Long-term trends in the incidence and management of shoulder dystocia in a tertiary obstetric unit in Hong Kong

Eric HL Chan, SL Lau, TY Leung *

ABSTRACT

Introduction: Because there have been changes in the management of macrosomic pregnancies and shoulder dystocia in the past decade, this study was conducted to compare the incidences of shoulder dystocia and perinatal outcomes between the periods of 2000-2009 and 2010-2019.

Methods: This retrospective study was conducted in a tertiary obstetric unit. All cases of shoulder dystocia were identified using the hospital's electronic database. The incidences, maternal and fetal characteristics, obstetric management methods, and perinatal outcomes were compared between the two study periods.

Results: The overall incidence of shoulder dystocia decreased from 0.23% (134/58 326) in 2000-2009 to 0.16% (108/65 683) in 2010-2019 (P=0.009), mainly because of the overall decline in the proportion of babies with macrosomia (from 3.3% to 2.3%; P<0.001). The improved success rates of the McRoberts' manoeuvre (from 31.3% to 47.2%; P=0.012) and posterior arm extraction (from 52.9% to 92.3%; P=0.042) allowed a greater proportion of affected babies to be delivered within 2 minutes (from 59.0% to 79.6%; P=0.003). These changes led to a significant reduction in the proportion of fetuses with low Apgar scores: <5 at 1 minute of life (from 13.4% to 5.6%; P=0.042) and <7 at 5 minutes of life (from 11.9% to 4.6%; P=0.045).

Conclusion: More proactive management of macrosomic pregnancies and enhanced training in the acute management of shoulder dystocia led to significant improvements in shoulder dystocia incidence and perinatal outcomes from 2000-2009 to 2010-2019.

Hong Kong Med J 2023;29:524–31
https://doi.org/10.12809/hkmj2210038

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This article was published on 14 Sep 2023 at www.hkmj.org.

New knowledge added by this study

- The incidence of shoulder dystocia decreased from 2000-2009 to 2010-2019, mainly because of a reduction in the proportion of babies with macrosomia.
- Perinatal outcomes in cases of shoulder dystocia were improved because of enhanced dystocia relief skills and an overall decline in birth weight.

Implications for clinical practice or policy

- Proactive management in cases of suspected macrosomia (eg, early induction of labour) effectively reduced the incidence of shoulder dystocia.
- The incidence of shoulder dystocia was significantly greater among cases with birth weight ≥4200 g, which may be a reasonable threshold for considering elective caesarean section.
- Appropriate training (eg, using SOPHIE course) led to improvements in shoulder dystocia relief skills and better perinatal outcomes.

Introduction

Shoulder dystocia is an uncommon obstetric emergency with an incidence that reportedly ranging from 0.58% to 0.7%.[1-3] It can result in severe perinatal morbidities, including brachial plexus palsies, clavicular fractures, humeral fractures, hypoxic-ischaemic encephalopathy, cerebral palsy, and even mortality soon after birth.[1-6] Considering the unpredictable and complex nature of shoulder dystocia, many professional bodies have established systematic approaches with routine training simulations and algorithms to improve fetal outcomes in such cases.[1,2,7-9] The most common approach is represented by the HELPERR mnemonic, which consists of a sequence of manoeuvres including the McRoberts' manoeuvre, suprapubic pressure, rotational methods, posterior arm delivery, all-fours position, and clavicular fracture.[7] Although the McRoberts' manoeuvre and suprapubic pressure are often the preferred initial manoeuvres, their success rates (56.0%) are lower than that of the rotational methods (62.4%) and posterior arm delivery

(86.1%).[5,6,10] The Royal College of Obstetricians and Gynaecologists (RCOG) in 2012[1] and the American College of Obstetricians and Gynecologists in 2017[2] revised their guidelines to indicate that either posterior arm delivery or rotational methods can be used after an unsuccessful attempt of the McRoberts' manoeuvre. Furthermore, a randomised controlled trial published in 2015 demonstrated that the induction of labour at 38 weeks in macrosomic pregnancies could reduce the risk of shoulder dystocia, compared with expectant management.[11] The overall caesarean rate did not increase when using this approach. Accordingly, early induction of labour has become an option in cases of suspected fetal macrosomia.

