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Cohort study of use of the hands-and knees-position as the first approach to resolving shoulder dystocia and preventing neonatal birth trauma

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ABSTRACT

Background: McRoberts' maneuver, turning the woman's thighs up in the supine position, has become the dominant method for resolving shoulder dystocia (defined as failure to deliver the fetal shoulder(s) with gentle downward traction on the fetal head, requiring additional obstetric maneuvers to effect delivery). Another method that is less commonly used is the Gaskin maneuver, which was first described by the midwife Ina May Gaskin, who learned of it from traditional midwives in Central America, and involves turning women to the hands-and-knees position. One retrospective observational study reported an 84% higher resolution of shoulder dystocia and less injury to the baby with the use of the hands-and-knees position as the first approach to resolving shoulder dystocia. The hands-and-knees position was reported to result in a wider pelvic diameter than the supine position and hence facilitate rotation of the baby and delivery, so it is possibly to resolving shoulder dystocia. The purpose of this study is to explore whether applying the Gaskin maneuver as the first approach for resolving cases of shoulder dystocia is a safer and better method than applying the McRoberts' maneuver first.

Methods: A time series cohort study was conducted in Laiwu Maternal and Child Health Hospital in Shandong, China over a seven -year period. Between January 2011 and July 2013 all women receiving traditional support at delivery were enrolled as a control group. During this time period, when shoulder dystocia was suspected, McRoberts' maneuver (MR) was the most commonly employed first maneuver as described in the HELPERR mnemonics. Between October 2013 and December 2017, a change of practice was implemented for all vaginal births at the site, whereby midwives were instructed to use the Gaskin maneuver (i.e., moving the mother onto hands-and-knees position) as the first protocol if shoulder dystocia was suspected. Patients in this group were assigned to the experimental group. The neonatal outcomes including birth asphyxia and baby injury in both groups were recorded and analyzed.

Results: The injuries in the control group included 14 clavicular fractures, and one permanent brachial plexus injury, three temporary arm movement disorders that resolved within 7 days and those cases were not calculated as baby injury cases (the same in experimental group). In the experimental group, 58 cases of shoulder dystocia were reported, with one case of clavicular fracture, three temporary arm movement disorders that resolved within 3 days, and no permanent brachial plexus injuries. The rate of baby injury in the control group [14.6% (15/103)] was higher than that in the experimental group [1.7% (1/58)], and this difference was statistically significant [$\chi^2 = 6.834$, $P = 0.009$; OR = 1.150 (1.055–1.254)]. Multiple logistic regression analysis showed that using the McRoberts' maneuver as the first approach in cases of shoulder dystocia [OR = 19.609 (1.620–273.430)], the mother's employment status [OR = 1.909 (1.118–3.262)], and intravenous dripping of oxytocin [OR = 5.969 (1.391–25.605)] are risk factors for baby injury. There was no difference in neonate Apgar score between the two groups, and no baby died in either group.

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Conclusions: Resolving shoulder dystocia by turning to the Gaskin maneuver as the first approach reduces the incidence of baby injury. This method should be recommended in clinical practice for better neonate outcomes.

1. Introduction

The incidence of shoulder dystocia was reported to range from 0.15% to 0.38% in the 18th century[1] and has risen to 2.4% (234/9767) in 2014,[2–4] complicates 0.3%–3% of all vaginal deliveries in recent report,[5] despite great effort on training and more liberally using of caesarean section. Brachial plexus injury is a significant sequela of shoulder dystocia, and the rates of Brachial plexus injury have not been reduced even with the liberal use of caesarean section.[6]

By the late 1990s, the McRoberts' maneuver (women placed with the thighs up and with the knees to the chest position while in the supine position), which was described as a simple and effective procedure for overcoming shoulder dystocia, had become widely known and adopted in many obstetric units as one of the first procedures to be used in cases of shoulder dystocia.[7] But, despite the dramatic increased use of the McRoberts' maneuver, the outcomes of shoulder dystocia did not change. Moreover, two studies from the West Midlands in the United Kingdom suggested that the rate of brachial plexus injury after shoulder dystocia had increased, from 1:77 in the early 1990s to 1:4 in 2003.[8]

Reported by Hoffman,[9] the successful resolution of 46% of shoulder dystocia cases when using the McRoberts' maneuver as the first procedure was similar to the 40% and 42% success rates reported for other maneuvers. What was surprising, as reported in this study, was the lack of effect on the rate of brachial plexus injuries, with 19 of the 20 cases shoulder dystocia since 2001 managed with the McRoberts' maneuver resulting in brachial plexus injury, compared with only eight of 13 cases before 2001.[9]

However, the recently professional consensus still recommended that McRoberts' maneuver, with or without a suprapubic pressure, is recommended in the first line (grade C). In case of failure, if the posterior shoulder is engaged, Wood's maneuver should be performed preferentially.[10]

Thus, new approaches should be considered in the management of shoulder dystocia.

