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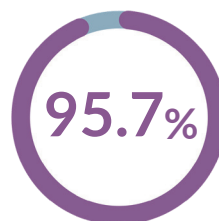
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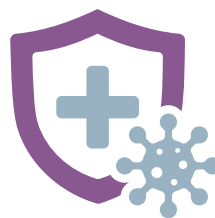
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GYNAECOLOGY, OBSTETRICS & MIDWIFERY

July 2026, Volume 26, Number 1

EDITORIAL

- Fertility and planned parenthood: key elements of global reproductive health** 5
Raymond Hang Wun LI, Mona Wai Cheung LAM

OBSTETRICS

- Pregnancy and perinatal outcomes of ethnic minorities in a public hospital in Hong Kong** 7
Joie Chor Kiu LAI, Jack Chun Kit WONG, Man Wai Catherine HUNG, Wai Lam LAU
- Propress versus Prostin E2 for cervical ripening and induction of labour** 13
Eunice Joanna WONG, Wai Hang CHUNG
- Venous thromboembolism in pregnancy among Chinese women in a regional hospital in Hong Kong: a 20-year cross-sectional case-control study** 19
Kwok Ting Jennifer LI, Linus Lin Tai LEE, Lin Wai CHAN
- Continuous glucose monitoring versus blood glucose self-monitoring in patients with gestational diabetes mellitus managed via diet control: a prospective pilot study** 24
Chin Wai LEUNG, Wai Yin LEUNG, Chun Kit WONG, Wai Kuen YUNG, Maria Wai Han MAK, Ka Fai LEE, Wai Lam LAU, Wing Cheong LEUNG

GYNAECOLOGY

- Enhanced recovery after surgery for hysterectomy for pelvic organ prolapse** 31
Pui Ying WONG, Chun Hung YU
- Intravenous iron isomaltoside versus oral iron supplementation in women with postpartum anaemia** 37
Yin Yu LI, Chun Kit WONG, Wai Lam LAU
- Accuracy of ultrasound in detecting retained products of gestation after second-trimester medical termination of pregnancy** 42
Hau Ting Janet HO, Kai Yeung TSE
- Self-management versus nurse-led care of vaginal pessary in patients with pelvic organ prolapse** 48
Joan Yuk Sheung FAN, Sze Man WONG, Joyce KING, Hiu Yi FUNG, Ka Wing LAU, Willy Cecilia CHEON

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Editorial

Fertility and planned parenthood: key elements of global reproductive health

A decline in birth rates has been a global crisis in recent years. This problem has been particularly exaggerated in Hong Kong, which has hovered at the bottom of global fertility rankings. We witnessed a historic low in the total fertility rate of 0.70 in 2022. The rate rebounded to 0.84 in 2024, partly reflecting a post-pandemic recovery and the Dragon Year effect, before falling again to 0.73 in 2025. To tackle this issue, our government has introduced various measures including expansion of publicly funded assisted reproductive services, tax deduction for expenses related to assisted reproductive treatment, and extension of pre-pregnancy care services.

For many years in the past, assisted reproductive services in public hospitals were overloaded, resulting in lengthy waiting time of 1 to 2 years and couples missing their best chance in their reproductive lifespan. The Hospital Authority has progressively increased the annual number of publicly funded in vitro fertilisation (IVF) cycles since 2024, from 1100 cycles to 1800 cycles by 2028-2029. With the declining fertility intention in the recent years, waiting times have substantially shortened, and are no longer a limiting factor for most couples in need. In terms of treatment cost, patients only need to pay for the nominal medical attendance fees and the laboratory costs, which generally amount to approximately HK\$20000 or less per IVF cycle on average. Medications for IVF have been reclassified from self-financed items to special drugs, for which patients only have to pay the standard fee. The government has also introduced a tax deduction scheme for expenses related to assisted reproductive treatment since the taxation year of 2024-2025. All these aimed at reducing the out-of-pocket payment by infertile couples and hence relieving their financial burden from seeking treatment.

Despite all these measures to reduce financial and service barriers, an important challenge remains: the continuing trend of delayed marriage and childbearing. The median age at first marriage has risen to 32.9 years for men and 31.3 years for women, whereas the median age of women at first childbirth has increased to 33.1 years. Given the age-related decline in fertility, some couples may not present for fertility assessment until they have already reached an advanced reproductive age. Furthermore,

publicly funded assisted reproductive treatment is currently available only to women below 40 years of age who have no living child; therefore, the window for eligible couples to seek assistance is relatively narrow. There is a growing need to strengthen public awareness of reproductive ageing and the importance of timely fertility assessment and intervention. Early investigation and treatment remain crucial to achieve the best outcomes before the peak of the biological fertility window is missed.

The government has restructured maternal and child health and family planning services, shifting the focus from traditional family planning to pre-pregnancy preparation. Couples contemplating pregnancy are encouraged to receive health assessment and counselling, together with physical check-ups and relevant investigations with an aim to achieve safer pregnancy and parenthood.

Healthcare professionals who work in public and private sectors, as well as The Family Planning Association of Hong Kong, are joining hands in enhancing the relevant services. Yet, the above medical measures mainly attempt to lower barriers in accessing fertility services and to improve obstetric and maternal-neonatal outcomes. As obstetricians and gynaecologists, we have to recognise our limitations that enhanced services cannot offset the root causes of unwillingness to conceive arising from challenges in the economy, childcare, housing, career development, and so on. We shall enhance our efforts in public education and endeavour to maintain a supportive network of fertility and pre-conception care services. We cannot bear the entire weight of reversing population decline alone.

In recent years, we observed a weakened emphasis on fertility regulation and a common misconception that provision of contraception and abortion contradicts our intention to support fertility. This reflects a lack of understanding that sexual and reproductive health adopts a life-course approach, supporting individuals and couples to achieve their reproductive goals, whether the goal involves preventing unintended pregnancies or planning for childbearing at the most appropriate time. Fertility services, maternity care, and family planning provisions constitute a holistic sexual and reproductive healthcare

model, fulfilling the needs and safeguarding the wellbeing of all women and families in their reproductive life course. We cannot imagine women falling pregnant at all times during their reproductive life, and they do have the need for safe and effective contraception, and occasionally abortion, at times outside their planned parenthood.

Supporting reproductive wellbeing is not about just increasing childbirths; it is about enabling people to build the lives and families they aspire to have. We, as obstetricians and gynaecologists, should cherish our special and unique roles in this regard and take a global view in championing not only the rights and dignity but also the joy, intimacy, and pleasure in the context of relationships and family building.

Raymond Hang Wun LI

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Pregnancy and perinatal outcomes of ethnic minorities in a public hospital in Hong Kong

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Objectives: To evaluate the pregnancy and perinatal outcomes of ethnic minorities at a public hospital in Hong Kong.

Methods: Medical records of non-Chinese women (excluding Western women) with singleton pregnancies who delivered at ≥ 24 weeks of gestation between 1 January 2023 and 31 December 2023 at Kwong Wah Hospital were retrieved, as were those of Chinese women matched for parity and maternal age with the closest delivery dates. The two groups were compared using multivariable regression analyses to determine independent factors associated with adverse outcomes.

Results: In total, 218 ethnic minority women and 218 matched Chinese women were included. Non-Chinese women were more often unbooked, had higher body mass index, had lower haemoglobin levels at booking visits, and were more likely to have chronic hypertension and preeclampsia. However, non-Chinese women had lower intrapartum blood loss and a lower incidence of postpartum haemorrhage but higher rates of overall and emergency lower-segment Caesarean section. Non-Chinese women were more likely to undergo Caesarean section due to cephalopelvic disproportion, lack of progress, failed induction, or hypertensive disorders. A trend towards higher neonatal intensive care unit admission rates was observed among non-Chinese women.

Conclusion: Compared with Chinese women, non-Chinese women had higher rates of unbooked antenatal care, preeclampsia, and Caesarean section, as well as lower haemoglobin levels at booking visits, but lower rates of postpartum haemorrhage. Early recognition and close monitoring of risk factors are particularly important for ethnic minority women.

Keywords: Ethnic and racial minorities; Pre-eclampsia; Pregnancy outcome

Introduction

According to the 2021 Census of Hong Kong, there were approximately 600 000 non-Chinese ethnic minorities, representing 8.4% of the population¹. Most were Filipinos and Indonesians, followed by South Asians (including Indians, Pakistanis, and Nepalese). Their monthly incomes were mostly <\$10 000, which was lower than the median for the overall working population in Hong Kong¹, reflecting lower socioeconomic status. These ethnic minorities also had lower age-adjusted educational attainment than the general population in Hong Kong¹. Although Western people are also classified as ethnic minorities in Hong Kong, they generally have higher incomes and educational attainment and experience fewer language barriers and less discrimination¹. Therefore, Western peoples are commonly excluded from the definition of ethnic minorities when studying health inequities^{1,2}. The World Health Organization framework on social determinants of health highlights health inequalities that arise from the conditions in which individuals are born, grow, live, work, and age³.

In Hong Kong, ethnic minority women often face structural disadvantages, including language barriers, unstable employment, and lower educational attainment, which limit their access to timely and appropriate healthcare. These challenges and disparities in health-seeking behaviour may lead to adverse obstetric outcomes.

Racial and ethnic disparities lead to differences in maternal morbidity and mortality. For instance, in United Kingdom, Black and Asian women have threefold and twofold higher risks of maternal mortality, respectively, compared with White women⁴. Black women also have a higher risk of pregnancy complications, including pregnancy-induced hypertension, asthma, placental disorders, gestational diabetes mellitus, and maternal mortality⁵. However, the associations between maternal

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ethnicity and neonatal morbidity remain inconsistent. Some studies have revealed lower morbidity among neonates born to Black women, whereas others have shown the higher crude frequency of adverse perinatal outcomes in term neonates born to Black women⁶⁻⁸. In Hong Kong, data regarding the association between pregnancy and perinatal outcomes among ethnic minorities are limited.

The obstetric unit of Kwong Wah Hospital, Hong Kong, recorded 2463 live births in 2023⁹. Approximately 8.9% of these deliveries were among non-Chinese women. This study aimed to evaluate the pregnancy and perinatal outcomes of ethnic minorities at Kwong Wah Hospital. We hypothesised that ethnic minority mothers and neonates would have a higher risk of adverse outcomes compared with Chinese women¹.

Methods

Medical records of non-Chinese women (excluding Western women) with singleton pregnancies who delivered at ≥ 24 weeks of gestation between 1 January 2023 and 31 December 2023 at Kwong Wah Hospital were retrieved, as were those of matched Chinese women with the closest delivery dates. Matching was based on parity (nulliparous or multiparous) and maternal age (≥ 35 years or < 35 years). This matched cohort design aimed to adjust for confounders such as maternal age and parity, which are known to influence obstetric outcomes.

Data collected included maternal characteristics (age, prepregnancy body mass index [BMI], booking status, parity, and pre-existing comorbidities), obstetric complications (hypertensive disease in pregnancy, gestational diabetes mellitus, antepartum haemorrhage, antepartum anaemia, postpartum haemorrhage [PPH], and maternal mortality), delivery details (type of labour, mode of delivery, gestational week, and birth weight), and composite adverse perinatal outcomes (low birth weight, low Apgar score of < 4 at 1 minute or < 7 at 5 minutes, neonatal intensive care unit admission, shoulder dystocia, and perinatal mortality). Unbooked antenatal care was defined as the absence of antenatal visits in public hospitals before admission for delivery. Data on prepregnancy BMI, haemoglobin level at the first visit, antenatal anaemia, and gestational diabetes mellitus were unavailable for unbooked women. Antenatal anaemia was defined as a haemoglobin level < 11 g/dL at the booking visit. Causes of anaemia were classified as haemoglobinopathy, iron deficiency, or unclassified. Alpha thalassaemia, beta thalassaemia, or

haemoglobin E were diagnosed by haemoglobin pattern. Iron deficiency was evidenced by a low ferritin level; unclassified cases were defined by normal haemoglobin pattern and ferritin levels. Obstetric service provision was identical for Chinese and non-Chinese women. Information and counselling sheets were available in Chinese and English. For women unable to read either language, on-site or telephone interpretation services were provided.

Statistical analysis was performed using SPSS (Windows version 27.0; IBM Corp, Armonk [NY], United States). Comparisons between the two groups were made using the Chi-squared test or Fisher's exact test for categorical variables and Student's *t* test or Mann-Whitney *U* test for continuous variables. Multivariable regression analyses were performed to determine independent factors associated with adverse outcomes. All tests were two-sided, and *p* values < 0.05 were considered statistically significant.

Results

In total, 218 ethnic minority women and 218 matched Chinese women were included. Non-Chinese women were more often unbooked (7.8% vs 0.5%, $p < 0.001$), had higher BMI (24.8 vs 22.5 kg/m², $p < 0.001$), had lower haemoglobin levels at booking visits (11.8 vs 12.1 g/dL, $p = 0.038$), and were more likely to have chronic hypertension (1.8% vs 0%, $p = 0.018$) and preeclampsia (7.8% vs 2.8%, $p = 0.018$) [Table 1]. However, non-Chinese women had lower intrapartum blood loss (255.96 vs 299.31 mL, $p = 0.006$) and a lower incidence of PPH (6.9% vs 14.2%, $p = 0.013$) but higher rates of overall (39.9% vs 23.9%, $p < 0.001$) and emergency (28.9% vs 12.4%, $p < 0.001$) lower-segment Caesarean section (Table 1).

Among women who underwent Caesarean section, non-Chinese women were more likely to undergo the procedure due to cephalopelvic disproportion (CPD) or lack of progress (21.8% vs 5.7%, $p < 0.001$), failed induction (20.7% vs 13.2%, $p = 0.023$), and hypertensive disorders (8.0% vs 0%, $p = 0.015$) [Table 2]. Regarding neonatal outcomes, a trend towards higher neonatal intensive care unit admission rates was observed among non-Chinese women (6.0% vs 2.3%, $p = 0.054$, Table 3).

In logistic and linear regression models, non-Chinese women were more likely to have preeclampsia (adjusted odds ratio [aOR]=3.35, $p = 0.026$) and lower-segment Caesarean section (aOR=2.36, $p < 0.001$) but were less likely to have PPH (aOR=0.29, $p = 0.002$) [Table 4].

Table 1. Maternal antepartum and intrapartum characteristics between non-Chinese and Chinese women.

Characteristic	Non-Chinese (n=218)	Chinese (n=218)	p Value
Age, y	31.3±5.6	32.0±4.7	0.142
Prepregnancy body mass index, kg/m ²	24.8±4.8	22.5±4.2	<0.001
Parity			1
Nulliparous	87 (39.9)	87 (39.9)	
Multiparous	131 (60.1)	131 (60.1)	
Previous Caesarean section	37 (17.0)	26 (11.9)	0.134
Ethnicity			
Chinese	-	218 (100)	
Indonesian	32 (14.7)	-	
Indian	19 (8.7)	-	
Pakistani	57 (26.1)	-	
Nepalese	48 (22.0)	-	
Vietnamese	28 (12.8)	-	
African	4 (1.8)	-	
Thai	8 (3.7)	-	
Filipino	20 (9.2)	-	
Yemeni	1 (0.5)	-	
Bangladeshi	1 (0.5)	-	
Unbooked antenatal care	17 (7.8)	1 (0.5)	<0.001
History of substance abuse	2 (0.9)	5 (2.3)	0.449
History of mental illness	7 (3.2)	4 (1.8)	0.36
Haemoglobin level at booking visit, g/dL	11.8±1.3	12.1±1.2	0.038
Antenatal anaemia (haemoglobin <11 g/dL)	40/201 (19.9)	39/217 (18.0)	0.615
Cause of antenatal anaemia			
Alpha trait	1 (2.5)	5 (12.8)	0.217
Beta trait	3 (7.5)	9 (23.1)	0.104
Haemoglobin E	0	1 (2.6)	1
Iron deficiency	35 (87.5)	24 (61.5)	0.062
Unclassified	1 (2.5)	0	0.481
Gestational diabetes mellitus	49/201 (24.4)	35/217 (16.1)	0.089
Chronic hypertension	4 (1.8)	0	0.018
Preeclampsia	17 (7.8)	6 (2.8)	0.018
Placenta previa	3 (1.4)	1 (0.5)	0.623
Antepartum haemorrhage	1 (0.5)	2 (0.9)	1
Maternal mortality	0	0	-
Gestation, wk	38.28±1.9	38.42±1.94	0.44
Preterm delivery			
<37 weeks	23 (10.6)	16 (7.3)	0.24
<34 weeks	3 (1.4)	4 (1.8)	1
Blood loss, mL	255.96±156.98	299.31±168.18	0.006
Postpartum haemorrhage ≥500 mL	15 (6.9)	31 (14.2)	0.013
Cause of postpartum haemorrhage			
Atony	6 (40.0)	10 (32.2)	0.308
Wound bleeding	7 (46.7)	14 (45.2)	0.117
Retained products of gestation	0	3 (9.7)	0.248
Coagulopathy	1 (6.7)	0	1
Atony and wound bleeding	1 (6.7)	4 (12.9)	0.372
Induction of labour	82 (37.6)	79 (36.2)	0.77
Mode of delivery			
Normal vaginal delivery	126 (57.8)	151 (69.3)	0.006
Lower-segment Caesarean section	87 (39.9)	52 (23.9)	<0.001
Emergency	63 (72.4)	27 (51.9)	<0.001
Elective	24 (27.6)	25 (48.1)	0.879
Classical Caesarean section	0	1 (0.5)	1
Instrumental delivery	5 (2.3)	13 (6.0)	0.054
Vacuum extraction	5 (100)	10 (76.9)	0.189
Forceps delivery	0	3 (23.1)	0.248
Assisted breech delivery	0	1 (0.5)	1
3rd or 4th degree perineal tear	0	2 (0.9)	0.499
Birth weight, g	3133.83±477.54	3126.15±488.62	0.868

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

Table 2. Indications for Caesarean section in non-Chinese and Chinese women.

