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Research Article

Neonatal Outcomes Following Rotational Instrumental Delivery: A Retrospective Study

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Abstract

Objective: Rotational instrumental delivery has previously been associated with adverse neonatal outcomes. Since a 1979 study demonstrated 3.49% neonatal mortality associated with Kielland's forceps there has been a gradual decline in its use, which coincided with a rise in Caesarean section rate. This study aimed to report neonatal outcomes following rotational instrumental delivery.

Methods: Data was collected retrospectively from 1,023 rotational instrumental deliveries (Kielland's forceps, ventouse rotations and manual rotations) conducted at St Mary's Hospital, Manchester between April 2009 and February 2012 for neonatal intensive care admission, jaundice, cooling, sepsis, injuries, ventilation and mortality.

Results: Numbers of babies with jaundice, cooling, sepsis, injuries, ventilation or mortality were low and not significantly different between rotational methods. More deliveries attempted initially with Kielland's forceps were unsuccessful compared to ventouse and manual rotation (p=0.037 and p=0.058 respectively). There was no significant difference in neonatal outcomes between successful and unsuccessful rotational deliveries, or babies delivered by consultants compared to junior trainees.

Conclusion: For prolonged second stage of labour secondary to malposition, rotational instrumental delivery is a safe option in terms of neonatal outcomes. Differences in method of delivery were marginal, with ventouse being more likely to result in second instrument use and NICU admission.

Keywords: Rotational, Instrumental, Delivery, Ventouse, Kielland's, Forceps, Manual rotation, Neonatala

Introduction

Faced with a malposition in the advanced second stage of labour, the obstetrician has several options for delivery, including Kielland's forceps, rotational ventouse, manual rotation or emergency Caesarean section. Each option is associated with both maternal and fetal complications. The potential complications of Kielland's rotational forceps have been widely reported in both the lay and medical literature, beginning with a 1979 retrospective cohort study associating Kielland's forceps with a 3.49% neonatal mortality rate [1]. This paper contributed to the decline in use of Kielland's forceps, and the corresponding rise in Caesarean section; with rates of Cesarean section in the USA increasing from 5.8% in 1970 to 32.3% in 2008 with no significant improvements in maternal or neonatal outcomes [2,3].

More recent studies examining rotational instrumental deliveries have shown contradictory results in terms of neonatal outcomes. A retrospective observational study showed comparable neonatal outcomes between Kielland's, ventouse and manual rotation [4], yet a 2009 retrospective study found Kielland's forceps to have a lower rate of neonatal morbidity than all other forms of instrumental delivery [5]. Emergency Caesarean section in the second stage of labour (without previous attempt at instrumental delivery) was associated with 11.2% neonatal admission rate compared to 3.3% and 3.8% for Kielland's and ventouse respectively [6].

This topic will never benefit from a randomised controlled trial, therefore this study aimed to add to the current literature by comparing a large data set of neonatal outcomes following attempted rotational instrumental delivery in a single tertiary

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	SCBU admission (n =78)	Jaundice (n= 119)	Cooling (n = 1)	Sepsis (n= 88)	Injuries (n= 17)	Ventilation (n=23)	Mortality (n= 6)
Successful rotations (n= 969)	72 (7.4%)	109 (11.2%)	1 (0.1%)	83 (8.6%)	14 (1.4%)	22 (2.3%)	6 (0.6%)
Failed rotations (n=54)	6 (11.1%)	10 (18.5%)	0 (0.0%)	5 (9.3%)	3 (5.6%)	1 (1.9%)	0 (0.0%)
Manual (n=516)	35 (6.8%)	58 (11.2%)	0 (0.0%)	38 (7.4%)	13 (2.5%)	8 (1.6%)	1 (0.2%)
Ventouse (n= 283)	30 (10.6%)	35 (12.4%)	0 (0.0%)	29 (10.2%)	2 (0.7%)	8 (2.8%)	4 (1.4%)
Kielland's (n=225)	13 (5.8%)	27 (12.0%)	1 (0.2%)	21 (9.3%)	2 (0.9%)	7 (3.1%)	1 (0.4%)
Second instrument use (n= 82)	6 (7.7%)	16 (13.4%)	0 (0.0%)	8 (9.8%)	3 (3.7%)	1 (1.2%)	0 (0.0%)
No second instrument use (n= 941)	72 (7.7%)	103 (10.9%)	1 (0.1%)	80 (8.5%)	14 (1.5%)	22 (2.3%)	6 (0.6%)
Total (n=1,023)	78 (7.7%)	119 (11.6%)	1 (0.1%)	88 (8.6%)	17 (1.7%)	23 (2.2%)	6 (0.6%)

Injuries= seizures, bruising, fractures, cephalhaematoma, shoulder dystocia
SCBU= special care baby unit

Table 1: Neonatal Outcome following Rotational Instrumental Delivery.

unit in the United Kingdom using the current Royal College of Obstetrics and Gynaecology guidelines [7].

