ORIGINAL ARTICLES

Adverse Obstetrical Outcomes in Adenomyosis and Correlation With #Enzian Score: A Retrospective Study

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Objective: *To analyse the prevalence of adverse obstetrical and neonatal outcomes in women with adenomyosis within a Dutch hospital, and assess correlation with the #Enzian classification.*

Study Design: *Retrospective observational cohort study.*

Setting: *The study was conducted at the Endometriosis Expertise Centre of Haaglanden Medical Centre (HMC), The Hague, the Netherlands.*

Population: *Women diagnosed with adenomyosis who delivered at HMC between January 1, 2017, and March 31, 2024 (n=196).*

Methods: *Data were extracted from electronic medical records. Outcomes were compared to national data from the Dutch Perinatal Register and literature.*

Main Outcome Measures: *Prevalence of obstetrical and neonatal complications.*

Results: *Compared to the general population, women with adenomyosis showed higher prevalence of prior caesarean sections (14.9% vs 7.4%, p=0.0001), and a history of hypertensive disorders in previous pregnancies (3.1% vs 0.6%, p<0.0001), subfertility (58.7% vs 16%, p<0.0001), fetal growth restriction (FGR) (6.5% vs 3.3%, p=0.03), placenta praevia (3.3% vs 0.84%, p=0.009), non-progressive labour (26.7% vs 11.8%, p<0.0001), assisted vaginal deliveries (12.3% vs 6.8%, p=0.008), induction of labour (34.4% vs 28.3%, p=0.004), and both elective (25.3% vs 9.4%, p<0.0001) and emergency (14.9% vs 8.3%, p=0.004) caesarean sections. A statistically significant but uncertain correlation was found between the presence of adenomyosis and involvement of #Enzian domains T and A.*

Conclusion: *Women with adenomyosis are at increased risk of adverse pregnancy outcomes. Further research is needed to explore the role of adenomyosis in obstetrical and neonatal outcomes more comprehensively, including the extent and location of endometriosis using #Enzian classification.*

BACKGROUND

Adenomyosis is characterized by the presence of endometrial epithelial and stromal cells within the myometrium.[1] Several theories exist regarding the pathogenesis of adenomyosis. The first posits that adenomyosis arises from the invagination of the basal endometrium into the myometrium, while the second suggests de novo development through metaplasia of embryonic Müllerian remnants.[2]

The clinical presentation of adenomyosis varies widely, ranging from the absence of symptoms to severe dysmenorrhea and Heavy menstrual bleeding. Approximately 30% of the patients with adenomyosis are asymptomatic.[3] The prevalence of adenomyosis ranges from 20% to 35%.[4]

Adenomyosis can be diagnosed using transvaginal ultrasound (TVU), magnetic resonance imaging (MRI) or histological examination. Histopathology, typically performed after hysterectomy, is considered the gold standard for diagnosis.

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However, as many women with symptoms of adenomyosis are in their reproductive years, histopathological confirmation is often not feasible.[5] Relatively accurate diagnoses can be achieved using TVU or MRI. The Morphological Uterus Sonographic Assessment (MUSA) consensus outlines specific ultrasound diagnostic criteria, including the presence of cysts, hyperechoic islands, fan-shaped shadowing, echogenic subendometrial lines and buds, translesional vascularity, an irregular junctional zone, and an interrupted junctional zone.[6]

Adenomyosis in pregnant women is associated with hypertensive disorders, preeclampsia, small-for-gestational-age infants, emergency caesarean delivery, and postpartum haemorrhage.[7] A study of Komatsu et al has reported increased risks of placenta accreta, placental abruption, fetal growth restriction, and uterine rupture.[8]

Recent systematic reviews and meta-analyses further support a strong association between adenomyosis and adverse obstetrical outcomes:

