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Editorial
Learn to teach and teach to learn

Everybody will agree that the Hong Kong College of Obstetricians and Gynaecologists (HKCOG) has produced high-quality specialists over the last 35 years. However, we still need to strengthen our training to adapt to the changing demands of the society. While we have persisted with our curriculum over the last 15 years, our partner—The Royal College of Obstetricians and Gynaecologists—has moved towards competence-based medical education (CBME), which emphasises on the development of non-clinical capacities. The Hong Kong Academy of Medicine (HKAM) has also advocated CBME. Its position paper on postgraduate medical education in 2010 details the direction of CBME and defines the capacities of 'Hong Kong Specialists' to include non-clinical roles in seven domains of competencies, namely professional expertise, health promotion, interpersonal communication, team working, academic expertise, manager-leader positions, and professionalism[1]. These were further stipulated in the second position paper in 2023[2].

CBME has many advantages. It is outcome-based, as opposed to the traditional process-based or time-based training, which does not ensure competency despite completing the training period. CBME is a more learner-focused training integrated with formative assessment and facilitates adjustment to individuals' progress, translating to more effective training that emphasises trainer-learner interaction.

As advocated by Dr Daniel Chan and me in the editorials in 2020 and 2022, I am grateful that HKCOG has started the curriculum review and almost completed it. The new curriculum will include more workplace-based assessments (WBAs) and formative assessments. Apart from the good curriculum, people, both trainees and trainers, are the most critical determining factor in making this change successful.

HKCOG introduced the Objective Structured Assessment of Technical Skills (OSATS) in 2018, pioneering WBAs in Hong Kong. It was an essential first step towards CBME. However, the OSATS were emphasised as a summative tool, whereas the formative component was underutilised. Unfortunately, there was no further development; over time, its educational value degraded when the culture in our training system took a wrong turn. The common problems included: (1) trainers were not available because they were always busy; (2) a fail or negative comments were viewed as a stigma; trainees were worried about being picked on during examinations or in their careers; (3) in many parts of our logbook, the OSATS became merely a tick-box exercise rather than an assessment as such; and (4) the OSATS was usually delayed until the last minute; even when feedback was given, the trainee had no time to act on the feedback and improve. Trainers were afraid to give a fail or negative comments even though there were deficiencies because they thought that the trainees were fragile and they would not want to hurt them.

To embrace our new curriculum, we need a change in the culture. Faculty development and feedback literacy development would be the key to this change in the culture.

Recently, HKAM produced a consultative paper titled Framework for Faculty Development, which states the tasks that trainers should do: (1) teach large and small groups; (2) teach in a clinical setting; (3) facilitate and manage learning; and (4) develop and work with learning resources. Trainers should approach these tasks with: (1) an understanding of the principles of education; (2) appropriate attitudes, ethical understanding, and legal awareness; and (3) appropriate decision-making skills and best evidence-based education. Trainers as professional teachers should: (1) demonstrate professional identity and integrity; (2) demonstrate respect for others; and (3) be committed to scholarship and reflection in medical education.

HKAM adopted the Basic Medical Education Course from the Hong Kong College of Emergency Medicine as the generic train-the-trainer course recommended to all the colleges. HKCOG has started to run the course regularly and aims to encourage all trainers to join the course in the next 3 to 4 years. The course will be customised to the needs of our college, such as practical training on our college e-portfolios and WBAs. The new curriculum will integrate this course into higher training, so our trainees will be equipped with the essential skills and knowledge as trainers when they become specialists.

Feedback literacy is the capability that students need to acquire. Its components include: (1) actively

seeking feedback and appreciating it as an improvement process; (2) interpreting feedback information and making sense of it; (3) acknowledging and working on emotion; (4) recognising feedback as a reciprocal process; and (5) enacting outcomes of feedback. In July 2024, HKCOG will have an induction workshop for our new trainees. Feedback literacy is one of the focuses for raising awareness in our new trainees. By integrating CBME and more WBAs into our new curriculum, trainees should have abundant opportunities and an appropriate environment to develop their feedback literacy.

To conclude, I believe that the effort involved in faculty development and facilitation of trainee feedback literacy can result in a change in culture and make our new CBME-oriented curriculum successful.

Dr Kwok Keung TANG
President
Obstetrical and Gynaecological Society of Hong Kong

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2. Hong Kong Academy of Medicine. Position Paper on Postgraduate Medical Education 2023. Accessed 8 February 2024. Available from: http://page.hkam.org.hk/PositionPaper2023.

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Editorial
Normal birth in Hong Kong

In the past two decades, one of the most significant developments in the midwifery practice is to support normal birth in low-risk pregnant women. This is well supported by obstetricians and midwives. To facilitate normal birth, midwives are responsible for the care of women's psychological health by providing a home-like environment and allowing the husband to accompany the woman during labour, as well as the care of women's physical health by providing non-pharmacological pain relief methods, supporting ambulation during labour, facilitating delivery with different delivery positions, and restricting the use of episiotomy.

Since 2006, midwives from Hong Kong have visited birth centres in the United Kingdom to learn the midwifery practice of normal birth. They have attended conferences held by the International Confederation of Midwives every 3 years and by the Normal Labour and Birth Research Conference every year to obtain updated knowledge. In addition, some midwives were sent to attend the normal birth module at the University of Central Lancashire in United Kingdom to obtain in-depth knowledge of normal birth. All these enable midwives in Hong Kong to make changes towards normal birth step by step.

Midwives provide training to pregnant women on non-pharmacological pain relief methods such as LK massage, aromatherapy, and birth-ball, with the hope to reduce the use of pharmacological pain reliefs such as pethidine or Entonox, which have adverse effects on women and babies. Both education and training are important in the development of a profession. The visits to birth centres and conferences inspired midwives in Hong Kong to implement midwifery practice on normal birth. However, more has to be done to further propagate the practice of normal birth. The guidelines by the Royal College of Midwives can help us plan for future development. Midwives are encouraged to learn updated information from evidence-based research.

On 28 to 30 October 2024, the International Normal Labour and Birth Research Conference will be held in Hong Kong. We are eagerly looking forward to this valuable opportunity to exchange knowledge and skills with renowned international experts to promote normal birth.

Dr Irene Lai Yin LEE
Co-Editor-in-Chief

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Transperineal ultrasound measurement of cervical length to predict preterm delivery in women with threatened preterm labour

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Objective: This study evaluated the predictive value of cervical length as measured by transperineal ultrasound for preterm delivery and the cut-off value in patients with threatened preterm labour.
Methods: Medical records of women admitted to Kwong Wah Hospital between 1 January 2019 and 31 December 2021 for threatened preterm labour at a gestational age between 24+0 and 33+6 weeks were reviewed retrospectively. Patient demographics, cervical length as measured by transperineal ultrasound on admission, and delivery outcomes were collected and analysed.
Results: Of 60 women admitted for threatened preterm labour, 21 (35.0%) delivered before 37 weeks. Ten (16.7%) women delivered within 7 days of admission. Cervical length as measured by transperineal ultrasound on admission was positively correlated with the admission-to-delivery interval (r=0.61, p<0.001). Using the cut-off value of 2.5 cm to predict delivery within 7 days of admission was the most sensitive (90.0%) and specific (86.0%). In univariate analysis, risk factors for preterm delivery were previous preterm delivery, maternal age, history of antepartum haemorrhage, and cervical length. In multivariate analysis, only cervical length remained significantly associated with preterm delivery.
Conclusion: Transperineal ultrasound is a non-invasive alternative to transvaginal ultrasound for measuring cervical length to predict preterm delivery in patients with threatened preterm labour. A cut-off value of 2.5 cm has high sensitivity and specificity.

Keywords: Cervical length measurement; Obstetric labor, premature; Ultrasonography

Introduction

Threatened preterm labour is diagnosed when a pregnant woman presents with regular uterine contractions before 37 weeks without cervical effacement or dilatation. It may or may not progress into preterm labour. Preterm birth is defined as delivery before 37 completed weeks (259 days)[1]. Identifying the risk of preterm labour is important as preterm birth is associated with significant neonatal morbidities and mortality, especially in extremely preterm infants (<28 weeks)[2-4]. It is important to identify those at risk of preterm labour and birth, so measures can be taken to reduce the risk of morbidities and mortality. For example, use of antenatal corticosteroids to reduce the risk of respiratory distress syndrome and neonatal death[5], and use of tocolysis and magnesium sulphate for neuroprotection[6].

The NICE (National Institute for Health and Care Excellence) guideline on preterm labour and birth suggests measuring cervical length by transvaginal ultrasound to determine the likelihood of birth within 48 hours. The ACOG (American Congress of Obstetricians and Gynecologists) finds that cervical length, as measured by transvaginal ultrasound, has good negative predictive value for preterm labour[6,7].

Ultrasound measurement of cervical length can be through the transabdominal, transperineal, or transvaginal route[8]. The transvaginal route is the gold standard, but it is invasive and may not be readily accepted by patients[9]. The transabdominal route causes the least discomfort, but it tends to overestimate cervical length, leading to underdiagnosis of short cervix in up to 50% of cases[10]. The transperineal route is reasonably accurate, with correlation coefficients ranging from 0.77 to 0.97. It is a sensible alternative in cases of premature preterm rupture of membranes (PPROM) or the patient is reluctant to undergo a vaginal examination[9], but its application is limited by the need for an experienced sonographer[9,11-13].

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In our unit, cervical length is routinely measured by transperineal ultrasound. This study evaluated the predictive value of cervical length as measured by transperineal ultrasound for preterm delivery and the cut-off value. The findings could help clinicians counsel patients admitted for threatened preterm labour about their risk of preterm delivery.

Materials and methods

This is a retrospective observational study. Medical records of women admitted to Kwong Wah Hospital between 1 January 2019 and 31 December 2021 for threatened preterm labour at a gestational age between 24+0 and 33+6 weeks were reviewed. Women with active preterm labour on admission (defined as cervical dilatation or cervical effacement with an unmeasurable cervical length), PPROM, multiple pregnancy, cervical incompetence, or who did not undergo a transperineal ultrasound were excluded.

Maternal characteristics and risk factors for preterm delivery were collected, including age, parity, ethnicity, body mass index (BMI), gestational age, antenatal risk factors for preterm birth such as a history of preterm delivery, short inter-pregnancy interval (<18 months), use of assisted reproductive technology, culture-proven bacteriuria, bacterial vaginosis, smoking, drinking alcohol, using drugs, and fetal abnormalities[14], as were the cervical lengths measured by transperineal ultrasound.

Transperineal ultrasound was performed by trained doctors (at least a second-year resident with a year's labour ward ultrasound experience) on admission using a MySono U6 (Samsung Medison). The patient lay in the supine position while the transducer was placed on the perineum and rotated until the complete cervical canal and the internal and external ora were identified (Figure 1). The callipers were placed at the external and internal ora[8]. The shortest distance was recorded when more than one measurement was made. All patients admitted for threatened preterm labour were given antenatal corticosteroids and tocolytics if no contraindications, regardless of cervical length.

Data analysis was performed using SPSS (Windows version 27, IBM, Armonk [NY], United States). The association between cervical length and delivery interval in threatened preterm labour was assessed using the Pearson correlation coefficient and receiver operating characteristic curve analysis together with logistic regression analysis. A value of $p<0.05$ was considered statistically significant. Univariate analysis was first performed for all potential risk factors for preterm delivery. Those with $p<0.2$ were included in the multivariate analysis.

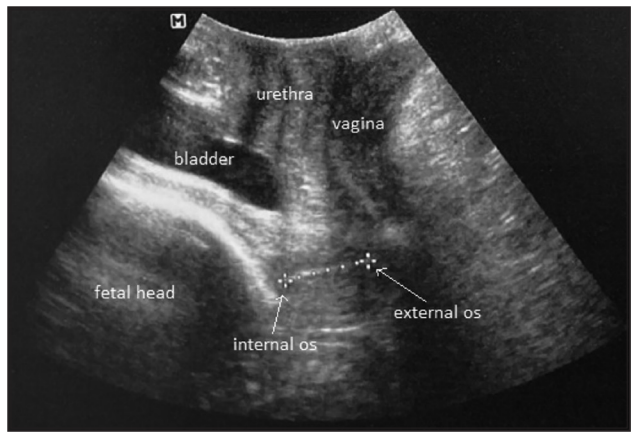

Figure 1. Transperineal ultrasound image for measuring cervical length.

Results

Of 103 women admitted for threatened preterm labour, 43 were excluded owing to multiple pregnancy (n=9), PPROM (n=12), active preterm labour (n=4), and no transperineal ultrasound performed (n=18). The remaining 60 women with a mean age of 32 years and a mean gestational age on admission of 31 weeks were included for analysis. Regarding risk factors for preterm birth[14], 40.0% of women were of advanced maternal age (≥35 years); 23.7% had low BMI (<18.5); 1.7% had high BMI (≥30); 13.3% had a history of antepartum haemorrhage; 10.0% had culture-proven bacteriuria, but none had culture-proven bacterial vaginosis; 12.9% of multiparous women had a history of preterm birth; 6.5% of multiparous women had a short inter-pregnancy interval (<18 months). None was smoker, alcohol drinker, or drug user. No fetus had anomalies. 30.0% of women did not have any risk factors for preterm birth (Table 1).

Of the 60 women, 12 (20.0%) delivered at early preterm (<34 weeks) and nine (15.0%) delivered at late preterm (34 to 36+6 weeks). Ten (16.7%) women delivered within 7 days of admission. Cervical length as measured by transperineal ultrasound on admission was positively correlated with the admission-to-delivery interval (r=0.61, $p<0.001$, Figure 2).