Considering changes in the management of macrosomic pregnancies and shoulder dystocia in the past decade, this study compared the incidences of shoulder dystocia, the maternal and fetal characteristics in such cases, and their obstetric management methods and perinatal outcomes between the periods of 2000-2009 and 2010-2019.

香港公立醫院產科肩難產發生率及處理的長期趨勢

陳浩霖、劉素玲、梁德楊

引言：由於巨大嬰兒妊娠和肩難產的管理在過去十年有所改變，因此本研究旨在比較2000至2009年間與2010至2019年間肩難產的發生率和妊娠結果。

方法：此項回顧性研究是在一所大學教學醫院的產科進行。我們從醫院電子數據庫識別出所有肩難產病例後，比較兩個研究期間的肩難產發生率、母胎特徵、產科管理方法和妊娠結果。

結果：肩難產總發生率由2000至2009年的0.23%（134/58 326）下降至2010至2019年的0.16%（108/65 683）[P=0.009]，主要原因是巨大嬰兒的數目下降（從3.3%下降到2.3%；P<0.001）。除此之外，屈大腿法（即McRoberts法）[從 31.3% 上升至47.2%；P=0.012]和牽後臂娩後肩法（從52.9%上升至92.3%；P=0.042）的成功率提高，令受影響嬰兒能夠在2分鐘內成功出生的比率由59.0%提升到79.6%（P=0.003）。這些轉變令阿普伽評分較低的胎兒比例顯著降低：出生後1分鐘<5分從13.4%下降至5.6%（P=0.042），出生後5分鐘<7分則從11.9%下降至4.6%（P=0.045）。

結論：從2000至2009年間到2010至2019年間，對巨大嬰兒妊娠更積極進行管理和加強對肩難產處理培訓，顯著改善了肩難產發生率和妊娠結果。

Methods

Study design

This retrospective study was conducted in a university tertiary obstetric unit that provided obstetric services in the New Territories East Cluster of Hong Kong. All consecutive cases of shoulder dystocia reported from 2000 to 2019 inclusive were identified using the hospital's electronic database.[12] Shoulder dystocia was objectively defined as the requirement of an ancillary obstetric manoeuvre following failed delivery of the anterior shoulder after downward fetal neck traction or head-to-body delivery interval (HBDI) >1 minute, as described in previous reports.[4,5,13] Multiple pregnancies, vaginal breech deliveries, and known stillbirths before labour were excluded. Our unit protocol for the management of shoulder dystocia followed the RCOG Green-top Guidelines for shoulder dystocia that was published in 2005 and updated in 2012.[1] Beginning in 2002, hands-on training in shoulder dystocia relief was routinely conducted using the ALSO (Advanced Life Support in Obstetrics) program[7]; the PROMPT (Practical Obstetric Multi-Professional Training)[8] and the SOPHIE (Safe Obstetric Practice for High risk and Emergency)[9] training methods were added in 2011, after the publication of our articles regarding shoulder dystocia.[4,5] The McRoberts' manoeuvre with or without suprapubic pressure was usually the first manoeuvre performed, followed by a rotational manoeuvre or posterior arm delivery if the McRoberts' manoeuvre was unsuccessful. A midwife was designated to document each event, including the personnel involved, usage and duration of manoeuvres, and delivery times of the fetal head and fetal body. Umbilical cord blood was collected immediately after delivery for blood gas analysis using a Bayer Rapidpoint 400 Blood Gas Analyzer (Bayer HealthCare, Seattle [WA], United States), as described in our previous reports.[14,15] Delivery data, including birth weight and perinatal complications, were recorded immediately after delivery by the attending staff, then crosschecked by another staff member. Two to 3 months later, fetal outcomes were subjected to further review and confirmation during postnatal follow-up and monthly audit meetings. All midwives and obstetricians attended annual training sessions regarding the management of shoulder dystocia.