- Bruun et al. reported an increased risk of preterm birth (based on four studies) and fetal growth restriction (FGR; based on three studies), though with substantial variation in effect size among studies.[9]
- Razavi et al. demonstrated associations with preterm birth (OR 3.05; 95% CI 2.08–4.47), preeclampsia (OR 4.35; 95% CI 1.07–17.72), and FGR (OR 5.05; 95% CI 2.56–9.96), though the analyses did not adequately control for confounding factors such as maternal age, parity, amenorrhea duration, and medical history.[10]
- Nirgianakis et al. identified associations with preeclampsia (OR 4.32; 95% CI 1.68–11.09), preterm birth (OR 2.65; 95% CI 2.07–3.39), caesarean delivery (OR 2.48; 95% CI 1.44–2.46), fetal malpresentation (OR 3.05; 95% CI 1.60–5.81), FGR (OR 2.86; 95% CI 1.68–4.88), and postpartum haemorrhage (OR 2.09; 95% CI 1.39–6.05), adjusting for maternal age and mode of conception.[11]
- Horton et al. found elevated risks of spontaneous miscarriage (OR 3.49; 95% CI 1.41–8.65), preterm birth (OR 2.74; 95% CI 1.89–3.79), FGR (OR 3.90; 95% CI 2.10–7.25), caesarean delivery (OR 2.62; 95% CI 1.00–6.89), and preeclampsia (OR 7.78; 95% CI 1.26–49.20).[12]

Adenomyosis is known to disrupt the junctional zone of the uterine wall. Given the critical role of the junctional zone in regulating uterine contractility, facilitating implantation and early pregnancy, and supporting placentation and spiral artery development, its disruption may lead to adverse obstetrical outcomes. Impaired uterine wall contractility is associated with various obstetrical complications, including prolonged labour, uterine overstimulation, atony, and retentio placentae. Furthermore, disruption of the junctional zone is thought to lead to abnormal placentation and defective formation of spiral arteries, which may lead to various obstetrical complications, including hypertensive disorders of pregnancy (HDP) and fetal growth restriction.[13]

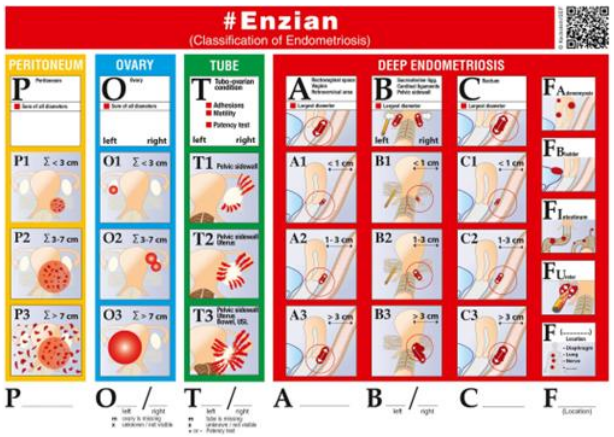
Based on current literature, adenomyosis appears to be more strongly associated with adverse obstetrical outcomes than endometriosis in general. Given that treatment options for adenomyosis are largely limited to hysterectomy or hormonal therapy—both of which are unfeasible for women desiring pregnancy—there is an urgent need for studies focused on periconceptional care and pregnancy monitoring in this population.

The #Enzian-classification is a classification system that provides a uniform description and detailed overview of the extent and location of endometriotic lesions.[14] This system encompasses seven distinct domains, arranged in the following sequence:

- P: Peritoneum;
- O: Ovary, including endometriomas and infiltrating ovarian surface foci;
-T: Tubo-ovarian condition, which includes adhesions that affect the mobility of the ovaries and tubes, as well as the patency of the fallopian tubes;
- A: Represents the craniocaudal axis, and involves the rectovaginal space, vagina, retrocervical area;
- B: Represents the mediolateral axis, including the sacrouterine ligaments, cardinal ligaments, pelvic sidewall;
-C: Represents the ventrodorsal axis, encompassing lesions in the anterior wall of the rectum;
- F: Other lesions, including:
    - A: Adenomyosis
    - B: Urinary bladder
    - I: Sigmoid colon
    - O: Other extragenital locations

The extent of endometriosis is graded using numbers 1, 2 and 3 within compartments P, O, T, A, B, and C. Detailed information regarding this classification can be found in figure I.[14]

Figure I:



Limited research has been conducted on the correlation between pregnancy outcomes and the #Enzian classification. Dirou et al. investigated the association between the preoperative #Enzian score and postoperative fertility following surgery for deep pelvic endometriosis. Their findings suggested that adenomyosis and a history of endometriosis surgery were negative predictors of live birth. Additionally, this study indicated that when endometriosis affects only compartment B, the complete removal of endometriosis results in improved postoperative live birth outcomes. However, the study noted that the sample size was too small to draw strong conclusions, and further research is needed.[15]

Interpretation of existing literature may be limited by heterogeneity in study populations, referral patterns, and disease severity. Tertiary endometriosis referral centres often manage a disproportionate number of patients with complex disease characteristics, including extensive deep infiltrating endometriosis, prior surgical interventions, and multifocal disease distribution. These factors may influence both baseline obstetric risk and pregnancy outcomes.

