preterm operative vaginal delivery given the current paucity of data available to guide clinicians.
Study design: A retrospective review of 64 cases was conducted, and neonatal outcomes were compared to spontaneous vaginal deliveries in similar gestations. The primary outcomes studied were death and occurrence of intraventricular haemorrhage. Secondary outcomes included admission to NICU, Apgar <3 at 5 min, ventilation requirement, jaundice requiring treatment, culture-proven sepsis and necrotising enterocolitis. The study was conducted in a stand-alone maternity unit of approximately 9000 deliveries per year.
Results and conclusions: We concluded that although vacuum delivery is avoided in preterm infants, outcomes were similar to forceps deliveries of similar gestations.

Keywords: Forceps; instrumental; intraventricular haemorrhage; operative delivery; preterm; vacuum.

Introduction

Operative vaginal delivery is uncommon in preterm labour. However, the need ocasionally arises. It has traditionally been recommended and generally accepted that vacuum delivery be avoided in infants <34 weeks' gestation due to the risk of intraventricular haemorrhage (IVH). In some instances, where the application of forceps is not possible due to malposition, the obstetrician is left only with the prospect of a fully dilated caesarean section as use of the vacuum is traditionally felt to be contraindicated. This is well known to carry both substantial risk of massive obstetric haemorrhage to the mother and injury to the fetus due to manipulation of the deeply engaged head. There is very little data available in this area to guide clinicians. The recent Royal College of Obstetricians and Gynaecologists (RCOG) Greentop Guideline 26 on Operative Vaginal Delivery (3) gives no specific guidance on the safety of preterm vacuum delivery between 34 and 36 weeks gestation. It states vacuum delivery is contraindicated below 34 weeks gestation.

The aim of this study was to compare outcomes in preterm infants (<35 weeks' gestation) delivered by vacuum and forceps and also to compare these groups to infants delivered by spontaneous vaginal delivery at <35 weeks. We reviewed data over a 10-year period at the Rotunda Hosptial, Dublin, Ireland, a standalone maternity unit in the Dublin city centre with approximately 9000 deliveries per year.

Methods

This was a retrospective study. The cases were identified using a computerised database that records details of all deliveries in the hospital. The charts of mothers and babies delivered by forceps or vacuum at <35 weeks gestation from 1999 to 2008, inclusive, were identified and systematically reviewed to extract the data. Singleton and twin pregnancies <35 weeks' gestation at delivery were included. Delivery of babies with major congenital and chromosomal anomalies were excluded. The results were compared to spontaneous vaginal delivery outcomes in similar gestations in the same 10-year time period as recorded on the Vermont Oxford Network Database. This is a standardised database used by neonatal intensive care units internationally to compare the details of infants admitted. To address gestational age as a confounding factor, the groups were stratafied broadly by gestational age.

Sixty-nine infants were delivered by vacuum or forceps. Five charts were unavailable despite extensive searches, and so 64 were included in the study. Of the cases reviewed, there were 11 twin pregnancies. The two primary outcomes were mortality and occurence of IVH. Secondary outcomes were Apgar scores, admission to the neonatal intensiver care unit (NICU), ventilation and continuous positive airway pressure (CPAP) requirements, phototherapy requirements, incidence of necrotising enterocolitis, culture-proven sepsis and length of hospital stay. Approval for the study was obtained from the Rotunda Hospital Research Ethics Committee. It was not noted whether rigid metal cups or other vacuum types were used in the delivery notes. Both metal cups and "kiwi" cups are in use in this unit. Keillands forceps were not used in any of the deliveries, only Neville Barnes forceps. The station of the head on assesment before delivery was not noted on all delivery notes, particularly in cases at the beginning of the 10-year study period. Cranial ultrasound imaging (where undertaken) was performed by a consultant paediatric radiologist.

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Results

The 64 infants in the instrumental delivery group were divided into four groups. First, the vacuum group contained 20 infants that ranged from 31+0 to 34+6 weeks. Forty-two infants were delivered by forceps. However, the range of gestational ages was from 24+0 to 34+6 weeks. To attempt to correct for the differences in gestational age, the forceps group was sub-divided into two groups: those from 24+0 to 30+6 weeks and those from 31+0 to 34+6 weeks. There were two infants for which a failed vacuum delivery was converted to a forceps delivery. As this is known to be an independent risk factor for morbidity, including IVH, these two infants were grouped alone. They were delivered at 33+4 and 34+3 weeks, respectively.

There were 11 twin pregnancies. In one of these cases, both twins were delivered by vacuum, and in another case, both babies were delivered by forceps. Two pregnancies had one twin delivered by vacuum and the other without instrumental assistance. Two cases had one twin delivered by vacuum, and the other was a breech extraction. Two pregnancies resulted in the first twin being delivered by forceps and the second delivered spontaneously, whereas in another two pregnancies, the first twin was delivered by forceps and the second was a breech extraction. Finally, in one set of twins, the first baby was delivered by forceps and the second by vacuum.

Fetal distress was cited as the reason for instrumental delivery in 43 cases. Twenty cases quoted "failure to advance in the second stage," and in one case pushing was contraindicated due to severe maternal congenital heart disease.