Use of the hands-and-knees position to resolve shoulder dystocia was first described by the midwife Ina May Gaskin who learned of it from traditional midwives in Central America.[11] When using this method, which is also called the Gaskin maneuver, the laboring woman is positioned with all four limbs on the floor or bed so that her abdomen is suspended and her hips are at a right angle to the floor or bed. Use of the hands-and-knees position during delivery has been reported to result in a wider pelvic diameter as compared with the supine position and hence facilitate rotation of the baby and delivery.[12] The hands-and- knees position is assumed to have many benefits,[13] and In a study 83% of shoulder dystocia cases were resolved using the Gaskin maneuver alone.[14] However, two important elements, waiting for the shoulders to emerge after the head is delivered and using the Gaskin maneuver to resolve shoulder dystocia, have been largely absent from current clinical practice.[15–17] One possible reason for the absence of this maneuver is the adherence to the widely accepted shoulder dystocia management protocol, the "HELPERR" protocol, where the second "R" stands for the Gaskin maneuver. The placement of the Gaskin maneuver in this mnemonic may make the staff in clinical settings reluctant to apply this maneuver as a first step in resolving shoulder dystocia, even though the HELPERR protocol does not state which maneuver should be used first and "there is no one maneuver superior to another".[18]

The hypothesis of this study is that by both waiting for the shoulder in all vaginal deliveries and using the Gaskin maneuver as the first approach in suspected cases of shoulder dystocia (defined as the "W-R" method) there will be a decreased rate of baby injury and fewer cases of shoulder dystocia.

2. Methods

2.1. Design

This was a cohort study comparing the rate of baby injury among the occurrences of shoulder dystocia in which the traditional method, McRoberts' maneuver, was used first to resolve shoulder dystocia (control group) and patients in which the Gaskin's maneuver was used as the first approach in suspected cases of shoulder dystocia (Experimental group).

2.2. Setting and participants

The study was conducted in Laiwu Maternal and Child Health Hospital in the city of Laiwu in Shandong Province, China. The control group consisted of shoulder dystocia cases occurring in women undergoing vaginal delivery from January 2011 to July 2013. The experimental group consisted of shoulder dystocia cases occurring in women undergoing vaginal delivery from October 2013 to December 2017. Incidences of shoulder dystocia were reported by clinical workers, and baby injury was confirmed by an x-ray examination and clinical signs. General information about the birth such as the rate of parity, postpartum bleeding, and asphyxia were also recorded.

2.3. Sample size calculation

The reported rates of shoulder dystocia in previous studies varied from 0.15% to 2.4%.[1–4] If an expected rate of shoulder dystocia of 0.15% in the experimental group can be achieved, 3349 cases vaginal births (with or without shoulder dystocia) are needed to achieve a statistical power of 80% at a significance level of 0.05 (2-sided).

2.4. Randomization

This study was not randomized. All vaginal births two years before and after applying the W-R method were included.

2.5. Intervention

Women undergoing vaginal birth with shoulder dystocia were enrolled. The hands-and-knees position (Gaskin method) was applied from October 2013 to December 2017 for all women undergoing vaginal delivery as an experimental intervention. Prof. Zhang acted as a trainer to ensure that all staff in the delivery unit understood how to carry out the Gaskin method, and a training program was conducted for each woman in labor and all staff in the delivery room to ensure that they understood the change in protocol of changing to the Gaskin maneuver (turning to hands-and-knees position) when needed.