The Endometriosis Expertise Centre of Haaglanden Medical Centre (HMC) functions as a supraregional referral centre, where a substantial proportion of patients present with advanced or surgically complex adenomyosis and endometriosis. Evaluating obstetric and neonatal outcomes within such a referral population may therefore provide clinically relevant insights, particularly for centres managing patients with moderate-to-severe disease. These findings may support improved risk stratification, tailored antenatal surveillance, and individualized patient counselling.

Moreover, limited data are available regarding the association between pregnancy outcomes and disease extent as classified by the #Enzian system, which may further influence obstetric risk through anatomical distribution and severity of lesions. Therefore, this study aims to evaluate the prevalence of adverse obstetric and neonatal outcomes in women with adenomyosis within a tertiary referral setting and to explore their association with disease extent according to the #Enzian classification.'

METHODS

Main research question: What are the obstetrical and neonatal outcomes in women with adenomyosis who gave birth between January 1, 2017, and March 31, 2024, at Haaglanden Medical Centre (HMC)?

Secondary Research Questions:

- What is the correlation between obstetrical outcomes and #Enzian classification in patients with adenomyosis?
- Is it possible to establish a preconception counselling protocol for women with adenomyosis at HMC?
- What is the appropriate care pathway for pregnant women diagnosed with adenomyosis regarding monitoring and additional diagnostic evaluations (e.g., biometric assessments) at HMC?

Study Objective

This study aimed to analyse the prevalence of adverse obstetrical and neonatal outcomes in women diagnosed with adenomyosis within a Dutch hospital population of the Haaglanden Medical Centre (HMC).

Study Design

This retrospective observational cohort study utilised hospital data from Haaglanden Medical Centre (HMC) spanning from January 1, 2017, to March 31, 2024.

Population

Inclusion Criteria:
Women aged 18–45 years at pregnancy intake with a diagnosis of adenomyosis who delivered at HMC between January 1, 2017, and March 31, 2024.

Exclusion Criteria:
Patients with missing obstetrical data were excluded from the study.

Data Collection

- Data were systematically extracted from the hospital's electronic health record system (HiX, ChipSoft, the Netherlands) and included out. The following data were collected:

- Patient characteristics: age, body mass index (BMI), ethnicity, medication, smoking, alcohol, and drug use, parity, history of chronic illnesses, history of abdominal surgery, history of obstetrical complications.

- Endometriosis details: adenomyosis subtype, diagnostic modality, presence of superficial or deep endometriosis, presence of endometriomas, American Society for Reproductive Medicine (ASRM) score, #Enzian classification (assessed through Transvaginal Ultrasound (TVU) or Magnetic Resonance Imaging (MRI)), hormonal treatments, endometriosis surgery, operative #Enzian classification
    - In cases where the #Enzian classification was not classified, it was retrospectively assessed based on imaging reports and images.

- Subfertility: Subfertility duration, conception method, assisted reproductive technology (ART) use, use of progestogens/acetylsalicylic acid during pregnancy.

- Obstetrical outcomes: live birth, singleton/multiple birth, miscarriage, PPROM, gestational diabetes (GD), placental complications, hypertensive disorders (pre-eclampsia (PE) and pregnancy induced hypertension (PIH)), fetal growth restriction (FGR), spontaneous hemoperitoneum in pregnancy (SHIP), use of progestogens / acetylsalicylic acid (ASA) during pregnancy.