In receiver operating characteristic curve analysis, using the cut-off value of 2.5 cm to predict delivery within 7 days of admission was the most sensitive (90.0%) and

Table 1. Maternal characteristics

Characteristics	No. (%) of patients (n=60)
Maternal age, y	
<18	2 (3.3)
18-34	34 (56.7)
≥35	24 (40.0)
Ethnicity	
Chinese	58 (96.7)
Non-Chinese	2 (3.3)
Gestation on admission, wk	
24-27+6	9 (15.0)
28-31+6	32 (53.3)
32-33+6	19 (31.7)
Parity	
Primigravida	29 (48.3)
Multigravida	31 (51.7)
History of preterm birth (n=31)	
Yes	4 (12.9)
No	27 (87.1)
Body mass index, kg/m^2 (n=59)	
<18.5	14 (23.7)
18.5-24.9	38 (64.4)
25-29.9	6 (10.2)
≥30	1 (1.7)
Inter-pregnancy interval, months (n=31)	
<18	2 (6.5)
≥18	29 (93.5)
History of antepartum haemorrhage	
Yes	8 (13.3)
No	52 (86.7)
Culture-proven bacteriuria	
Yes	6 (10.0)
No	54 (90.0)
Bacterial vaginosis	0
Smoker/alcohol drinker/drug abuser	0
Fetal anomalies	0

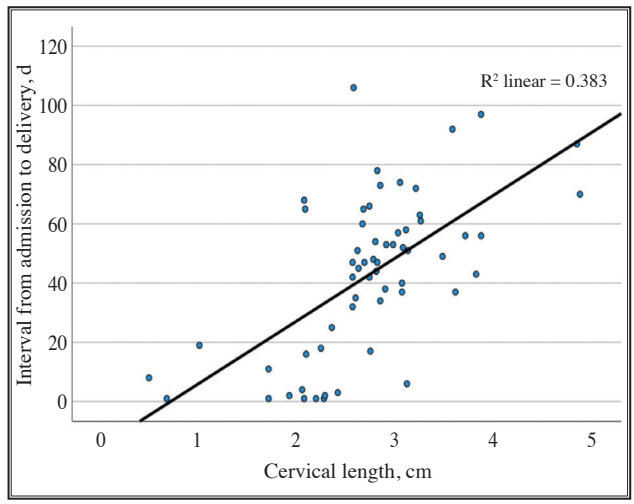

Figure 2. Cervical length is positively correlated with the interval from admission to delivery (r=*0.61, p<0.001).*

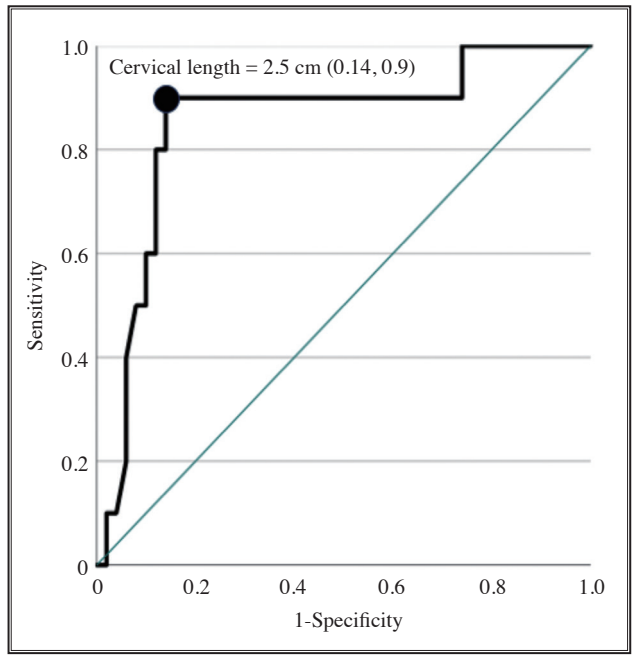

Figure 3. Receiver operating characteristic curve showing a cervical length cut-off value of 2.5 cm for predicting delivery within 7 days of admission.

specific (86.0%), with a positive predictive value of 62.5% and a negative predictive value of 97.7% (Figure 3).

In univariate analysis, risk factors for preterm delivery were previous preterm delivery, maternal age, history of antepartum haemorrhage, and cervical length. In multivariate analysis, only cervical length remained significantly associated with preterm delivery (Table 2).

Discussion

In the present study, cervical length as measured by transperineal ultrasound was a predictor for preterm delivery; the cut-off value of 2.5 cm had 90% sensitivity and 86% specificity. This concurs with NICE's and ACOG's suggestion on measuring cervical length via ultrasound to predict preterm delivery[6,7], and with a study reporting 84.6% sensitivity, 78.1% specificity, 75.9%

Table 2. Multivariate analysis for risk factors for preterm delivery

Variable	Odds ratio (95% confidence interval)	p Value
Previous preterm birth	26.8 (0.7-1003.3)	0.075
Cervical length	0.1 (0.1-0.3)	0.003
History of antepartum haemorrhage	7.5 (0.1-135.7)	0.171
Maternal age	1.2 (0.9-1.5)	0.244

positive predictive value, and 86.2% negative predictive value for the cut-off value of 2.5 cm[12].

In a meta-analysis, a cut-off value of 2.5 cm, as measured by transvaginal ultrasound, for predicting preterm birth within 7 days has a pooled sensitivity of 78.3% and a pooled specificity of 70.8%[15]. Independent predictors for delivery within 7 days are cervical length (odds ratio [OR]=0.69, 95% confidence interval [CI]=0.63-0.76) and vaginal bleeding (OR=19.42, 95% CI=3.87-97.4)[16]. Our findings based on transperineal ultrasound concur that cervical length is an independent predictor for preterm birth.

Nonetheless, different cut-off values should be used at different gestational ages, as the cervix naturally shortens as the gestation advances[17]. The false positive rate is higher if the cut-off value of 2.5 cm is used after 32 weeks of gestation; therefore, a cut-off value of 1.5 cm should be used after 32 weeks to improve sensitivity and positive predictive value.[17] Our sample was too small to stratify according to gestational age.

In the present study, only 10 (16.7%) women delivered within 7 days of admission although 21 (35.0%) women delivered preterm (before 36+6 weeks). We used delivery within 7 days of admission as an endpoint because antenatal corticosteroids are most effective if given within 7 days of delivery[18]. Not all women admitted for threatened preterm labour will deliver preterm[16]. Our protocol may need to be updated considering that most women with cervical length >2.5 cm did not deliver within 7 days of admission. Further studies with a larger sample are warranted to support such change.

The study has limitations. The sample is small; a larger sample may determine cut-off values of cervical length at different gestational ages. Transperineal ultrasound is operator-dependent and has a learning curve; therefore, there could have been inter-observer variations. We could not obtain clear images via transperineal ultrasound in some cases, possibly owing to pubic symphysis shadowing or bowel shadowing. Elevating the patient's hips can improve image resolution in 50% of cases[9].

Transperineal ultrasound may be an alternative to transvaginal or abdominal ultrasound for measuring cervical length in patients with threatened preterm labour. It can be used in patients with PPROM to reduce the risk of infection[19].

Conclusion

Cervical length, as measured by transperineal ultrasound, can predict preterm delivery in patients with threatened preterm labour. It is a non-invasive alternative to transvaginal ultrasound. A cut-off value of 2.5 cm has high sensitivity and specificity for predicting preterm delivery.

Contributors

All authors designed the study, acquired the data, analysed the data, drafted the manuscript, and critically revised 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

All authors have disclosed no conflicts of interest.

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Data availability

All data generated or analysed during the present study are available from the corresponding author upon reasonable request.

Ethics approval

The study was approved by the Kowloon Central / Kowloon East Cluster Research Ethics Committee (reference: KC/KE-23-0065/ER-2). The patients were treated in accordance with the tenets of the Declaration of Helsinki. The patients provided written informed consent for all treatments and procedures and for publication.

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COVID-19 infection and adverse pregnancy outcomes: a retrospective study

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Objective: To determine whether COVID-19 infection in pregnancy is associated with adverse obstetric and perinatal outcomes.
Methods: We conducted a retrospective cohort study in pregnant women who delivered in the Queen Elizabeth Hospital between 1 February 2022 and 30 April 2022. Outcome measures included adverse maternal outcomes (maternal intensive care unit [ICU] admission), obstetric outcomes (abnormal cardiotocography, mode of delivery, postpartum haemorrhage), and adverse perinatal outcomes (preterm delivery, low Apgar score, low birth weight, neonatal ICU admission, neonatal death). The association between maternal COVID-19 infection status and preterm delivery was evaluated.
Results: Among 481 pregnant women, 136 were infected with or recovered from COVID-19 during pregnancy and 345 were not. COVID-19 infection during pregnancy resulted in higher rates of preterm delivery (adjusted odds ratio=2.30), maternal ICU admission, and neonatal ICU admission.
Conclusion: COVID-19 infection during pregnancy is associated with an increased risk of adverse maternal and perinatal outcomes.

Keywords: COVID-19; Pregnancy outcome; Premature birth

Introduction

COVID-19 infection has a wide range of severity from asymptomatic, mild coryzal symptoms to moderate or severe pneumonia to acute respiratory distress syndrome and septic shock[1,2]. Pregnant women are more susceptible to the infection owing to physiological cardiorespiratory and immunological changes[3]. Most patients have mild-to-moderate disease[4], but pregnant women are at a higher risk of developing severe infection. COVID-19 infection is associated with adverse perinatal outcomes[5].

The Queen Elizabeth Hospital is a tertiary public hospital in Hong Kong with 4000 to 5000 deliveries per year. In 2022, it was converted into a designated hospital for COVID-19 patients in the Kowloon Central Cluster. All COVID-19-positive women receiving antenatal care in hospitals of this cluster were transferred to our hospital, whereas COVID-19-negative women in our hospital were referred to other hospitals according to the patient's preference. Nonetheless, a considerable proportion of COVID-19-negative women stayed and delivered in our hospital. We evaluated the association between COVID-19 infection during pregnancy and adverse maternal, obstetric, and fetal outcomes.

Materials and methods

Medical records of women with a singleton pregnancy delivering in the Queen Elizabeth Hospital between 1 February 2022 and 30 April 2022 were retrieved and retrospectively reviewed. Women with multiple pregnancies, stillbirth, or incomplete data were excluded.

Data collected included maternal age, ethnicity, parity, comorbidities (obesity, diabetes mellitus, chronic hypertension, antiphospholipid syndrome and systemic lupus erythematosus, and chronic renal disease), obstetric history (fetal growth restriction, fetal chromosomal abnormalities, gestational diabetes, and gestational hypertensive disorders), and pregnancy and neonatal outcomes (mode of delivery, maternal intensive care unit [ICU] admission, postpartum haemorrhage, abnormal cardiotocography, preterm delivery before 37 weeks of gestation, abnormal low birth weight <2.5 kg, low Apgar score, neonatal ICU admission, respiratory distress, neonatal jaundice, and neonatal death). Obstetric conditions were defined according to international criteria[6-10].

During the pandemic, all pregnant women admitted to our hospital were screened for COVID-19 using real-

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time reverse transcriptase polymerase chain reaction, except for those who recovered from infection within 90 days. Those with indeterminate results were tested with SAR-COV2 protein receptor-binding domain antibody; those with a positive antibody result were considered to have recovered and were managed on the general ward.

Pregnant women with COVID-19 were kept in negative-pressure isolation wards. A single room with negative pressure was used for vaginal delivery and Caesarean section. All staff taking care of COVID-19 patients wore personal protective equipment, surgical gloves, and N95 respirators.

Those with active COVID-19 infection during pregnancy were monitored for vital signs and oxygen saturation. Complete blood tests were performed. Chest radiography was performed to evaluate any pneumonia after obtaining written consent from the mothers, who were explained of the negligible effect of the radiation dose on fetus[11]. Cardiotocography for fetal heart rate monitoring was performed for a gestational age beyond 28 weeks. Ultrasonography was performed for fetal wellbeing if clinically indicated. Symptomatic treatment and antipyretics were given. Given that COVID-19 predisposes to thromboembolic events[12], pregnant women were offered pharmacological thromboprophylaxis up to 10 days after hospital discharge in accordance with the suggestion of The Royal College of Obstetricians and Gynaecologists[13]. Those who refused or had contraindications to pharmacological thromboprophylaxis were supplied with compression stockings as mechanical prophylaxis. Antiviral treatment such as nirmatrelvir/ritonavir (Paxlovid) or remdesivir (Veklury) was prescribed after an assessment by infectious disease specialists. Antibiotic treatment was given if a secondary bacterial infection was present. Those with severe COVID-19 infection were admitted to the ICU for close observation and treatment.

ICU admission was based on the severity of the COVID-19 infection and the need for organ support or invasive monitoring. Those with severe disease, defined by clinical signs of pneumonia plus tachypnoea or desaturation, were admitted to the ICU because of the need for ventilatory support. Those with sepsis that was not responsive to antibiotics and fluid resuscitation were also admitted to the ICU.

Clinical management included invasive monitoring with arterial line and central line insertion to monitor blood pressure and to guide fluid resuscitation, intravenous remdesivir, and empirical antibiotics (for secondary bacterial infection), and ventilatory support, according to inputs from intensive care and infectious disease specialists.

The timing of delivery depended mainly on the severity of the COVID-19 infection as well as the maternal and fetal conditions. Induction of labour or Caesarean section was offered to those with mild-to-moderate COVID-19 infection, based on standard obstetric indications. For those with severe or critical COVID-19 infection, the delivery decision was made jointly by the obstetrician, intensive care physician, and infectious disease specialist after consideration of gestational age, severity of maternal respiratory compromise and sepsis, and fetal wellbeing. Medically indicated deliveries were not delayed owing to COVID-19-positive status alone.

The COVID-19-positive group included those with a history of or active COVID-19 infection during pregnancy. The COVID-19-negative group included those with no history of COVID-19 infection during pregnancy and a negative COVID-19 result on admission for delivery.

Statistical analyses were performed using SPSS (Windows version 29.0.1; IBM Corp, Armonk [NY], United States). The COVID-positive and -negative groups were compared using the Pearson Chi-squared test and the Fisher's exact test, as appropriate. A p value of <0.05 was considered statistically significant. A multivariate logistic regression was used to evaluate the associations between COVID-19 infection and adverse outcome of preterm delivery, adjusting for confounding variables.

Results

Of 481 women included for analysis, 136 (28.3%) were classified into the COVID-19-positive group who had active COVID-19 (n=76) or were recovered from COVID-19 (n=60) and 345 (71.7%) were classified into the COVID-19-negative group (Table). The two groups were comparable in terms of demographics, maternal comorbidities, and current obstetric history, except that the proportion of multiparous women was higher in the COVID-19-positive group.