The distribution of birthweights in each group is represented by box plots in Figure 1. The primary outcomes of death and IVH are detailed in Table 1. First, with respect to the occurence of IVH, 204 of the 235 infants in the preterm singular value decomposition (SVD) group (24+0 to 30+6) underwent cranial ultrasound scanning (CRUSS). Of these, 91 (38%) were found to have an IVH. In the preterm SVD group (31+0 to 34+6), 49 of 82 infants had CRUSS. Of these, four (4.8%) were found to have an IVH. In the forceps group (24+0 – 30+6) all eight infants had CRUSS. Four (50%) of these were found to have an IVH. In the other forceps group (31+0 to 34+6), 12 of the 34 infants had CRUSS and two (5.8%) were found to have IVH. No IVH was recorded in the vacuum delivery group; however, only three of these infants underwent CRUSS. The decision to undertake CRUSS was made by the neonatal clinician on a case by case basis.

Regarding mortality, three infants in the instumental delivery groups died in the first 28 days of life (4.6%). One was a vacuum delivery, and two were in the forceps (24+0 to 30+6) group. The infant who died in the vacuum group died at 17 days with a suspected diagnosis of a restrictive dermopathy. This infant was 33+3 weeks' gestation and had a history of preterm premature rupture of the membranes for 2 weeks before birth. Steroids had been given antenatally. The skin was noted to be peeling extensively at birth. However, there had been debate that this baby should have been classified as a congenital abnormality, and so it remains questionable as to whether this infant should have been included in the study. The infants that died in the forceps group were 28+4 weeks' and 29+6 weeks gestation, respectively. The first had a history of PPROM from 19 weeks gestation, and a diagnosis of pulmonary hypoplasia was made. The other case was a twin pregnancy and died at 2 days after a respiratory arrest. There was no evidence of sepsis in that case. Steroids were given 2 weeks' before delivery, and this had been an IVF pregnancy. Extensive facial bruising was noted at delivery. The indication for forceps delivery was a prolonged deceleration on cardiotocograph (CTG). The second twin (assisted breech delivery) died in the delivery suite in the very early neonatal period. It was not possible to compare mortality

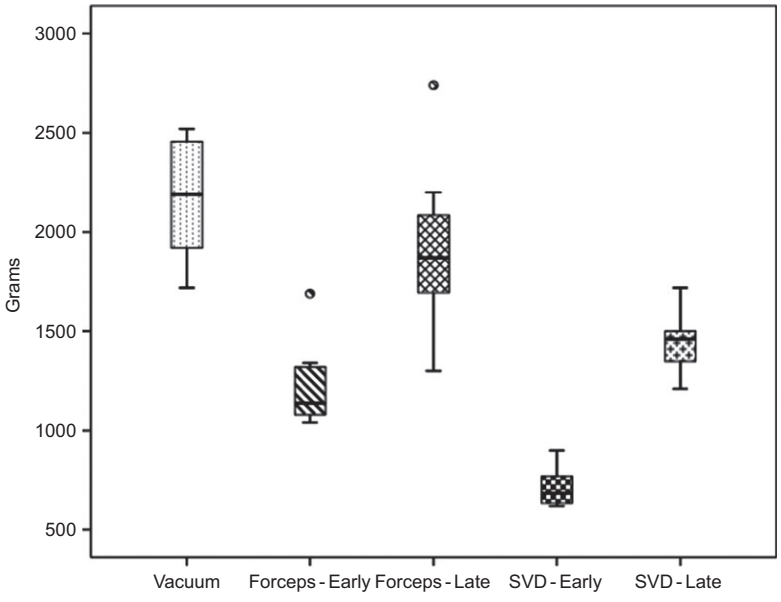

Figure 1 Birthweights.

Table 1 Primary outcomes.

GA	Outcomes	Mode of delivery			P-value
		Vacuum (Late) [1]	Forceps [2]	SVD [3]	
Early	Total (n)	–	8	235	–
(24+0 to 30+6)	Mortality n (%)		2 (25%)	–	
	IVH n (%)		4 (50%)	91 (39%)	0.7150 [2 vs. 3]
Late	Total (n)	20	34	82	–
(31+0 to 34+6)	Mortality n (%)	1 (5%)	0	–	1.000 [1 vs. 2]
	IVH n (%)	0	2 (25%)	4 (5%)	1.000 [1 vs. 2] 1.000 [1+2 vs. 3]

IVH=intraventricular haemorrhage.

to the preterm SVD group as the Vermont Oxford Network Database recorded death prior to discharge rather than in the first 28 days of life. Secondary outcomes are detailed in Table 2.