Identified cases and corresponding medical records were reviewed to collect maternal, fetal, and obstetric characteristics. Advanced maternal age was defined as ≥35 years at the estimated date of delivery. Short stature was defined as maternal height <150 cm. Maternal body weights at booking and delivery were recorded to calculate the body mass index (BMI) at each time point. Obesity was defined as BMI >30 kg/m^2, in accordance with World Health Organization guidelines.[16,17] Parity and diabetes mellitus/gestational diabetes mellitus statuses were noted. Obstetric and neonatal characteristics were recorded, including delivery mode, fetal distress, birth weight, HBDI duration, and the use and sequence of manoeuvres. Macrosomia was defined as birth weight ≥4000 g. Neonatal outcomes were

also recorded, including the Apgar scores at 1 minute and 5 minutes of life, cord arterial pH, and neonatal complications (eg, subgaleal haemorrhage, hypoxic-ischaemic encephalopathy, brachial plexus injury, clavicular fracture, and humeral fracture).

Statistical analysis

The incidences of shoulder dystocia were calculated for three groups: all singleton live pregnancies (excluding multiple pregnancies and stillbirths), all singleton live cephalic-presenting pregnancies with spontaneous onset of labour (excluding cases of fetal malpresentation and elective caesarean deliveries), and all singleton live cephalic-presenting pregnancies with successful vaginal delivery (excluding emergency caesarean deliveries).[12] The incidences of shoulder dystocia were also calculated for various birth weight ranges.

The incidences of shoulder dystocia, maternal and fetal characteristics in each case, and perinatal outcomes were compared between 2000-2009 and 2010-2019. Analyses were performed using SPSS (Windows version 26.0; IBM Corp, Armonk [NY], United States). The incidences of shoulder dystocia; maternal, obstetric, and fetal characteristics; and neonatal complications related to shoulder dystocia during 2000-2009 and 2010-2019 were analysed using the Chi squared test and Fisher's exact test for categorical variables, *t* test for parametric continuous variables, and Mann-Whitney *U* test for non-parametric continuous variables. The threshold for statistical significance was set at P<0.05.

Results

In total, this study included 242 cases of shoulder dystocia in the study unit. Table 1 shows the incidences of shoulder dystocia in each decade according to type of birth and range of birth weight. The overall incidence of shoulder dystocia among all singleton live pregnancies decreased from 0.23% (134/58 326) during 2000-2009 to 0.16% (108/65 683) during 2010-2019 (P=0.009). Similarly, the incidence of shoulder dystocia among singleton cephalic-presenting pregnancies with spontaneous onset of labour decreased from 0.25% to 0.19% (P=0.031), and the incidence of shoulder dystocia among singleton cephalic-presenting pregnancies with vaginal delivery decreased from 0.29% to 0.21% (P=0.017). The incidences of shoulder dystocia were generally similar across birth weight categories, but the incidence considerably decreased in the 4200-4399 g group.

Table 2 shows the birth weight distribution for all singleton cephalic live pregnancies. The mean birth weight decreased from 3180 ± 472 g during 2000-2009 to 3132 ± 463 g during 2010-2019 (P<0.001). The proportion of babies weighing ≥4000 g was 3.3% during 2000-2009, whereas it was

TABLE 1. Incidences of shoulder dystocia according to birth weight category among all singleton pregnancies, singleton cephalic-presenting pregnancies with spontaneous onset of labour, and singleton live cephalic-presenting pregnancies delivered vaginally during the periods of 2000-2009 and 2010-2019*