- Labour and delivery: Onset of Labour, reason for induction, mode of delivery, amniotic fluid, oxytocin stimulation, fetal position, non-progressive delivery, delivery duration, complications peripartum, interventions during labour, pain medication during labour, caesarean section complications
- Postpartum complications: manual removal of placenta, postpartum haemorrhage, endometritis
- Neonatal outcomes: birthweight, gestational age, Apgar score, fetal pH, congenital anomalies, NICU admission

Statistical Analysis

Descriptive statistics were used to summarise the baseline characteristics of the study population.
Categorical variables were compared using the Chi-squared test or Fisher's exact test where appropriate. Continuous variables were analysed using Student's t-test or the Mann–Whitney U test based on distribution normality assessed with the Shapiro–Wilk test. Logistic regression analysis was performed to assess associations between #Enzian domains and adverse obstetric outcomes. A p-value <0.05 was considered statistically significant. Statistical analyses were conducted using SPSS (Version 29)
The data were compared with those of the general population at Haaglanden Medical Centre (HMC), using information provided by Perined. Perined is a national database that collects detailed information on pregnancies managed in both primary and secondary care throughout the Netherlands.

For variables where this data was unavailable, data from the general population, as reported in the literature, were used. The corresponding sources for the comparison are specified in the footnotes.

RESULTS

The adenomyosis population was found to be significantly older than the general population (p<0.001). Nulliparity was more common among the adenomyosis group (65.8% vs. 46.3%, p<0.00001), as were prior caesarean sections (14.9% vs. 7.4%, p=0.0001), and a history of hypertensive disorders in previous pregnancies (3.1% vs. 0.6%, p<0.0001). Subfertility was more prevalent in the adenomyosis group (58.7% vs. 16%, p<0.0001). However, spontaneous conception occurred more frequently in this group compared to the general population (62.3% vs. 45.0%, p=0.02). The baseline characteristics are displayed in table I.

Data are presented as n (%), mean (SD), median (interquartile range, 25th to 75th percentile), and p (95% confidence interval), when available. In cases where a subgroup was analysed, this is noted in the footnotes of the tables.

Miscarriages were significantly more common in the adenomyosis group (18.6% vs 12.7%, p<0.015), as were fetal growth restriction (FGR) (6.5% vs 3.3%, p=0.03), and non-progressive labor (26.7% vs 11.8%, p<0.0001). A significant difference was observed in the prevalence of placenta previa between the two groups (3.3% vs 0.84%, p=0.009), with no significant differences noted for other placental complications. The prevalence of spontaneous vaginal deliveries was significantly lower in the adenomyosis group (47.4% vs 74.7%, p<0.0001). In line with this, induction of labour (34.4% vs 28.3%, p=0.004), assisted vaginal deliveries (12.3% vs 6.8%, p=0.008), and both elective (25.3% vs 9.4%, p<0.0001) and emergency (14.9% vs 8.3%, p=0.004) caesarean sections, were more frequent in the adenomyosis group.

Table I: Baseline Characteristics

Variable	Adenomyosis population (n=196)	General population	P-value
Age at time of pregnancy intake	Mean 33.67 (4.38)	Mean 29.15 (4.43)[b]	p<0.001[b]
BMI	Mean 24.4516 (4.25)		
Ethnicity	Caucasian: 77 (73.3) Other: 28 (26.7)	Caucasian: 711,765 (77.4)[a] Other: 208,224 (22.6)[a]	p=0.32
Medication	106 (54.1) Hormonal treatment: 22 (11.2), Pain medication: 3 (1.5), Anticoagulants: 7 (3.6), Antihypertensives: 8 (4.1), Antidiabetics: 4 (2), Thyroid medication: 13 (6.6), Antidepressants: 11 (5.6), Antiepileptics: 2 (1), Immunomodulators: 3 (1.5), Supplements: 65 (33.2), Other: 5 (2.6)		
Substance use	Alcohol: 5 (2.6) Smoking: 11(5.6) Drugs: 11 (5.6)		
Parity	Nullipara: 129 (65.8) Multipara: 67 (34.2)	Nullipara: 455,711 (46.3)[a] Multipara: 529,525 (53.7)[a]	p<0.00001