Indication	Non-Chinese (n=87)*	Chinese (n=53)*	p Value
Cephalopelvic disproportion or lack of progress	19 (21.8)	3 (5.7)	<0.001
Failed induction	18 (20.7)	7 (13.2)	0.023
Placenta previa or accreta spectrum	1 (1.1)	2 (3.8)	1
Intrauterine growth restriction	1 (1.1)	1 (1.9)	1
Previous Caesarean section	32 (36.8)	23 (43.4)	0.194
Hypertensive disorder of pregnancy	7 (8.0)	0	0.015
Malpresentation	3 (3.4)	9 (17.0)	0.079
Non-reassuring fetal status or suboptimal cardiotocogram	5 (5.7)	7 (13.2)	0.558
Unfavourable cervix	1 (1.1)	1 (1.9)	1

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

Table 3. Neonatal outcomes in non-Chinese and Chinese women.

Neonatal outcome	Non-Chinese (n=218)*	Chinese (n=218)*	p Value
Baby born before arrival	2 (0.9)	0	0.499
Composite adverse perinatal outcome	27 (12.4)	22 (10.1)	0.484
Low birth weight (≤ 2400 g)	14 (6.4)	14 (6.4)	1
Low Apgar score			
<4 at 1 minute	0	2 (0.9)	0.499
<7 at 5 minutes	0	1 (0.5)	1
Shoulder dystocia	0	0	-
Neonatal intensive care unit admission	13 (6.0)	5 (2.3)	0.054
Neonatal mortality	0	0	-

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

Table 4. Adverse outcomes in non-Chinese women.

Adverse outcome	Adjusted odds ratio or β (95% confidence interval)	p Value
Postpartum haemorrhage ≥ 500 mL	0.29 (0.14-0.64)	0.002
Preeclampsia	3.35 (1.15-9.73)	0.026
Lower-segment Caesarean section	2.36 (1.42-3.94)	<0.001
Low birth weight	19.5 (-48.07 to 87.04)	0.571
Neonatal intensive care unit admission	2.68 (0.75-9.6)	0.130

Discussion

In England, South Asian women have higher risks of stillbirth, preterm birth, and fetal growth restriction, compared with White women¹⁰. However, differences

in fetal and other antenatal complications have not been widely investigated. In a cohort of 13 165 singleton pregnancies in the United Kingdom, South Asian women had a twofold higher prevalence of placental dysfunction—including hypertensive disorders, preterm birth, small-for-gestational-age infants, and stillbirth—compared with White women¹¹. Nevertheless, South Asian women constituted only 17% of the study population.

The present study demonstrated that maternal ethnicity had a significant effect on adverse obstetric outcomes, which may be related to cultural differences and language barriers¹². Ethnic minority women were more likely to have irregular or absent antenatal visits. Nevertheless, the present study did not address potential bias regarding quality of care, discrimination against ethnic minority women, or accessibility to healthcare.

Preeclampsia affects 2% to 5% of pregnant women and is a leading cause of maternal and perinatal morbidity

and mortality¹³. The prevalence of preeclampsia is lower in Chinese women (1.4%-2.8%) than in Indian women (4.6%) or Filipino women (5.6%)¹⁴⁻¹⁶. This finding suggests a genetic susceptibility to preeclampsia among South Asians. Moreover, lifestyle and diet contribute to differences among ethnic groups¹⁷. Low-dose aspirin prophylaxis is widely used in early pregnancy, optimally initiated before 16 weeks of gestation, for prevention of preeclampsia¹⁸. However, given the higher proportion of unbooked antenatal cases among ethnic minority women, risk factors may not be addressed in a timely manner, and aspirin prophylaxis may not be prescribed for preeclampsia prevention. Differences in health-seeking behaviour may also lead to reduced awareness of warning symptoms of potential obstetric complications and less frequent blood pressure monitoring at home.

Non-Chinese women were more likely to deliver by Caesarean section secondary to CPD. There is a lack of universal diagnostic criteria for CPD in current guidelines; however, in our practice, CPD is commonly diagnosed when labour progress is slow or arrested despite adequate uterine contractions, in the presence of a contracted pelvis and substantial caput and moulding on pelvic examination. Pelvimetry studies have shown that many women in Thailand and the Philippines have rounder pelvic inlets and often oval-shaped, narrower pelvises, features compatible with the anthropoid pelvic type, which predisposes to obstructed labour¹⁸. Further studies are warranted to evaluate the association between pelvimetry findings among ethnic minority women and obstructed labour, given that a contracted pelvis remains a key cause of obstructed labour leading to Caesarean delivery.

Non-Chinese women were significantly less likely to experience PPH than Chinese women. PPH is a leading cause of maternal mortality and morbidity. The most common cause of PPH is uterine atony, followed by perineal wound bleeding, retained placenta, and coagulation abnormalities. There may be a genetic predisposition to PPH¹⁹. Differences in thrombogenicity and bleeding tendency exist among ethnic groups. East Asians have a higher risk of bleeding events than Western populations; genetic differences affecting platelet function and responsiveness have been suggested as possible explanations^{20,21}.

The main limitations of the present study were its retrospective design and the small sample size from a single obstetric centre in Hong Kong. The 1:1 matched

case-control design restricted the sample size and may have reduced the power to detect rare outcomes. Further studies with larger sample sizes could allow subgroup analyses of different ethnicities. There may have been recall bias regarding prepregnancy BMI. Some women with antenatal anaemia may have had undiagnosed alpha thalassaemia traits, given that alpha genotyping was not performed for all participants; haemoglobin pattern analysis alone cannot detect concealed alpha thalassaemia.

Public hospitals in Hong Kong have implemented measures to facilitate access to healthcare for ethnic minorities, including interpretation services and patient information leaflets in multiple languages²². Nevertheless, further efforts should be made to raise health awareness among ethnic minority women, particularly regarding preeclampsia prevention through antenatal screening and aspirin prophylaxis. Regular antenatal care is crucial to ensure safe delivery. Equity in maternal healthcare will require targeted policy initiatives that foster healthier and more effective health-seeking behaviour.

Conclusion

Compared with Chinese women, non-Chinese women had higher rates of unbooked antenatal care, preeclampsia, and Caesarean section, as well as lower haemoglobin levels at booking visits, but lower rates of PPH. Early recognition and close monitoring of risk factors are particularly important for ethnic minority women.

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

As an editor of the journal, WLL was not involved in the peer review process. Other 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 on reasonable request.

Ethics approval

This study was approved by the Central Institutional

Review Board of Hospital Authority (reference: CIRB-2024-587-5). The patients were treated in accordance with the tenets of the Declaration of Helsinki. The requirement for patient consent was waived by the Board due to the retrospective nature of the research.

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Propess versus Prostin E2 for cervical ripening and induction of labour

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Objectives: To compare the efficacy and safety of Propess and Prostin E2 for induction of labour (IOL) in women with an unfavourable cervix.

Methods: Medical records of women who had a singleton pregnancy at ≥ 37 weeks' gestation with cephalic presentation and had undergone IOL using Prostin E2 (between January and December 2017) or Propess (between April 2018 and March 2019) were retrospectively reviewed. The primary outcome was the duration from IOL to delivery. Secondary outcomes included delivery within 24 hours of IOL, mode of delivery, additional use of Prostin E2 or Propess, oxytocin use, failed IOL, maternal complications, and neonatal outcomes.

Results: In total, 471 women who received Prostin E2 ($n=245$) or Propess ($n=226$) were included in the analysis. Compared with the Prostin E2 group, the Propess group had a shorter IOL-to-delivery interval (1686 vs 2073 minutes, $p=0.02$), particularly among multiparous women (1078 vs 1568 minutes, $p=0.009$). Additionally, the Propess group had a higher rate of delivery within 24 hours of IOL overall (51.3% vs 37.6%, $p=0.003$), as well as among nulliparous (42.0% vs 29.7%, $p=0.017$) and multiparous (77.2% vs 56.2%, $p<0.001$) women. However, the Propess group had a higher rate of failed IOL overall (11.1% vs 5.7%, $p=0.035$), particularly among nulliparous women (14.2% vs 7.0%, $p=0.003$). Notably, the rate of failed IOL among multiparous women was lower in the Propess group (1.8% vs 2.7%, $p<0.001$). The Propess group had a higher rate of uterine hyperstimulation overall (23.5% vs 7.8%, $p<0.001$) and in both nulliparous (23.7% vs 5.8%, $p<0.001$) and multiparous (22.8% vs 12.3%, $p<0.001$) women. However, there was no significant increase in the incidence of non-reassuring fetal heart rate requiring Caesarean delivery. The Propess group even had lower rates of Caesarean section among multiparous women (7.0% vs 13.7%, $p<0.001$) and neonatal intensive care unit admission (0.9% vs 4.9%, $p=0.01$).

Conclusion: Propess appears to be a safe and effective alternative to Prostin E2 for IOL in women with an unfavourable cervix and intact membranes. Its use was associated with a shorter IOL-to-delivery interval and a higher rate of vaginal delivery within 24 hours of IOL. Although Propess was associated with a higher incidence of uterine hyperstimulation, there was no significant increase in the incidence of non-reassuring fetal heart rate requiring Caesarean delivery or neonatal morbidity.

Keywords: Delivery, obstetric; Dinoprostone; Labor, induced

Introduction

Induction of labour (IOL) is performed to stimulate uterine contractions to achieve vaginal delivery. According to a territory-wide audit conducted in 2014 by the Hong Kong College of Obstetricians and Gynaecologists, 23.4% of parturient women required IOL¹. Common indications include prelabour rupture of membranes (36.8%), social reasons (21.6%), post-term pregnancy (14.4%), gestational diabetes (9.3%), and hypertensive disorders (4.6%). Decisions should be based on both maternal and fetal well-being; careful monitoring is required to detect potential risks such as uterine hyperstimulation.

Dinoprostone, also known as prostaglandin E2, stimulates the myometrium to produce uterine contractions and softens the cervix, facilitating cervical dilatation and effacement. Preparations of dinoprostone include vaginal suppository (Prostin E2), vaginal insert (Propess), and

cervical gel (Prepidil). Prostin E2 is designed to dissolve and release 3 mg of dinoprostone over several hours and can be repeated to achieve delivery. Propess provides controlled release of dinoprostone over 24 hours at a rate of 0.3 mg/h; it requires only a single application, thus reducing the number of vaginal examinations, invasiveness, and patient discomfort. The vaginal insert can be removed to terminate its effect if uterine hyperstimulation or tachysystole occurs. Patient acceptability is higher for the vaginal insert than for the vaginal suppository².

Uterine hyperstimulation includes uterine tachysystole (≥ 5 contractions in 10 minutes for at least 20 minutes) and uterine hypertonia (≥ 1 contraction lasting

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>2 minutes). It may be associated with fetal heart rate abnormalities that can lead to fetal hypoxia, including deceleration, tachycardia, and decreased fetal heart rate variability, requiring emergency Caesarean section. Other complications include failed IOL and uterine scar rupture.

The National Institute for Health and Care Excellence recommends further research into the effects of different dinoprostone preparations on outcomes and cost-effectiveness^{3,4}. Findings remain inconsistent. The vaginal insert is reportedly associated with longer intervals to vaginal delivery and lower rates of active labour⁵, as well as higher rates of vaginal delivery and reduced oxytocin use⁶, compared with other preparations. However, another study showed no clinically significant differences between the vaginal insert and alternatives⁷. These contrasting findings may reflect heterogeneity in indications, parity, pre-induction cervical status, primary outcomes, and administration regimens. Therefore, we aimed to compare the efficacy and safety of Propess and Prostin E2 for IOL in women with an unfavourable cervix.

Methods

In March 2018, our hospital replaced Prostin E2 with Propess for cervical ripening and IOL. Medical records of women who had a singleton pregnancy at ≥ 37 weeks' gestation with cephalic presentation and had undergone IOL using Prostin E2 (between January and December 2017) or Propess (between April 2018 and March 2019) were retrospectively reviewed. Women were excluded if they were at <37 weeks of gestation, had multiple pregnancies, a uterine scar, rupture of membranes, contraindications to vaginal delivery, evidence of spontaneous labour, or Bishop score ≥ 6 .

Prostin E2, containing 3 mg of dinoprostone, was administered to the posterior vaginal fornix. If cervical ripening (Bishop score ≥ 6) or rupture of membranes occurred, no further Prostin E2 was administered, regardless of cervical status. If the cervix remained unfavourable (Bishop score ≤ 5), a second dose was inserted after 24 hours. If labour was not induced on the first or second day, the procedure was repeated on the third day. In the presence of painful uterine contractions, Prostin E2 administration was delayed until contractions subsided. If uterine hyperstimulation or non-reassuring fetal heart rate occurred, Prostin E2 was removed.

Propess, a 10 mg dinoprostone controlled-release pessary, was administered to the posterior vaginal fornix. If cervical ripening or rupture of membranes occurred, no

further Propess was administered. However, if the cervix remained unfavourable after 24 hours, a second dose of Propess was inserted. Propess was removed in the presence of uterine tachysystole, uterine hypertonus, uterine hyperstimulation, successful cervical ripening, or rupture of membranes; it was also removed 24 hours after insertion. Although there is no consensus regarding a second dose⁸, our departmental protocol considers it justified, given the aim of increasing vaginal delivery rates and decreasing Caesarean section rates, with subsequent reductions in neonatal and maternal morbidity.

Fetal heart rate was monitored using cardiotocography before administration, 2 hours after administration, and at the onset of contractions. If successful cervical ripening occurred, oxytocin infusion could be initiated approximately 30 minutes after removal of Prostin E2 or Propess.

The primary outcome was the duration from IOL to delivery. Secondary outcomes included delivery within 24 hours of IOL, mode of delivery (normal vaginal delivery, operative delivery, and Caesarean section), additional use of Prostin E2 or Propess, oxytocin use, failed IOL (failure to reach the active phase of labour, defined as cervical dilatation ≥ 3 cm in the presence of regular uterine contractions after ≥ 12 hours of oxytocin use with artificial rupture of membranes), maternal complications (uterine hyperstimulation, primary postpartum haemorrhage, and uterine rupture), and neonatal well-being (admission to the neonatal intensive care unit and Apgar score at 5 minutes).

The mean number of deliveries in our unit was approximately 3000 per year between 2016 and 2018. Assuming a 5% confidence limit, 80% power, and a 20% IOL rate, 176 women were required in each arm⁹. Statistical analysis was performed using SPSS (version 26.0; IBM, Chicago [IL], United States). The two groups were compared using Student's *t* test for normally distributed continuous variables, the Mann-Whitney *U* test for skewed data, and the Chi-squared test or Fisher's exact test for dichotomous variables. A *p* value of <0.05 was considered statistically significant.

Results

In total, 471 women who received Prostin E2 (*n*=245) or Propess (*n*=226) were included in the analysis (Table 1). Of the 245 women who received Prostin E2, 190 (77.6%) received a single dose, 38 (15.5%) received two doses, and 17 (6.9%) received three doses. Of the 226 women who received Propess, 195 (86.3%) received a

Table 1. Maternal and neonatal characteristics and outcomes among women receiving Prostin E2 or Propress for induction of labour (IOL).

Variable	Prostin E2 (n=245)*	Propress (n=226)*	p Value
Age, y	31.3±5.1	31.5±5.3	0.738
Parity			0.747
Nulliparous	172 (70.2)	169 (74.8)	
Multiparous	73 (29.8)	57 (25.2)	
Gestational age, weeks + days	39+4	39+5	0.278
Bishop score at IOL	3.3±1.2	3.1±1.4	0.095
Indication for IOL			0.297
Post-term	124 (50.6)	100 (44.3)	
Diabetic disorder	61 (24.9)	69 (30.5)	
Hypertensive disorder/proteinuria	15 (6.1)	24 (10.6)	
Fetal growth restriction/oligohydramnios	35 (14.3)	25 (11.1)	
Others	10 (4.1)	8 (3.5)	
No. of doses			-
1	190 (77.6)	195 (86.3)	
2	38 (15.5)	31 (13.7)	
3	17 (6.9)	0	
IOL-to-delivery interval, min	2073±1360	1686±1177	0.020
Delivered within 24 h	92 (37.6)	116 (51.3)	0.003
Mode of delivery			0.872
Normal vaginal delivery	153 (62.4)	128 (56.6)	
Instrumental delivery	34 (13.9)	31 (13.7)	
Caesarean section	58 (23.7)	67 (29.7)	
Failed IOL	14 (5.7)	25 (11.1)	0.035
Oxytocin use	116 (47.3)	108 (47.8)	0.924
Uterine hyperstimulation, tachysystole, or hypertonus	19 (7.8)	53 (23.5)	<0.001
Terbutaline use	0	0	-
Estimated blood loss, mL	268±195	276±232	0.686
Estimated blood loss ≥1000 mL	2 (0.8)	5 (2.2)	0.211
Neonatal weight, g	3219.6±552.0	3206.8±460.8	0.075
Apgar score at 5 min			-
7-10	245 (100)	226 (100)	
<7	0	0	
Admission to neonatal intensive care unit	12 (4.9)	2 (0.9)	0.010

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

single dose and 31 (13.7%) received two doses. The two groups were comparable in terms of maternal age, parity, gestational age, and Bishop score.