After spontaneous birth of the head, midwives were instructed to wait for the next contraction and allow the shoulder to rotate and be delivered by maternal effort combined with the force of the next uterine contraction. Women were encouraged to choose any position they preferred for labor and birth. If the shoulder was not delivered at the first contraction after delivery of the head, the woman was moved onto all fours to support shoulder delivery. If this was not effective, another maneuver for shoulder management was attempted according to the preference of the staff followed with local authority protocol in the site in the hands-and-knees position, Actually, all cases resolved with Gaskin maneuver alone

in this study.

The control group consisted of women who gave birth spontaneously between January 2011 and July 2013. The main methods applied in the control group were the McRoberts' maneuver and pubic pressure.

2.6. Measurements and data collection

The primary outcomes were neonatal morbidities such as humeral or clavicular fracture and branchial plexus injury, and information about the mother and baby, namely age of the mother, weeks of gestation, length of the labor process, interventions applied during the labor process (i.e., oxytocin, ARM [artificial rupture of membrane], and episiotomy), BMI of the mother, and neonatal outcomes (i.e., birth weight, Apgar score, and birth injury). Maneuvers applied to resolve shoulder dystocia were also recorded. All of these outcome measurements were available from the electronic case notes. The rate of baby injury was calculated by dividing the number of injured babies (baby with temporary arm disorder was not included) by the number of shoulder dystocia cases.

2.7. Ethical considerations

Ethical approval was obtained from the Health Research Ethics Boards of the hospital (LWMCED-C2015-001). The control group data were obtained from electronic clinical records. All data identifiers were removed and individual consent was not obtained for the birth records of patients in the control group. The midwives working in the study provided written and oral information to women in the experimental group including the purposes and nature of the research, confidentiality of data collected, anonymity, and the right to refuse participation. Written consent was obtained. Participants were free to withdraw from this study at any time.

2.8. Data analysis

The data were analyzed using IBM SPSS Statistics for Windows version 21 (IBM Corp., Armonk, NY). A per-protocol analysis was performed, as outcome data were only available for women who completed the study protocol. Descriptive statistics were used to report participant demographics and outcome variables. Independent sample *t*-tests were used to compare the varies in normal distribution. Multiple logistic regression was used to test the risk factors for baby injury. The level of statistical significance was set at $P < 0.05$ and all inferential tests were two-tailed.

3. Results

In control group, among 103 reported cases of shoulder dystocia there were 15 cases of baby injury, including 14 clavicular fractures,1 permanent brachial plexus injury. There were three temporary arm movement disorders that resolved within 7 days and those cases were not calculated as baby injury cases. In the experimental group there was one case of clavicular fracture, three cases of temporary arm movement disorder that resolved within 3 days, and no permanent brachial plexus injury. The rate of baby injury was higher in the control group [14.6% (15/103)] than in the experimental group [1.7% (1/58)], and this difference was statistically significant [$\chi^2 = 6.834$ $P = 0.009$. OR = 1.150 (1.055–1.254)]. There was no difference in maternal BMI or birth weight between the groups (Table 1).

Multiple logistic regression showed that using the McRoberts' maneuver as the first approach in cases of shoulder dystocia [OR = 19.609 (1.620–273.430)], mother's employment status [OR = 1.909 (1.118–3.262)], and intravenous dripping of oxytocin [OR = 5.969 (1.391–25.605)] are risk factors for baby injury (Table 2).

Table 1
Maternal and neonate outcomes in the two groups ($\overline{X}$±SD).

Indicators	Control group N = 103	Experimental group N = 58	*t*	*P*
Maternal BMI	29.59 ± 3.14	28.90 ± 3.98	1.197	0.233
Birth weight (g)	3901.94 ± 360.61	3947.50 ± 547.48	0.635	0.526

BMI: body mass index.

4. Discussion

Use of the Gaskin maneuver (hands-and-knees position) as the first approach for reducing the rate of baby injury.

The Gaskin maneuver was first reported by Ina May Gaskin in 1966. This maneuver is implemented by moving the patient to her hands and knees in cases of suspected shoulder dystocia; it is not the knee-chest position in the supine position. Brunauer et al.[14] reported that out of 82 patients with shoulder dystocia who were managed with this technique 68 (83%) delivered without the need for any additional maneuvers. The authors concluded that the maneuver seems to be a rapid, safe, and effective technique for reducing shoulder dystocia in laboring woman.