History of chronic illness	(33.2): DM: 4 (2), IBD: 6 (3.1), Rheumatic disease: 2 (1), Hypertension: 5 (2.6), Trombophilia: 1 (0.5), Trombopathia: 0, kidney disease: 1 (0.5), lung disease: 12 (6.1), heart disease: 1 (0.5), Thyroid disorder: 16 (8.2), Thalassemia: 6 (3.1), Neurological disease: 11 (5.6), Malignancy: 3 (1.5), Other: 11 (5.6)		
History of abdominal surgery	123 (63.4)		
History of obstetrical complications	92 (47.2) CS: 29 (14.9), Miscarriage: 57 (29.2), Hypertensive disorder: 6 (3.1), DG: 1 (4.6), Intra uterine fetal death (IUFD): 2 (1), Premature birth: 1 (0.5), FGR: 5 (2.6), Fluxus: 8 (4.1), Placental complications: 9 (4.6), Other: 13 (6.7) Type of placental complications: Praevia 4: (2), Abruptio: 1 (0.5), Retentio: 3 (1.5), Other: 1 (0.5) Other complications: Partus immaturus 3, EUG 3, SHIP 1, SGA 1	Miscarriage: 1,226,139 (26.6) [b] CS: 73,122 (7.4) [a] Hypertensive disorder: 3224 (0.6) [a] 652 (0.1) [a] SGA:: 6510 (1.2) [a]	Miscarriage: p=0.40 CS: p=0.0001 Hypertensive disorder: p<0 .0001 DG: p=0.21 SGA: p=0.73
Adenomyosis	Focal: 59 (30.1) Diffuse: 36 (18.4) Not specified: 101 (51.5)		
Diagnosis	Prior to pregnancy: (92.9) Method: Ultrasound (suspicion): 28 (14.4), Ultrasound (evident): 158 (81), MRI: 56 (28.7), Intraoperatively: 11 (5.6), Hysteroscopy: 4 (2)		
Concurrent endometriosis	Superficial endometriosis: 54 (73.0) * Deep endometriosis: (61.7) Endometriomas: (44.8)		
ASRM classification	1: 11 (12.8), 2: 8 (9.3), 3: 21 (24.4), 4: 46 (53.5) *		
Hormonal treatment prior to pregnancy	69 (37.7) In context of fertility treatment: 20 (10.9) Time prior to pregnancy: mean 9.43 months (1.542) Type: Oral contraceptives: 27 (14.8), Progestogens: 20 (10.9), GnRH agonist: 27 (14.8) *		
History of endometriosis surgery	107 (54.6) In context of fertility treatment: 34 (33.7) Time prior to pregnancy: mean 25.15 months (2.428) Type: Diagnostic laparoscopy: 14 (7.1), Resection superficial endometriosis: 57 (29.1), Resection deep endometriosis: 62 (31.6), Treatment endometrioma: 53 (27), Bowel surgery: 22 (11.2), Bladder surgery: 9 (4.6), Plexus surgery: 3 (1.5), Other: 2 (1) Type of bowel surgery: Shave: 2 (1), Disk: 4 (2), LAR: 15 (7.7), Appendectomy: 1 (0.5), Other: 2 (1)		

Subfertility	115 (58.7) Time of subfertility: mean 35.6 months (22.267)	697 (16)[c]	p<0.0001
Conception method	Spontaneous: 124 (62.3) ART: 72 (36.7) Type of ART: IUI: 7 (3.6), IVF: 40 (20.4), ICSI: 8 (4.1), Cryo ET: 13 (6.6), Other: 4 (2) Indication: Endometriosis: 53 (27), Tubal factor: 4 (2), Male factor: 2 (1), PCOS: 6 (3.1), E.c.i.: 2 (1)	Spontaneous conception: 2,536,563 (55.0) [b]	p=0.02
Use of progestogens / ASA during pregnancy	Progestogens: 56 (32.4) Acetylsalicylic acid: 24 (13.9) *		

Data are presented as n (%) and mean (SD). a. Perined (national average) b. Rees et al. [7] c. Terävä et al. [16]
* Missing values >5%

The prevalence of (13.2% vs 25.3%, p=0.0006) was lower in the adenomyosis group, as was large-for-gestational-age (LGA) infants (5.4% vs 11.3%, p=0.03).
No significant differences were observed for SGA infants, preterm birth and postpartum hemorrhage. Obstetrical and neonatal outcomes are summarized in table II.

SHIP was not observed in the pregnancies included in the study. However, it is notable that it was present in Although SHIP was not observed in the index pregnancies, one patient had a prior history of SHIP at 17+6 weeks of gestation, requiring embolization and blood transfusion.