Methods

Data were collected from all women who delivered after attempted Kielland's forceps, rotational ventouse or manual rotation at St Mary's Hospital in Manchester between April 2009 and February 2012. These records were electronically completed contemporaneously by the doctor conducting each delivery and included successful and unsuccessful deliveries (resulting in Caesarean section). Date and time of birth was used to identify the neonates from these deliveries on the neonatal systems. The mode of delivery was classified as the method used to actually rotate the fetus. For example, an unsuccessful attempt at manual rotation which resulted in Kielland's forceps being used would be classified as a failed manual rotation but a successful Kielland's rotation.

Neonatal records were interrogated to collect information on: jaundice (defined as requiring phototherapy); cooling; sepsis (defined as a CRP greater than 10); injuries (seizures, bruising, fractures); cephalhaematoma and shoulder dystocia; need for assisted ventilation and mortality. Any babies discharged from hospital without any investigations or treatments found on the hospital records were assumed not to have had any significant adverse outcomes.

Following the Governance arrangements for NHS Research Ethics Committees (GAfREC) ruling on September 1st 2011, a formal application to the ethics committee was not required for this research. All data were collected anonymously and analysed using IBM SPSS Statistics 20 software.

Results

Medical records were obtained for 1,023 rotational deliveries between April 2009 and February 2012 (20% of all deliveries). There were 516 (50.4%) manual rotations, 283 (27.7%) rotational ventouse and 224 (21.9%) Kielland's forceps. The indication for delivery was failure to progress in 56.8% (582) women and abnormal cardiotocography (CTG) or low fetal scalp pH in 40.2% (411). 0.76% [5] had a maternal indication for a rotational operative delivery and there were 25 women without an indication listed. In 54/1023 cases (5.3%) attempted vaginal delivery was unsuccessful resulting in caesarean section. Kiellands forceps were unsuccessful more often (19/224, 8.4%) compared to ventouse (11/283, 3.9%) and manual rotation (24/516, 4.7%) (p=0.037 and p=0.058 respectively).

	Junior operator	Consultant operator	Not Recorded
Manual (483)	408 (84.5%)	75 (15.5%)	33 (6%)
Ventouse (264)	235 (80%)	29 (11.0%)	19 (7%)
Kielland's (195)	141 (72.3%)	54 (27.7%)	29 (13%)

Junior Operator: ST 1-7

Table 2: Operator experience and method of rotation.

Using independent samples t- Test, babies delivered by ventouse were lighter (3271.3g, standard deviation (SD) 551.0g) than those delivered by Kielland's forceps (3430.6g, SD 500.1g) (p=0.001) or manual rotation (3417.7g, SD 523.0g) (p= <0.001). There was no difference in weight between those delivered by Kielland's forceps and manual rotation (p=0.876).

The mean weight of babies in the failed instrumental delivery group was significantly larger at 3596.9g (SD 538.60g) compared to 3368.9g (SD 527.5g) for successful vaginal deliveries (p= 0.002).

Overall, 78/1023 babies (7.7%) required admission to the special care baby unit (SCBU) (Table 1), with no significant difference for any of the adverse neonatal outcomes considered between successful and unsuccessful deliveries. The method of initial rotation used was also not associated with any differences in adverse neonatal outcome (Table 1.)

There were 6 neonatal deaths (Table 1). Causes of death were not thought to be secondary to mode of delivery: 1 infant died of chromosomal anomaly, 1 alveolar capillary dysplasia, 1 diaphragmatic hernia, 1 cardiac complications, 1 renal complications and 1 death during cardiac surgery. We can therefore conclude that there was no mortality associated with instrumental delivery.

Use of a second instrument was associated with an increased risk of neonatal jaundice (p= 0.021 Fisher's exact test), but not with any of the other neonatal outcomes (Table 1).

The majority of the deliveries were conducted by junior operators, with consultants doing a higher proportion of the Kielland's rotations compared to manual rotations (p=<0.001 Fisher's exact test) (Table 2).

There were no significant differences between any of the neonatal outcomes in babies delivered by consultants compared to more junior training grades.

Discussion

This study has shown that attempted instrumental deliveries

are associated with a low rate of neonatal complications, and that the chosen method of rotation did not influence neonatal outcomes. Although there were more SCBU admissions and injuries following a failed instrumental delivery, these differences were not statistically significant compared to a successful delivery. Furthermore, seniority of operators did not influence neonatal outcomes.

Of all three rotation types, ventouse rotation was associated with the most SCBU admissions, however as there was no association with any other specific neonatal outcome, the reason for this increase is unclear. Stock et al 2013 also found that vacuum extraction resulted in a non- significant increase in the rate of neonatal admission compared to Kielland's forceps [6]**.** Lucas, et al. 1994 suggested that the apparent ease of use of vacuum extraction can result in overconfidence of operators, which may account for this increase in SCBU admission [8]. An unexpected finding was the lack of relationship between ventouse rotation and either bruising or jaundice. Ali et al 2009 described a 5% risk of scalp lacerations, cephalohematomas and hyperbilirubinaemia resulting from vacuum extraction, however this was not specific to rotational ventouse which may explain the difference in results [9].