Why the Gaskin maneuver works is unknown; the mere act of turning a woman from the supine to the hands-and-knees position may provide sufficient movement to displace the fetus. Borell and Fernstrom have proposed that when laboring patients are moved from the supine position during delivery to the all-fours position, there is an increase in the true obstetric conjugate by as much as 10 mm and an increase of up to 20 mm in the sagittal diameter of the pelvic outlet.[19]

This procedure has recently been included in the curriculum for the American Academy of Family Physicians' course "Advanced Life Support in Obstetrics" as the additional "R" in the HELPERR mnemonics.[20]

The all-fours maneuver takes advantage of the laxity of the sacroiliac joint at term, which may result in an increase of 1–2 cm in the sagittal diameter of the pelvic outlet. The dorsal lithotomy position restricts this posterior movement of the sacrum. The all-fours maneuver eases the delivery of the posterior fetal shoulder.[21] All maneuvers should aim to disimpact the shoulder without resulting in excessive impaction of the fetal head. Jevitt[6] also described the management of shoulder dystocia with maternal position changes (left lateral and Gaskin maneuver), which are often omitted from management protocols but which have been demonstrated to be effective in decreasing the incidence of and/or alleviating shoulder dystocia.

One previous study suggested that managing shoulder dystocia with the primary maneuvers McRoberts' and suprapubic pressure resulted in the lowest percentage of neonates with an injury (6.1%–14.0%). The Gaskin maneuver was performed 22 times in this stusy, with one neonatal injury, this rate of baby injury 4.5% (1/22) is lower than observed when the McRoberts' maneuver and suprapubic pressure were applied, but unfortunately the author did not include the Gaskin maneuver in the final analysis.[22]

In this study in the control group in which the McRoberts' maneuver was applied as the first approach in resolving shoulder dystocia, the rate of baby injury was 14.6% (15/103), which was similar to the rate of baby injury rate mentioned above. In the experimental group, the rate of baby injury was lower than that in control group [1.7% (1/58)], and this difference was statistically significant [$\chi^2 = 6.834$, $P = 0.009$; OR = 1.150 (1.055–1.254)]. Multiple logistic regression analysis has revealed that using the McRoberts' maneuver as the first approach in cases of shoulder is risk factors to baby injury [OR = 19.609 (1.620–273.430].

The rate of baby injury in this study is similar to that of the control group and higher than that in the experimental group in our study. The findings of the current study, in which the widely used primary maneuvers McRoberts' and Gaskin were compared, support the hypothesis that the Gaskin maneuver performed as the first approach has the potential to reduce baby injury.

Table 2
Analysis of the risk factors for baby injury.

Factors	B	S.E.	Wals	Sig.	Exp (B)	Exp (B) 95% C.I.	
						Lower	Super
Use of the McRoberts' maneuver as the first approach in cases of shoulder dystocia	2.976	1.272	5.470	0.019	19.609	1.620	237.430
Mother's employment status	0.647	0.273	5.604	0.018	1.909	1.118	3.262
Oxytocin	1.787	0.743	5.781	0.016	5.969	1.391	25.605
Constant	−7.877	1.710	21.224	0.000	0.000		

4.1. The intravenous application of oxytocin may be a risk factor for baby injury

This study revealed that the intravenous dripping of oxytocin [OR = 5.969 (1.391–25.605)] is a risk factor for baby injury. This finding is consistent with the findings by Yenigül AE et al.[22] that the mother's age and induction of labor are independent risk factors for brachial plexus injury (OR = 1.599 and 81.862, respectively). Gestational weight gain ($P = 0.003$) and neonatal birth weight ($P = 0.047$) were also found to independent risk factors for shoulder dystocia.[22]

The results of the current study also indicate that the mother's employment status is a risk factors for baby injury. The reason for this is not clear and is worth further investigating.

Contrary to general belief, in this study there was no statistical difference in the BMI of the mother or birth weight between the two groups, and they were not found to be risk factors in logistic regression. This suggests we should re-evaluate the risk factors for shoulder dystocia and baby injury.

5. Conclusions

Use of the Gaskin maneuver (turning women from the supine position to the hands-and-knees position) as the first approach in cases of suspected shoulder dystocia reduced the rate of baby injury without increasing neonate asphyxia. The application of the Gaskin maneuver in the management of shoulder dystocia should be seriously considered for better neonatal outcomes.

Declaration of competing interest

We declare that there is no conflict of interest.

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