Compared with the Prostin E2 group, the Propress group had a shorter IOL-to-delivery interval (1686 vs 2073 minutes, $p=0.02$), particularly among multiparous women (1078 vs 1568 minutes, $p=0.009$); the difference

among nulliparous women was not significant (1897 vs 2324 minutes, $p=0.093$) [Table 2]. Additionally, the Propress group had a higher rate of delivery within 24 hours of IOL overall (51.3% vs 37.6%, $p=0.003$) and in both nulliparous (42.0% vs 29.7%, $p=0.017$) and multiparous (77.2% vs 56.2%, $p<0.001$) women. However, the Propress group had a higher rate of failed IOL overall (11.1% vs 5.7%, $p=0.035$), particularly among nulliparous women (14.2%

Table 2. Subgroup analysis of maternal outcomes among nulliparous and multiparous women.

Outcome	Nulliparous (n=341)			Multiparous (n=130)		
	Prostin E2 (n=172)*	Propess (n=169)*	p Value	Prostin E2 (n=73)*	Propess (n=57)*	p Value
Induction-to-delivery duration, min	2324±1361	1897±1230	0.093	1568±1209	1078±724	0.009
Delivered within 24 h	51 (29.7)	71 (42.0)	0.017	41 (56.2)	44 (77.2)	<0.001
Caesarean section	48 (27.9)	63 (37.3)	0.065	10 (13.7)	4 (7.0)	<0.001
Failed induction of labour	12 (7.0)	24 (14.2)	0.003	2 (2.7)	1 (1.8)	<0.001
Uterine hyperstimulation, tachysystole, or hypertonus	10 (5.8)	40 (23.7)	<0.001	9 (12.3)	13 (22.8)	<0.001

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

vs 7.0%, $p=0.003$). Notably, the rate of failed IOL among multiparous women was lower in the Propess group (1.8% vs 2.7%, $p<0.001$).

The Propess group had a higher rate of uterine hyperstimulation overall (23.5% vs 7.8%, $p<0.001$) and in both nulliparous (23.7% vs 5.8%, $p<0.001$) and multiparous (22.8% vs 12.3%, $p<0.001$) women. No women required terbutaline for management of uterine hyperstimulation. In the Propess group, among the 53 women with uterine hyperstimulation, eight required emergency Caesarean section for fetal distress ($n=1$), abruptio placentae ($n=1$), and other indications ($n=6$) including failed IOL, cephalopelvic disproportion, lack of labour progress, and prolonged latent phase. In the Prostin E2 group, among the 19 women with uterine hyperstimulation, none required Caesarean section or tocolysis; all achieved vaginal delivery, except for one who required low forceps delivery for fetal distress. Among multiparous women, the Propess group had a lower rate of Caesarean section (7.0% vs 13.7%, $p<0.001$).

All neonates had an Apgar score ≥ 7 at 5 minutes. The Propess group had a lower rate of neonatal intensive care unit admission (0.9% vs 4.9%, $p=0.01$).

Discussion

Most women required only one dose of Prostin E2 or Propess to achieve successful IOL. Propess use was associated with a shorter IOL-to-delivery interval and a higher rate of delivery within 24 hours of IOL among both nulliparous and multiparous women, consistent with the findings of a previous study¹⁰. Nonetheless, Propess was associated with a higher rate of failed IOL among nulliparous women. In contrast, one study revealed longer intervals to vaginal delivery after Propess use⁵, although

another showed no significant differences between the vaginal insert and other vaginal or cervical prostaglandin preparations regarding delivery within 24 hours⁷. These contrasting findings may reflect heterogeneity in parity, pre-induction cervical status, primary outcomes, and administration regimens. The National Institute for Health and Care Excellence recommends administering one cycle of Prostin E2, with a second dose given 6 hours after the first if labour is not started. In contrast, our departmental protocol previously recommended administering a single dose of Prostin E2 over a 24-hour period. Differences in regimens may explain the discrepancy.

Propess use was associated with a higher rate of uterine hyperstimulation, consistent with findings in a systematic review and meta-analysis⁶. Uterine hyperstimulation occurred in 23.5% of women who received Propess, which is higher than the previously reported 5% to 15%. The difference may be related to the careful monitoring of fetal cardiotocography and maternal uterine hyperstimulation in the present study. No women required terbutaline. There was no significant increase in the rate of Caesarean section due to non-reassuring fetal heart rate secondary to uterine hyperstimulation. Moreover, there was no significant difference in Apgar score at 5 minutes between groups, and neonates in the Propess group had a lower rate of neonatal intensive care unit admission. This finding may be attributed to the shorter IOL-to-delivery interval associated with Propess. Prolonged active labour is known to increase neonatal intensive care unit admission due to higher risks of fetal distress, low Apgar score, and infection^{11,12}.

Approximately 11.1% to 14.3% of women underwent IOL for fetal growth restriction. Although

Propess was associated with more uterine hyperstimulation, there was no significant difference in Apgar score at 5 minutes or neonatal intensive care unit admission. This finding indicates that Propess is safe for fetuses with growth restriction.

The present study had several limitations. Its retrospective design permits assessment of correlation rather than causation. There may have been variability in the interpretation, documentation, and management of events and outcomes, given the involvement of multiple healthcare professionals in antepartum and intrapartum care. Further studies are needed to confirm our findings and to determine the optimal dosages and administration regimens of Prostin E2 and Propess, as well as the efficacy and safety of other dinoprostone preparations.

Conclusion

Propess appears to be a safe and effective alternative to Prostin E2 for IOL in women with an unfavourable cervix and intact membranes. Its use was associated with a shorter IOL-to-delivery interval and a higher rate of vaginal delivery within 24 hours of IOL. Although Propess was associated with a higher incidence of uterine hyperstimulation, there was no significant increase in the incidence of non-reassuring fetal heart rate requiring Caesarean delivery. The use of Propess was also associated with a higher rate of failed IOL; however, the overall Caesarean section rate was not significantly increased.

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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 on reasonable request.

Ethics approval

This study was approved by the Kowloon Central / Kowloon East Cluster Research Ethics Committee (reference: KC/KE-21-0052/ER-3). The patients were treated in accordance with the tenets of the Declaration of Helsinki. The requirement for patient consent was waived by the Committee due to the retrospective nature of the research.

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Venous thromboembolism in pregnancy among Chinese women in a regional hospital in Hong Kong: a 20-year cross-sectional case-control study

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Objective: To determine the prevalence and risk factors of venous thromboembolism (VTE) in pregnancy among Chinese women in a regional hospital.

Methods: Medical records of ethnic Chinese residents who delivered at ≥ 24 weeks of gestation or earlier with active resuscitation between January 2004 and December 2023 at Pamela Youde Nethersole Eastern Hospital were retrospectively reviewed. To determine VTE prevalence, cases occurring during pregnancy and the postpartum period (up to 6 weeks after delivery) were identified. Cases were excluded if associated with prophylactic anticoagulant use, negative imaging findings, or a history of VTE without active disease during pregnancy. To determine risk factors for VTE, cases were compared with matched controls (within 3 days of the delivery date) at a 1:5 ratio.

Results: In total, 22 cases of VTE occurring in the antepartum ($n=15$) or postpartum ($n=7$) period were identified. The prevalence was 0.5 per 1000 deliveries. Of the 22 cases, 16 were deep vein thrombosis, three were pulmonary embolism, and three involved both conditions. The most common symptom was limb swelling or pain ($n=17$). Two patients experienced cardiac arrest and underwent perimortem Caesarean section and subsequent mechanical thrombectomy by interventional radiologists. The remaining 20 patients with VTE received low-molecular-weight heparin treatment. The case and control groups were comparable, except that the case group had higher rates of substance use (13.6% vs 0.9%, $p=0.001$), varicose veins (4.5% vs 0%, $p=0.025$), preterm delivery (27.3% vs 7.3%, $p=0.005$), Caesarean section (63.6% vs 36.4%, $p=0.018$), blood transfusion (22.7% vs 2.7%, $p<0.001$), and stillbirth or neonatal death (4.5% vs 0%, $p=0.025$).

Conclusion: The prevalence of VTE in pregnancy among Chinese women at a regional hospital in Hong Kong was 0.5 per 1000 deliveries, lower than that reported internationally. The risks and benefits of pharmaco-prophylaxis should be weighed on an individual basis.

Keywords: East Asian people; Pregnancy complications, cardiovascular; Venous thromboembolism

Introduction

Pregnancy is a hypercoagulable state that develops as a protective mechanism to reduce haemorrhage at childbirth. It increases the risk of venous thromboembolism (VTE), which is a leading cause of maternal death¹. Prophylactic measures include compression stockings, early mobilisation, and pharmaco-prophylaxis; however, the latter is associated with bleeding risks. Risk-benefit analysis depends on the presumed prevalence of bleeding risks in different populations. The prevalences of VTE in pregnancy have been reported to be 1.4 per 1000 worldwide and 1.3 per 1000 in the Chinese population^{2,3}. In Hong Kong, the reported prevalence ranges from 0.4 to 1.88 per 1000 in tertiary units^{4,5}. We aimed to determine the prevalence and risk factors of VTE in pregnancy among Chinese women in a regional hospital across 20 years.

delivered at ≥ 24 weeks of gestation or earlier with active resuscitation between January 2004 and December 2023 at Pamela Youde Nethersole Eastern Hospital were retrospectively reviewed. Non-local residents were excluded, as were women with ectopic pregnancies, miscarriages, or abortions before fetal viability. During the study period, no standardised protocols or routine pharmaco-prophylaxis for VTE prevention in pregnancy were implemented. Clinicians provided prophylactic measures on an individual basis; non-pharmacological measures, such as compression stockings, were commonly prescribed for prolonged hospitalisation.

Data retrieved included anticoagulant use, limb ultrasound scans, computed tomography thoracic scans,

Methods

Medical records of ethnic Chinese residents who

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ventilation-perfusion scans, and diagnoses of VTE and related conditions between 280 days (40 weeks) before delivery and 100 days (~14 weeks) after delivery. There were no missing data.

To determine VTE prevalence, cases occurring during pregnancy and the postpartum period (up to 6 weeks after delivery⁶) were identified. Cases were excluded if associated with prophylactic anticoagulant use, negative imaging findings, or a history of VTE without active disease during pregnancy.

To determine risk factors for VTE, cases were compared with matched controls (within 3 days of the delivery date) at a 1:5 ratio to maximise statistical power⁷. The two groups were compared using the Chi-squared test for categorical variables and the *t* test for continuous variables. Statistical analysis was performed using SPSS (Windows version 29.0; IBM Corp, Armonk [NY], United States).

Results

Among 43 626 deliveries by Chinese residents, 22 cases of VTE occurring in the antepartum (n=15) or postpartum (n=7) period were identified. The prevalence was 0.5 per 1000 deliveries. Of the 22 cases, 16 were deep vein thrombosis, three were pulmonary embolism, and three involved both conditions (Table 1). The most common symptom was limb swelling or pain (n=17). Two patients experienced cardiac arrest and underwent perimortem Caesarean section and subsequent mechanical thrombectomy by interventional radiologists. The remaining 20 patients with VTE received low-molecular-weight heparin treatment. Only 11 of the 22 patients underwent thrombophilia screening after the VTE event.

The case and control groups were comparable, except that the case group had higher rates of substance use (13.6% vs 0.9%, $p=0.001$), varicose veins (4.5% vs 0%, $p=0.025$), preterm delivery (27.3% vs 7.3%, $p=0.005$), Caesarean section (63.6% vs 36.4%, $p=0.018$), blood transfusion (22.7% vs 2.7%, $p<0.001$), and stillbirth or neonatal death (4.5% vs 0%, $p=0.025$) [Table 2]. Indications for Caesarean section included placenta previa, maternal disease, twin pregnancy, failed induction after preterm prelabour rupture of membranes, and cardiac arrest.

Discussion

The incidence of VTE is lower among Asians, including ethnic Chinese⁸⁻¹⁰. The prevalence of VTE in pregnancy in our hospital between 2004 and 2023 was 0.50

Table 1. Characteristics of the 22 cases of venous thromboembolism (VTE).

Characteristic	Value*
Occurrence	
Antepartum	15 (68.2)
>1st trimester	5 (33.3)
>2nd trimester	2 (13.3)
>3rd trimester	8 (53.3)
Postpartum	7 (31.8)
Presentation	
Limb swelling or pain	17 (77.3)
Cardiac arrest	2 (9.1)
Others (shortness of breath, stroke, tachycardia)	3 (13.6)
VTE type	
Deep vein thrombosis	16 (72.7)
Pulmonary embolism	3 (13.6)
Both	3 (13.6)
Site of deep vein thrombosis	n=19
Left lower limb	12 (63.2)
Right lower limb	5 (26.3)
Bilateral lower limbs	1 (5.3)
Left upper limb	1 (5.3)
Site of pulmonary embolism	n=6
Right main artery	1 (16.7)
Right lobar artery	2 (33.3)
Right segmental artery	1 (16.7)
Bilateral main arteries	1 (16.7)
Bilateral lobar arteries	1 (16.7)
Treatment	
Low-molecular-weight heparin	20 (90.9)
Thrombectomy	2 (9.1)
Thrombophilia screening	11 (50.0)

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

per 1000 deliveries (31.8% occurred postpartum), which was lower than the 1.3 per 1000 deliveries reported in the Chinese population³ and the 1.88 per 1000 deliveries (75% occurred postpartum) reported between 1998 and 2000 at Prince of Wales Hospital, Hong Kong⁴. It was similar to the 0.4 per 1000 deliveries (one case occurred postpartum) reported between 2004 and 2016 at Queen Mary Hospital, Hong Kong⁵. Regional differences within Hong Kong may reflect variations in socioeconomic status; higher socioeconomic status is associated with a decreased risk of VTE^{3,11}.

Table 2. Risk factors for venous thromboembolism (VTE).

Variable	VTE*		p Value
	Yes (n=22)	No (n=110)	
Age, y	33.5±4.3	33.2±4.4	-
Nulliparous	12 (54.5)	50 (45.5)	0.435
Parity			0.183
0	12 (54.5)	50 (45.5)	
1	7 (31.8)	49 (44.5)	
2	2 (9.1)	10 (9.1)	
3	0	0	
4	0	1 (0.9)	
≥5	1 (4.5)	0	-
Body mass index, kg/m ²	22.87±3.38	22.57±3.49	0.711
Smoker	4 (18.2)	8 (7.3)	0.104
Substance use	3 (13.6)	1 (0.9)	0.001
Comorbidities	1 (4.5)	0	0.025
Cardiac	0	1 (0.9)	0.653
Antiphospholipid syndrome	0	0	-
Systemic lupus erythematosus	0	1 (0.9)	0.653
History of VTE	0	0	-
Varicose veins	1 (4.5)	0	0.025
Others (sickle cell disease, urinary tract infection, irritable bowel disease)	0	0	-
Gestational diabetes	3 (13.6)	25 (22.7)	0.341
Pre-existing diabetes	1 (4.5)	1 (0.9)	0.202
Chronic hypertension	0	0	-
Pregnancy-induced hypertension	0	1 (0.9)	0.653
Pre-eclampsia	1 (4.5)	3 (2.7)	0.650
Intrauterine growth restriction	0	1 (0.9)	0.653
Artificial reproductive technology	2 (9.1)	5 (4.5)	0.385
Gestation at delivery, wk	38.1±2.1	38.9±1.5	0.056
Preterm delivery	6 (27.3)	8 (7.3)	0.005
Multiple pregnancies	2 (9.1)	3 (2.7)	0.153
Mode of delivery			0.048
Vaginal	6 (27.3)	60 (54.5)	
Instrumental	2 (9.1)	10 (9.1)	
Caesarean	14 (63.6)	40 (36.4)	0.018
Blood loss, mL	995±1974	311±210	0.119
Blood transfusion	5 (22.7)	3 (2.7)	<0.001
Manual removal of placenta	0	2 (1.8)	0.524
Stillbirth/neonatal death	1 (4.5)	0	0.025

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

In the present study, inclusion of only local residents may have minimised cases with incomplete information or loss to follow-up. Most women remain in hospital for 3 to 5 days postpartum; most postpartum VTE occurs within the first week¹² and should therefore have been captured, particularly 90% of admissions are under Hospital Authority¹³. Although routine pharmaco-prophylaxis was not provided, mechanical measures (eg, compression stockings) for prolonged hospitalisations were offered on an individual basis. Routine pharmaco-prophylaxis during antepartum and postpartum periods has become more common in recent years¹⁴. Additionally, increased awareness of VTE, along with early mobilisation and adequate hydration postpartum, may reduce the incidence of postpartum VTE¹⁵. This trend of improved obstetric practice has also been observed internationally¹.