COVID-19 infection status was associated with maternal ICU admission, preterm delivery, neonatal ICU admission, and respiratory distress, but not associated with obstetric outcomes and rates of instrumental delivery and Caesarean section. In multivariate logistic regression, COVID-19 infection was predictive of preterm delivery

Table. Comparison of COVID-19-positive and -negative groups

Characteristic	COVID-19 positive (n=136)*	COVID-19 negative (n=345)*	p Value
Age, y			0.168
<35	98 (72.1)	226 (65.5)	
≥35	38 (27.9)	119 (34.5)	
Ethnicity			0.636
Asian	134 (98.5)	340 (98.6)	
Non-Asian	2 (1.5)	5 (1.4)	
Parity			0.003
Nulliparous	49 (36.0)	177 (51.3)	
Multiparous	87 (64.0)	168 (48.7)	
Obesity (body mass index ≥30 kg/m^2)	10 (7.4)	18 (5.3)	0.320
Pre-existing diabetes	2 (1.5)	2 (0.6)	0.318
Pre-existing hypertension	0	4 (1.2)	0.263
Systemic lupus erythematosus and antiphospholipid syndrome	1 (0.7)	0	0.283
Chronic renal disease	0	0	-
Gestational diabetes	11 (8.1)	41 (11.9)	0.227
Gestational hypertension	4 (2.9)	4 (1.2)	0.162
Pre-eclampsia	3 (2.2)	9 (2.6)	0.546
Fetal growth restriction	10 (7.4)	22 (6.4)	0.699
Fetal chromosomal abnormalities	2 (1.5)	4 (1.2)	0.543
Abnormal cardiotocography	13 (9.6)	22 (6.4)	0.226
Spontaneous vaginal delivery	92 (67.6)	230 (66.7)	0.837
Instrumental delivery	6 (4.4)	22 (6.4)	0.407
Caesarean section	38 (27.9)	93 (27.0)	0.827
Postpartum haemorrhage >500 ml	6 (4.4)	28 (8.1)	0.153
Postpartum haemorrhage >1000 ml	1 (0.7)	6 (1.7)	0.366
Thromboembolism	0	0	-
Maternal intensive care unit admission	5 (3.7)	1 (0.3)	0.008
Preterm delivery	16 (11.8)	20 (5.8)	0.025
Spontaneous	8 (5.9)	10 (2.9)	
Iatrogenic	8 (5.9)	10 (2.9)	
Low birth weight <2.5 kg	13 (9.6)	23 (6.7)	0.278
Low Apgar score <7 at 5 min	1 (0.7)	1 (0.3)	0.487
Neonatal intensive care unit admission	98 (72.1)	121 (35.1)	<0.001
Respiratory distress	36 (26.5)	51 (14.8)	0.003
Oxygen required	13 (9.6)	31 (8.9)	0.730
Neonatal jaundice requiring phototherapy	17 (12.5)	38 (11.0)	0.645
Neonatal death	0	0	-

* Data are presented as No. (%) of participants

(adjusted odds ratio [OR]=2.30, 95% confidence interval [CI]=1.13-4.68, p=0.022).

Five women in the COVID-19-positive group were admitted to the ICU owing to pneumonia with desaturation requiring oxygen support (n=2), severe sepsis requiring invasive monitoring (n=1), severe pre-eclampsia requiring intravenous antihypertensives and the HELLP (haemolysis, elevated liver enzymes, and low platelets) syndrome (n=1), or severe primary postpartum haemorrhage secondary to uterine atony with disseminated intravascular coagulopathy (n=1). However, only one woman in the COVID-19-negative group was admitted to the ICU owing to severe postpartum haemorrhage secondary to a vaginal haematoma.

Eight women in the COVID-19-positive group had iatrogenic preterm delivery owing to severe COVID infection with pneumonia requiring oxygen support (n=2), preterm prelabour rupture of membrane (n=4), severe pre-eclampsia requiring intravenous antihypertensives and the HELLP syndrome (n=1), or abnormal cardiotocography (n=1).

Discussion

In the present study, more COVID-19-positive women were multiparous, probably because families with more school-age children are at higher risk of exposure to the virus[14], and these families are more likely to employ domestic helpers for childcare.

Pregnant women are at an increased risk of severe COVID-19 infection because of physiological changes in the respiratory system, in which progesterone causes oedema in the respiratory mucosa and the diaphragm is lifted up by the gravid uterus, as well as changes in the immune system to accommodate the fetus[15]. Thus, pregnant women are more susceptible to severe COVID-19 infection and its associated comorbidities. They are more likely to be admitted to the ICU and require ventilation support and extracorporeal membrane oxygenation[16], consistent with the findings of the present study.

Clinical manifestations of COVID-19 infection differ across viral strains. Compared with the wild-type, alpha and delta strains result in significantly higher rates of maternal morbidities and mortalities, whereas the omicron variant was not associated with a significant increase in these outcomes[17]. The COVID-19 vaccination rate was also increased in 2022, compared with the earlier waves of the outbreak. The rates of hospitalisation and critical care admission associated with severe COVID-19 infection are lower in the vaccinated group[18,19]. Thus, no invasive ventilatory support or maternal death occurred in those admitted to the ICU.

In the present study, COVID-19-positive women had a higher risk of preterm delivery. This suggests that COVID-19 has a different mechanism rather than an iatrogenic delivery secondary to maternal diseases[20,21]. Further research is warranted. Although the rate of neonatal ICU admission secondary to respiratory distress was higher in the COVID-19-positive group, all these neonates tested negative. Vertical transmission of COVID-19 infection is uncommon.

In a systemic review and meta-analysis of 42 studies involving 438 548 pregnant women[22], COVID-19 infection during pregnancy is associated with an increased odds of pre-eclampsia (OR=1.33, 95% CI=1.03-1.73), maternal ICU admission (OR=4.78, 95% CI=2.03-11.25), preterm delivery (OR=1.82, 95% CI=1.38-2.39), neonatal ICU admission (OR=3.69, 95% CI=1.39-9.82), and stillbirth (OR=2.11, 95% CI=1.14-3.90). No association with fetal distress, Caesarean section, low birth weight, postpartum haemorrhage, or neonatal death was observed. In the present study, COVID-19 infection was not associated with pre-eclampsia or stillbirth, probably owing to the small sample size.

A designated hospital for patients with COVID-19 enabled prompt diagnosis and management and reduced morbidities. The laboratory could take up a large number of tests and prompt diagnoses. Medical staff were trained to provide care on COVID-19 infection and recognise severe infection. Infectious disease specialists provided input to the care, especially on patients with underlying comorbidities and severe illness. Antiviral medications were in adequate supply for immediate prescription after the diagnosis. Women in the COVID-19-positive group were monitored more frequently for blood pressure, temperature, and oxygen saturation to detect severe infection and a need for organ support. This also enabled earlier diagnosis of pre-eclampsia or gestational hypertension.

The present study has limitations. The sample size was small and the study was retrospective. Some COVID-19-positive cases were self-reported or asymptomatic/undiagnosed. The vaccination status was not investigated; vaccination reduces rates of hospitalisation and critical care admission[19]. The effects of antiviral treatment were not evaluated; antiviral treatment reduces rates of maternal

mortality and preterm delivery[23,24]. Long-term outcomes of the newborns were not investigated.

Conclusion

COVID-19 infection during pregnancy is associated with an increased risk of maternal ICU admission, preterm delivery, respiratory distress, and neonatal ICU admission.

Contributors

Both authors designed the study, acquired the data, analysed the data, drafted the manuscript, and critically revised the manuscript for important intellectual content. Both 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

As an editor of the journal, KYL was not involved in the peer review process. The other author has disclosed no conflicts of interest.

Funding/support

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

Data availability

All data generated or analysed during the present study are available from the corresponding author on reasonable request.

Ethics approval

The study was approved by the Kowloon Central/ Kowloon East Cluster Research Ethics Committee (Reference: KC/KE-22-0144/ER-1). The patients were treated in accordance with the tenets of the Declaration of Helsinki. The patients provided written informed consent for all treatments and procedures and for publication.

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Anxiety and depression symptoms in pregnant women at the end of the COVID-19 pandemic

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Objective: To evaluate the prevalence of depression and anxiety among women giving birth at a public hospital at the end of the COVID-19 pandemic and to determine factors associated with depression and anxiety.
Methods: Women giving birth at the Queen Elizabeth Hospital in January 2023 were invited to complete a questionnaire. Data collected included age, marital status, economic status, education level, employment status, health personnel status, presence of comorbidities, history and severity of COVID, and whether their antenatal or intrapartum care was affected by COVID. The Patient Health Questionnaire-9 (PHQ-9) and the Generalised Anxiety Disorder-7 scale (GAD-7) were used to evaluate depression and anxiety, respectively. Multinomial logistic regression analysis was performed to determine factors associated with depression and anxiety.
Results: Among 100 participants, 26% had mild depression or above (PHQ-9 score ≥5), 36% had mild anxiety or above (GAD-7 score ≥5), and 1% had severe depression and anxiety. Women with birth companion delayed or prohibited during labour were associated with higher GAD-7 scores (p=0.015).
Conclusion: At the end of the COVID-19 pandemic, women with birth companion delayed or prohibited during labour are associated with higher anxiety levels.

Keywords: Anxiety; COVID-19; Depression; Mental health; Pregnancy

Introduction

During the COVID-19 pandemic, the stress level and prevalence of anxiety and depressive symptoms and subjective unhappiness were greatly increased in Hong Kong population[1-4]. In a study of mental health in Hong Kong in 2020, up to 19% of respondents had probable depression (with Patient Health Questionnaire-9 [PHQ-9] score ≥10) and 14% had probable anxiety (with Generalised Anxiety Disorder-7 [GAD-7] score ≥10)[1].

In March 2022, Queen Elizabeth Hospital was converted into a COVID-19-designated hospital. At the peak of the pandemic, most women giving birth in the hospital could not be accompanied during labour, and pain-relieving options were limited, especially if they had active COVID. For instance, Entonox was not allowed if women had active COVID. As time went by, public health measures started to loosen up and borders reopened. On 19 January 2023, isolation requirements for patients with COVID was ended. However, infection control measures remained in place in hospitals. Women with active COVID were not allowed to be accompanied during labour. The birth companion had to be tested negative for COVID within the last 48 hours before being allowed into the labour ward. Anyone with upper respiratory tract symptoms, fever, new loss of taste or smell, diarrhoea, rash, conjunctivitis or shortness of breath was not allowed to accompany labour.

Childbearing is intrinsically a stressful process for both the mind and the body, and the mental health of women giving birth during the COVID-19 pandemic is worth examining. We evaluated the prevalence of depression and anxiety among women giving birth at Queen Elizabeth Hospital in January 2023 and determined factors associated with depression and anxiety.

Methods

This cross-sectional study was conducted in women giving birth at Queen Elizabeth Hospital in January 2023. The first 100 participants with none of the exclusion criteria (having severe COVID, preterm delivery, needing intensive care unit care, having severe psychotic disorders, being mentally incapacitated, being illiterate, and being prisoners) were asked to complete a questionnaire, in either English or Chinese, in the postnatal ward.

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Data collected included age, marital status, economic status, education level, employment status, health personnel status, presence of comorbidities, history and severity of COVID, and whether their antenatal or intrapartum care was affected by COVID.

The PHQ-9 and the GAD-7 were used to evaluate depression and anxiety levels, respectively. The PHQ-9 is a 9-item questionnaire for screening depression in the past 2 weeks. Depression symptom is defined as none (score 0-4), mild (score 5-9), moderate (score 10-14), and severe (score ≥15). Scores of ≥10 indicate a possible major depressive disorder, with a sensitivity of 88% and specificity of 88%[5]. The Chinese version of PHQ-9 has been validated[6]. The GAD-7 is a 7-item questionnaire for screening common anxiety disorders. Total scores range from 0 to 21; anxiety is defined as none/minimal (score 0-4), mild (score 5-9), moderate (score 10-14), and severe (score ≥15). Scores of ≥10 indicate possible anxiety, with a sensitivity of 89% and a specificity of 82%[7]. The GAD-7 has been validated as a screening tool for anxiety among pregnant Chinese women[8].

The prevalences of depression and anxiety among participants were calculated. Multinomial logistic regression analysis was performed to determine factors associated with depression and anxiety. Statistical analysis was performed with SPSS (Windows version 24.0; IBM Corp, Armonk [NY], United States). All tests were two-tailed. A p value of <0.05 was considered statistically significant.

Results

Of 100 participants, 26% had mild depression or above (PHQ-9 score ≥5), 36% had mild anxiety or above (GAD-7 score ≥5), and 1% had severe depression and severe anxiety (Table 1). Using the cut-off score of 10, 9% of participants had possible major depression and 7% of participants had possible anxiety. Table 2 shows the demographics of pregnant women and COVID-related impacts.

In multinominal logistic regression analysis, women with birth companion delayed or prohibited during labour were associated with higher GAD-7 scores (p=0.015, Table 3).

Discussion

At the end of the COVID-19 pandemic in January 2023, 26% and 36% of women giving birth in a Hong Kong hospital had symptoms of depression and anxiety, respectively. These percentages were lower than the 37% and 57% reported in a study of pregnant women in Canada in 2020[9], which used the Edinburgh Depression Scale for depressive symptoms and the Patient-Reported Outcomes Measurement Information System Anxiety Adult 7-item short form for general anxiety symptoms.

Table 1. Symptoms of depression and anxiety in pregnant women at the end of the COVID-19 pandemic

Severity	No. (%) of participants	
	Patient Health Questionnaire-9 for depression symptom	Generalised Anxiety Disorder-7 for anxiety symptom
Normal	74 (74)	64 (64)
Mild	17 (17)	29 (29)
Moderate	8 (8)	6 (6)
Severe	1 (1)	1 (1)

Using the cut-off score of 10, the prevalences of depression and anxiety in general Hong Kong population in 2020 were 19.8% and 14%, respectively[1], whereas the prevalences of depression and anxiety in women giving birth in 2023 were lower at 9% and 7%, respectively. Both studies used the PHQ-9 and the GAD-7. In a meta-analysis in 2022, the pooled prevalence was 25.1% for depression and 18.7% for anxiety[10]. Possible reasons for the lower prevalences in our participants include adaptation to the pandemic, less fear of COVID-19 with improved understanding, availability of vaccinations, and loosened social-distancing measures resulting in less social isolation.