Birth weight category, g	2000-2009				2010-2019			
	No. of ShD cases	All (n=58 326)	Lab (n=53 036)	Vag (n=45 902)	No. of ShD cases	All (n=65 683)	Lab (n=56 390)	Vag (n=50 348)
	Incidence of ShD				Incidence of ShD			
<3000	1	18 515 (0.01%)	16 245 (0.01%)	14 286 (0.01%)	1	23 184 (0.00%)	19 034 (0.01%)	17 061 (0.01%)
3000-3199	4	10 952 (0.04%)	10 019 (0.04%)	8896 (0.04%)	6	12 804 (0.05%)	11 116 (0.05%)	10 170 (0.06%)
3200-3399	20	10 863 (0.18%)	10 161 (0.20%)	8931 (0.22%)	14	12 160 (0.12%)	10 755 (0.13%)	9672 (0.14%)
3400-3599	20	8263 (0.24%)	7758 (0.26%)	6671 (0.30%)	17	8570 (0.20%)	7691 (0.22%)	6817 (0.25%)
3600-3799	31	5120 (0.61%)	4791 (0.65%)	4011 (0.77%)	25	4984 (0.50%)	4470 (0.56%)	3899 (0.64%)
3800-3999	21	2674 (0.79%)	2449 (0.86%)	1960 (1.07%)	25	2458 (1.02%)	2133 (1.17%)	1794 (1.39%)
4000-4199	10	1185 (0.84%)	1029 (0.97%)	747 (1.34%)	9	1020 (0.88%)	841 (1.07%)	669 (1.35%)
4200-4399	18	461 (3.90%)	383 (4.70%)	268 (6.72%)	5	337 (1.48%)	243 (2.06%)	193 (2.59%)
4400-4599	5	199 (2.51%)	144 (3.47%)	98 (5.10%)	3	113 (2.65%)	77 (3.90%)	51 (5.88%)
≥4600	4	94 (4.26%)	57 (7.02%)	34 (11.76%)	3	53 (5.66%)	30 (10.00%)	22 (13.64%)
Total	134	58 326 (0.23%)	53 036 (0.25%)	45 902 (0.29%)	108	65 683 (0.16%)	56 390 (0.19%)	50 348 (0.21%)
P value†						0.009[a]	0.031[b]	0.017[c]

Abbreviations: All = all singleton pregnancies; Lab = singleton cephalic-presenting pregnancies with spontaneous onset of labour; ShD = shoulder dystocia; Vag = singleton live cephalic-presenting pregnancies delivered vaginally

* Data are shown as No. (%), unless otherwise specified

† There were significant differences between the two study periods in the rates of shoulder dystocia among all deliveries[a], among all cases with labour onset[b], and among all vaginal deliveries[c]

2.3% during 2010-2019.

Table 3 illustrates the maternal and obstetric characteristics in cases of shoulder dystocia during each decade. There were no statistically significant differences between the two decades in terms of advanced maternal age, maternal age, maternal height, maternal weight at booking and delivery, BMI at booking and delivery, obesity at delivery, or nulliparity. However, the proportion of shoulder dystocia cases involving maternal diabetes increased from 9.0% during 2000-2009 to 19.4% during 2010-2019 (P=0.018). Additionally, the proportion of shoulder dystocia cases involving instrumental delivery decreased from 65.7% to 47.2% (P=0.004), but there was no statistically significant difference in the proportion of deliveries involving fetal distress. Although there was no significant change in birth weight, the proportion of babies with macrosomia among shoulder dystocia cases tended to decrease over time (from 27.6% to 18.5%; P=0.097).

Table 4 shows the success rates of various manoeuvres in terms of alleviating shoulder dystocia. During 2010-2019, 79.6% of babies in cases of shoulder dystocia had HBDI ≤2 minutes; 14.8% and 5.6% of such babies had HBDI of 3-4 minutes and ≥5 minutes, respectively. These proportions were significantly better than the proportions during 2000-2009 (59.0%, 31.3%, and 9.7%, respectively; P=0.003). The success rate of the McRoberts' manoeuvre in terms of alleviating shoulder dystocia increased from 31.3% to 47.2% (P=0.012) among all vaginal deliveries, which was partially attributed to the increased success rate among instrumental deliveries (from 20.5% to 39.2%; P=0.017). Although the rotational manoeuvre continued to be preferred over posterior arm extraction (77.6% vs. 22.4%) after failure of the McRoberts' manoeuvre and suprapubic pressure, the success rate of posterior arm extraction increased from 52.9% in 2000-2009 to 92.3% in 2010-2019 (P=0.042). Table 5 shows