Although the bleeding risks associated with pharmaco-prophylaxis are not negligible^{14,16}, VTE in pregnancy remains uncommon in Hong Kong; thus, the risks and benefits of pharmaco-prophylaxis should be carefully weighed on an individual basis⁸.

Most VTEs were of deep vein thrombosis; symptoms predominantly affected the left lower limb, consistent with venous stasis in pregnancy¹⁷. Most cases occurred in the third trimester and postpartum periods. Maternal cardiac arrest is an uncommon presentation of pulmonary embolism in pregnancy¹⁸. Thrombectomy is preferred over thrombolysis, which may cause life-threatening haemorrhage¹⁹, highlighting the importance of the availability of interventional radiologists in obstetric units²⁰. Among patients with VTE, the prevalence of thrombophilia is high²¹. However, thrombophilia screening does not alter management and is therefore no longer advocated²².

Most patients with VTE had no known risk factors or comorbidities; only one had varicose veins. Risk factors for VTE include maternal age >35 years and obesity; lower prevalences of these risk factors may contribute to a reduced risk of VTE²³. Clinicians should maintain a high index of suspicion in pregnant women with symptoms suggestive of VTE, given that pregnancy itself is a risk factor^{22,24}. Substance abuse is associated with VTE in pregnancy, underscoring the importance of prevention and intervention efforts²⁵. Most postpartum VTEs are preceded by Caesarean section²³. Anticoagulation increases the risk of bleeding at delivery and postpartum, as well as the likelihood of blood transfusion, which itself is a risk factor for VTE²³.

The present study had several limitations. Considering the retrospective study design, patients' medical histories may not have been comprehensively recorded, and risk factors may have been underreported, potentially limiting the reliability of the results.

Conclusion

The prevalence of VTE in pregnancy among Chinese women at a regional hospital in Hong Kong was 0.5 per 1000 deliveries, lower than that reported internationally. The risks and benefits of pharmaco-prophylaxis should be weighed on an individual basis.

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.

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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 on reasonable request.

Ethics approval

This study was approved by the Hospital Authority Central Institutional Review Board (reference: CIRB-2024-601-5). The patients were treated in accordance with the tenets of the Declaration of Helsinki. The requirement for patient consent was waived by the Committee due to the retrospective nature of the research.

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Continuous glucose monitoring versus blood glucose self-monitoring in patients with gestational diabetes mellitus managed via diet control: a prospective pilot study

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Objectives: To compare agreement between continuous glucose monitoring (CGM) and self-monitoring of blood glucose and to assess the acceptance and satisfaction of CGM among Chinese women with gestational diabetes mellitus (GDM) in Hong Kong.

Methods: Chinese women diagnosed with GDM after 28 weeks of gestation and managed via diet control were recruited at Kwong Wah Hospital, Hong Kong, between January 2025 and June 2025. Participants were instructed to wear a CGM sensor for 15 days. Additionally, they were instructed to perform self-monitoring of blood glucose via finger prick four times per day on 4 separate days. Fasting glucose levels in the morning and postprandial glucose levels 2 hours after each meal were recorded. Participants' knowledge, application, usage, and acceptance and satisfaction of CGM were assessed using an 18-item questionnaire. Satisfaction with CGM was also assessed using the validated Chinese version of the Glucose Monitoring Satisfaction Survey.

Results: In total, 50 Chinese women diagnosed with GDM after 28 weeks of gestation and managed via diet control were included in the analysis. A total of 711 paired measurements were collected. Agreement between CGM and self-monitoring measurements was good, with a concordance correlation coefficient of 0.836. The linear-mixed-effects-based Bland-Altman plot showed a mean bias between the two methods of 0.069 mmol/L. Deming regression yielded an intercept of -0.046 and a slope of 1.017, indicating minimal fixed and proportional bias. The mixed-effects model showed a precision ratio of 0.626. The mean absolute relative difference was 8.04%. Parkes error grid analysis indicated that 100% of paired measurements were in zone A or B. Overall, 83.7% were satisfied with CGM and accepted its use for glucose monitoring during pregnancy when the sensor was provided free of charge.

Conclusion: Agreement between CGM and self-monitoring measurements was good in Chinese women with GDM. CGM can be used as an adjunct to self-monitoring with finger pricks, which should be performed at least weekly to cross-check agreement. Most women with GDM accepted and were satisfied with CGM.

Keywords: Blood glucose self-monitoring; Continuous glucose monitoring; Diabetes, gestational; Patient satisfaction

Introduction

Gestational diabetes mellitus (GDM) is characterised by glucose intolerance resulting in hyperglycaemia during pregnancy¹. Women with GDM have a higher risk of adverse maternal and fetal outcomes, including macrosomia, preterm delivery, neonatal respiratory distress syndrome, neonatal intensive care unit admission, and

Caesarean section². The prevalence of GDM has increased over the past few decades³, owing to rising rates of obesity and advanced maternal age^{4,5}. In Hong Kong, the incidence

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of GDM in 2016 was 32.5%, based on the World Health Organization 1999 criteria⁶. At Kwong Wah Hospital, Hong Kong, the incidences in 2025 were 24.1% for GDM, 4.2% for diabetes mellitus in pregnancy, and 1.9% for pre-existing diabetes mellitus.

Glycaemic control is essential to reduce GDM-related complications. Self-monitoring of blood glucose via finger prick is the standard practice in Hong Kong⁷. The National Institute for Health and Care Excellence guidelines recommend daily testing of fasting and postprandial blood glucose levels in pregnant women with GDM managed via diet control⁸. However, finger pricking can cause discomfort and inconvenience, potentially reducing adherence to glycaemic monitoring⁹.

Continuous glucose monitoring (CGM) is a small device attached to the upper arm to enable real-time or intermittent monitoring of glucose concentrations in interstitial fluid¹⁰, thereby facilitating reductions in mean glycated haemoglobin levels, mean glucose levels, and hypoglycaemic episodes, while improving patient satisfaction, among patients with types 1 and 2 diabetes mellitus^{11–13}. Satisfaction with CGM is high among Western pregnant women^{14,15}. A physiological time lag in glucose diffusion from the vascular space to the interstitial fluid can lead to discrepancies between self-monitored and CGM glucose levels¹⁶. Physiological changes during pregnancy, such as increased blood volume and hormonal fluctuations, may affect sensor performance. This study aimed to compare agreement between CGM and self-monitoring of blood glucose and to assess the acceptance and satisfaction of CGM among Chinese women with GDM in Hong Kong.

Methods

Chinese women diagnosed with GDM after 28 weeks of gestation and managed via diet control were recruited at Kwong Wah Hospital, Hong Kong, between January 2025 and June 2025. Women with pre-existing diabetes mellitus, diabetes mellitus in pregnancy, GDM requiring insulin therapy, or in the first or second trimester of gestation were excluded. The cut-off of 28 weeks of gestation corresponds to the timing of the oral glucose tolerance test (for fasting and 2-hour plasma glucose levels), which is selectively offered to women with identified risk factors; most GDM cases are identified at this time. GDM was defined as a fasting plasma glucose level of ≥ 5.1 mmol/L or a 2-hour plasma glucose level of ≥ 8.5 mmol/L¹⁷.

Participants were instructed to wear a CGM sensor (FreeStyle Libre 2 Plus; Abbott Diabetes Care, United

Kingdom) for 15 days. Additionally, they were instructed to perform self-monitoring of blood glucose via finger prick (Contour Plus Elite blood glucose meter and Contour Plus blood glucose test strips; Ascensia Diabetes Care Holdings AG, Switzerland) four times per day on 4 separate days. Fasting glucose levels in the morning and postprandial glucose levels 2 hours after each meal were recorded.

Participants' knowledge, application, usage, and acceptance and satisfaction of CGM were assessed using an 18-item questionnaire. Items were rated as yes/no or on a five-point Likert scale ranging from strongly disagree (1) to strongly agree (5). Satisfaction with CGM was also assessed using the validated Chinese version of the Glucose Monitoring Satisfaction Survey^{18,19}, which comprises four domains: openness, emotional burden, behavioural burden, and worthwhileness. The maximum score for each domain is 5; higher scores indicate greater domain-specific outcomes.

The sample size was based on similar studies in the literature^{20–22}. Agreement between the two methods was assessed using the concordance correlation coefficient. Fixed and proportional biases were evaluated using Deming regression. A linear-mixed-effects-based Bland-Altman plot was constructed to visualise systematic bias, with adjustments for repeated measurements and within-participant variability. A precision ratio was calculated using a mixed-effects model to compare the variance of random error terms between the two methods. The mean absolute relative difference was calculated to determine average percentage error. Parkes error grid analysis was conducted to evaluate clinical safety (no or little effect on altering clinical action or outcome) by categorising paired measurements into risk zones (A to E)²³. All statistical analyses were performed using R software (version 4.5.1).

Results

In total, 50 Chinese women diagnosed with GDM after 28 weeks of gestation and managed via diet control were included in the analysis (Table 1). Of these, 45 completed all measurements, and five experienced sensor dislodgement (between days 7 and 13). A total of 711 paired measurements were collected; glucose levels ranged from 3.1 to 12.3 mmol/L for the self-monitoring method and from 3.3 to 10.5 mmol/L for the CGM method. The mean number of CGM scans per person was 33 ± 30 per day. In self-monitoring, 76.3% of fasting glucose levels and 74.8% of 2-hour postprandial glucose levels met the recommended targets of < 5.3 mmol/L and < 6.8 mmol/L, respectively⁷.

Table 1. Characteristics of participants (n=50).

	Value*
Age, y	34.8±4.2
Ethnicity	
Chinese	50 (100.0)
Non-Chinese	0
Education level	
Primary	0
Secondary	16 (32.0)
Tertiary or above	34 (68.0)
Pre-pregnancy body mass index, kg/m ²	23.6±3.1
Parity	
Nulliparous	31 (62.0)
Multiparous	19 (38.0)
Type of pregnancy	
Singleton	50 (100.0)
Twin	0
Gestational age at recruitment, wk	30.1±1.0
Oral glucose tolerance test	
Fasting glucose, mmol/L	4.9±0.4
2-hour postprandial glucose, mmol/L	9.0±1.1
Glycated haemoglobin, %	5.5±0.4

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

Agreement between CGM and self-monitoring measurements was good, with a concordance correlation coefficient of 0.836 (lower 95% confidence limit, 0.813). The linear-mixed-effects-based Bland-Altman plot showed a mean bias between the two methods of 0.069 mmol/L (95% limits of agreement, -1.146 to 1.285 mmol/L, $p=0.1995$, Figure 1). Deming regression yielded an intercept of -0.046 (95% prediction interval, -0.363 to 0.264) and a slope of 1.017 (95% prediction interval, 0.961-1.073), indicating minimal fixed and proportional bias. The mixed-effects model showed a precision ratio of 0.626 (95% confidence interval, 0.333-1.176). The mean absolute relative difference was 8.04%. Parkes error grid analysis indicated that 94.7% of paired measurements were in zone A and 5.3% were in zone B (Figure 2).

Among participants with a pre-pregnancy body mass index (BMI) <25 kg/m² (n=35), 94.3% of paired measurements were in zone A and 5.7% were in zone B.

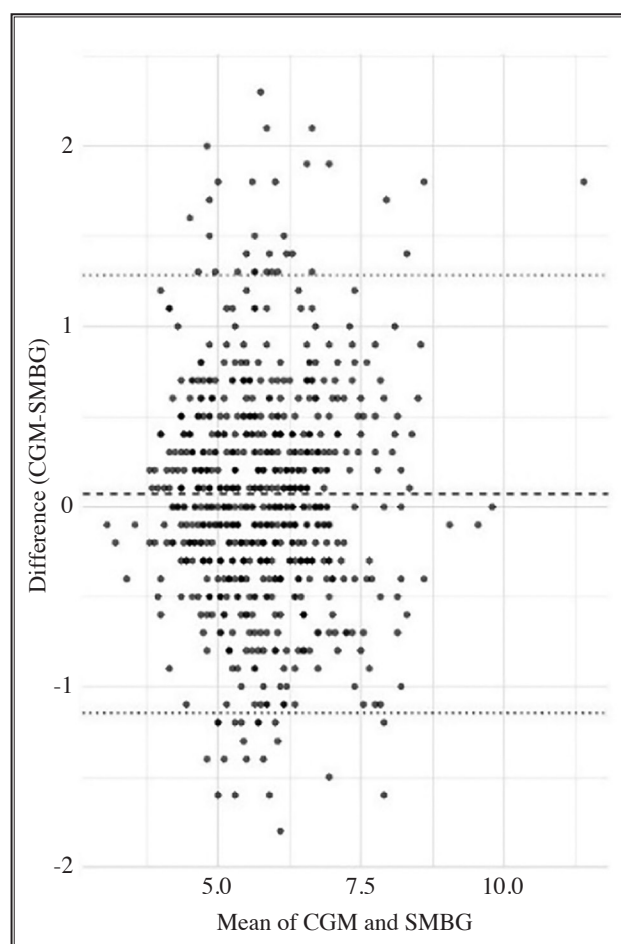


Figure 1. Linear-mixed-effects-based Bland-Altman plot to assess agreement between continuous glucose monitoring (CGM) and self-monitoring of blood glucose (SMBG) measurements.

Among participants with a pre-pregnancy BMI ≥ 25 kg/m² (n=15), 95.6% of paired measurements were in zone A and 4.4% were in zone B (Figure 2). The mean absolute relative differences were 8.2% among participants with a pre-pregnancy BMI of <25 kg/m² and 7.7% among participants with a pre-pregnancy BMI ≥ 25 kg/m².

Among 49 of the participants, 53.1% had heard of CGM previously; 34.7% had considered using it during pregnancy; 98% considered the CGM device easy to apply; 85.7% reported that CGM was less painful; and 89.8% agreed that CGM was more convenient, compared with self-monitoring via finger pricks (Table 2). Notably, 93.9% felt that CGM increased their awareness of glucose levels, and 83.7% reported that they maintained tighter dietary control. Overall, 83.7% were satisfied with CGM and accepted its use for glucose monitoring during pregnancy when the sensor was provided free of charge; 71.5% indicated a preference for CGM.

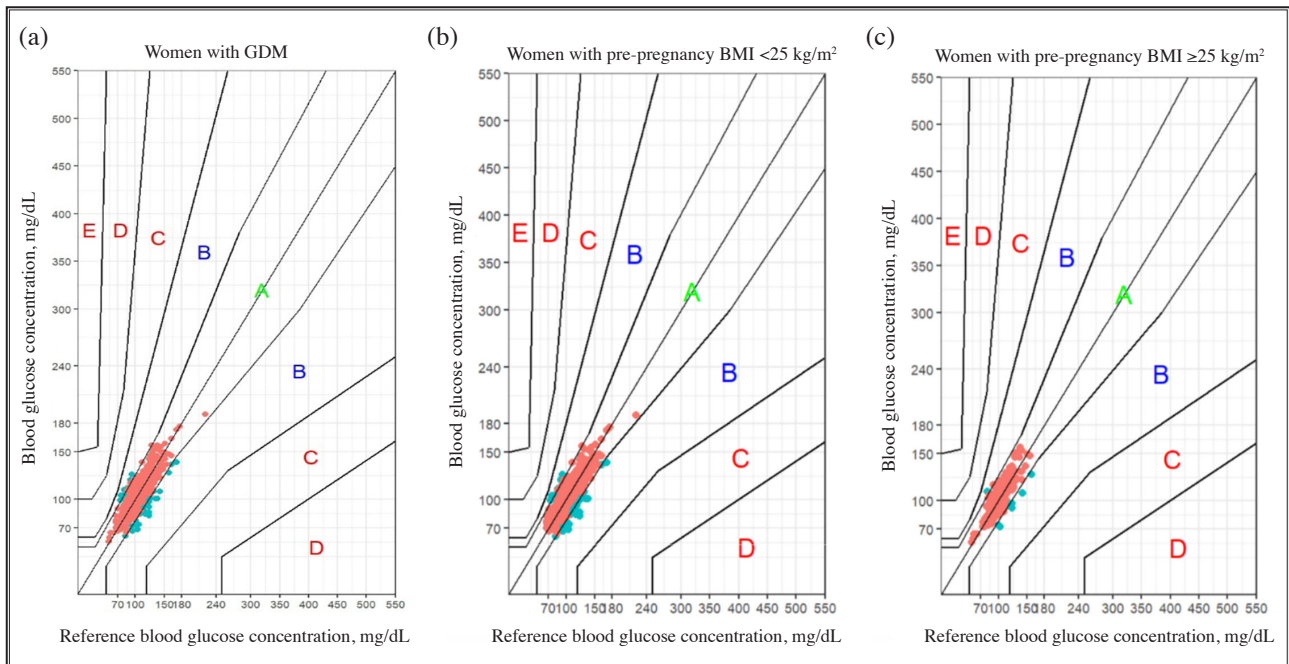


Figure 2. Parkes error grids comparing continuous glucose monitoring and self-monitoring of blood glucose measurements in (a) women with gestational diabetes mellitus (GDM) managed via diet control ($n=50$), (b) women with pre-pregnancy body mass index (BMI) $<25 \text{ kg/m}^2$ ($n=35$), and (c) women with pre-pregnancy BMI $\geq 25 \text{ kg/m}^2$ ($n=15$). Zone A includes pair measurements that are clinically accurate and have no effect on clinical action. Zone B represents altered clinical action with little or no effect on clinical outcome. Zone C represents altered clinical action that is likely to affect clinical outcome. Zone D represents altered clinical action that poses clinically significant risk. Zone E represents altered clinical action with potentially dangerous consequences.