Table II: Obstetrical And Neonatal Outcomes

Variable	Adenomyosis population (n=196)	General population	P-value
Live birth	- No: 40 (20.9) Miscarriage n=36, TOP: n=2, EUG: n=2 - Yes: 156 (79.1)		
Singleton/multiple	- Singleton: 194 (99) - Multiple: 2 (1)	- Singleton: 959,092 (97.1) [a] - Multiple: 28,722 (2.9) [a]	p=0.14
Miscarriage	- (18.6) AD <12 weeks: 35 (97.2), AD >12 weeks: 1 (2.8)	- : 43,803 (12.7) [g]	p=0.015
Obstetrical complications[1]	- PPROM: 8 (5.31) - GD 20 (13.2) - Placental complications: 8 (5.3) Praevia: 5 (3.3), Abruptio: 1 (0.7), Accreta: 1 (0.7), Retentio: 2 (1.3), Other: 1 (0.7) - Hypertensive disorder: PIH: 4 (2.6), PE: 3 (2) mean 31.15 weeks (1.2021) - FGR: No: (6.5) - SHIP: No: 0	GD: 25,015 (25.3) [a] Placental complications: - Praevia: 216 (0.84) [b] - Abruptio: 491 (0.5) [a] - Accreta: 7001 (0.12) [c] - Retentio: 108,035 (0.78) [d] Hypertensive disorder: 390,071 (6.3) [h] - PIH: 264,768 (4.3), PE: 125,303 (2.0) FGR: 1020 (3.3) [f]	GD: p=0.0006 Praevia: p=0.009 Abruptio: p=0.52 Accreta: p=0.17 Retentio: p=1.0 PIH: p=0.42 PE: p=1.0 FGR: p=0.03

666

Start labour[1]	- Spontaneous: 70 (46.4) - Induction: 52 (34.4) - Elective CS: 29 (19.2)	- Spontaneous: 595,538 (63)[a] - Induction: 267,681 (28.3) [a] - Elective CS: 82,061 (8.7) [a]	Spontaneous: p=0.02 Induction: p=0.004 Elective CS: p<0.0001
Reason for induction[1]	- Hypertensive disorder: 3 (2.0), FGR: 6 (3.9), Macrosomia: 8 (5.2), GD: 5 (2.6), Term: 5 (3.3), Patients request / surmenage: 13 (8.5), Age: 2 (1.3), Related to medical history: 7 (4.6), Fetal position: 2 (1.3), Other: 4 (2.6)		
Modus of delivery	- Spontaneous vaginal delivery: 73 (47.4) - Assisted vaginal delivery: 19 (12.3) - Elective CS: 39 (25.3) - Emergency CS: 23 (14.9)	- Spontaneous vaginal delivery: 706,050 (74.7) [a] - Assisted vaginal delivery: 64,581 (6.8) [a] - Elective CS: 89,090 (9.4) [a] - Emergency CS: 78,834 (8.3) [a]	Spontaneous vaginal delivery: p<0 .0001 Assisted vaginal delivery: p=0.008 Elective CS: p<0.0001 Emergency CS: p=0.004
Amniotic fluid[1]	- Clear: 128 (86.5), Meconium: 16 (10.8), Hemorrhagic: 1 (0.7), Other: 1 (0.7)	Meconium: - No: 933,685 (88.0) [a] - Yes: 127,167 (12.0) [a]	p=0.70
Non progressive labour[1]	- 27 (26.7) Mean dilatation: 4.77 cm (1.166) Duration: First stage: mean 336 min (254.422), Second stage: mean 35 min (29.194)	- No: 935,709 (88.2) [a] - Yes: 125,143 (11.8) [a]	p<0.0001
Complications peripartum	- 38 (35.8)		
Interventions during labour[2]	- No: 75 (75.8) - Yes: 24 (24.2) Episiotomy: 19 (19.2), Shoulder dystocia management: 1 (1), Vacuum extraction: 17 (17.2), Other: 1 (1)	Episiotomy: - 145,222 (14.8) [a]	p=0.21
Complications postpartum	- Fluxus[1]: No: 11 (7.4) Median 1400 cc (1200 - 2000) - Manual removal of placenta[4]: No: 85 (96.6), Yes: 3 (3.4) - Endometritis[1]: No: 149 (99.3), Yes: 1 (0.7)	Fluxus: No: 60,183 (6.1) [a] Manual removal of placenta: No: 10340 (95.8), Yes: 457 (4.2) [e]	Fluxus: p=0.51 Manual removal of placenta: p=1.0
CS complications[3]	- (13.6) - Bladder damage: 1 (1.7), Uterus rupture: 1 (1.7), Ruptured uterine wound: 1 (1.7), Other: 5 (8.5)		
Birthweight[1]	- Mean 3217.5 grams (2860-3568.75)		
Percentile birthweight[1]	- Mean 41.997 (29.0105) - SGA <p10: 21 (14.3), - LGA >p90: 8 (5.4),	- SGA: 100,702 (11.5), - LGA: 99,196 (11.3),	SGA: p=0.28 LGA: p=0.03