TABLE 2. Birth weight distribution among all singleton cephalic live pregnancies during the periods of 2000-2009 and 2010-2019*

	2000-2009	2010-2019
Birth weight category, g†		
All	58 326 (100%)	65 683 (100%)
<3000	18 515 (31.7%)	23 184 (35.3%)
3000-3199	10 952 (18.8%)	12 804 (19.5%)
3200-3399	10 863 (18.6%)	12 160 (18.5%)
3400-3599	8263 (14.2%)	8570 (13.0%)
3600-3799	5120 (8.8%)	4984 (7.6%)
3800-3999	2674 (4.6%)	2458 (3.7%)
4000-4199	1185 (2.0%)	1020 (1.6%)
4200-4399	461 (0.8%)	337 (0.5%)
4400-4599	199 (0.3%)	113 (0.2%)
≥4600	94 (0.2%)	53 (0.1%)
Birth weight, g†	3180 ± 472	3132 ± 463

* Data are shown as No. (%) or mean ± standard deviation
† P<0.001

TABLE 3. Maternal and obstetric characteristics in cases of shoulder dystocia during the periods of 2000-2009 and 2010-2019*

	2000-2009 (n=134)	2010-2019 (n=108)	P value
Maternal age ≥35 years	33 (24.6%)	31 (28.7%)	0.475
Maternal age, y	31.5 ± 4.9	31.5 ± 5.4	0.975
Maternal height, cm	156.6 ± 7.3	157.5 ± 5.8	0.301
Short stature (<150 cm in height)	11 (8.2%)	6 (5.6%)	0.582
Maternal weight at booking, kg	60.0 ± 10.9	59.5 ± 11.3	0.743
Maternal weight at delivery, kg	69.7 ± 15.5	71.2 ± 10.7	0.281
Maternal BMI at booking, kg/m^2	24.8 ± 7.8	23.9 ± 4.1	0.305
Maternal BMI at delivery, kg/m^2	28.7 ± 7.5	28.7 ± 3.8	0.929
BMI >30 kg/m^2 at delivery	32 (23.9%)	31 (28.7%)	0.395
Nulliparous	74 (55.2%)	63 (58.3%)	0.628
DM/GDM	12 (9.0%)	21 (19.4%)	0.018
Instrumental delivery	88 (65.7%)	51 (47.2%)	0.004
Fetal distress	42 (31.3%)	27 (25.0%)	0.277
Birth weight, g	3780 ± 392	3740 ± 367	0.206
Birth weight ≥4000 g	37 (27.6%)	20 (18.5%)	0.097

Abbreviations: BMI = body mass index; DM = diabetes mellitus; GDM = gestational diabetes mellitus
* Data are shown as No. (%) or mean ± standard deviation, unless otherwise specified

TABLE 4. Performances of various manoeuvres in terms of alleviating shoulder dystocia during the periods of 2000-2009 and 2010-2019*

	2000-2009 (n=134)	2010-2019 (n=108)	P value
HBDI, min	2 (2-3)	2 (1-2)	<0.001
HBDI, min			0.003
≤2	79 (59.0%)	86 (79.6%)	
3-4	42 (31.3%)	16 (14.8%)	
≥5	13 (9.7%)	6 (5.6%)	
McRoberts' manoeuvre ± suprapubic pressure success on 1st attempt	42 (31.3%)	51 (47.2%)	0.012
Rate after spontaneous delivery	24 of 46 (52.2%)	31 of 57 (54.4%)	0.823
Rate after instrumental delivery	18 of 88 (20.5%)	20 of 51 (39.2%)	0.017
Success within 2 manoeuvres	100 (74.6%)	89 (82.4%)	0.146
Success within 3 manoeuvres	122 (91.0%)	99 (91.7%)	0.864
MP rate	17 of 91 (18.7%)	13 of 58 (22.4%)	0.580
MP success rate	9 of 17 (52.9%)	12 of 13 (92.3%)	0.042
MR rate	74 of 91 (81.3%)	45 of 58 (77.6%)	0.580
MR success rate	52 of 74 (70.3%)	27 of 45 (60.0%)	0.250