Regarding the Glucose Monitoring Satisfaction Survey, the overall satisfaction score was 3.7 ± 0.32 , the openness score was 3.65 ± 0.53 , the emotional burden score was 2.75 ± 0.53 , the behavioural burden score was 1.94 ± 0.42 , and the worthwhileness score was 3.9 ± 0.49 . One participant developed serious adverse events (severe pre-eclampsia, abruptio placentae, and intrauterine fetal death) that were unrelated to the two monitoring methods.

Discussion

CGM measurements demonstrated good agreement with self-monitoring measurements, with high trueness (minimal systematic bias) and good precision (consistent reproducibility). According to the International Organization for Standardization 15197:2013 specifications for glucose monitoring systems, at least 99% of paired measurements must fall within zones A and B of the Parkes error grid to meet the required accuracy criteria²⁴. A study in the United States showed that 99.8% of paired measurements fell within zones A and B of the Parkes error grid (76.9% in zone A and 22.9% in zone B)²⁵. In the present study, 100% of paired measurements fell within zones A and B, indicating clinical accuracy and safety with no or little

effect on altering clinical action or outcome.

The mean absolute relative differences for various CGM systems typically range from 10% to 12%²⁶. Reported values were 12.9% in healthy male adults, 13.2% in adults with type 1 diabetes, 11.4% in adults with type 1 or type 2 diabetes, and 15.9% in women with GDM^{21,25,27,28}. In our participants with GDM, the mean absolute relative difference was 8.04%. Measurements at 2 hours postprandially provided a reasonable estimation of blood glucose levels, given the physiological time lag in glucose diffusion from capillary blood to interstitial fluid. Further research is needed to determine whether shorter or longer postprandial measurement intervals can yield a lower mean absolute relative difference and higher correlation.

Participants with pre-pregnancy BMI <25 or $\geq 25 \text{ kg/m}^2$ did not significantly differ in terms of paired measurements within zones A and B of the Parkes error grid between CGM and self-monitoring methods, consistent with a finding among women with pre-pregnancy BMI <30 or $\geq 30 \text{ kg/m}^2$ in a study²⁵. Both the mean absolute difference and Parkes error grid demonstrated similar levels

Table 2. Knowledge, application, usage, and acceptance and satisfaction of continuous glucose monitoring (CGM) among participants (n=49).

Question	No. (%) of participants				
	No	Yes			
Knowledge					
I have heard of a CGM device before	23 (46.9)	26 (53.1)			
I have considered using a CGM device for glucose monitoring during pregnancy	32 (65.3)	17 (34.7)			
	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
I previously had a good understanding of the CGM device	6 (12.2)	16 (32.7)	20 (40.8)	6 (12.2)	1 (2.0)
Application					
The CGM sensor was easy to apply	0	0	1 (2.0)	31 (63.3)	17 (34.7)
I did not experience pain when applying the CGM sensor to my skin	0	4 (8.2)	7 (14.3)	15 (30.6)	23 (46.9)
Applying a CGM sensor was less painful than a routine finger prick	0	2 (4.1)	5 (10.2)	9 (18.4)	33 (67.3)
Usage					
The CGM sensor was comfortable to wear	0	3 (6.1)	5 (10.2)	32 (65.3)	9 (18.4)
The CGM sensor did not interfere with my daily activities	0	3 (6.1)	6 (12.2)	23 (46.9)	17 (34.7)
Obtaining a glucose reading with the CGM sensor was more convenient than a finger prick	1 (2.0)	1 (2.0)	3 (6.1)	15 (30.6)	29 (59.2)
I used the CGM sensor to measure my glucose level more frequently than finger pricks	0	0	2 (4.1)	15 (30.6)	32 (65.3)
I had greater awareness of my glucose level when using the CGM sensor	0	0	3 (6.1)	20 (40.8)	26 (53.1)
I had tighter dietary control when using the CGM sensor	0	0	8 (16.3)	25 (51.0)	16 (32.7)
Acceptance and satisfaction					
I accept using CGM to monitor my glucose level during pregnancy	1 (2.0)	0	7 (14.3)	20 (40.8)	21 (42.9)
I would like to continue using CGM during pregnancy	0	2 (4.1)	14 (28.6)	24 (49.0)	9 (18.4)
I prefer CGM over self-monitoring of blood glucose (ie, finger prick)	1 (2.0)	5 (10.2)	8 (16.3)	19 (38.8)	16 (32.7)
Overall, I am satisfied with the CGM device	1 (2.0)	3 (6.1)	4 (8.2)	25 (51.0)	16 (32.7)
I would recommend CGM to other pregnant women	1 (2.0)	3 (6.1)	9 (18.4)	19 (38.8)	17 (34.7)
Each CGM sensor costs around \$600 in Hong Kong; I am willing to purchase the CGM sensor again	2 (4.1)	10 (20.4)	25 (51.0)	10 (20.4)	2 (4.1)

of agreement and clinical safety; however, the sample size for the subgroup analysis was small.

When the CGM sensor was provided free of charge, overall user acceptance and satisfaction were high. Most participants found the device easy and convenient to use and less painful than finger pricks; these advantages may improve adherence. Most participants reported improved glucose awareness and dietary control with CGM use. Real-time feedback may empower women to make more informed lifestyle and dietary choices to manage GDM. However, only 24.5% of participants were willing to pay for CGM, indicating that cost may be a major barrier to

continued use.

Regarding the Glucose Monitoring Satisfaction Survey, the overall satisfaction score of 3.7 and the emotional burden score of 2.75 were higher than scores reported in Western patients with type 1 diabetes, whereas the behavioural burden score of 1.94 was similar²⁹. Although CGM is generally well accepted, it may contribute to increased anxiety and frustration related to glucose control.

The present study had several limitations. The sample size was relatively small, and no formal sample size calculation was performed; thus, this pilot study provides

feasibility data only. Nonetheless, data completeness was high. The sample comprised women with GDM managed via diet control; those receiving insulin or oral hypoglycaemic agents may exhibit different agreement profiles due to medication pharmacokinetics. Both CGM and self-monitoring measurements, along with their corresponding timestamps, were self-reported and may have introduced bias. Performance and satisfaction findings associated with the FreeStyle Libre 2 sensor may not be generalisable to other CGM brands. The Parkes error grid was used to assess the clinical safety of CGM; however, it was originally developed to evaluate point-of-care glucose measurements in non-pregnant populations with diabetes and may not be fully applicable to women with GDM, for whom no venous blood reference standard was available. We did not assess other CGM-derived metrics such as time in range, time above range, hypoglycaemic episodes, or their associations with obstetric outcomes. A randomised controlled trial showed that outcomes were not improved by CGM, compared with self-monitoring, among women with GDM; however, preference for CGM was higher³⁰. This finding may be attributable to the similarly intensive glucose monitoring provided in both groups.

Conclusion

Agreement between CGM and self-monitoring measurements was good in Chinese women with GDM. CGM can be used as an adjunct to self-monitoring with finger pricks, which should be performed at least weekly to cross-check agreement. Most women with GDM accepted and were satisfied with CGM.

Contributors

CWL and WCL designed the study. CWL and

WYL acquired the data. CWL and CKW analysed the data. CWL drafted the manuscript. All authors 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

As an editor of the journal, WL Lam was not involved in the peer review process. The other 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 on reasonable request.

Ethics approval

This study was approved by the Central Institutional Review Board of Hospital Authority (reference: CIRB-2024-172-2). 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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Enhanced recovery after surgery for hysterectomy for pelvic organ prolapse

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Objectives: To investigate whether enhanced recovery after surgery (ERAS) for major urogynaecological surgery could reduce length of stay (LOS) and accelerate recovery, as measured by time to full mobilisation and resumption of oral intake.

Methods: An ERAS programme was implemented in our hospital in March 2022. We retrospectively reviewed medical records of women who underwent vaginal hysterectomy with or without laparoscopic assistance or concomitant procedures (pelvic floor repair, sacrospinous fixation, and continence surgery) performed or supervised by at least one urogynaecology subspecialist between July 2020 and May 2023.

Results: In total, 73 patients who underwent vaginal hysterectomy before (n=32) or after (n=41) ERAS implementation were included. The ERAS group had shorter LOS (3.2 vs 4.9 days, $p<0.001$) and faster recovery, as measured by times to full mobilisation (1 vs 1 day, $p<0.001$), oral intake resumption (0 vs 0 day, $p<0.001$), and successful urethral catheter removal (1 vs 2 days, $p<0.001$). In the ERAS group, the mean self-reported pain scores were 0.56 at rest and 2.73 during movement. Seven (17.1%) patients experienced postoperative nausea and vomiting. The predictor of LOS was the time to successful urethral catheter removal ($\beta=0.052$, $p<0.001$). One patient in each group was readmitted within 30 days for vaginal bleeding. Two patients without ERAS developed vault infection, which resolved with antibiotic treatment.

Conclusion: The ERAS programme can shorten LOS among patients undergoing vaginal hysterectomy. The duration of urethral catheter use was the main predictor of LOS.

Keywords: *Enhanced recovery after surgery; Length of stay; Pelvic organ prolapse*

Introduction

Enhanced recovery after surgery (ERAS) aims to promote recovery using evidence-based practices throughout the pre-, intra-, and post-operative periods to reduce surgical stress and optimise patient outcomes, involving multidisciplinary professionals, including surgeons, anaesthetists, physiotherapists, and dietitians^{1,2}. ERAS was first adopted in colorectal surgery and later extended to gynaecological oncology cases³. It can decrease length of stay (LOS), complications, and costs associated with surgical interventions^{4,5}.

Various ERAS measures are applied throughout the surgical journey⁶⁻¹⁰. Preoperatively, patients are advised to reduce smoking and alcohol consumption, and to meet doctors and anaesthetists for informed consent. They may be given an oral carbohydrate drink prior to anaesthesia to maintain hydration, improve preoperative well-being, and reduce postoperative insulin resistance. Fasting duration is kept as short as possible, and bowel preparation is not recommended. Additionally, anaesthetists adopt a multimodal approach to control postoperative pain, as well as postoperative nausea and vomiting (PONV), using a

combination of analgesics perioperatively. Postoperatively, patients are encouraged to eat and mobilise early; intravenous fluids should be discontinued when patients resume oral intake. Drain insertion is avoided, and the Foley catheter is removed as early as feasible.

Most patients undergoing urogynaecological surgery are older adults with multiple comorbidities. Older age is a risk factor for postoperative morbidity and mortality¹¹, and almost 40% of older patients develop postoperative complications¹². A meta-analysis showed that older colorectal patients managed via ERAS experienced fewer complications and shorter LOS, without any increase in readmission rates¹³. Nonetheless, the benefits of ERAS for urogynaecological surgery remain unclear. Some studies have shown that ERAS reduces LOS by <1 day^{14,15}; others have shown that ERAS results in a higher percentage of same-day discharge¹⁶. The present study aimed to investigate whether ERAS for major urogynaecological surgery could reduce LOS and accelerate recovery, as

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measured by time to full mobilisation and resumption of oral intake.

Methods

An ERAS programme was implemented in our hospital in March 2022. We retrospectively reviewed medical records of women who underwent vaginal hysterectomy with or without laparoscopic assistance or concomitant procedures (pelvic floor repair, sacrospinous fixation, and continence surgery) performed or supervised by at least one urogynaecology subspecialist between July 2020 and May 2023.

Before ERAS implementation, patients were discharged when they could ambulate, eat, and void as they did preoperatively. Intra- or post-operative analgesics were not routinely used. Fasting durations varied according to anaesthetists' preferences, and most patients fasted after midnight; no carbohydrate loading was provided. Prophylactic antibiotics were administered at induction of anaesthesia. Postoperative care was based on the preferences of the attending physicians and patients. After ERAS implementation, standardised instructions were followed (Table 1) unless modified by the attending physicians.

Table 1. Details of the enhanced recovery after surgery (ERAS) programme.

Pre-operation	Patients are assessed by a urogynaecologist, ERAS manager, anaesthetist, and physiotherapist 2 months before surgery. An ERAS manager and a designated nurse provide general advice to patients and their family members on smoking, alcohol consumption, and diet. The ERAS manager explains details of the entire surgical journey and addresses patient concerns regarding mood, finances, and postoperative care. Patients are referred to medical social workers if needed. Nutritional status is assessed using metabolic equivalents of task, and patients are referred to a dietitian for preoperative carbohydrate loading if not contraindicated. The physiotherapist provides preoperative assessment, including exercise tolerance, venous thromboembolism risk, prescription of home exercises, and referral to a prehabilitation programme, if indicated.
Intra-operation	Standardised multimodal analgesics are administered as pre-anaesthetic medications, including paracetamol, non-steroidal anti-inflammatory drugs, and pregabalin, if no contraindications are present. Carbohydrate loading is provided if patients do not have diabetes mellitus or impaired fasting glucose. Venous thromboembolism preventive measures, including graduated elastic compression stockings, sequential compression devices, and low-molecular-weight heparin, are administered according to stratified risk. Bowel preparation is performed for sacrocolpopexy or cases with anticipated dense adhesions. Patients maintain a short fasting period (ie, solids up to 6 hours and clear fluids up to 2 hours). A standardised anaesthetic protocol is implemented to maintain normovolaemia and normothermia.
Post-operation	Regular administration of standardised multimodal analgesics, including paracetamol, non-steroidal anti-inflammatory drugs, and tramadol, as well as antiemetics, including ondansetron or metoclopramide, is provided to reduce postoperative pain, nausea, and vomiting. Pain scores at rest and during movement are assessed daily by an ERAS nurse. Sips of water are allowed in the post-anaesthesia care unit, and patients are encouraged to resume oral intake as early as feasible after returning to the general ward. All tubes and drains are removed as early as feasible, balancing the risk of urinary retention. The urethral catheter is usually removed on postoperative day 1. Restrictive intravenous fluid infusion is adopted to maintain normovolaemia. Patients are followed up by a physiotherapist for chest physiotherapy, lower limb circulatory exercises, and mobilisation exercises to achieve early mobilisation and recovery to preoperative ambulatory status. The ERAS manager reviews recovery progress throughout the perioperative period and liaises with the gynaecologist, anaesthetist, physiotherapist, and family members.

Data collected included patient age, body mass index, type of operation, estimated intraoperative blood loss, pre- and post-operative haemoglobin levels, days required to regain preoperative mobility, days required to resume oral intake, days required for successful urethral catheter removal without urinary retention, intra- and post-operative complications (based on the Clavien-Dindo classification system¹⁷), unexpected readmissions within 30 days, and LOS.

Statistical analysis was performed using SPSS (Windows version 26.0; IBM Corp, Armonk [NY], United States). The two groups were compared using the *t* test, Fisher's exact test, or Mann-Whitney *U* test, as appropriate. Significant variables were analysed using logistic regression to identify predictors of LOS. A *p* value of <0.05 was considered statistically significant.

Results

In total, 73 patients who underwent vaginal hysterectomy before (*n*=32) or after (*n*=41) ERAS implementation were included (Table 2). The two groups were comparable in terms of baseline characteristics, except that patients in the ERAS group tended to be younger (67.1 vs 70.2 years, *p*=0.054), had longer surgical duration (151.0 vs 116.8 minutes, *p*=0.001), and had greater blood loss (100 vs 50 mL, *p*=0.049).

Compared with patients without ERAS, a larger proportion of patients with ERAS received multimodal analgesia on induction (75.6% vs 21.9%, *p*<0.001), used graduated elastic compression stockings and sequential compression devices (95.1% vs 18.8%, *p*<0.001), received carbohydrate loading (56.1% vs 0%, *p*<0.001), received antiemetics (61.0% vs 28.1%, *p*<0.001), and received postoperative multimodal analgesia (95.1% vs 37.5%, *p*<0.001).

The ERAS group had shorter LOS (3.2 vs 4.9 days, *p*<0.001) and faster recovery, as measured by times to full mobilisation (1 vs 1 day, *p*<0.001), oral intake resumption (0 vs 0 day, *p*<0.001), and successful urethral catheter removal (1 vs 2 days, *p*<0.001). In the ERAS group, the mean self-reported pain scores were 0.56 at rest and 2.73 during movement. Seven (17.1%) patients experienced PONV despite intravenous ondansetron use. The predictor of LOS was the time to successful urethral catheter removal (β =0.052, *p*<0.001).

The two groups were comparable in terms of intra- and post-operative complications and unplanned

readmission. One patient in each group was readmitted within 30 days for vaginal bleeding; vault haematoma was found in the patient without ERAS. Two patients without ERAS developed vault infection, which resolved with antibiotic treatment.