Comment and conclusions

There is scant data available to guide the obstetrician on safety and outcomes of operative delivery in the premature infant. When reviewing the literature, we found one small retrospective study from 1995 that reviewed outcomes of deliveries of infants weighing 1500 g to 2500 g that showed no difference in Apgar scores, umbilical cord pH or IVH when comparing vacuum extraction with controls who delivered spontaneously [2]. They did not compare the data with infants delivered by forceps. The study concluded that neonatal morbidity was not increased in vacuum extraction in this group of preterm infants. We also identified one very old study from 1969 that looked at vacuum deliveries in premature infants (gestation not specified) weighing less that 2.47 kg compared to full-term infants delivered by vacuum (weight not specified). They found a higher incidence of low Apgar scores and "cerebral irritation" in the premature group but similar rates of cerebral haemorrhage, abrasion and ulceration, scalp sepsis and cephalhaematoma [4]. This study concluded that prematurity is a relative contraindication to vacuum extraction. In general, vacuum delivery has been avoided in infants <34 weeks' gestation due to the percieved risk of (IVH). Aldo Vacca, one of the pioneers of vacuum-assisted delivery, cautions against using the vacuum between 34 and 36 weeks' gestation and does not recommend its use in delivery of infants <34 weeks [6]. However, he does not support this recommendation for clinical reasons. The clinical practice guidelines of the Society of

Table 2 Secondary outcomes.

Outcome	Preterm SVD All (n=317)	Preterm SVD (24/40 to 30+6) (n=235)	Preterm SVD (31/40 to 34+6/40) (n=82)	Vacuum (all 31/40 to 34+6/40) (n=20)	Forceps (24/40 to 30+6/40) (n=8)	Forceps (31/40 to 34+6/40) (n=34)	Failed vacuum converted to forceps (33+4 and 34+3 respectively), (n=2)
Apgar <3 at 5 min	9 (2.8%)	8 (3.4%)	1 (1.2%)	1 (5%)	0 (0%)	0 (0%)	0 (0%)
Intubated and ventilated	186 (58%)	171 (72%)	15 (18.2%)	1 (5%)	7 (87.5%)	2 (5.8%)	0 (0%)
CPAP	176 (55.5%)	156 (66.3%)	20 (24.3%)	2 (10%)	3 (37.5%)	7 (20.5%)	0 (0%)
Admission to NICU directly after delivery	By definition of the group 100%			10 (50%)	8 (100%)	34 (100%)	2 (100%)
Assigned to general post natal ward care and later admitted to NICU	N/A	N/A	N/A	8 (40%)	0	0	0
Length of stay in NICU >5 days	Not recorded uniformly			18 (90%)	6 (75%)	28 (82%)	2 (100%)
Jaundice requiring phototherapy	Not recorded			14 (70%)	6 (75%)	27 (79%)	1 (50%)
Culture-proven sepsis during stay in NICU	Only recorded in database if sepsis occurred on or before day 3 of life			0 (0%)	5 (62.5%)	1 (2.9%)	0 (0%)
Necrotising enterocolitis	42 (13.2%)	26 (11%)	16 (19%)	0 (0%)	2 (25%)	1 (2.9%)	0 (0%)

Obstetricians and Gynaecologists of Canada (SOCG) [5] and the practice bulletin of the American College of Obstetricians and Gynaecologists (ACOG) [1] both only sanction the use of a vacuum for operative vaginal delivery over 34 weeks' gestation. We noted there was no data on long-term follow-up of preterm instrumental deliveries specifically.

During the initial analysis of the data, we became aware that the gestational age in the forceps and vacuum groups may be a confounding factor for some of these results. With this in mind, we stratafied the forceps deliveries broadly into two groups by gestational age. As expected, much of the morbidity and mortality in the forceps group was attributable to gestational age and comparable to that of spontaneous vaginal deliveries of similar gestations. It is very difficult to draw any meaningful conclusions from the early gestaional age group, which contained only eight forceps deliveries, as reliable statistical analysis cannot be performed on such small numbers. The data is only included in the study to illustrate the rarity of the event of operative vaginal delivery in this very preterm setting.

The database used to identify spontaeous vaginal deliveries of similar gestations was the Vermont Oxford Network Database. The entry criteria for this database is birthweight ≤1500 g. This may have skewed the results of the SVD group, particularly in the late preterm group as it may include many growth-restricted infants. The overall numbers of preterm deliveries may appear low due to this inclusion criteria of the database and also owing to the fact that many are delivered by cesarean section and so are not included.

One of the most interesting observations in this study is that there was no case of IVH recorded in the vacuum group The risk of IVH is often cited as the primary reason to avoid this method of operative delivery. This study identified only 20 cases of vacuum delivery in preterm infants over 10 years, and so the small number of cases limits the power of the study. We must also take into account that the study was conducted retrospectively and not every infant in the study had a cranial ultrasound. The decision to carry out a cranial ultrasound was made on a case by case basis.

This study was a retrospective review of instrumental delivery of preterm infants and adds to the scant evidence base on the safety of operative delivery of the preterm infant. We acknowlege that this study has significant limitations, as it was conducted retrospectively and the relatively small number of cases in both operative delivery groups limits the power of the study. However, these results suggest that a larger multicentre review of the outcomes in preterm instrumental delivery would be worthwhile in view of the paucity of data currently available. With this in mind, a prospective multicentre observational study has been initiated and hopefully will clarify the issue further.This may give obstetricians a greater degree of confidence and reassurance in the use of operative vaginal delivery in the preterm setting and may ultimately guide practice.

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