Abbreviations: HBDI = head-to-body delivery interval; MP = McRoberts' manoeuvre ± suprapubic pressure followed by posterior arm extraction; MR = McRoberts' manoeuvre ± suprapubic pressure followed by rotational manoeuvres

* Data are shown as No. (%) or median (interquartile range), unless otherwise specified

TABLE 5. Neonatal outcomes of shoulder dystocia during the periods of 2000-2009 and 2010-2019*

	2000-2009 (n=134)	2010-2019 (n=108)	P value
Apgar score <5 at 1 min	18 (13.4%)	6 (5.6%)	0.042
Apgar score <7 at 5 min	16 (11.9%)	5 (4.6%)	0.045
Cord arterial pH <7	2 (1.5%)	0	0.504
Cord arterial pH <7.1	13 (9.7%)	5 (4.6%)	0.212
Cord arterial pH <7.2	57 (42.5%)	36 (33.3%)	0.143
Subgaleal haemorrhage	1 (0.7%)	0	-
HIE	2 (1.5%)	3 (2.8%)	0.659
Neonatal/infant death from HIE	1 (0.7%)	1 (0.9%)	0.999
Brachial plexus injury	9 (6.7%)	7 (6.5%)	0.999
Clavicular fracture	8 (6.0%)	4 (3.7%)	0.610
Humeral fracture	3 (2.2%)	0	0.256
All types of fractures	11 (8.2%)	4 (3.7%)	0.239
All types of injuries	19 (14.2%)	14 (13.0%)	0.784

Abbreviation: HIE = hypoxic-ischaemic encephalopathy

* Data are shown as No (%), unless otherwise specified

the neonatal outcomes of shoulder dystocia. There were significant reductions in the rates of low Apgar scores: for an Apgar score <5 at 1 minute of life, the rate decreased from 13.4% to 5.6% (P=0.042); for an Apgar score <7 at 5 minutes of life, the rate decreased from 11.9% to 4.6% (P=0.045). There were no statistically significant changes in the rates of other neonatal complications.

Discussion

Trend in the incidence of shoulder dystocia

This study revealed a significant reduction in the overall incidence of shoulder dystocia over the past two decades in a tertiary obstetric unit in Hong Kong. One possible reason is the increased use of caesarean delivery, in both elective and emergency

settings, in cases of suspected macrosomia. This hypothesis is supported by the decrease in the incidences of shoulder dystocia among all births and among all pregnancies with onset of labour in the 4200-4399 g subgroup during 2010-2019 (Table 1). However, such decreases were not observed in other subgroups with babies weighing ≥4000 g (4000-4199 g, 4400-4599 g, and ≥4600 g) [Table 1]. These findings suggest that caesarean delivery in cases of suspected macrosomia is not a major factor contributing to shoulder dystocia prevention. Furthermore, the absence of any change in shoulder dystocia incidence among subgroups with babies weighing <4200 g was consistent with our departmental practice of using 4200 g, rather than 4000 g, as a threshold for offering caesarean delivery to non-diabetic women. The use of a lower fetal weight threshold (eg, 4000 g) in pregnant Chinese women could lead to an unnecessary increase in the rate of caesarean delivery.[18] The practice of early induction of labour in cases of suspected macrosomia may be the main factor contributing to the decrease in shoulder dystocia incidence.[11] Since 2011, women with a fetal abdominal circumference or estimated fetal weight above the 97th percentile (but <4200 g) have been counselled about the risk of difficult labour, along with the benefits and risks of inducing labour to prevent further macrosomia. These approaches are consistent with the decreases in overall mean birth weight and proportion of babies ≥4000 g from 2000-2009 to 2010-2019 (Table 2).