The ERAS programme received high satisfaction ratings both at discharge and at the 6-week follow-up. Patients were satisfied with preoperative counselling provided by the gynaecologist, anaesthetist, and physiotherapist, as well as with perioperative follow-up by a designated ERAS nurse. Postoperative pain control was considered satisfactory by 97% of patients. Antiemetics were administered to 61% of patients, who reported effectiveness in managing PONV. Although only 45% of patients received consultation from a medical social worker, 86.5% of these patients were satisfied with the support provided. Two patients reported a preference for earlier removal of the urethral catheter, whereas one patient expressed a desire to delay mobilisation due to postoperative fatigue.

Discussion

Among patients who underwent vaginal hysterectomy, LOS shortened after ERAS implementation from 4.9 to 3.2 days. One study demonstrated discharge at 13.8 hours after surgery in 91.7% of cases following major prolapse surgery¹⁶. However, these results required more intensive patient education and support from clinical staff and caregivers. Same-day discharge programmes usually require daily telephone contact by nurses, early outpatient follow-up visits, and close monitoring for complications.

The duration of urethral catheter use was the main predictor of LOS. In our unit, the urethral catheter was generally kept until the morning after hysterectomy, given that the risk of postoperative voiding dysfunction can be as high as 60%¹⁸. Although urethral catheterisation may be omitted for simple vaginal hysterectomy, and a trial of retrograde bladder filling should be considered¹⁹, 6.3% of urogynaecology patients who underwent day surgery failed a voiding trial and were discharged with an indwelling catheter¹⁹.

Compliance with ERAS is particularly important for older patients²⁰, given their increased morbidity, frailty, and need for more intensive care. Older patients may be less able to comply with early ambulation or early oral intake. The compliance rate among geriatric colorectal patients reportedly ranged from 42.3% to 77.2%; it was higher in those undergoing laparoscopic surgery^{13,21}. In patients undergoing open gynaecological surgery, compliance rates

Table 2. Characteristics and outcomes of patients who underwent vaginal hysterectomy with or without enhanced recovery after surgery (ERAS).

Variable	No ERAS (n=32)*	ERAS (n=41)*	p Value
Age, y	70.2±1.1	67.1±1.1	0.054
Body mass index, kg/m ²	24.2±3.3	24.3±2.9	0.866
Hypertension	22 (68.8)	19 (46.3)	0.063
Diabetes mellitus	11 (34.4)	11 (26.8)	0.608
Use of anticoagulants	3 (9.4)	0	0.080
Respiratory disease	4 (12.5)	1 (2.4)	0.091
Smoker	0	1 (2.4)	0.374
American Society of Anesthesiologists physical status III	9 (28.1)	5 (12.2)	0.244
Preoperative haemoglobin, g/dL	12.8±1.3	12.7±1.2	0.614
History of abdominal surgery (except bilateral tubal ligation)	7 (21.9)	4 (9.8)	0.194
Advanced stage of prolapse	13 (40.6)	12 (29.3)	0.754
Weight of uterus, g	58 (38.5-69.5)	66 (46.0-103.0)	0.099
Surgical duration, min	116.8±33.7	151.0±42.3	0.001
Duration in recovery room, min	39 (36.0-44.0)	40 (32.8-48.3)	0.951
Blood loss, mL	50 (30.0-137.5)	100 (50.0-150.0)	0.049
Vaginal hysterectomy			0.497
Without laparoscopic assistance	29 (90.6)	34 (82.9)	
With laparoscopic assistance	3 (9.4)	7 (17.1)	
Concomitant continence surgery	2 (6.3)	5 (12.2)	0.456
Concomitant sacrospinous fixation	10 (31.3)	8 (19.5)	0.283
Anaesthesia type			1.000
General	19 (59.4)	25 (61.0)	
Spinal	13 (40.6)	16 (39.0)	
Antibiotics on induction	32 (100)	41 (100)	1.000
Vaginal packing	10 (31.3)	9 (22.0)	0.427
Analgesia on induction	25 (78.1)	37 (90.2)	0.114
Unimodal	18 (56.3)	6 (14.6)	<0.001
Multimodal	7 (21.9)	31 (75.6)	<0.001
Bowel preparation	1 (3.1)	0	0.438
Use of graduated elastic compression stockings and sequential compression devices	6 (18.8)	39 (95.1)	<0.001
Carbohydrate loading	0	23 (56.1)	<0.001
Use of antiemetics	9 (28.1)	25 (61.0)	<0.001
Postoperative use of analgesics	20 (62.5)	41 (100)	<0.001
Unimodal	8 (25.0)	2 (4.9)	<0.001
Multimodal	12 (37.5)	39 (95.1)	<0.001
Oral intake, d	0 (0-1)	0	<0.001
Full mobilisation, d	1 (1-2)	1 (1-1)	<0.001
Successful urethral catheter removal, d	2 (2-2)	1 (1-1)	<0.001
Postoperative haemoglobin change, g/dL	-1.3 (-1.7 to -0.5)	-1.2 (-2.0 to -0.8)	0.399
Intraoperative complications	3 (9.4)	0	0.080
Postoperative pain, nausea, and vomiting	-	7 (17.1)	-
Postoperative complications	5 (15.6)	6 (14.6)	0.907
Postoperative severe complications (Clavien-Dindo classification ≥3a)	2 (6.3)	0	0.189
Readmission	1 (3.1)	1 (2.4)	0.859
Postoperative length of hospital stay, d	4.9±0.7	3.2±0.3	<0.001

* Data are presented as mean ± standard deviation, No. (%) of participants, or median (interquartile range)

exceeding 80% are associated with improved outcomes²². Customised ERAS protocols for geriatric patients may further improve outcomes¹³. In our unit, a designated ERAS manager is responsible for monitoring postoperative progress and fostering rapport and trust between patients and the medical team. Medications for pain relief and PONV are reviewed daily by the gynaecologist, anaesthetist, and ERAS manager. The ERAS manager also provides instructions to patients and their families to facilitate early ambulation and feeding. Compliance rates for most components reached 80% to 90%; the lowest rate (70%) was observed for tolerance of sips of water in the post-anaesthesia care unit. Most patients declined to try, whereas others were sleepy and fatigued after surgery.

The present study had several limitations. The sample size was relatively small and derived from a single unit, which may introduce selection bias. Patients in the ERAS group tended to be younger; this may have contributed to the shorter LOS. Additionally, documentation was more comprehensive in the ERAS group because a designated ERAS nurse was responsible for patient follow-up. Patient satisfaction and clinical symptoms were not systematically assessed before ERAS implementation. Complications were rare; therefore, differences between patients with and without ERAS may not have been detectable. Most patients underwent vaginal hysterectomy for pelvic organ prolapse, which may limit the generalisability of the findings.

Conclusion

The ERAS programme can shorten LOS among patients undergoing vaginal hysterectomy. The duration

of urethral catheter use was the main predictor of LOS. Further studies to evaluate same-day removal of the urethral catheter to further shorten LOS and enhance patient recovery and satisfaction are warranted.

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 on reasonable request.

Ethics approval

This study was approved by the Kowloon Central / Kowloon East Cluster Research Ethics Committee (reference: KC/KE-23-0161/ER-3). The patients were treated in accordance with the tenets of the Declaration of Helsinki. The requirement for patient consent was waived by the Committee due to the retrospective nature of the research.

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Intravenous iron isomaltoside versus oral iron supplementation in women with postpartum anaemia

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Objectives: To compare oral iron supplementation with intravenous (IV) iron isomaltoside (Monofer) in terms of haemoglobin (Hb) level, ferritin level, and fatigue at 2 and 6 weeks in women with severe postpartum anaemia.

Methods: Medical records of patients with severe postpartum anaemia (Hb ≤ 8 g/dL), irrespective of mode of delivery, who were admitted between January 2023 and December 2024 at Kwong Wah Hospital were retrospectively reviewed. Patients received either a single 500 mg dose of IV Monofer or oral iron supplementation, and then both groups were prescribed oral iron supplements for 12 weeks if the Hb level was ≤ 8.0 g/dL at discharge. Primary outcome measures included changes in Hb and ferritin levels, as well as change in Multidimensional Fatigue Inventory scores, from baseline to weeks 2 and 6. Secondary outcome measures included adverse reaction rates and changes in blood transfusion rates after implementation of the new IV Monofer protocol for severe postpartum anaemia.

Results: In total, 177 patients who received either IV Monofer (n=141) or oral iron supplementation (n=36) were included in the analysis. Compared with the oral iron group, the IV Monofer group showed greater increases in mean Hb levels at week 2 (3.11 vs 2.37 g/dL, $p<0.001$) and week 6 (4.89 vs 3.55 g/dL, $p<0.001$), as well as higher mean ferritin levels at week 2 (599.5 vs 109 pmol/L, $p<0.001$) and week 6 (189 vs 100 pmol/L, $p<0.001$). No patients experienced serious adverse reactions or anaphylaxis following IV Monofer administration. Only two (1.1%) patients reported mild adverse reactions, which resolved spontaneously.

Conclusion: A single fixed dose of IV iron isomaltoside (Monofer) resulted in more rapid improvements in Hb levels and iron stores in women with severe postpartum anaemia, compared with oral iron. IV Monofer is an effective alternative to blood transfusion for the management of severe postpartum anaemia.

Keywords: Anemia, iron-deficiency; Iron isomaltoside 1000; Postpartum hemorrhage

Introduction

Postpartum anaemia affects up to 50% of women, regardless of mode of delivery, even in well-developed countries¹. It has become a major maternal health concern worldwide. Iron deficiency resulting from antenatal anaemia or intrapartum blood loss remains the primary cause². Postpartum anaemia is associated with maternal morbidities, including postpartum depression, fatigue, and impaired cognition, which negatively affect maternal-infant bonding and quality of life^{1,3}. Early iron supplementation can significantly improve health-related quality of life and reduce the risk of postpartum depression².

Oral iron supplementation has been the first-line treatment for women with mild to moderate postpartum iron deficiency anaemia because of its affordability and availability. However, oral supplementation takes time to have an effect and is often poorly tolerated due to adverse gastrointestinal effects, such as nausea, vomiting, and constipation, which lead to poor adherence and treatment

failure. Intravenous (IV) iron acts more rapidly, is better tolerated than oral iron, and can replace blood transfusion for women with severe postpartum anaemia who have minimal symptoms or cannot tolerate or have failed oral iron therapy⁴⁻⁷.

IV iron is widely used to treat severe iron deficiency anaemia in medical and gynaecological patients⁸. Compared with oral iron, it leads to more rapid improvements in haemoglobin (Hb) concentration and iron stores, making it an alternative to blood transfusion in haemodynamically stable patients with severe postpartum anaemia. In postpartum women with anaemia, IV iron isomaltoside (Monofer) has demonstrated excellent efficacy and safety⁹. Nonetheless, the absence of a control group (oral iron alone) limits direct comparison, and the dosage of IV Monofer has varied according to patients' body weight (500 mg for <50 kg

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and 1000 mg for ≥ 50 kg). Since 2021, our department has implemented a new protocol to treat postpartum anaemia with a standardised single dose of IV Monofer. This study aimed to compare oral iron supplementation with IV Monofer in terms of Hb level, ferritin level, and fatigue at 2 and 6 weeks in women with severe postpartum anaemia.

Methods

Medical records of patients with severe postpartum anaemia (Hb ≤ 8 g/dL), irrespective of mode of delivery, who were admitted between January 2023 and December 2024 at Kwong Wah Hospital were retrospectively reviewed via the Clinical Data Analysis and Reporting System. Patients who were lost to follow-up or who received blood transfusion after oral or IV iron therapy were excluded, but those who received blood transfusions prior to oral or IV iron therapy were included; their post-transfusion Hb levels were regarded as baseline values.

Complete blood count was routinely assessed on day 2 post-delivery. According to our departmental protocol, patients with postpartum haemorrhage (Hb 6–8 g/dL) or a prenatal-to-postnatal Hb drop of ≥ 3 g/dL were offered IV Monofer. Haemodynamically stable patients with minimal symptoms were offered either IV Monofer or oral iron supplementation, whereas patients with Hb < 6 g/dL, haemodynamic instability, or severe symptoms were offered blood transfusion. In patients with Hb ≤ 8.0 g/dL at discharge, oral iron supplements, either ferrous sulphate 300 mg/day or iron (III) hydroxide polymaltose complex chewable tablets 100 mg/day (for those intolerant to ferrous sulphate), were prescribed for 12 weeks.

A standardised single dose of 500 mg IV Monofer infusion over 60 minutes was administered, irrespective of body weight. Vital signs, including blood pressure, pulse, temperature, and oxygen saturation, were monitored at the start of administration, every 15 minutes during infusion, at the end of infusion, and 30 minutes post-infusion. For patients with asthma or multiple drug allergies, a single dose of IV hydrocortisone 200 mg was administered prior to IV Monofer. Any adverse or hypersensitivity reactions were documented and managed accordingly.

Primary outcome measures included changes in Hb and ferritin levels, as well as change in Multidimensional Fatigue Inventory (MFI) scores, from baseline to weeks 2 and 6. Secondary outcome measures included adverse reaction rates and changes in blood transfusion rates after implementation of the new IV Monofer protocol for severe postpartum anaemia.

The self-report MFI comprises 20 items designed to evaluate fatigue¹⁰. Each item is rated on a five-point Likert scale ranging from 1 (yes, that is true) to 5 (no, that is not true). Total scores range from 20 to 100; higher scores indicate greater fatigue severity. The MFI has been validated across diverse populations, including individuals with anaemia as well as pregnant and postpartum women, demonstrating consistency and sensitivity^{11,12}. The Hong Kong Chinese version of the MFI has also been validated¹³.

Statistical analysis was performed using SPSS (Windows version 27.0; IBM Corp, Armonk [NY], United States). A *p* value of < 0.05 was considered statistically significant. The IV Monofer group and the oral iron group were compared using the independent *t* test or Mann-Whitney *U* test for continuous variables and the Chi-squared test for categorical variables.

Results

Of 263 patients with severe postpartum anaemia (Hb ≤ 8 g/dL) identified, 42 were lost to follow-up, 44 received blood transfusion alone or after oral or IV iron therapy, and the remaining 177 patients who received either IV Monofer ($n=141$) or oral iron supplementation ($n=36$) were included in the analysis (Table).

The two groups were comparable in terms of maternal age, parity, mode of delivery, ethnicity, and body mass index. Most patients were Chinese, nulliparous, had spontaneous vaginal deliveries, and experienced minor postpartum haemorrhage. Thirty (16.9%) women received blood transfusion prior to oral or IV iron therapy.

Compared with the oral iron group, the IV Monofer group showed greater increases in mean Hb levels at week 2 (3.11 vs 2.37 g/dL, $p < 0.001$) and week 6 (4.89 vs 3.55 g/dL, $p < 0.001$), as well as higher mean ferritin levels at week 2 (599.5 vs 109 pmol/L, $p < 0.001$) and week 6 (189 vs 100 pmol/L, $p < 0.001$) [Table]. Post-treatment MFI scores did not significantly differ between the two groups.

In our obstetric unit, the blood transfusion rate decreased from 1.83% during 2018–2019 to 1.06% during 2023–2024 ($p < 0.001$) following implementation of the new IV Monofer protocol for severe postpartum anaemia. Data from 2020 to 2022 were excluded due to the influence of COVID-19 pandemic on rates of postpartum haemorrhage and blood transfusions.

No patients experienced serious adverse reactions or anaphylaxis following IV Monofer administration.

Table. Characteristics and outcomes of patients with severe postpartum anaemia receiving intravenous (IV) Monofer or oral iron, followed by 12 weeks of oral iron supplementation.

Variable	IV Monofer (n=141)	Oral iron (n=36)	p Value
Age, y	32.85±4.89	32.61±5.65	0.799
Body mass index, kg/m ²	22.03±3.89	21.92±2.53	0.876
Ethnicity			0.247
Chinese	133 (94.3)	32 (88.9)	
Non-Chinese	8 (5.7)	4 (11.1)	
Parity			0.796
Nulliparous	101 (71.6)	25 (69.4)	
Multiparous	40 (28.4)	11 (30.6)	
Mode of delivery			0.648
Normal vaginal delivery	91 (64.5)	24 (66.7)	
Vaginal enhanced delivery	24 (17.0)	4 (11.1)	
Fetal distress	7 (5.0)	1 (2.8)	
Lower segment Caesarean section	19 (13.5)	7 (19.4)	
Haemoglobinopathy			0.147
Thalassemia trait	22 (15.6)	6 (16.7)	
Other	8 (5.7)	6 (16.7)	
Blood transfusion prior to treatment	22 (15.6)	8 (22.2)	0.345
Blood loss, mL	550 (400-800)	400 (300-600)	<0.001
Baseline outcome			
Haemoglobin, g/dL	7.4 (7.05-7.8)	7.8 (7.15-7.9)	0.021
Ferritin, pmol/L (n=133 vs 17)	127 (81.5-209.5)	125 (82-203)	0.826
Multidimensional Fatigue Inventory			
Total score (n=131 vs 26)	54.02±14.23	55.85±15.84	0.82
Physical fatigue score (n=131 vs 26)	13.09±4.49	14.68±5.32	0.079
Week 2 outcome			
Haemoglobin, g/dL (n=125 vs 30)	10.55±0.9	10.15±1.05	0.035
Change in haemoglobin, g/dL (n=125 vs 30)	3.11±0.90	2.37±1.06	<0.001
Ferritin, pmol/L (n=124 vs 29)	599.5 (466.3-760.5)	109 (63.5-228)	<0.001
Multidimensional Fatigue Inventory			
Total score (n=112 vs 27)	49.22±14.23	50.37±13.8	0.706
Change in total score (n=106 vs 24)	-4.07±11.77	-3.54±13.49	0.192
Physical fatigue score (n=113 vs 26)	10.9±3.44	11.35±3.82	0.562
Change in physical fatigue score (n=106 vs 24)	-1.36±3.23	-1.08±3.39	0.71
Week 6 outcome			
Haemoglobin, g/dL (n=130 vs 35)	12.31±0.97	11.34±1.35	<0.001
Change in haemoglobin, g/dL (n=130 vs 35)	4.89±0.99	3.55±1.29	<0.001
Ferritin, pmol/L (n=129 vs 33)	189 (130-254)	100 (62-167.5)	<0.001
Multidimensional Fatigue Inventory			
Total score (n=108 vs 26)	46.17±14.06	48.61±10.4	0.467
Change in total score (n=102 vs 21)	-7.07±12.35	-7.24±15.83	0.957
Physical fatigue score (n=108 vs 26)	9.84±3.59	10.92±2.62	0.151
Change in physical fatigue score (n=102 vs 21)	-2.38±3.81	-2.29±4.43	0.918

* Data are expressed as mean ± standard deviation, No. (%) of patients, or median (interquartile range)

Only two (1.1%) patients reported mild adverse reactions (localised skin rash in one, palpitations and tachycardia in the other); both reactions resolved spontaneously.