Delaying or prohibiting birth companion during labour was associated with anxiety. Labour companionship can provide emotional, psychological, and practical support so that women have less fear and stress during labour. The companion can bridge communication gaps, provide massage or handholding to relieve pain, and reassure women's feeling in control[11], thus reducing anxiety.

There are limitations to the present study. The PHQ-9 and the GAD-7 are screening tools only and are not valid to make diagnoses. The women may be prone to recall bias, especially immediately after delivery. They may be more likely to be joyous after delivery and tend to disregard depressive and anxious feelings that occurred before the delivery. The sample was from a single centre

Table 2. Demographics of pregnant women and COVID-related impacts

Variable	No. (%) of participants
Age, y	
<30	17 (17)
≥30	83 (83)
Marital status	
Married	96 (96)
Single, divorced or separated	4 (4)
Education level	
Secondary schooling or below	30 (30)
Diploma or the equivalent and above	70 (70)
Employment status	
Employed	75 (75)
Unemployed	25 (25)
Monthly income per person, HK$	
≤20 000	67 (67)
≥20 001	33 (33)
Health personnel	
Yes	16 (16)
No	84 (84)
Presence of comorbidities	
Yes	4 (4)
No	96 (96)
History of COVID	
Yes	72 (72)
No	28 (28)
COVID severity (n=72)	
Asymptomatic/stable	72 (100)
Serious/critical	0
COVID-related hospitalisation (n=72)	
Yes	4 (6)
No	68 (94)
Duration of recovery from COVID, mo (n=70)	
0-3	56 (80)
≥3	14 (20)
History of quarantine	
Yes	43 (43)
No	57 (57)
Quarantine duration, d (n=70)	
0-7	30 (43)
>7	40 (57)
Delay/cancellation of antenatal check-up	
Yes	22 (22)
No	78 (78)
Mode of delivery	
Normal vaginal delivery	59 (59)
Instrumental delivery	3 (3)
Caesarean section	38 (38)
Pain control limitation	
Yes	8 (8)
No	92 (92)
Birth companion delayed or prohibited during labour	
Yes	29 (29)
No	71 (71)

Table 3. Factors associated with depression and anxiety in women giving birth at the end of the COVID-19 pandemic

Factor	Depression		Anxiety			
	Univariate analysis		Univariate analysis		Multivariate analysis	
	Odds ratio	p Value	Odds ratio	p Value	Odds ratio	p Value
Age	3.8	0.279	0.376	0.945	-	-
Marital status	1.381	0.710	0.670	0.880	-	-
Education level	2.512	0.473	7.007	0.072	2.729	0.435
Employment status	2.811	0.422	6.319	0.097	2.263	0.520
Personal monthly income	2.176	0.537	0.831	0.842	-	-
Health personnel	5.050	0.168	2.500	0.475	-	-
Presence of comorbidities	1.565	0.667	1.683	0.641	-	-
History of COVID	1.175	0.759	1.611	0.657	-	-
COVID severity	0.639	0.888	0.847	0.838	-	-
Duration of recovery from COVID	2.829	0.419	2.330	0.507	-	-
Mode of delivery	3.662	0.722	6.089	0.413	-	-
Pain control option limited	3.395	0.335	2.859	0.414	-	-
Birth companion delayed or prohibited during labour	2.509	0.474	10.565	0.014	10.499	0.015
History of quarantine	1.939	0.585	2.369	0.499	-	-
Duration of quarantine	3.070	0.381	2.942	0.401	-	-
Antenatal care cancelled/postponed	0.557	0.904	3.630	0.304	-	-
Hospitalisation secondary to COVID	2.702	0.440	1.482	0.686	-	-

and thus the results may not be generalisable. Women in different hospitals may have different antenatal and intrapartum experiences as well as different depression and anxiety levels. There may be a self-selection bias; women who are more concerned with their mental well-being may be more willing to participate.

Conclusions

At the end of the COVID-19 pandemic, women with birth companion delayed or prohibited during labour are associated with higher anxiety levels. Companionship for women during labour can alleviate stress and anxiety and should not be prohibited. Screening of anxiety symptoms can be included postpartum care, along with the existing postpartum depression screening.

Contributors

Both authors designed the study, acquired the data, analysed the data, drafted the manuscript, and critically revised the manuscript for important intellectual content. Both 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

As an editor of the journal, KYL was not involved in the peer review process. The other author has disclosed no conflicts of interest.

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Data availability

All data generated or analysed during the present study are available from the corresponding author upon reasonable request.

Ethics approval

This study was approved by the Kowloon Central / Kowloon East Cluster Research Ethics Committee (reference: KC/KE-22-0129/ER-4). The patients were treated in accordance with the tenets of the Declaration of Helsinki. The patients provided written informed consent for all treatments and procedures and for publication.

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Ever-increasing incidence of postpartum haemorrhage in Hong Kong: a perspective

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Postpartum haemorrhage (PPH) is a leading cause of maternal morbidity and mortality. In 2022, the incidence of PPH in Hong Kong increased to a historic high of 14.7%, despite advances in prevention and treatment modalities such as the use of uterotonics, balloon tamponade, and compression sutures. Were the prevention and treatment modalities ineffective or were pregnant women at higher risk of PPH? Factors behind the increasing incidence of PPH include: (1) computerisation of medical records and improved coding resulting in increased awareness and openness in reporting; (2) higher maternal risks such as advanced maternal age, increasing rates of Caesarean section and thus previous Caesarean sections; and (3) increasing use of low-dose aspirin and low-molecular-weight heparin.

PPH is defined as a blood loss ≥500 ml within 24 hours of delivery, irrespective of the mode of delivery. The increase in incidence of PPH from 2016 to 2022 was attributed mainly to the increase in the category of blood loss of 501 to 1000 ml (Figure 1). In particular, cases with blood loss of 500 ml accounted for 3.7% of all maternity cases or 25.2% (3.7/14.7) of all PPH cases. Thus, this subgroup should be the target to reduce the overall incidence of PPH, which is 12.5% (8.8%+3.7%) of all maternity cases or 85.0% (12.5/14.7) of all PPH cases. Prevention is always better than treatment, and prevention of PPH reduces maternal morbidity and mortality and improves the childbirth experience.

Uterine atony was the most common cause of PPH, accounting for 47.4% of cases of PPH ≥500 ml (Figure 2). There are three types of uterotonic medications for prevention of PPH: Syntocinon, Syntometrine, and Carbetocin (Figure 3). Intramuscular Syntometrine is used routinely after vaginal deliveries without contraindications such as hypertension, asthma, and valvular heart disease. Adverse effects of Syntometrine include increased blood pressure, headache, and vomiting. Intravenous (bolus and/or infusion) Syntocinon is commonly used after vaginal deliveries with a high risk of uterine atony such as high parity, induction of labour, instrumental deliveries, and contraindications to Syntometrine. Syntocinon is routinely used for PPH prophylaxis after Caesarean sections, which account for 30% of deliveries in public hospitals. The incidence of PPH (≥500 ml) after Caesarean sections has been as high as 30%, so it is the target subgroup. In 2017, Carbetocin was introduced into the drug formulary of the Hospital Authority. Initially, owing to the high costs, Carbetocin was limited to cases of Caesarean sections with high risk factors for PPH such as twin pregnancies, large fibroids, polyhydramnios, fetal macrosomia, and placenta praevia, all of which account for <10% of all deliveries in public hospitals. Some obstetrics units extend the indications for the use of Carbetocin to vaginal deliveries with high-risk factors for PPH. If the indications for use of Carbetocin as PPH prophylaxis were extended to all cases of Caesarean sections and vaginal deliveries with high-risk factors for PPH as well as those with contraindications for Syntometrine and ultimately to all cases of Caesarean sections and vaginal deliveries, the overall incidence of PPH (≥500 ml) could be reduced.

The World Health Organization and the Asia and Oceania Federation of Obstetrics and Gynaecology recommend using heat-stable Carbetocin (100 μg,

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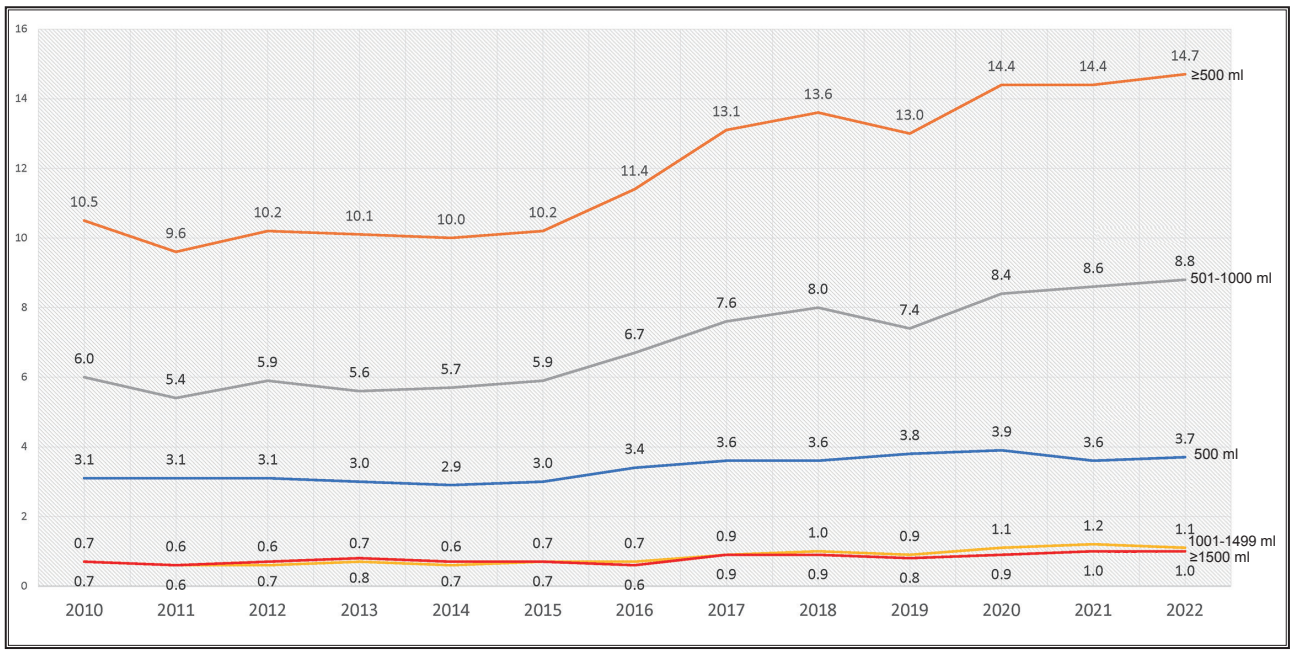

Figure 1. Incidences of postpartum haemorrhage (as percentages of maternity cases) in public hospitals from 2010 to 2022

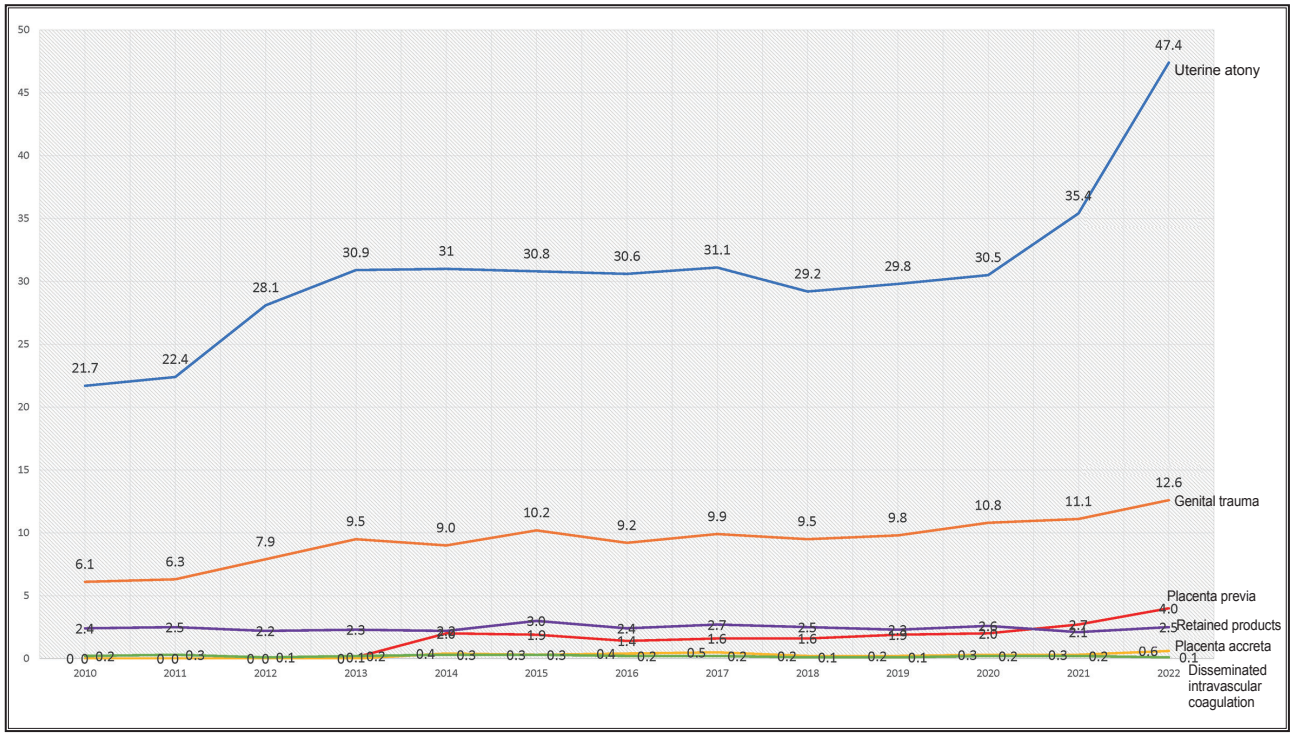

Figure 2. Causes of postpartum haemorrhage ≥500 ml and their percentages, irrespective of mode of delivery

intramuscularly or intravenously) for the prevention of PPH for all births in regions where its cost is comparable to other effective uterotonics[1-5]. Intravenous Carbetocin can result in sustained uterine contractions within 2 minutes for about 6 minutes and then rhythmic contractions for 60 minutes, whereas intramuscular Carbetocin can result in sustained uterine contractions for about 11 minutes and then rhythmic contractions for 120 minutes. Apparently, this recommendation applies only to resource-challenged and warm-climate settings, where cold chain transport and