Gestational age[1]	- Mean 38.757 weeks (1.8601) - Premature birth: 11 (7.1) AD 24-32 weeks: 2 (1.3) - AD 32-37 weeks: 9 (5.8)	Premature birth: 70,565 (9)[a]	p=0.73
Apgar score[1]	- 5 minutes: <7: 3 (2.1), ≥7: 141 (97.9) - 10 minutes: ≥7: 143 (100) - *	5 minutes: <7: 29,861 (3.4), ≥7: 855,919 (96.6) [a] *	p=0.64
Fetal pH[1]	- Median 7.23 (7.1575 - 7.2925) - Asphyxia (pH <7): 2 (2.1)		
Congenital abnormalities[1]	- (1.3)	- 6,418 (0.6) [a]	p=0.26
Admission NICU/pediatric department[1]	- 39 (25.8)		

Data are presented as n (%), mean (SD), median (interquartile range, 25th to 75th percentile).
a. Perined (national average), b. Alhubaishi et al.[17], c. Jauniaux et al.[18], d. Jiang et al.[19], e. Perined (healthcare institution average), f. Atallah et al.[20], g. Magnus et al.[38], h. Olié et al.[39], 1. Live births: n=156, 2. Live births - elective CS: n=115, 3. Elective + emergency CS: n=62, 4. Live births - CS: n=92, * Missing values >5%

In addition to adenomyosis, endometriosis in the #Enzian domain T was most frequently scored positively, followed by domains O, A, B, and C, respectively. In domains O, B, C, and F, no significant correlations were found with the adverse pregnancy outcomes studied. However, in domain T, a significant correlation was observed, with an odds ratio of 6.6 (p=0.03, 95% CI [1.202–36.244]) for preterm birth in the presence of T3 lesions in addition to adenomyosis. A similar correlation was found in domain A, where the presence of A1 or A3 lesions was associated with preterm birth. Specifically, the odds ratio for preterm birth with A1 lesions was 7.909 (p=0.049, 95% CI [1.010–61.923]), while for A3 lesions, the odds ratio was 9.667 (p=0.032, 95% CI [1.212–77.117]). These findings are presented in table III.