Discussion

According to the Hong Kong Hospital Authority's annual report, the prevalence of primary postpartum haemorrhage (≥ 500 mL) reached a historic high of 14.7% in 2022¹⁴. Despite advances in prevention and treatment, the incidence of postpartum haemorrhage has significantly increased in recent decades¹⁵. This leads to higher rates of postpartum anaemia, which adversely affect women's physical and mental health-related quality of life².

Postpartum women treated with IV iron experience greater improvements in Hb levels than those treated with oral iron alone¹⁵. In our study, Hb concentrations at 6 weeks postpartum were approximately 1 g/dL higher in the IV iron group than in the oral iron group, consistent with findings from a meta-analysis¹. Nonetheless, both IV and oral iron treatments produced comparable effects on maternal fatigue at 6 weeks postpartum, consistent with findings from a randomised controlled trial¹⁶. Fatigue may not be directly correlated with haemoglobin levels because multiple factors can influence maternal fatigue, including sleep deprivation from infant care, breastfeeding demands, hormonal changes, nutritional status, psychological stress, and postpartum depression. Additionally, mental fatigue and reduced motivation may contribute to the total MFI score.

First-line treatment with oral iron is often associated with gastrointestinal adverse effects, resulting in poor compliance. In contrast, IV iron enables rapid replenishment of iron stores and a faster rise in Hb levels while avoiding the gastrointestinal adverse effects linked to oral iron. Newer generations of IV iron preparations, such as iron isomaltoside (Monofer), are stable iron-carbohydrate complexes with a very low risk of severe allergic reactions. In our study, only two patients experienced mild adverse reactions, which resolved spontaneously; none developed severe adverse reactions or anaphylaxis. IV Monofer may therefore serve as an alternative to blood transfusion in haemodynamically stable patients with severe postpartum anaemia.

Although body weight is a key variable in the Ganzoni formula for calculating the optimal IV iron dosage¹⁷, a Hong Kong study of IV iron therapy in gynaecological patients found no correlation between body weight and Hb increase⁸. Therefore, we adopted a dose-standardised protocol for IV iron administration, avoiding

complex dose calculations and prolonged hospitalisation. This dose-standardised protocol effectively increased both Hb and ferritin levels in our patients, regardless of body weight or body mass index.

IV iron therapy can substantially reduce the need for blood transfusion by approximately 26%, thus lowering associated costs and risks¹⁸. It also requires less time and monitoring, and hospital stay, compared with blood transfusion. Unnecessary blood transfusion can be avoided and reserved for women who are haemodynamically unstable or have severe anaemic symptoms¹⁹.

This study had several limitations. It was conducted at a single centre with a relatively small sample size, particularly in the oral iron group. Given its retrospective design, some data were missing due to incomplete documentation; thus, certain variables were reported using different denominators. The blood transfusion rate included both postnatal and antenatal patients, although the number of antenatal patients was small. Outcomes in the oral iron group may have been confounded by patients' adherence to treatment. Ferritin levels may also have been falsely elevated after delivery due to the inflammatory response associated with childbirth. Nevertheless, selection bias was minimal because treatment decisions and adverse event management followed a standardised protocol. Further large-scale, prospective, randomised controlled trials are warranted to validate the efficacy of IV iron therapy.

Conclusion

A single fixed dose of IV iron isomaltoside (Monofer) resulted in more rapid improvements in Hb levels and iron stores in women with severe postpartum anaemia, compared with oral iron, although MFI scores were similar between groups. IV iron is an effective alternative to blood transfusion for the management of severe postpartum anaemia.

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

As an editor of the journal, WLL was not involved in the peer review process. Other 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 on reasonable request.

Ethics approval

This study was approved by the Kowloon Central / Kowloon East Cluster Research Ethics Committee (reference: CIRB-2025-247-5). The patients were treated in accordance with the tenets of the Declaration of Helsinki. The requirement for patient consent was waived by the Committee due to the retrospective nature of the research.

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Accuracy of ultrasound in detecting retained products of gestation after second-trimester medical termination of pregnancy

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Objectives: To determine the diagnostic accuracy of ultrasound parameters in detecting retained products of gestation (RPOG) after second-trimester medical termination of pregnancy (MTOP) and to identify predictors of RPOG.

Methods: Medical records of women who underwent second-trimester MTOP, followed by ultrasound evaluation and surgical evacuation for suspected RPOG, at Queen Elizabeth Hospital, Hong Kong, between 1 January 2019 and 31 December 2024 were reviewed. Clinical features were documented, as were ultrasound features, including endometrial thickness, the presence of endometrial masses and heterogeneous echogenicity, and endometrial vascularity. The diagnostic accuracy of endometrial thickness in detecting RPOG was assessed using the area under the curve. Diagnostic performances of other ultrasound variables were also determined. Multivariate logistic regression was performed to determine predictors of RPOG.

Results: In total, 237 women were included in the analysis. Of these, 196 (82.7%) had histopathology-confirmed RPOG and 41 (17.3%) had no histological evidence of RPOG. The RPOG-positive group had a lower median gestational age at termination (16 vs 19 weeks, $p=0.008$), a higher percentage of women with prior surgical evacuation (27.6% vs 7.3%, $p=0.006$), and a greater median endometrial thickness (22.5 vs 21.0 mm, $p=0.018$). The area under the curve for endometrial thickness in diagnosing RPOG was 0.613. The highest Youden index (0.205) was observed at an endometrial thickness of 27.9 mm, yielding a sensitivity of 23% and specificity of 97.6%. The presence of intrauterine mass and heterogeneous echogenicity demonstrated high sensitivity (72.4% and 81.1%, respectively) but low specificity (22.0% and 7.3%, respectively). Among 11 women who underwent colour Doppler ultrasound, vascularity yielded a sensitivity of 90% and specificity of 100%. Multivariate logistic regression identified lower gestational age at termination (adjusted odds ratio [OR]=0.854, $p=0.004$), prior abortion requiring surgical evacuation (adjusted OR=5.993, $p=0.016$), and increased endometrial thickness (adjusted OR=1.104 per mm, $p=0.003$) as independent predictors of RPOG.

Conclusion: Increased endometrial thickness is an ultrasound predictor of RPOG after second-trimester MTOP, with high specificity but low sensitivity at a high cut-off value. The favourable diagnostic performance of vascularity supports routine use of colour Doppler ultrasound. Clinicians should adopt a comprehensive, individualised approach that integrates clinical and ultrasound parameters.

Keywords: Abortion, induced; Placenta, retained; Pregnancy trimester, second; Ultrasonography

Introduction

Retained products of gestation (RPOG) complicate 15% to 21% of second-trimester medical termination of pregnancy (MTOP) cases; these rates are substantially higher than those for first-trimester abortion^{1,2}. Residual placental or fetal tissue within the uterus is associated with a considerably increased risk of maternal complications including haemorrhage and infection^{3,4}. Surgical evacuation of RPOG can lead to uterine perforation, intrauterine adhesions, and infertility⁵, highlighting the importance of accurate and timely diagnosis.

Ultrasound is the standard diagnostic modality for RPOG. Prior studies have predominantly involved first-trimester or postpartum populations, in which findings such

as endometrial thickness, intrauterine mass, echogenicity, and vascularity are well established^{6,7}. Endometrial thickness is the most widely used diagnostic criterion, with cut-off values ranging from 10 to 25 mm^{8,9} and area under the curve (AUC) values ranging from 0.7 to 0.8^{10,11}. However, evidence supporting the use of ultrasound to diagnose RPOG after second-trimester MTOP remains limited. This study aimed to determine the diagnostic accuracy of ultrasound parameters in detecting RPOG after second-trimester MTOP and to identify predictors of RPOG.

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Methods

Medical records of women who underwent second-trimester (13 to 23 weeks + 6 days of gestation) MTOP, followed by ultrasound evaluation and surgical evacuation for suspected RPOG, at Queen Elizabeth Hospital, Hong Kong, between 1 January 2019 and 31 December 2024 were reviewed. Cases with incomplete records or missing ultrasound or histopathology data were excluded.

Pelvic ultrasound (transabdominal, transvaginal, or both) was routinely performed within 24 hours of abortus passage. Endometrial thickness (maximum longitudinal anteroposterior diameter) and the presence of endometrial masses and heterogeneous echogenicity were documented. When necessary, colour Doppler ultrasound was performed to assess endometrial vascularity¹². Ultrasound findings were classified as ‘suspected RPOG’ or ‘normal’ by the attending physician.

Women with suspected RPOG were counselled regarding management options, including expectant management, medical evacuation via misoprostol, and surgical evacuation. Follow-up ultrasound was arranged 1 week after expectant management or medical evacuation. Surgical evacuation was arranged for those in whom conservative management had failed. Curetted tissue was sent for histopathological examination; the presence of

chorionic villi or trophoblastic tissue confirmed RPOG.

The diagnostic accuracy of endometrial thickness in detecting RPOG was assessed using the AUC. Sensitivity, specificity, positive predictive value (PPV), and negative predictive value (NPV) of other ultrasound variables (eg, intrauterine mass, echogenicity, and vascularity) were also determined. RPOG-positive and -negative cases were compared using the Student’s *t* test for continuous data and the Chi-squared test or Fisher’s exact test for categorical data. Univariate analysis was performed to identify ultrasound and clinical variables with $p < 0.2$. Multivariate logistic regression was performed to determine predictors of RPOG. A *p* value of < 0.05 was considered statistically significant. Statistical analyses were performed using SPSS (Windows version 29.0; IBM Corp, Armonk [NY], United States).

Results

In total, 237 women were included in the analysis. Of these, 196 (82.7%) had histopathology-confirmed RPOG and 41 (17.3%) had no histological evidence of RPOG (Table 1). The two groups were comparable, except that the RPOG-positive group had a lower median gestational age at termination (16 vs 19 weeks, $p = 0.008$), a higher percentage of women with prior surgical evacuation (27.6% vs 7.3%, $p = 0.006$), and a greater median endometrial thickness (22.5

Table 1. Characteristics and outcomes of participants who underwent surgical evacuation of retained products of gestation (RPOG) after second-trimester medical termination of pregnancy.

Characteristics	RPOG*		p Value
	Yes (n=196)	No (n=41)	
Age, y	34 (31-37)	33 (29-35)	0.220
Gestational age, wk	16 (14-19)	19 (15-21)	0.008
Gravidity	2 (1-3)	2 (1-2)	0.690
Parity	1 (0-1)	0 (0-1)	0.326
Prior abortion	79 (40.3)	11 (26.8)	0.106
Prior abortion with surgical evacuation	54 (27.6)	3 (7.3)	0.006
Twin pregnancy	5 (2.6)	0	0.591
Vaginal bleeding during surgical evacuation	194 (99.0)	40 (97.6)	0.460
Major bleeding (>500 mL) before surgical evacuation	5 (2.6)	2 (4.9)	0.424
Endometrial thickness, mm	22.5 (19-27)	21.0 (17-25.4)	0.018
Intrauterine mass	142 (72.4)	32 (78.0)	0.46
Echogenicity	159 (81.1)	38 (92.7)	0.072
Vascularity	n=10	n=1	0.182
Present	9 (90.0)	0	
Absent	1 (10.0)	1 (100.0)	

* Data are presented as median (interquartile range) or No. (%) of participants

vs 21.0 mm, $p=0.018$). The AUC for endometrial thickness in diagnosing RPOG was 0.613 (Figure). The highest Youden index (0.205) was observed at an endometrial thickness of 27.9 mm, yielding a sensitivity of 23% and specificity of 97.6%.

An intrauterine mass was identified in 142 RPOG-positive women and 32 RPOG-negative women, yielding a sensitivity of 72.4%, specificity of 22.0%, PPV of 81.6%, and NPV of 14.3%. Echogenicity was identified in 159 RPOG-positive women and 38 RPOG-negative women, yielding a sensitivity of 81.1%, specificity of 7.3%, PPV

of 80.7%, and NPV of 7.5%. Although these ultrasound variables were sensitive for detection of RPOG, their low specificity hindered independent diagnostic utility. Among 11 women who underwent colour Doppler ultrasound, vascularity was present in nine RPOG-positive women and zero RPOG-negative women, yielding a sensitivity of 90%, specificity of 100%, PPV of 100%, and NPV of 50%.

Multivariate logistic regression identified lower gestational age at termination (adjusted odds ratio [OR]=0.854, $p=0.004$), prior abortion requiring surgical evacuation (adjusted OR=5.993, $p=0.016$), and increased endometrial thickness (adjusted OR=1.104 per mm, $p=0.003$) as independent predictors of RPOG (Table 2).

Discussion

Increased endometrial thickness was identified as an ultrasound predictor of RPOG, with an AUC of 0.613, which is substantially lower than that reported in other studies^{10,11}. Its clinical utility was limited by low sensitivity (23%), despite high specificity (97.6%) at the high cut-off of 27.9 mm. Other ultrasound variables demonstrated poor diagnostic performance, except for vascularity, which showed high sensitivity and specificity; however, vascularity was assessed in only 11 women. Additional predictors of RPOG included lower gestational age at termination and prior surgical evacuation.

Our findings substantially differ from those in studies of first-trimester abortion. Among 193 patients with suspected RPOG, the sensitivity and specificity of ultrasound in detecting RPOG were 75.22% and 72.50%, respectively, and the mean endometrial thickness was 13.5 mm in individuals with histopathologically confirmed

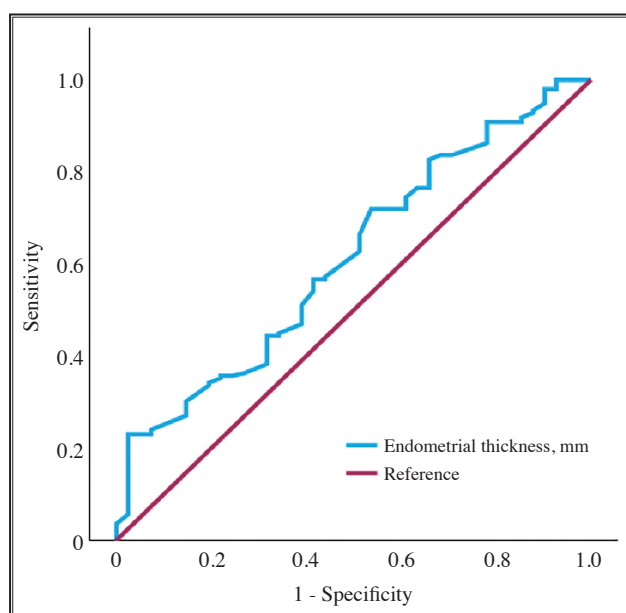


Figure. Receiver operating characteristic curve for endometrial thickness showing an area under the curve of 0.613. The highest Youden index (0.205) occurs at an endometrial thickness of 27.9 mm, yielding a sensitivity of 23% and specificity of 97.6%.

Table 2. Predictors of retained products of gestation after second-trimester medical termination of pregnancy.

Variable	Univariate analysis	Multivariate analysis	
	p Value	Adjusted odds ratio (95% confidence interval)	p Value
Gestational age	0.008	0.854 (0.767-0.951)	0.004
Prior abortion	0.109	0.761 (0.296-1.96)	0.572
Prior abortion with surgical evacuation	0.011	5.993 (1.394-25.774)	0.016
Endometrial thickness	0.015	1.104 (1.035-1.178)	0.003
Intrauterine mass	0.462	-	-
Echogenicity	0.085	0.313 (0.088-1.121)	0.074
Vascularity*	0.028	-	-

* Excluded from multivariate analysis due to small sample size.