Neonatal injury was commonest following manual rotation (3.5%) and the lowest for Kielland's forceps (1.1%), in contrast to the findings of Shaffer et al 2006 [10] who showed manual rotation had the lowest rate of birth injury (1.1%) and Kielland's forceps had the highest (3.8%) [10]. This 2006 paper also found that manual rotation had the highest failure rate resulting in Caesarean section (7.6%) and that Kielland's forceps had the lowest (2.3%) whereas ours demonstrated the opposite, with 8.0% of Kielland's rotations and 3.8% of manual rotations resulting in Caesarean section (p= 0.037) [10]. It is possible that previous reports of the safety of manual rotation have resulted in a false idea that it is an 'easier' technique with relatively low risk, making it the most likely choice for less experienced operators. Indeed, consultants conducted more of the Kielland's forceps in this study. The contradictions may also be explained by the different methodology between the two studies; Shaffer et al 2006 classed birth injuries as ICH, nerve palsies and fractures only, but our study also included seizures and bruising which we feel would be viewed as important outcomes by the parents [10].

Kielland's forceps had the highest rate of failure resulting in caesarean section, which is contrary to previous studies [5,10], and ventouse had the lowest failure rate (p=0.037). The mean baby weight was largest for Kielland's forceps deliveries, and for the unsuccessful rotational deliveries, and smallest for ventouse deliveries. It is possible that the clinical situation influenced clinical decision making, as faced with a large baby with a malposition a consultant may attempt a Kielland's forceps, whereas a more junior doctor may opt for a caesarean section. A 2005 study demonstrated that consultant presence could result in reversal of a decision for a caesarean delivery made by a junior with an instrumental delivery being attempted instead [11]. A recent 2015 study also supported the idea that a more senior operator increases the likelihood that a rotational instrumental delivery will be performed over an emergency caesarean section, as well as finding no significant difference in neonatal outcomes between these two delivery methods [12]. Liverpool 2013 compared Kielland's forceps, rotational ventouse and primary emergency caesarean section and found comparable neonatal outcomes. Along with our study this reinforces current RCOG guidelines that the operator should choose the instrument with which they are most comfortable [2].

Babies delivered after an unsuccessful attempt at a rotational delivery had a higher rate of neonatal injury compared to the successful instrumental deliveries. It is arguably to be expected that the difficult deliveries are more likely to result in injury, but it perhaps suggests that the threshold for abandoning difficult deliveries and opting for a caesarean section ought to be lower in order to avoid neonatal injury. However Revah, et al. 1997 compared the outcome of immediate caesarean section in cases of arrested second stage of labour to those who had a failed trial of vacuum or forceps delivery first, and found that there was no difference in maternal or neonatal outcomes between the two groups [13].

The strength of this study is the large number of deliveries in the data set. This was a retrospective study of all rotational instrumental deliveries conducted in a single unit between April 2009 and February 2012 and since all clinical documentation had to be completed electronically, has the advantage of reviewing all deliveries in that time period.

One weakness of this study was that it only looked at the results from one centre and was retrospective data from a cohort, rather than a prospective randomised controlled trial. Complete data were available for 1023/1110 (92%) of the deliveries which means that 8% of the original data set was excluded. This is one of the biggest causes of bias in retrospective studies. In addition, confounding variables were not included that have previously been shown to influence outcomes such as parity, maternal age, body mass index, African American race, diabetes, polyhydramnios, induction of labour, dysfunctional and prolonged second stage of labour [14]. Indication for delivery was included but did not influence outcome.

This study did not set out to investigate outcomes for babies born following emergency caesarean section at full dilatation where instrumental delivery has not been attempted.

Whilst this would be a useful comparison, these deliveries would be those in which instrumental delivery was not considered a safe option by the operator whereas we were interested in the outcomes where delivery was attempted vaginally.

It is highly unlikely that a randomised controlled trial will ever be possible to answer the question of which is the safest mode of delivery when faced with a malposition at full dilatation. Therefore, large complete retrospective data sets such as this represent one of the only sources of data to answer this important question.

Conclusion

This study has shown that instrumental delivery for a malposition in the second stage remains a safe and successful form of delivery, but careful case selection and a skilled operator are of paramount importance.

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ER is a junior doctor working at Concord Hospital in Sydney. OA is also a junior doctor working at Aberdeen Royal Infirmary, Aberdeen. RC is a junior doctor working in Liverpool. AE is a

consultant in neonatal medicine at St Mary's Hospital Manchester and GS, SV and CT are consultants in foetal and maternal medicine at St Mary's Hospital, Manchester.

Disclosure of Interests

No interests to disclose.

Contribution to Authorship

Maternal data was collected by GS, neonatal data was collected by ER, OA and RC, neonatal outcomes measured was advised by AE, the paper was written by ER and edited by SV and CT.

Details of Ethics Approval

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