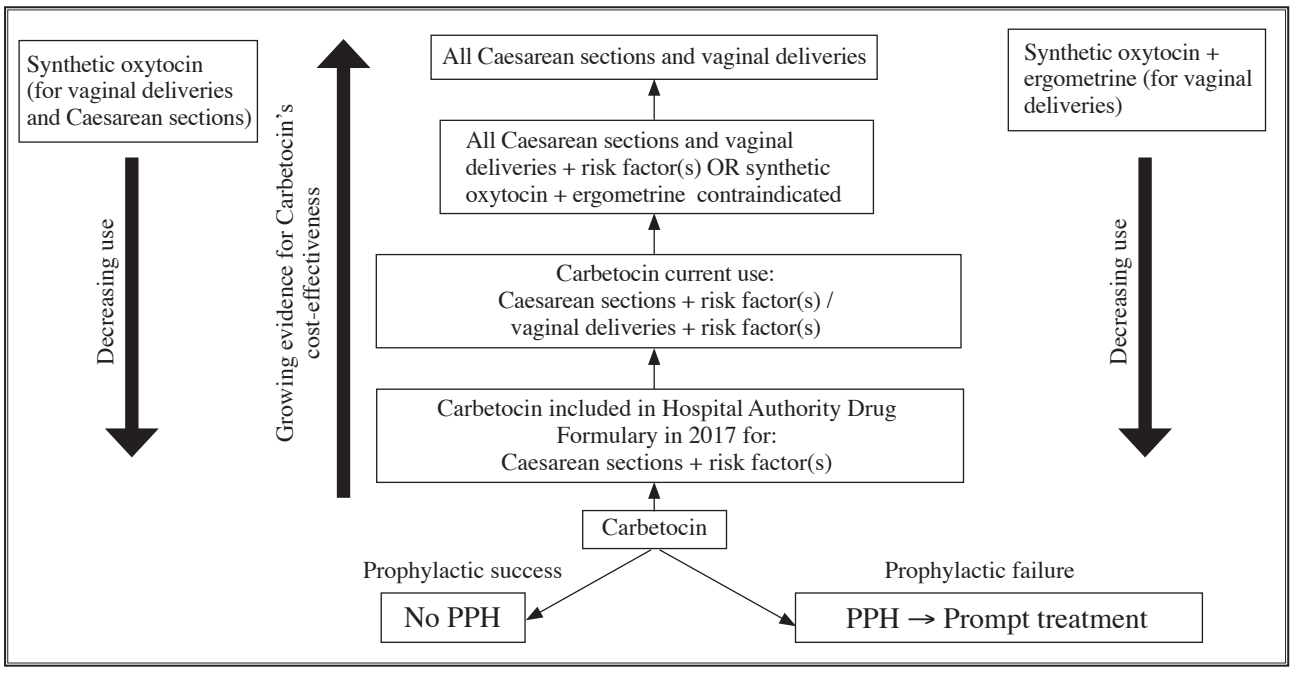

Figure 3. Uterotonics for postpartum haemorrhage (PPH) prophylaxis

storage are often not available, and the quality of oxytocin and other injectable uterotonics is compromised. However, Carbetocin is superior to Syntocinon in preventing uterine atony after Caesarean section and is non-inferior to Syntocinon for PPH prevention after vaginal deliveries. Carbetocin may not be more effective than Syntometrine, but its profile of adverse effects is much better. Thus, it is worthwhile stepping up the use of and indications for Carbetocin and then evaluating any change in the incidence of PPH. Although the cost of drugs will be increased, if the incidence of PPH is reduced, there may be significant savings in terms of reduced use of second-line measures (such as balloon tamponade and compression sutures), obstetric and midwifery manpower, and length of hospital stay (including in the intensive care unit or high dependency unit)[6].

The increasing effectiveness of uterotonic prophylaxis reduces the overall incidence of PPH. If PPH occurs despite uterotonic prophylaxis, prompt treatment should be started including medical treatment (Syntocinon, Transamin, and Carboprost), second-line measures (balloon tamponade, compression sutures, and uterine artery embolisation), and, ultimately, hysterectomy. The overall incidence of PPH has been increasing, despite the increased use of all medical and second-line treatments, which are usually started after a blood loss of ≥500 ml. Thus, the overall incidence of PPH has not been reduced. The effectiveness of treatments would have been reflected by the decreased incidences of PPH ≥1000 ml and emergency hysterectomy. However, the incidence of PPH of 1001 to 1499 ml or ≥1500 ml (defined as massive PPH) has remained at around 1% (Figure 1). The incidence of emergency hysterectomy for PPH has remained at 0.05% to 0.06% of maternity cases. Other outcome measures are related to the use of blood products (packed cells, platelet concentrate, fresh frozen plasma and cryoprecipitate) for PPH; such data are provided by the Hong Kong Red Cross Blood Transfusion Service.

Are medical treatments and second-line measures not used early enough and aggressively enough? In 2023, a group comprising representatives from obstetrics units of all eight public hospitals was formed to investigate the ever-increasing incidence of PPH and to recommend solutions. A comparative analysis of management details of PPH across the eight obstetrics units from 2014 to 2022 will be performed using big data from the Hospital Authority Clinical Data Analysis and Reporting System. It is hoped that the findings could provide insights into reducing the overall incidence of PPH.

Contributors

All authors designed the study, acquired the data, analysed the data, drafted the manuscript, and critically revised 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

All authors have disclosed no conflicts of interest.

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Data availability

All data generated or analysed during the present study are available from the corresponding author upon reasonable request.

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Prevention of maternal death: a perspective

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Although the maternal mortality rate in Hong Kong remains low over the past 43 years, there were five reported maternal deaths in 2021 to 2023. In a cross-sectional study on maternal death events in Hong Kong from 2000 to 2019, the leading causes of direct maternal death were suicide, hypertensive disorders, and obstetric haemorrhage, followed by amniotic fluid embolism, pregnancy-related infection, pulmonary embolism, and cardiac diseases, whereas the leading causes of indirect maternal deaths were stroke and cancer, followed by infection (including hepatitis B virus) and cardiac diseases.

Measures to improve maternal safety include evidence-based safety bundles, team communication and training, integrated multidisciplinary care for high-risk patients, risk-stratified levels of maternal care, and improvements in communication between providers and patients about early warning signs. A review of cases of severe maternal morbidity or near-missed cases may help prevent maternal mortality. The Hospital Authority has set up special maternity care units for monitoring of women with high-risk obstetric conditions by a multidisciplinary team of obstetricians, anaesthetists, and specialised midwives with critical care training. As most unintentional maternal deaths occurred between 6 weeks and 1 year after delivery, there is a need to extend postpartum care beyond the traditional 6-week postpartum period, especially for women with multiple medical conditions, mental health issues, or substance use disorders. Obstetricians should be aware of the causes of and preventive measures for maternal death. Every effort should be made to prevent maternal death.

Keywords: Maternal death; Maternal mortality; Obstetrics

Introduction

Maternal death is devastating for women, their families, and healthcare providers. The World Health Organization calls for urgent efforts to end preventable maternal deaths everywhere[1]. Although there are no effective interventions to prevent maternal death in some cases, there are opportunities for effective interventions in other cases[2].

In Hong Kong, the maternal mortality rate (MMR) remains low over the past 43 years[3,4]. There were no maternal deaths in 2013, 2016, 2019, and 2020, but there were five reported maternal deaths in 2021 to 2023[3]. The aim of this paper is to review the leading causes of and the current preventive measures for maternal death in Hong Kong.

Trend and causes of maternal mortality in Hong Kong

Maternal mortality is defined as the death of a woman during pregnancy or within 42 days of the termination of the pregnancy from any cause related to or aggravated by the pregnancy or its management but not from accidental causes[4]. The MMR is an important indicator of the quality of a health system. Over the past 43 years, the MMR per 100 000 live births in Hong Kong was <12, similar to that in Australia, Japan, Singapore, New Zealand, and Korea[3,5,6]. In recent 20 years, the MMR was <5, similar to that in Canada, Denmark, Greece, Sweden, and Switzerland[7]. The low MMR is multifactorial and related to the provision of good obstetric, medical, and surgical care, as well as good health conditions of pregnant women[6,8]. Hong Kong has an efficient transportation network, a universal low-cost healthcare system, free comprehensive high-quality antenatal and intrapartum care and emergency obstetric services[9,10].

Although there were no maternal deaths in 2019 and 2020, there were three, one, and one reported maternal deaths in 2021, 2022, and 2023, respectively[3]. Similarly, global maternal deaths have ceased to decline or have increased since 2015[11,12]. Such a surge in maternal mortality in high-income countries could be due to a delay in childbearing, which results in a larger proportion of pregnant women who were of advanced maternal age, used

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assisted reproductive techniques, or had complex medical conditions[11,12].

In a cross-sectional study on maternal death events from 2000 to 2019 in Hong Kong, the leading direct causes were suicide, hypertensive disorders, and obstetric haemorrhage, followed by amniotic fluid embolism, pregnancy-related infection, pulmonary embolism, and cardiac diseases, whereas the leading indirect causes were stroke and cancer, followed by infection (including hepatitis B) and cardiac diseases[9]. Deaths related to abortion or ectopic pregnancy have become uncommon[9,10].

General preventive measures

Measures to improve maternal safety include evidence-based safety bundles, team communication and training, integrated multidisciplinary care for high-risk patients, risk-stratified levels of maternal care, and improvements in communication between providers and patients about early warning signs[8]. Safety bundles for obstetric haemorrhage, severe hypertension in pregnancy, maternal sepsis, and peripartum venous thromboembolism have been developed[13,14].

The use of maternal early warning signs can facilitate communication between bedside nurses and clinicians. Early detection of abnormal vital signs enables prompt evaluation and treatment to prevent morbidity or mortality[15]. Although the same observation chart is used to monitor vital signs in both pregnancy and postpartum periods, maternal vital signs (such as blood pressure and heart rate) change after delivery[16]. For example, the 97th centile of women's temperature was slightly higher postpartum than during pregnancy (37.8°C vs 37.5°C), although there was no clinical significance.

Before being discharged home, patients can be educated about danger signs for prompt recognition of symptoms and medical evaluation[15], for example, home monitoring of blood pressure.

Reviewing cases of severe maternal morbidity may help prevent maternal mortality[17]. Severe maternal morbidity is defined as an index of 21 indicators of life-threatening events including blood transfusion, hysterectomy, heart failure, eclampsia, respiratory distress, and sepsis[18]. Its predictors are pre-pregnancy body mass index, maternal age, gestational age at delivery, mode of delivery, chorioamnionitis, and maternal diagnosis of cardiac disease, pre-eclampsia, and mental health condition[19].

In Hong Kong, the maternal near miss (or severe maternal morbidity) ratio in 2019 was 5.51 per 1000 livebirths[20]. The common causes of maternal near miss were postpartum haemorrhage (PPH) and severe complications of abortion or early pregnancy. Common organ dysfunctions were coagulation/haematological dysfunction, cardiovascular dysfunction, and uterine dysfunction. Early identification, close monitoring, and early intervention can prevent maternal mortality[20]. Since 2018, the Hospital Authority has set up special maternity care units for monitoring of women with high-risk obstetric conditions by a multidisciplinary team of obstetricians, anaesthetists, and specialised midwives with critical care training[20].

As most unintentional maternal deaths occurred between 6 weeks and 1 year after delivery, there is a need to extend postpartum care beyond the traditional 6-week postpartum period, especially for women with multiple medical conditions, mental health issues, or substance use disorders[21].

Preventive measures for specific disorders

Successful implementation of hospital-based bundles can reduce severe maternal morbidity from obstetric haemorrhage by 20.8%[22]. As delivery by Caesarean section increases the risk of haemorrhage, steps should be taken to reduce the number of unnecessary Caesarean sections[23]. Uterine atony is the most common cause of PPH. Risk factors of uterine atony include prior PPH of any aetiology, placenta previa, placental abruption, uterine rupture, multiple gestations, and prolonged labour. The Royal College of Obstetricians and Gynaecologists and the International Federation of Gynaecology and Obstetrics published guidelines on the management of PPH in 2016 and 2022, respectively[24,25]. The visual estimation of peripartum blood loss is inaccurate; clinical signs and symptoms of hypovolaemia should be included in the assessment of PPH[24]. Rarely, PPH can be occult (without heavy vaginal bleeding) in cases of haemoperitoneum, paravaginal haematoma, or rectus sheath haematoma. Early use of intravenous tranexamic acid, in addition to oxytocin, should be considered as soon as PPH is diagnosed[24,25]. A combination of pharmacological, mechanical, and surgical methods should be prepared to stop the bleeding according to the causative factor. Conservative measures should be tried first. If they fail, more invasive procedures should be performed promptly before the development of coagulation problems and organ damage. Massive transfusion protocols with early and aggressive transfusion of red blood cells,

fresh frozen plasma, platelets, and cryoprecipitate to correct coagulopathy, as well as laboratory and point-of-care testing to assess coagulopathy are useful for managing major PPH[24,25].

Screening for pre-eclampsia should be provided to pregnant women in early pregnancy. Using a combination of clinical risk markers, uterine artery pulsatility index, and placental growth factor at 11 to 14 weeks of gestation is more predictive than using clinical risk factors with or without the uterine artery pulsatility index[26,27]. For women at increased risk of pre-eclampsia, low-dose aspirin prophylaxis should be commenced before 16 weeks of gestation and until 36 weeks of gestation[27]. When pregnant women develop hypertension with a blood pressure ≥140/90 mmHg, antihypertensive therapy is recommended, particularly urgently for pregnant or postpartum women with blood pressure ≥160/110 mmHg. When pregnant women develop severe hypertension or pre-eclampsia with one or more maternal adverse conditions, inpatient care is required. Magnesium sulphate is the recommended treatment and prophylaxis for eclampsia. Timed delivery should be considered in women with pre-eclampsia from 36 weeks of gestation[27].