Improvements in the acute management of shoulder dystocia

Additionally, our study revealed improvements in the acute management of shoulder dystocia. In particular, the overall success rate of the McRoberts' manoeuvre in terms of alleviating shoulder dystocia improved from 31.3% during 2000-2009 to 47.2% during 2010-2019; these results were consistent with rates in published reports, which have considerably varied from 23% to 70%.[5,6,19-21] Our improved success rate was mainly attributed to the increased success rate among instrumental deliveries (from 20.5% to 39.2%) [Table 4]. We previously speculated that instrumental delivery increased the risk of shoulder dystocia while reducing the likelihood of McRoberts' manoeuvre success, presumably related to delayed descent of the shoulders during instrumental delivery.[22] The SOPHIE training emphasises that proper performance of the McRoberts' manoeuvre should result in cephaloid rotation of the mother's pelvis, manifested by elevation of the mother's buttocks from the bed. To achieve this goal, the best method for hyperflexion of the mother's hips involves grasping the back of the mother's distal thigh and pushing it in the direction of the mother's head. By leaning in the same direction, the clinician can use their own weight to facilitate hip hyperflexion. A common mistake is holding the mother's knee and pushing at the foot. The resulting force is reduced and the mother may experience discomfort at the ankle joint (Fig a and b).[9]

Importantly, this study showed an increasing trend in the utilisation of posterior arm delivery during 2010-2019, which is consistent with the updated practice guidelines from the RCOG and the American College of Obstetricians and Gynecologists during the same period.[1,2] The success rate of posterior arm delivery also substantially increased (from 52.9% to 92.3%) [Table 4] and humeral fracture (a complication associated with posterior arm delivery) did not occur in any case during 2010-2019. The improvement in the success and safety may be related to the enhanced training through the SOPHIE course, which emphasises that the clinician should use the correct hand (ie, right hand for a fetus facing the mother's left side, and vice versa); this hand should be inserted into the vagina with sufficient depth to reach the fetal posterior forearm, and extraction should be conducted by grasping the forearm (rather than the elbow or

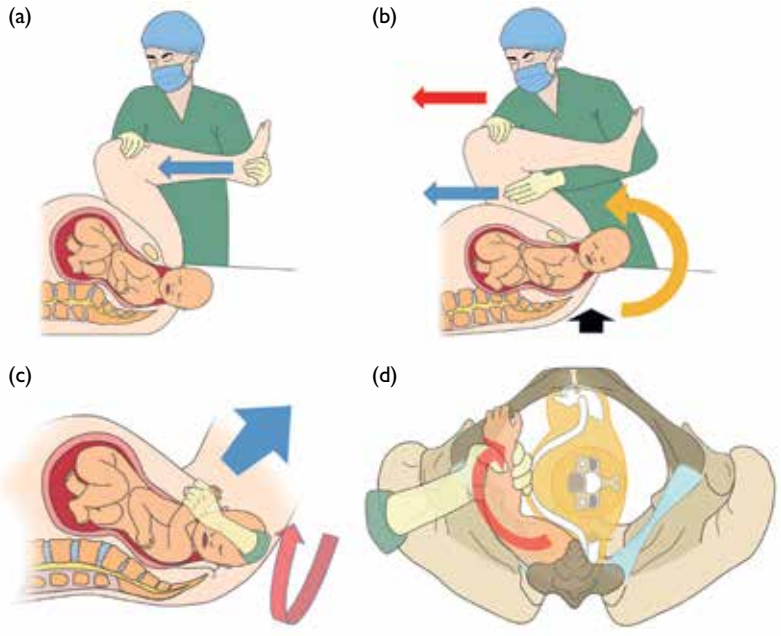

FIG. McRoberts' manoeuvre. (a) A common mistake involves holding the mother's knee and pushing at the foot (blue arrow), which makes the manoeuvre less effective. (b) Hyperflexion of the mother's hips is achieved by grasping the back of the mother's distal thigh and pushing it in the direction of the mother's head (blue arrow). By leaning in the same direction (red arrow), the clinician can use their own weight to facilitate hip hyperflexion. An effective McRoberts' manoeuvre should result in cephaloid rotation of the mother's pelvis (curved yellow arrow), manifested by elevation of the mother's buttocks from the bed (black arrow). (c and d) Posterior arm delivery. The fetal left posterior forearm is grasped by the clinician's left hand. The direction of the extraction is outward and upward (blue straight arrow), enabling rotation of the posterior shoulder (curved red arrows; clockwise direction in this scenario)