RPOG¹³. Similarly, an endometrial thickness cut-off of 14.9 mm yielded a sensitivity of 78.7% and specificity of 77.8% in predicting RPOG after abortion or delivery, with an AUC of 0.808¹¹. A meta-analysis concluded that variability in cut-off thresholds and limited specificity hinder diagnostic reliability, although an endometrial thickness of ≥ 15 mm is frequently used to identify RPOG⁹.

Several factors may explain the poor discrimination of ultrasound variables in our cohort. First, the high prevalence of RPOG (82.7%) may have reduced variability in endometrial thickness and compressed the AUC towards chance performance. Second, second-trimester MTOP involves more extensive endometrial disruption and bleeding than first-trimester abortion, potentially resulting in higher post-abortion endometrial thicknesses among RPOG-positive and RPOG-negative populations. Third, most ultrasound examinations were performed within 24 hours post-abortion, which may have captured an intermediate state in which the endometrium remains globally thickened due to a mixture of blood and tissue debris. The interval between abortion and ultrasound assessment strongly influences findings; earlier scans increase the likelihood of false-positive results¹⁴.

Contrary to suggestions that echogenic intrauterine masses are among the most sensitive and specific ultrasound features for RPOG^{9,15}, the present study revealed that both echogenicity and the presence of an intrauterine mass had poor diagnostic performance; neither was a predictor of RPOG. The low specificity reflects their high prevalence in the immediate post-abortion period, when both clotted blood and placental tissue may appear as an echogenic intrauterine mass, particularly when ultrasound is routinely performed irrespective of clinical symptoms.

Colour Doppler ultrasound demonstrated high diagnostic performance of endometrial vascularity in detecting RPOG¹⁶. Endometrial vascularity is strongly correlated with RPOG; moderate to marked vascularity exhibits a PPV of 100%¹⁷. Enhanced myometrial vascularity and structured Doppler classification systems (eg, the Gutenberg classification) may improve risk stratification for bleeding and guide management decisions¹⁸. Nevertheless, operator variability and the lack of standardised protocols for colour Doppler ultrasound may affect its diagnostic performance.

Multivariate logistic regression identified lower gestational age at termination and prior surgical evacuation as predictors of RPOG. Lower gestational age is associated

with incomplete placental development and less efficient placental separation², whereas prior uterine instrumentation predisposes to abnormal myometrial involution and impaired expulsion of subsequent pregnancy products^{19,20}.

Ultrasound alone showed limited utility in detecting or excluding RPOG after second-trimester MTOP. This finding contrasts with studies of first-trimester abortion or postpartum settings, in which ultrasound has higher diagnostic precision. In second-trimester MTOP, the larger placental mass, more extensive decidualisation, and deeper trophoblastic invasion of the myometrium result in distinct pathophysiological features. Second-trimester MTOP—particularly when protracted or incomplete—may result in fragmented placental remnants, haemorrhagic infiltration of the endometrial cavity, and reactive myometrial changes, all of which confound ultrasound interpretation. The absence of standardised diagnostic criteria and operator-dependent variability further limit accuracy. Diagnosing RPOG through ultrasound alone remains challenging due to heterogeneous imaging findings and inter-observer variability; a multimodal approach integrating greyscale and Doppler findings, along with clinical evaluation, is advocated²¹.

This study had several limitations. First, the retrospective design may have introduced selection bias. Only women who underwent surgical evacuation for RPOG with available histopathology were included. Thus, the findings may not be generalisable to the broader post-MTOP population, including individuals who received expectant or medical management. Second, ultrasound was routinely performed within 24 hours of abortus passage, which may have contributed to over-referral for surgical treatment. The uterine cavity typically contains a mixture of blood clots and tissue debris that may spontaneously resolve without intervention. Third, histopathological confirmation of RPOG does not establish that surgical intervention was absolutely indicated. Conversely, the absence of trophoblastic tissue on histology does not exclude pre-existing RPOG, given that sampling error or tissue fragmentation and degradation can yield false-negative results. Fourth, the classification of suspected RPOG was based on the physician's assessment rather than a validated scoring system, potentially introducing inter-observer variability. Finally, the small sample size for vascularity assessment precludes definitive conclusions regarding this parameter.

Conclusion

Increased endometrial thickness is an ultrasound

predictor of RPOG after second-trimester MTOP, with high specificity but low sensitivity at a high cut-off value. The favourable diagnostic performance of vascularity supports routine use of colour Doppler ultrasound. Clinicians should adopt a comprehensive, individualised approach that integrates clinical and ultrasound parameters.

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.

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

This study was approved by the Central Institutional Review Board of Hospital Authority (reference: CIRB-2025-345-2). All patients were treated in accordance with the tenets of the Declaration of Helsinki. The patients provided informed consent for all treatments and procedures and for publication.

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Self-management versus nurse-led care of vaginal pessary in patients with pelvic organ prolapse

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Objectives: To compare the outcomes and complications of self-management and nurse-led care in patients with pelvic organ prolapse (POP).

Methods: This retrospective study reviewed medical records of patients aged >18 years with a diagnosis of POP who used a ring vaginal pessary and attended at least two follow-up visits, with an interval of >3 months, at the outpatient urogynaecology POP nurse clinic of Queen Elizabeth Hospital, Hong Kong, between 1 January 2021 and 31 December 2023. Patients were assessed at each follow-up visit. Satisfaction with vaginal pessary use was assessed using a visual analogue scale ranging from 0 to 100. Quality of life was assessed using the Pelvic Floor Distress Inventory-20.

Results: In total, 812 patients were included in the analysis. Of these, 343 were able to perform regular vaginal pessary self-management and 469 required nurse-led care. The two groups were comparable in terms of POP stage. Patients who performed self-management were younger at initiation of vaginal pessary use (64.1 vs 70.0 years, $p<0.001$) and had fewer follow-up visits during the 3-year study period (3.83 vs 5.48, $p<0.001$). The proportion of patients with vaginal discharge was higher in the self-management group (43.4% vs 37.1%, $p=0.068$), but the proportion of patients with vaginal ulcers with deep tissue penetration and scarring or vaginal erosion on examination was lower in the self-management group (6.4% vs 11.9%, $p=0.008$). Self-management and nurse-led care groups had comparable vaginal pessary satisfaction scores (74.05 vs 74.31, $p=0.87$) and showed improvements in quality of life scores between the first and last follow-up visits.

Conclusion: Vaginal pessary self-management can reduce healthcare service utilisation. Caregiver involvement in self-management may enhance adherence. Patients who performed self-management had a lower rate of vaginal ulcers on examination, which may increase the longevity of pessary use.

Keywords: Nurse practitioners; Pelvic organ prolapse; Pessaries; Self care

Introduction

Pelvic organ prolapse (POP) is the descent of the anterior vaginal wall, posterior vaginal wall, uterus (cervix), and/or vaginal apex (vaginal vault or cuff scar after hysterectomy)¹. The reported prevalence of POP was as high as 65%². Follow-up for women with POP places a heavy burden on both patients and the healthcare system. As life expectancy increases, the number of women affected by POP is likely to rise. Optimisation of POP management is crucial to enhance patient quality of life (QOL) and alleviate the healthcare burden.

The severity of POP is measured according to the Pelvic Organ Prolapse Quantification system developed by the International Continence Society³. A vaginal pessary is a supportive device inserted into the vagina to hold the pelvic organs in place and relieve symptoms. Overall, 98%

of American urogynaecologists offer vaginal pessaries as first-line therapy for POP⁴. They are effective in alleviating prolapse symptoms and improving QOL⁵⁻⁸. Nonetheless, adverse events such as abnormal vaginal discharge, vaginal erosion, and vaginal bleeding are common and may affect the longevity of pessary use^{9,10}. Rare complications, including incarcerated vaginal pessary, vesicovaginal fistula, and rectovaginal fistula, have also been reported¹¹⁻¹³.

Conventionally, vaginal pessaries require care by healthcare professionals. Self-management refers to regular removal (at night), cleansing, and reinsertion (in

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the morning) of the vaginal pessary by patients to maintain good hygiene and provide a resting period for the vaginal tissue. Regular vaginal pessary self-management greatly reduces the complication rate¹⁴ and empowers patients with greater autonomy and convenience in sexual activities¹⁵.

At Queen Elizabeth Hospital, Hong Kong, patients newly diagnosed with POP are taught vaginal pessary self-management at the outpatient urogynaecology POP nurse clinic using a pelvic model and a supplementary educational leaflet. Patients are required to demonstrate competency in (1) performing hand hygiene before the procedure, (2) removing the vaginal pessary by inserting a finger into the vagina and gently hooking and pulling out the pessary, (3) cleaning the vaginal pessary with soapy water and storing it properly before reinsertion, (4) allowing the vaginal tissue to rest overnight, and (5) reinserting the vaginal pessary by folding it in half, applying lubricant, and inserting it into the vagina. Patients who are able to perform self-management are encouraged to do so daily whenever possible, or at least weekly; their follow-up intervals are gradually extended from 6 months to 2 years. Those who are unable or unwilling to perform self-management receive nurse-led care every 3 to 6 months. Since 2019, caregivers (eg, relatives or maids) have been invited to learn and assist with vaginal pessary self-management. This study aimed to compare the outcomes and complications of self-management and nurse-led care in patients with POP.

Methods

This retrospective study reviewed medical records of patients aged >18 years with a diagnosis of POP who used a ring vaginal pessary and attended at least two follow-up visits, with an interval of >3 months, at the outpatient urogynaecology POP nurse clinic of Queen Elizabeth Hospital, Hong Kong, between 1 January 2021 and 31 December 2023. Patients were excluded if they were pregnant, used other types of vaginal pessary, or had only one follow-up visit or two follow-up visits with an interval of <3 months.

Data collected included age at initiation of vaginal pessary use, POP stage, number of follow-up visits, and complications associated with vaginal pessary use (eg, vaginal ulcers, vaginal discharge, per-vaginal bleeding, and vaginal pain), as well as the person performing self-management and the frequency of self-management, when applicable. Patients were assessed at each follow-up visit. Satisfaction with vaginal pessary use was assessed using a visual analogue scale ranging from 0 to 100. QOL was assessed using the Pelvic Floor Distress Inventory-20,

which comprises the Colorectal-Anal Distress Inventory-8, Urinary Distress Inventory-6, and Pelvic Organ Prolapse Distress Inventory-6. Additionally, QOL was assessed using the Urinary Impact Questionnaire-7 and Pelvic Organ Prolapse Impact Questionnaire-7. These inventories are commonly used to assess QOL among women with pelvic floor disorders, including urinary incontinence, POP, and faecal incontinence¹⁶⁻¹⁸. Patients were instructed to call the clinic hotline if they experienced any pessary-related issues, and ad hoc follow-up visits were arranged as soon as possible.

Statistical analysis was performed using SPSS (Windows version 24.0; IBM Corp, Armonk [NY], United States). Self-management and nurse-led care groups were compared using the Student's *t* test or Chi-squared test, as appropriate. A *p* value of <0.05 was considered statistically significant.

Results

In total, 812 patients were included in the analysis. Of these, 343 were able to perform regular vaginal pessary self-management and 469 required nurse-led care because they did not learn or refused to learn self-management (*n*=266), learned but were unable to perform self-management (*n*=128), or learned but did not practise self-management (*n*=75). The two groups were comparable in terms of POP stage. Patients who performed self-management were younger at initiation of vaginal pessary use (64.1 vs 70.0 years, *p*<0.001) and had fewer follow-up visits during the 3-year study period (3.83 vs 5.48, *p*<0.001) [Table 1]. Among the 343 patients who performed self-management, 290 (84.5%) did so independently and 53 (15.5%) required caregiver assistance. Regarding the frequency of self-management, 44.9% performed it daily to a few times per week, 41.7% weekly to a few times per month, and 13.4% monthly.

The proportion of patients with vaginal discharge was higher in the self-management group (43.4% vs 37.1%, *p*=0.068), but the proportion of patients with vaginal ulcers with deep tissue penetration and scarring or vaginal erosion on examination was lower in the self-management group (6.4% vs 11.9%, *p*=0.008) [Table 1].

Self-management and nurse-led care groups had comparable vaginal pessary satisfaction scores (74.05 vs 74.31, *p*=0.87) and showed improvements in QOL scores between the first and last follow-up visits, except for the Colorectal-Anal Distress Inventory-8 score in the self-management group (Table 2).

Table 1. Self-management versus nurse-led care of vaginal pessary in patients with pelvic organ prolapse (n=812).

Variable	Self-management (n=343)*	Nurse-led care (n=469)*	p Value
Age, y	64.1±10.8	70.0±9.8	<0.001
No. of follow-up visits	3.83±1.75	5.48±2.21	<0.001
Pelvic Organ Prolapse Quantification stage			0.65
I	9 (2.6)	11 (2.3)	
II	256 (74.6)	355 (75.7)	
III	75 (21.9)	93 (19.8)	
IV	2 (0.6)	7 (1.5)	
Not measured	1 (0.3)	3 (0.6)	
Complication			
Vaginal discharge	149 (43.4)	174 (37.1)	0.068
Vaginal ulcer	22 (6.4)	56 (11.9)	0.008
Vaginal bleeding	101 (29.4)	119 (25.4)	0.197
Vaginal pain	13 (3.8)	30 (6.4)	0.101

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

Table 2. Quality of life scores in patients with pelvic organ prolapse managed with vaginal pessaries (n=734).

Quality of life	Self-management (n=317)			Nurse-led care (n=417)		
	First visit*	Last visit*	p Value	First visit*	Last visit*	p Value
Pelvic Floor Distress Inventory-20	86.28±26.53	82.29±23.28	0.002	80.75±24.41	76.43±20.83	<0.001
Colorectal-Anal Distress Inventory-8	27.39±4.64	27.42±3.96	0.879	27.11±4.59	26.92±3.71	0.400
Urinary Distress Inventory-6	24.25±18.09	22.99±16.66	0.137	21.67±17.33	20.44±16.25	0.064
Prolapse Distress Inventory-6	34.63±13.01	31.85±11.48	<0.001	31.98±10.80	29.08±8.47	<0.001
Urinary Impact Questionnaire-7	6.45±17.38	5.76±15.31	0.461	4.31±13.53	4.26±14.41	0.929
Pelvic Organ Prolapse Impact Questionnaire-7	5.54±15.48	3.29±11.46	<0.001	4.02±12.27	2.16±9.65	0.003

* Data are presented as mean±standard deviation

Discussion

Approximately 42.2% of patients with POP were able to perform vaginal pessary self-management. Of these, 15.5% required caregiver assistance. Caregivers can provide support and education, thereby enhancing patient adherence to self-management. Patients who performed self-management had significantly fewer follow-up visits, suggesting reduced utilisation of healthcare resources^{19,20}. Patients who performed self-management were younger at initiation of vaginal pessary use, consistent with a previous study in Hong Kong²¹. Younger patients may be more willing to learn self-management and have greater dexterity for inserting and removing the vaginal pessary. Patients

who perform self-management are typically younger, have higher education levels, have milder disease, and use larger vaginal pessaries²².

The proportion of patients with vaginal ulcers exhibiting deep tissue penetration and scarring or vaginal erosion on examination was significantly lower among those who performed self-management. This finding highlights the beneficial effect of self-management in increasing the longevity of pessary use. Unusual vaginal discharge is a bothersome complication among patients with POP managed with vaginal pessaries²³. Women who perform self-management are more confident in addressing

pessary-related problems and more willing to report their observations; 98.6% report vaginal discharge²⁴. Patients who perform self-management may thus be more aware of the presence of vaginal discharge on the pessary.

The reported satisfaction rate with vaginal pessaries ranges from 70% to 92%²⁵. In the present study, the self-management and nurse-led care groups had comparable levels of satisfaction with vaginal pessary use and demonstrated significant improvements in QOL scores at the last follow-up visit. For patients performing self-management, long-term management involves discharge from follow-up if they are using self-purchased silicone vaginal pessaries and agree to be discharged. If polyvinyl chloride vaginal pessaries are used, patients will continue to attend follow-up visits.

The present study had several limitations. Data were collected retrospectively; key variables influencing patients' decisions regarding self-management, such as education level, family support, and cultural factors, may not have been captured. Moreover, women are less likely to consider self-management when the option is offered after a prolonged period of healthcare professional-led pessary care—they may perceive that professional involvement is necessary for safe management²⁰.

Conclusion

Vaginal pessary self-management can reduce healthcare service utilisation. Caregiver involvement in self-management may enhance adherence. Patients who performed self-management had a lower rate of vaginal

ulcers on examination, which may increase the longevity of pessary use.

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 on reasonable request.

Ethics approval

This study was approved by the Central Institutional Review Board of the Hospital Authority (reference: Central IRB-2024-574-5). The requirement for patient consent was waived due to the retrospective nature of the research. The patients were treated in accordance with the tenets of the Declaration of Helsinki.

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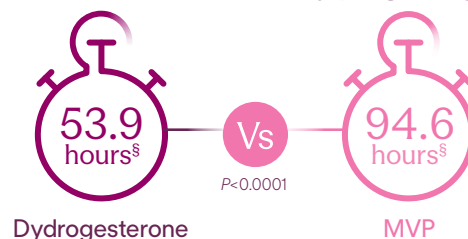


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MVP, micronized vaginal progesterone.

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