Risk factors for suicide include a history of psychiatric disorders, psychopharmacotherapy during pregnancy, and intimate partner violence[28]. It is important to screen pregnant women during the antenatal period and provide at-risk women interdisciplinary perinatal management and psychobehavioural interventions[29]. Screening pregnant women for drug abuse is a challenge because they are complicit in it. Screening for postnatal depression is needed[30]. The Department of Health and the Hospital Authority have implemented the Comprehensive Child Development Service programme. One of its objectives is to identify and manage mothers with postnatal depression. Postpartum psychosis is related to maternal death from suicide. Personal and family histories of bipolar disorders are a risk factor for postpartum psychosis[31]. Frequent follow-up of women with mental health disorders within 1 year of delivery may facilitate prompt recognition of those at risk.

Amniotic fluid embolism is rare but associated with a high fatality rate. Although it cannot be prevented, early diagnosis and intervention may lead to better obstetric outcomes[32]. Its diagnosis is made clinically. It should be considered when there is sudden cardiorespiratory compromise in a pregnant woman, particularly if such events are followed by a coagulopathy and there are no other probable causes. Known risk factors include Caesarean section, surgical vaginal delivery, placenta previa, placenta accreta, and abruption[32]. The immediate management is high-quality cardiopulmonary resuscitation. Ongoing management should involve a multidisciplinary team including anaesthesia, intensive care, and maternal-fetal medicine[32].

Pregnancy-related infection can be prevented by evidence-based measures during labour or leaking. Early recognition and treatment of infection are important but challenging because the normal physiological changes of pregnancy may mask the signs and symptoms of sepsis[33]. The diagnosis of sepsis should be considered in pregnant women with unexplained deteriorating status or end-organ damage in the presence of an infectious process, regardless of the presence of fever[33]. Sepsis and septic shock are medical emergencies that require immediate treatment and resuscitation[33]. When sepsis is suspected, empirical broad-spectrum antibiotics should be administered, ideally, within 1 hour. The deadliest pathogen is the invasive group A streptococcus[34]. Half of the patients infected with this pathogen may rapidly deteriorate and develop septic shock within 2 hours of the first signs of infection[34]. If the mean arterial pressure is <65 mmHg or the serum lactate level is >4 mmol/L, fluid resuscitation should be initiated rapidly[34]. Cultures (blood, urine, respiratory, and others as indicated) and early source control should be obtained as soon as possible[33,34].

Thromboembolism has become the leading cause of death in Hong Kong[10]. Pulmonary embolism in pregnancy appears to be increasing, probably related to the increase in pregnancies conceived using artificial reproductive technology, advancing maternal age, obesity, and Caesarean deliveries, as well as improved detection[10,35]. The American College of Obstetricians and Gynecologists provides guidelines on screening for thromboembolism risk, giving prophylaxis for those at increased risk of thrombotic events, and treating acute thrombotic events[36]. The use of pneumatic compression devices in at-risk women can reduce maternal deaths from post-Caesarean pulmonary embolism[8].

Cancer diagnosed during pregnancy is uncommon, but its incidence is likely to increase owing to an increasing childbearing age[37]. Common cancer in pregnancy includes breast cancer, cervical cancer, malignant melanoma, and lymphoma[37]. Gastric cancer during pregnancy is extremely rare, but its prognosis is poor. Pregnancy-associated breast cancers tend to have more aggressive features, but

overall survival remains similar[38]. Early diagnosis and a multidisciplinary approach are required[38].

Pregnancy is a known risk factor for stroke, and haemorrhagic stroke or intracranial haemorrhage accounts for more than half of all strokes arising in both pregnancy and postpartum periods[39]. Pre-existing risk factors associated with intracranial haemorrhage include increasing maternal age, chronic hypertension, new-onset pre-eclampsia, and eclampsia[39]; it is important to control acute hypertension for prevention[27,39]. In pregnant women with hypertensive disorder, ergometrine that has an adverse effect of hypertension should be avoided in the management of PPH. Maternal coagulation should be normalised by using intravenous tranexamic acid and fibrinogen replacement if needed[39]. Timely diagnosis of intracranial haemorrhage by computed tomography or magnetic resonance imaging is vital for subsequent neurosurgical management[39].

Cardiovascular disease (CVD) can pre-exist or develop in both pregnancy and postpartum periods. Examples of CVD are coronary artery disease, pulmonary hypertension, valvular disease, cardiomyopathies, arrhythmias, aortopathies, and congenital heart disease. Women with established CVD should receive multidisciplinary assessment, counselling, and optimisation before conception, as well as close monitoring and medication management during both pregnancy and postpartum periods[40]. A multidisciplinary team should include representatives from cardiology, anaesthesia, obstetrics, maternal-fetal medicine, and specialised nursing[40]. If pregnant women develop adverse pregnancy outcomes including hypertensive disorders of pregnancy, fetal growth restriction, placental abruption, preterm delivery, or gestational diabetes mellitus, their short- and long-term risks of CVD events are increased because of decreased uterine artery blood flow, vascular endothelial dysfunction, inflammation, and vasospasm[40]. So, pregnant women who develop CVD or adverse pregnancy outcomes should be counselled about their future CVD risk and the importance of sustainable healthy lifestyle modification and appropriate treatments to reduce subsequent CVD risk[41].

Severe COVID-19 infection can cause maternal death in the second or third trimester[42]. Vaccination is the best way to reduce the risk of COVID-19 infection and its morbidity and mortality. Acute hepatitis B virus infection is uncommon with universal vaccination. Acute infection in pregnant women is associated with fewer typical clinical symptoms and delayed hepatitis B surface antigen loss and seroconversion, compared with acute infection in non-pregnant women[43]. Close monitoring of liver biochemistries, prothrombin time, and changes in mental status are required. In rare cases, acute infections may progress to acute liver failure necessitating liver transplantation, which is associated with a high perinatal mortality rate[44].

Conclusion

Although the MMR in Hong Kong remains low, there were five reported maternal deaths in 2021 to 2023. Obstetricians should be aware of the causes of and preventive measures for maternal death. Every effort should be made to prevent maternal death.

Contributor

The author designed the study, acquired the data, analysed the data, drafted the manuscript, and critically revised the manuscript for important intellectual content. The author had full access to the data, contributed to the study, approved the final version for publication, and takes responsibility for its accuracy and integrity.

Conflicts of interest

As an editor of the journal, KYL was not involved in the peer review process.

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Data availability

All data generated or analysed during the present study are available from the corresponding author upon reasonable request.

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Laparoscopic myomectomy in a single centre over 10 years: a retrospective study

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Introduction: We retrospectively reviewed medical records of patients who underwent laparoscopic myomectomy in a hospital in Hong Kong over a period of 10 years.
Methods: Medical records of women who underwent laparoscopic myomectomy at the United Christian Hospital between January 2012 and December 2021 were retrospectively reviewed. Outcomes were compared between patients with fibroids >8 cm and patients with fibroids ≤8 cm and between patients with fibroids at the broad ligament or low positions and patients with fibroids at common locations.
Results: A total of 225 women aged 25 to 56 years were identified and a total of 460 fibroids were removed. Of 225 women, 47 (20.9%) had a fibroid >8 cm, whereas 17 (3.7%) had a fibroid at the broad ligament or low positions. Intraoperative complications included subcutaneous emphysema (n=3), breakage of the bag during contained power morcellation (n=1), and blood loss of 1400 ml (n=2). Postoperative complications included fever (n=4), wound infection with gaping (n=3), and pelvic haematoma (n=1). The rate of complication was 6.22%, and the rate of major complication was 2.22%. The rate of undiagnosed uterine malignancy was 0.4%. Compared with patients with fibroids ≤8 cm, patients with fibroids >8 cm had higher blood loss (161.56 vs 265.96 ml, p=0.029), operating time (145.44 vs 183.30 min, p=0.002), and intraoperative complications (1 vs 5, p<0.001). However, patients with fibroids at common locations were comparable with patients with fibroids at the broad ligament or low positions in terms of blood loss, operating time, inpatient stay, and intraoperative and postoperative complications.
Conclusions: Laparoscopic myomectomy is safe for fibroids >8 cm or at the broad ligament or low positions.

Keywords: Laparoscopic myomectomy; Leiomyoma; Morcellation; Myomectomy

Introduction

Uterine leiomyomata (fibroids) are common in women, with a cumulative incidence at the age of 45 years being 70% to 80%[1]. Depending on the location and size, the fibroids may be asymptomatic. However, up to 50% of women have symptoms such as heavy menstrual bleeding, pressure symptoms, pelvic pain, and infertility[1]. Although medical treatments may relieve some symptoms such as heavy menstrual bleeding, surgical treatment may still be needed in most women. Myomectomy is the surgery of choice for women who wish to preserve the uterus. Laparoscopic myomectomy results in a faster recovery and a lower postoperative pain score[2]. Most studies of laparoscopic myomectomy are from Europe, India or Korea.[3] We retrospectively reviewed medical records of patients who underwent laparoscopic myomectomy in a hospital in Hong Kong over a period of 10 years. The current guidelines recommend an open approach in cases with lower-segment or cervical fibroids, or fibroids >6 to 10 cm[1].

Methods

We retrospectively reviewed the medical records of women who underwent laparoscopic myomectomy at the United Christian Hospital between January 2012 and December 2021. Cases are identified by the Clinical Data Analysis and Reporting System. Data collected included demographics (age, parity, menopausal status, body mass index, previous surgery), presenting symptoms, any use of preoperative gonadotrophin-releasing hormone agonist (GnRH-a), operative details (number, size, and location of fibroids removed, location of primary trocar insertion, operating time, blood loss, any use of electromechanical morcellation, and any intraoperative complications), length of stay, postoperative complications, and the histological diagnosis of the fibroids. Intraoperative complications were defined as blood loss >1000 ml, major organ damage involving bowel, bladder, and blood vessels, laparo-conversion, the need for hysterectomy, and the presence of subcutaneous emphysema. Perioperative complications included postoperative fever, wound complication, and haematoma formation.

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All patients were assessed by the operating surgeon preoperatively. In general, patients with uterine sizes >20 weeks or with more than two fibroids >8 cm and previous surgery were advised to have the open approach. Laparoscopic myomectomies were performed under general anaesthesia with patients in the lithotomy position. The urinary bladder was catheterised using a Foley catheter. A uterine manipulator could be used to aid in the mobilisation of the uterus. An intraumbilical incision was used in all cases, except for those with uterine size >16 weeks. Supraumbilical incisions (3 cm above umbilicus) were used for primary trocar insertion. Three 5-mm ancillary lateral ports were used; the one at the left lower quadrant was extended to 12 to 15 mm for morcellation. Diluted vasopressin (20 international units diluted into 100 ml of normal saline) was injected into the myometrium to minimise bleeding. For most cases, a Harmonic scalpel was used and a 5-mm myoma screw was used to aid the enucleation of the fibroid. In earlier cases, the myometrium and serosa were closed in two to three layers of 0 Vicryl sutures with baseball sutures at the outermost layer. Later, self-retaining sutures such as V-Loc or Stratafix were used to close the myometrium, whereas the uterine serosa was closed by 0 Vicryl in baseball sutures. Vicryl sutures (2/0) were used to close the endometrial cavity if the cavity was entered. The fibroids were morcellated electromechanically via the left lower ancillary using the Supercut Sawalhe II Morcellator (Karl Storz, Tuttlingen, Germany). Since 2017, with the warning by the United States Food and Drug Administration of the possibility of upgrading the staging of leiomyosarcoma through the use of power morcellation[4], we have changed to in-bag morcellation using MetraBag (Bowa Medical, Gomaringen, Germany) or the Vaxcon safe pouch SPB10XL bag (BNR, Sejong-si, South Korea). Anti-adhesives were used in selected cases.

Outcomes were compared between patients with fibroids >8 cm and patients with fibroids ≤8 cm and between patients with fibroids at the broad ligament or low positions and patients with fibroids at common locations.

Results

A total of 225 women aged 25 to 56 years with a body mass index of 14.4 to 37 kg/m^2 were identified (Table 1). Of these, 99 (44%) were nulliparous and 126 (56%) were parous. One (0.44%) woman was menopausal. With regard to the symptoms, 96 (42.7%) women had menorrhagia, 73 (32.4%) women had pressure symptoms, 26 (11.6%) women had both, 17 (7.6%) women had pelvic pain, and 13 (5.8%) women were infertile. In addition, 182 (80.9%) women had no previous surgery, whereas

Table 1. Patient characteristics

Characteristic	Value*
Age, y	40 (25-56)
Body mass index, kg/m^2	22.5 (14.4-37)
Parity	1 (0-3)
No. of fibroids removed	1 (1-16)
Size of largest fibroid removed, cm	7 (3-16)
Blood loss, ml	100 (10-1400)
Operative time, min	140 (60-433)
Length of stay, d	3 (1-8)

* Data are presented as median (range)

31 (13.8%) women had a Caesarean section, six (2.7%) women had open surgery, and six (2.7%) women had laparoscopic surgery.

A total of 460 fibroids were removed. Of these, 206 (44.8%) were intramural, 190 (41.3%) were subserosal, 21 (4.6%) were submucosal, and 43 (9.3%) were pedunculated. With regard to fibroid location, 179 (38.9%) were anterior, 163 (35.4%) were posterior, 70 (15.2%) were fundal, and 31 (6.7%) were at the lateral uterine wall, whereas 17 (3.7%) were at the broad ligament (n=13) or low positions (n=4), which include fibroids posterior to the cervix, posteriorly lower and lateral at the internal os level and lower segment (Table 2). Supraumbilical ports were used in nine patients (Table 3). After 2017, preoperative GnRH-a was used in 16 (7.1%) patients to shrink the fibroids for more operative space. The supraumbilical port was used in one of the 16 patients.