upper arm). The direction of the extraction should be outward and upward to generate a rotational effect on the shoulders (Fig c and d).[9,10]

In addition to enhanced clinician skills, improved management of shoulder dystocia may have resulted from a decline in birth weight from 2000-2009 to 2010-2019, although the difference was not statistically significant. Improvements in the success rates of the McRoberts' manoeuvre and posterior arm delivery led to improved management of shoulder dystocia, represented by a shorter HBDI (Table 4). Among cases of shoulder dystocia, the proportion of babies with an HBDI of ≤2 minutes increased from 59.0% during 2000-2009 to 79.6% during 2010-2019; conversely, the proportion of such babies with HBDI ≥5 minutes decreased from 9.7% to 5.6% (Table 4). Along with the improvement in HBDI, fewer babies had a low Apgar score. However, such improvements did not lead to significant reductions in the incidences of severe fetal acidosis and hypoxic-ischaemic encephalopathy, possibly because of the small sample size. The management of prenatally missed macrosomia with severe shoulder dystocia remains a substantial challenge. Our group recently reported a severe case of shoulder dystocia in which the posterior shoulder was also lodged in the middle of the pelvic cavity. The situation was resolved by our modified posterior axillary sling traction technique, which involved using a ribbon gauze to form a sling, in combination with long and slim right-angle forceps to facilitate sling placement.[23] In our report as well as in our recent review, we emphasised that the sling primarily functions by facilitating shoulder rotation to enable delivery through the wider diagonal diameter of the outlet of the birth canal.[10]

Strengths and limitations

The strengths of this study include its analysis of a relatively large number of women over two decades, the use of complete and audited outcomes data, and the uniform management of pregnancy complications in accordance with standard guidelines and department protocols.[12] However, because this was a retrospective study, causal factors underlying the findings could not be fully elucidated; possible confounding factors included changes in the management of pregnancy complications, management of babies with macrosomia, and management of shoulder dystocia, as well as changes in the levels of skills and experience among clinical personnel during the study period.

Conclusion

More proactive management of macrosomic pregnancies led to decreases in the overall proportion of babies with macrosomia and incidence of shoulder dystocia from 2000-2009 to 2010-2019. Improvements in shoulder dystocia relief skills were demonstrated by increases in the success rates of manoeuvres (eg, the McRoberts' manoeuvre and posterior arm delivery), as well as decreases in HBDI and Apgar scores.

Author contributions

All authors contributed to the concept or design of the study, acquisition of the data, analysis or interpretation of the data, drafting of the manuscript, and critical revision of the manuscript for important intellectual content. All authors had full access to the data, contributed to the study, approved the final version for publication, and take responsibility for its accuracy and integrity.

Conflicts of interest

The corresponding author is the programme director for the Safe Obstetric Practice for High risk and Emergency (SOPHIE) course. Other authors have disclosed no conflicts of interest.

Acknowledgement

The authors thank the creators of the SOPHIE course (https://www.obg.cuhk.edu.hk/training-education/sophie-course/) and Ms Catherine Chan at the Department of Obstetrics and Gynaecology, The Chinese University of Hong Kong for contributing to the illustrations.

Funding/support

This research received no specific grant from any funding agency in the public, commercial, or not-for-profit sectors.

Ethics approval

Ethical approval was obtained from the Joint Chinese University of Hong Kong–New Territories East Cluster Clinical Research Ethics Committee (Ref No.: CRE 2017.442). Informed patient consent was waived by the Committee due to the retrospective nature of the study.

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