Power morcellation was used. In 14 (6.2%) patients, manual morcellation with a cold knife through the umbilical port was used, based on the surgeon's preference or machine failure. After March 2018, in-bag morcellation was used in 106 (47.1%) patients to avoid the possibility of upgrading the staging of leiomyosarcoma through the use of power morcellation.

With regard to intraoperative complications, three patients had subcutaneous emphysema; one of them needed intensive care unit admission. One patient had breakage of the bag during contained power morcellation; the fibroid was 16×8 cm^2 and weighed 727 g, and the left lower ancillary port was extended to 4 cm for manual morcellation afterwards. Two patients had blood loss of 1400 ml; one of them required blood transfusion of one unit (Table 4). No patient had a bladder, bowel or

Table 2. Details of 17 patients with fibroids at the broad ligament or low positions

Year of operation	Size of fibroid, cm^2	Location of fibroid	Operating time, min	Blood loss, ml
2021	12×12	Lower anterior wall with left broad ligament involvement	156	50
2021	7×7	Right anterolateral wall extending to broad ligament	109	100
2019	10×10	Right broad ligament	202	200
2018	8×8	Left lateral extending to broad ligament	278	450
2018	10×9 8×8	Lower posterior down to cervix Anterior intramural	285	800
2017	4×4	Right lower broad ligament	90	100
2017	7×7	Left lower segment with submucosal component	115	100
2017	8×7	Right broad ligament	148	300
2016	10×10	Posterior subserosal just above cervix	369	200
2015	8×8	Right broad ligament	154	350
2015	5×5	Left broad ligament	269	200
2015	6×5	Right broad ligament	182	100
2015	6×6	Right broad ligament	111	50
2015	4×4	Pedunculated and arising from left lateral wall below uterine artery	81	10
2015	10×10	Left broad ligament	188	150
2014	10×5	Right broad ligament	76	10
2014	8×7	Right broad ligament	130	880

vascular injury. No laparo-conversion or hysterectomy was performed. Postoperative complications included fever (n=4), which was resolved with antibiotics; wound infection with gaping over the umbilical wound (n=2) or the left lower ancillary port wound (n=1), which was managed by re-suturing of the wounds under local anaesthesia; and a 5-cm pelvic haematoma resulting in a 4g/dL decrease in the haemoglobin level (n=1). This woman had an 8-cm right broad ligament fibroid and intraoperative blood loss of 880 ml; she was managed conservatively with intravenous antibiotics.

For the histological diagnoses, 208 (92.4%) cases were leiomyomas, 12 (5.3%) cases were adenomyomas, one (0.4%) case was a leiomyoma with bizarre nuclei, two (0.9%) cases were smooth muscle tumours of uncertain malignant potential, one (0.4%) case was an atypical leiomyoma with low risk of recurrence, and one (0.4%) case was a high-grade endometrial stromal sarcoma, for which power morcellation was not used owing to the soft consistency of the mass, which was retrieved inside an endobag through the ancillary port. The patient subsequently had a total abdominal hysterectomy.

One patient had iatrogenic parasitic fibroids. In April 2014, she underwent laparoscopic myomectomy with power morcellation for a 6×7 cm^2 anterior wall intramural fibroid at age 38 years. In 2015, she was diagnosed with gastric carcinoma and underwent distal radical gastrectomy. In 2017, she had a self-palpable pelvic mass, and computed tomography showed a 5-cm pedunculated fibroid and two masses (10 cm and 4 cm) suspicious of peritoneal metastasis. Ultrasound-guided biopsy results showed a cellular leiomyoma. In March 2018, she underwent total abdominal hysterectomy and bilateral salpingo-oophorectomy. There was a 4-cm pedunculated soft-tissue mass arising from the back of the uterus and buried in the left pararectal space and another 4-cm soft tissue mass on the top of the uterus. Histology confirmed a leiomyoma.

Compared with patients with fibroids ≤8 cm, patients with fibroids >8 cm had higher blood loss (161.56 vs 265.96 ml, p=0.029), operating time (145.44 vs 183.30 min, p=0.002), and intraoperative complications (1 vs 5, p<0.001) [Table 5]. However, patients with fibroids at common locations were comparable with patients with fibroids at the broad ligament or low positions in terms of blood loss, operating time, inpatient stay, and intraoperative and postoperative complications.

Discussion

The overall complication rate of laparoscopic

Table 3. Details of nine patients with the use of supraumbilical ports

Year of operation	Size of uterus, wk	No. of fibroids	Size of fibroids, cm	Location of fibroids	Weight of fibroids, g
2021	20	3	8	Anterior intramural	471
			6	Anterior intramural	
			4	Anterior intramural	
2019	18	2	10	Posterior intramural extending to broad ligament	450
			3	Anterior subserosal	
2018	18	4	10	Posterior subserosal down to cervix	408
			8	Anterior intramural	
			4	Fundal subserosal	
			4	Fundal subserosal	
2018	20	1	15	Fundal subserosal	571
2017*	14	1	8	Lateral subserosal	192
2017	20	1	12	Anterior intramural	502
2017	18	1	12	Right anterior	260
2016	18	3	12	Fundal subserosal	442
			2	Anterior subserosal	
			2	Anterior subserosal	
			2	Anterior subserosal	
2015	16	3	14	Lateral subserosal	650
			3	Lateral pedunculated	
			2	Left anterior subserosal	

* The patient underwent laparoscopic ovarian cystectomy at the same time for an endometriotic cyst (10×12 cm^2)

Table 4. Intraoperative and postoperative complications

Complications	No. (%) of patients
Intraoperative	
Subcutaneous emphysema	2 (0.89)
Surgical treatment for subcutaneous emphysema requiring intensive care unit admission*	1 (0.44)
Blood loss >1000 ml*	2 (0.89)
Breakage of bag with extension of wound for specimen retrieval*	1 (0.44)
Postoperative	
Fever	4 (1.78)
Wound infection	3 (1.33)
Pelvic haematoma*	1 (0.44)
Overall complications	**14 (6.22)**
Overall major complications	**5 (2.22)**

* Major complication

myomectomy in our centre over a period of 10 years was 6.22%, comparable with the 2.08% to 11% reported in other series[5]. The rate of major complications was 2.22%, compatible with the 0.31% to 3.5% reported in other series[5]. For uterine size >16 weeks, we used supraumbilical port entry or preoperative GnRH-a to maximise the surgical spaces. GnRH-a was not used in earlier cases, because it can make the plane of cleavage less obvious and lead to obliteration of the pseudocapsule[6]. In later cases, we found that the use of GnRH-a would not increase the difficulty in enucleation of fibroids laparoscopically. We thus used GnRH-a more often for cases with uterine size >16 weeks. The histological diagnosis in one (0.4%) patient was a high-grade endometrial stromal sarcoma; the rate of unexpected malignancy is similar to the 0.1% to 0.4% reported in other series[5]. Around 14% of sarcomas have ultrasound signs typical of a benign fibroid, and endometrial stromal sarcoma was most often misclassified as benign on ultrasound[7]. The incidence of an inadvertent leiomyosarcoma is <1 in 1000 for women aged <40 years[8], but up to 1 in 158 for women aged 55 to 59 years[9]. Power morcellation should be used with extreme caution in women aged >45 years. Other risk factors for leiomyosarcoma include African ethnicity, use of tamoxifen for >5 years, pelvic radiation, and hereditary predisposition to uterine cancer[6].

One (0.4%) patient had iatrogenic parasitic fibroids after uncontained power morcellation. It is likely to have

Table 5. Comparison between patients with fibroids >8 cm and patients with fibroids ≤8 cm and between patients with fibroids at common locations and patients with fibroids at broad ligament or low positions

Operative characteristic	Fibroid size		P value	Fibroid location		P value
	≤8 cm (n=178)	>8 cm (n=47)		Common locations (n=208)	Broad ligament or low positions (n=17)	
Mean blood loss, ml	161.56	265.96	0.029	178.45	243.53	0.314
Mean operating time, min	145.44	183.30	0.002	151.48	176.18	0.234
Mean inpatient stay, d	3.01	3.34	0.145	3.04	3.59	0.148
No. of intraoperative complications	1	5	<0.001	6	0	1.0
No. of postoperative complications	6	2	0.771	6	2	0.115

been caused by high-speed spinning of the morcellator with rotational cutting of the fibroid. Tissue fragments can spread all over the peritoneum, resulting in parasitic fibroids or disseminated peritoneal leiomyomatosis when tissue fragments neovascularised from the implanted sites. Such an incidence is reported to be 0.1% to 1%[10]. Contained morcellation can decrease the risk of upstaging the disease of an unexpected leiomyosarcoma from stage I (confined to the uterus) to stage III (peritoneal disease) and the risk of parasitic fibroids or disseminated peritoneal leiomyomatosis.

Blood loss and operating time were significantly higher for patients with fibroids >8 cm. Two patients had blood loss of 1400 ml; both had a uterine size >16 weeks with 12×12 cm^2 intramural fibroids weighing 502 g and 618 g, respectively. These patients underwent surgery in 2017 and were not given preoperative GnRH-a. The blood loss could have been reduced if preoperative GnRH-a had been given. Three patients had subcutaneous emphysema; the operating time in two of whom was 207 and 214 minutes. Risk factors for subcutaneous emphysema include the use of >5 cannulas, size of trocar >10 mm, procedure time >3.5 hours, repetitive movements causing disruption of tissue integrity, and consequent structural weakness[11]. Nevertheless, repetitive movements cannot be avoided during morcellation, especially for large fibroids, and the trocar size for a morcellator is 12 to 15 mm. In patients with large fibroids, the surgeon should liaise with the anaesthetist for prompt recognition and management of subcutaneous emphysema, which usually resolves spontaneously owing to the high diffusion rate of carbon dioxide.

The 17 patients with fibroids at the broad ligament or low positions were comparable with patients with fibroids at common locations in terms of blood loss, operating time, inpatient stay, and intraoperative and postoperative complications. The lack of a significant difference may be the result of the small sample size and no major intraoperative complications in the 17 patients with fibroids at the broad ligament or low positions.

Conclusion

Laparoscopic myomectomy is safe for fibroids >8 cm or fibroids at the broad ligament or low positions.

Contributors

Both authors designed the study, acquired the data, analysed the data, drafted the manuscript, and critically revised the manuscript for important intellectual content. Both 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

Both authors have disclosed no conflicts of interest.

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Data availability

All data generated or analysed during the present study are available from the corresponding author upon reasonable request.

Ethics approval

The study was approved by the Kowloon Central Cluster Research Ethics Committee (reference: KC/KE-22-0129/ER-4). The patients were treated in accordance with the tenets of the Declaration of Helsinki. The patients provided written informed consent for all treatments and procedures and for publication.

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Hysteroscopic morcellator versus hysteroscopic scissors for endometrial polypectomy: a retrospective study

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Objective: To compare hysteroscopic morcellation with hysteroscopic scissors for endometrial polypectomy in terms of operating time, the need for cervical dilatation, blood loss, complications, and completeness of removal.
Methods: Medical records of patients who underwent hysteroscopic polypectomy using either the Intrauterine BIGATTI Shaver (IBS) system or hysteroscopic scissors between January 2020 and August 2022 at the United Christian Hospital or Tseung Kwan O Hospital were retrospectively reviewed.
Results: A total of 1063 women were operated on using the IBS (n=132) or hysteroscopic scissors (n=931). More patients in the IBS group required general/spinal anaesthesia (97.7% vs 71.1%, p<0.001) and cervical dilatation (77.3% vs 30.1%, p<0.001). The operating time was shorter in the IBS group when removing one polyp (18.6 vs 20.0 min, p=0.049) and when performed by trainees independently (17.9 vs 19.8 min, p=0.007) but was longer when performed by specialists (22.7 vs 19.7 min, p<0.001). All patients in the IBS group achieved complete removal of polyps, compared with five patients with incomplete removal of polyps in the scissors group.
Conclusion: Compared with hysteroscopic scissors, hysteroscopic morcellation requires less operating time when removing one polyp and when performed by trainees independently and is more effective in achieving complete removal, but the need for cervical dilatation and anaesthesia is more for hysteroscopic morcellation.

Keywords: Endometrial neoplasms; Hysteroscopy

Introduction

Endometrial polyps are a common cause of abnormal uterine bleeding including menorrhagia, intermenstrual bleeding, and postmenopausal bleeding. Its mainstay treatment is hysteroscopic polypectomy[1], which is traditionally performed with a high-frequency electric-current resectoscope, hysteroscopic cold scissors, or forceps. However, owing to the need to retrieve tissue fragments to ensure clear visualisation, additional instrumentation and operating time may be required, which can increase the risk of fluid overload, cervical laceration, and uterine perforation.

New hysteroscopic morcellator systems such as the TruClear, Myosure, and Intrauterine BIGATTI Shaver (IBS) have been introduced and widely used[2,3]. The IBS consists of an angled telescope with an integrated 8-mm sheath and a working channel. The shaver system can be inserted via the working channel, which is connected to a suction system. Therefore, this device can simultaneously cut and extract polyps using the same working channel. It enables clear visualisation throughout the procedure, resection without high-frequency electric current, and a reduction in cervical dilatation and the risk of fluid overload[4]. It also enables retrieval of specimens because specimens are aspirated directly into the suction system during morcellation.

In a meta-analysis of six randomised controlled trials comparing hysteroscopic morcellation with electrosurgical resection, morcellation is associated with a shorter procedure and operating time[5]. Compared with electrosurgical resection, the mechanical tissue-removal system is significantly faster, uses less fluid, and achieves greater success in complete removal of polyps[6-8]. We compared a hysteroscopic morcellator with hysteroscopic scissors for removal of endometrial polyps in terms of operating time, the need for cervical dilatation, blood loss, complications, and completeness of removal.

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Materials and methods

The medical records of patients who underwent hysteroscopic polypectomy using either the IBS system or hysteroscopic scissors between January 2020 and August 2022 at the United Christian Hospital or Tseung Kwan O Hospital were retrieved from the Clinical Data Analysis and Reporting System. Women who underwent hysteroscopic polypectomy with other surgical techniques such as Bonney forceps and a resectoscope were excluded.

The choice of polypectomy technique was based on the surgeon's preference. Operations were performed by either specialists or trainees independently or under the supervision of specialists. Trainees were competent in both polypectomy techniques. The use of anaesthesia was based on the patient's preference. Diagnostic hysteroscopy was performed before surgery. The IBS system consisted of a 6° angulated hysteroscope with a 24-Fr (8-mm) outer sheath[9], whereas the hysteroscopic scissors were inserted into a 6-mm operating sheath. Sodium chloride 0.9% was used as the distension medium. Patients were usually discharged on the same day.

The data collected included patient demographics, operating time, the need for cervical dilatation, estimated blood loss, intraoperative complications, and completeness of polyp removal. The operating time was defined as the actual operating time for morcellation or resection. Hysteroscopic scissors were readily available in the operating theatre, whereas the IBS system was stored in the storage room and was more complicated to set up. The set-up time for the IBS system was the time from ordering IBS to the time of set-up completion. The set-up time for 17 cases was recorded; the mean was 11 minutes, which was deducted from the operating time. The primary outcome was the operating time; secondary outcomes were the need for cervical dilatation, estimated blood loss, any complications such as uterine perforation and completeness of polyp removal.

Statistical analysis was performed using SPSS (Windows version 29.0; IBM Corp, Armonk [NY], United States). Comparisons were made using the Chi-squared test or independent *t* test, as appropriate. A p value of <0.05 was considered statistically significant.

Results

Of 1111 women who underwent hysteroscopic polypectomy, 1063 were operated on using either the IBS (n=132) or hysteroscopic scissors (n=931). The two groups were comparable in terms of all patient characteristics, except that patients were older in the IBS group than in the scissors group (55.25 vs 52.67 years, p=0.01, Table 1).

Compared with the scissors group, the IBS group had higher proportions of patients who had ≥2 polyps (42.4% vs 27.9%, p<0.001), who had polyps at the fundus (25.0% vs 14.0%, p<0.001), who required general/spinal anaesthesia (97.7% vs 71.1%, p<0.001), and who required cervical dilatation (77.3% vs 30.1%, p<0.001). The mean size of the polyps was larger in the IBS group than in the scissors group (2.37 vs 1.19 cm, p=0.008). The blood loss was comparable in both groups (4.89 vs 4.75 ml, p=0.972).

The operating time was shorter in the IBS group than in the scissors group when removing one polyp (18.6 vs 20.0 min, p=0.049) and when performed by trainees independently (17.9 vs 19.8 min, p=0.007) but was longer when performed by specialists (22.7 vs 19.7 min, p<0.001) and when polyps were located at the fundus (26.1 vs 23.1, p=0.007) [Table 2]. The operating time was comparable between groups in terms of all sizes of polyps.

One case of uterine perforation occurred in the scissors group, but no cervical dilation was required. The perforation occurred at the time of insertion of the hysteroscope. The patient was discharged home the next day with antibiotics. One case of vaginal tear occurred in the IBS group. The patient presented with postmenopausal bleeding and was not sexually active. Intraoperatively, the cervix was dilated with the Hegar No. 8 dilator, and the IBS was used to remove a large intracavity polyp occupying two-thirds of the cavity. After completion of the procedure, active oozing was noted near the introitus of the right vagina. Haemostasis was achieved after the wound was sutured with Vicryl 2/0. Given the location of the tear at the introitus, it is postulated that the tear was caused by insertion of a relatively large speculum into a narrow vagina. One case of bleeding occurred in the IBS group. This was noted after removal of a polyp of 2×3 cm^2 and resolved with 5 units of Syntocinon and 1 g of Transamin. The total blood loss was 50 ml. All three patients made a good recovery. There were five cases of incomplete removal of polyps; all occurred in the scissors group.

Discussion

In patients with ≥3 polyps, the operating time was shortened by 12.8% in the IBS group, compared with the scissors group, although the difference was not significant. The percentage of complete removal of polyps was higher in the IBS group. Our findings are consistent with those

Table 1. Patient characteristics and intraoperative parameters between the Intrauterine BIGATTI Shaver (IBS) group and hysteroscopic scissors group

Characteristic	IBS (n=132)*	Scissors (n=931)*	p Value
Age, y	55.25±10.7	52.67±10.6	0.01
Body mass index, kg/m^2	25.19±4.4	24.91±4.7	0.518
Parity	1.38±1.1	1.34±1.2	0.739
Previous vaginal delivery			0.893
Yes	74 (56.1)	532 (57.1)	
No	58 (43.9)	399 (42.9)	
Menopausal status			0.329
Premenopausal	61 (46.2)	473 (50.8)	
Postmenopausal	71 (53.8)	458 (49.2)	
Presenting symptoms			0.163
Postmenopausal bleeding	45 (34.1)	335 (36.0)	
Menorrhagia/ prolonged menses/ IMB	47 (35.6)	332 (35.7)	
Suspicion on ultrasound	40 (30.3)	244 (26.2)	
Endometrial hyperplasia	0	19 (2.0)	
Abnormal cervical smear	0	1 (0.1)	
Anaesthesia			<0.001
No anaesthesia	3 (2.3)	268 (28.8)	
General anaesthesia / spinal anaesthesia	129 (97.7)	662 (71.1)	
Local anaesthesia	0	1 (0.1)	
Cervical dilatation			<0.001
Yes	102 (77.3)	280 (30.1)	
No	30 (22.7)	651 (69.9)	
No. of polyps			<0.001
1	76 (57.6)	671 (72.1)	
2	31 (23.5)	187 (20.1)	
≥3	25 (18.9)	73 (7.8)	
Polyp size, cm	2.37±1.0	1.19±0.8	0.008
Polyp location			0.001
Fundal	33 (25.0)	130 (14.0)	
Non-fundal	99 (75.0)	801 (86.0)	
Blood loss, ml	4.89±5.94	4.75±46.5	0.972
Intraoperative complication	2 (1.5)	1 (0.1)	0.005
Incomplete removal of polyps	0	5 (0.5)	0.005

* Data are presented as mean±standard deviation or No. (%) of patients

from studies comparing hysteroscopic morcellation and hysteroscopic resection using a resectoscope[5-8,10-16]. As the IBS can simultaneously remove and aspirate tissue fragments by suction, there is no need to retrieve tissue repeatedly with in-and-out movements. The number of insertions of the tool is lower in the morcellation arm than in the resection arm (1.0 vs 8.2, p<0.001)[17]. This benefit is especially evident when removing multiple polyps. The significantly shorter operating time for the IBS group performed by trainees implies that the IBS has a shorter learning curve and is more surgeon friendly. The mechanics of the IBS ensure complete removal of polyps. In contrast, complete resection of large or sessile polyps is more difficult using hysteroscopic scissors.

Table 2. Operating times between the Intrauterine BIGATTI Shaver (IBS) group and hysteroscopic scissors group

	Operating time, min*		p Value
	IBS (n=132)	Scissors (n=931)	
Surgeon level			
Trainee independent	17.9±12.3	19.8±11.1	0.007
Trainee under supervision	22.9±12.4	29.2±16.1	0.723
Specialist	22.7±21.5	19.7±11.4	<0.001
No. of polyps			
1	18.6±13.8	20.0±11.9	0.049
2	23.5±16.7	22.3±10.8	0.055
≥3	23.8±21.0	27.3±18.1	0.759
Size of polyps, cm			
<1	12.8±13.7	16.7±8.1	0.054
1	16.3±8.8	21.1±11.8	0.365
2	21.5±12.7	27.0±16.1	0.331
≥3	22.4±21.0	28.6±14.7	0.120
Location of polyps			
Non-fundus	18.9±12.9	20.8±12.4	0.333
Fundus	26.1±22.6	23.1±12.4	0.007

* Data are presented as mean±standard deviation; an 11-minute set-up time is deducted in the operating time of the IBS group

In the Kowloon East Cluster, all types of hysteroscopies were performed in the operating theatre; outpatient hysteroscopy was not available until October 2023. The type of anaesthesia is determined by the patient's preference after counselling with surgeons and consideration of factors including poor tolerance to speculum examination and an anticipated need for cervical dilatation and polypectomy.

More patients in the IBS group needed anaesthesia and cervical dilatation than in the scissors group. This is probably because the diameter of the outer sheath of the IBS is larger than that of hysteroscopes (8 vs 6 mm). Regional or general anaesthesia is mandatory for the hysteroscopic morcellation procedure because it requires more extensive cervical dilatation[18]. Smaller sized hysteroscopic shavers (such as TruClear) may reduce the need for cervical dilatation and anaesthesia. In October 2023, the TruClear 5C hysteroscopic shaver with a 5-mm scope and a 5.7-mm sheath was introduced to the United Christian Hospital. Further studies are warranted to compare the IBS with the TruClear in terms of efficacy and patient satisfaction.

There are limitations to the present study. The data were subject to selection bias because the study was retrospective. The choice of polypectomy technique was subject to the surgeon's preference; surgeons might preferentially choose the IBS for removal of multiple or large endometrial polyps. The logistics in the operating theatre about IBS storage affects the accuracy of calculation of the operating time in the IBS group, despite a deduction of 11 minutes. Further prospective randomised controlled trials are needed to confirm the benefits of hysteroscopic morcellation for endometrial polypectomy.

Conclusion

Compared with hysteroscopic scissors, hysteroscopic morcellation requires less operating time when removing one polyp and when performed by trainees independently and is more effective in achieving complete removal, but the need for cervical dilatation and anaesthesia is more for hysteroscopic morcellation. The IBS is more expensive and may not be readily available, so hysteroscopic scissors may still be the preferred choice.

Contributors

All authors designed the study, acquired the data, analysed the data, drafted the manuscript, and critically

revised 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

All authors have disclosed no conflicts of interest.

Funding/support

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Data availability

All data generated or analysed during the present study are available from the corresponding author upon reasonable request.

Ethics approval

The study was approved by the Kowloon Central / Kowloon East Cluster Research Ethics Committee (reference: KC/KE-22-0222/ER-1). The patients were treated in accordance with the tenets of the Declaration of Helsinki. The patients provided written informed consent for all treatments and procedures and for publication.

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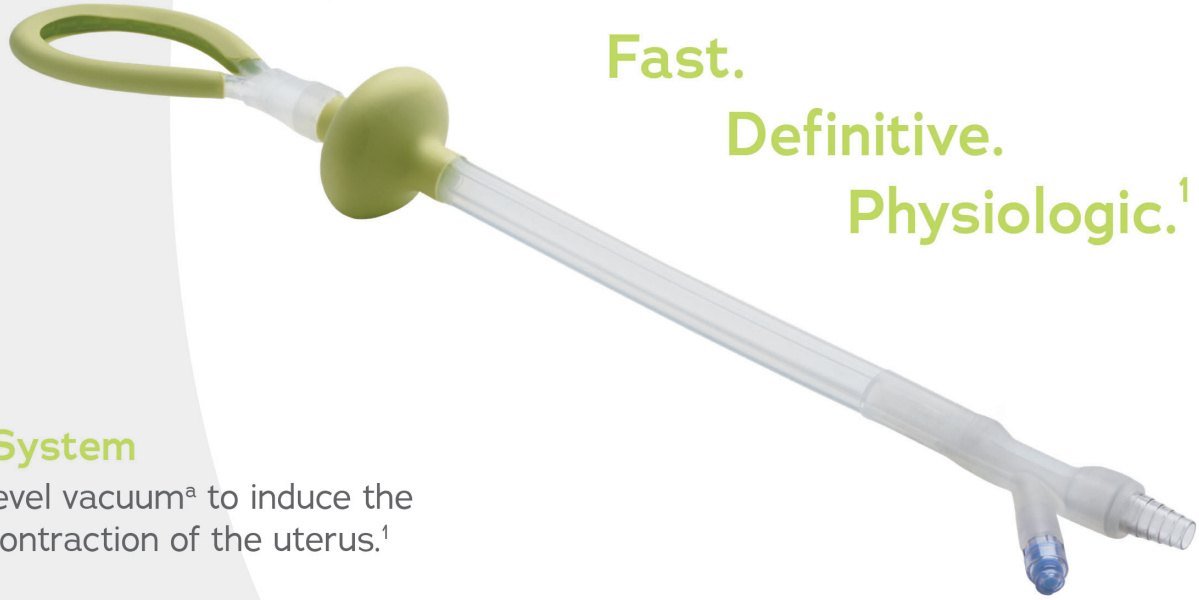

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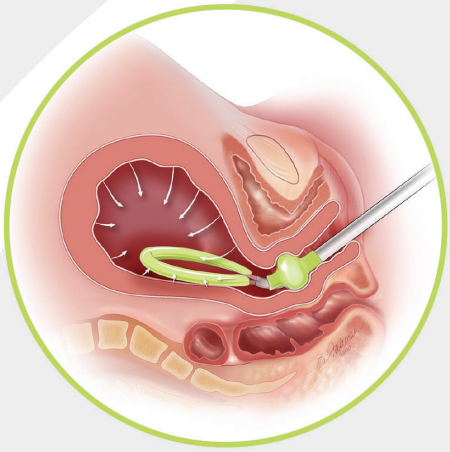
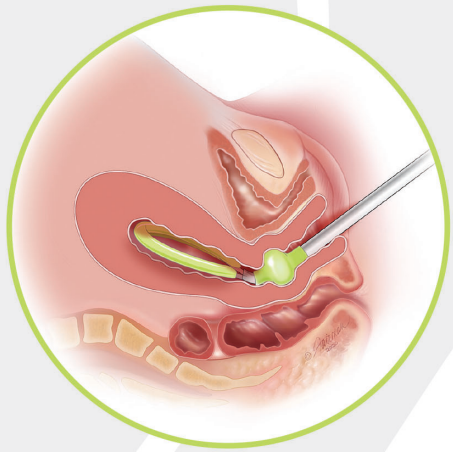


Low-level vacuum[a] induces collapse of the atonic postpartum uterus[1]



Contraction of the myometrium provides physiologic control of bleeding[1]

[a] 80 mm Hg +/- 10 mm Hg. The maximum vacuum pressure is 90 mm Hg. Do not increase the vacuum pressure higher than 90 mm Hg or tissue trauma may occur.

[b] Primary effectiveness was the control of postpartum hemorrhage, defined as the avoidance of non-surgical, second-line, or surgical intervention to control uterine hemorrhage.[1]

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