Table III: Enzian classification and obstetrical outcomes

#Enzian domain	Adenomyosis population (n=196)	Obstetrical outcomes		
O	- 0: 116 (62.7) - 1: 34 (18.2) - 2: 30 (16) - 3: 7 (3.7)	FGR: 1: p=0.524 (0.306-10.26) 2: p=0.221 (0.556-12.691) 3: p=0.999 (0.000) SGA: 1: p=0.058 (0.963-10.138) 2: p=0.418 (0.469-6.198) 3: p=0.227 (0.381-57.605)	Miscarriage: 1: p=0.868 (0.418-2.811) 2: p=0.116 (0.066-1.350) 3: p=0.153 (0.654-15.039) Premature birth: 1: p=0.750 (0.078-6.282) 2: p=0.733 (0.246-7.354) 3: p=0.999 (0.000)	Hypertensive disorder: 1: p=0.998 (0.000) 2: p=0.744 (0.243-7.267) 3: p=0.999 (0.000) Placental complication: 1: p=0.673 (0.263-7.930) 2: p=0.688 (0.071-5.715) 3: p=0.999 (0.000)
T	- 0: 82 (43.9) - 1: 13 (7) - 2: 50 (26.7) - 3: 42 (22.5)	FGR: 1: p=0.412 (0.251-29.244) 2: p=0.648 (0.059-5.834) 3: p=0.131 (0.697-15.934) SGA: 1: p=0.272 (0.457-16.135) 2: p=0.168 (0.706-7.451) 3: p=0.505 (0.410-6.120)	Miscarriage: 1: p=0.368 (0.460-8.157) 2: p=0.418 (0.568-3.904) 3: p=0.083 (0.898-5.841) Premature birth: 1: p=0.269 (0.335-50.763) 2: p=0.998 (0.000) **3: p=0.030 (1.202-36.244)**	Hypertensive disorder: 1: p=0.419 (0.247-28.799) 2: p=0.639 (0.058-5.746) 3: p=0.654 (0.241-9.628) Placental complication: 1: p=0.999 (0.000) 2: p=0.327 (0.038-2.980) 3: p=0.922 (0.168-5.033)
A	- 0: 115 (61.5) - 1: 16 (8.6) - 2: 41 (21.9) - 3: 15 (8)	FGR: 1: p=0.136 (0.647-24.153) 2: p=0.267 (0.509-11.477) 3: p=0.999 (0.000) SGA: 1: p=0.346 (0.473-8.462) 2: p=0.591 (0.181-2.650) 3: p=0.641 (0.070-5.123)	Miscarriage: 1: p=0.516 (0.126-2.823) 2: p=0.545 (0.276-1.976) 3: p=0.506 (0.442-5.230) Premature birth: **1: p=0.049 (1.010-61.923)** 2: p=0.283 (0.404-22.267) **3: p=0.032 (1.212-77.117)**	Hypertensive disorder: 1: p=0.140 (0.640-23.879) 2: p=0.998 (0.000-0.000) 3: p=0.512 (0.218-21.169) Placental complication: 1: p=0.999 (0.000) 2: p=0.790 (0.231-6.866) 3: p=0.643 (0.180-16.045)
B	- 0: 123 (65.8) - 1: 31 (16.6) - 2: 22 (11.8) - 3: 11 (5.9)	FGR: 1: p=0.552 (0.062-4.420) 2: p=0.998 (0.000) 3: p=0.999 (0.000) SGA: 1: p=0.350 (0.514-6.553) 2: p=0.475 (0.408-6.847) 3: p=0.437 (0.362-10.500)	Miscarriage: 1: p=0.952 (0.358-2.628) 2: p=0.497 (0.174-2.335) 3: p=0.399 (0.049-3.313) Premature birth: 1: p=0.998 (0.000) 2: p=0.998 (0.000) 3: p=0.774 (0.152-12.523)	Hypertensive disorder: 1: p=0.361 (0.389-13.290) 2: p=0.999 (0.000) 3: p=0.429 (0.254-25.108) Placental complication: 1: p=0.998 (0.000) 2: p=0.999 (0.000) 3: p=0.999 (0.000)

C	- 0: 134 (71.7) - 1: 7 (3.7) - 2: 28 (15) - 3: 18 (9.6)	FGR: 1: p=0.999 (0.000) 2: p=0.993 (0.112–8.746) 3: p=0.202 (0.550–17.042) SGA: 1: p=0.896 (0.097–7.676) 2: p=0.587 (0.136–3.099) 3: p=0.999 (0.000)	Miscarriage: 1: p=0.999 (0.000) 2: p=0.120 (0.823–5.430) 3: p=0.219 (0.655–6.306) Premature birth: 1: p=0.229 (0.405–43.730) 2: p=0.768 (0.148–13.282) 3: p=0.098 (0.753–27.992)	Hypertensive disorder: 1: p=0.999 (0.000) 2: p=0.998 (0.000) 3: p=0.770 (0.154–12.535) Placental complication: 1: p=0.999 (0.000) 2: p=0.971 (0.118–9.231) 3: p=0.770 (0.154–12.535)
F	Multiple options possible: - A: 187 (100) - B: 5 (2.7) - I: 6 (3.2) - U: 2 (1.1) - Other (1.6)	FGR: B: p=0.999 (0.000) I: p=0.999 (0.000) U: p=0.999 (0.000) Other: p=0.999 (0.000) SGA: B: p=0.999 (0.000) I: p=0.212 (0.359–100.296) U: p=0.999 (0.000) Other: p=0.999 (0.000)	Miscarriage: B: p=0.763 (0.144–14.130) I: p=0.999 (0.000) U: p=0.999 (0.000) Other: p=0.999 (0.000) Premature birth: B: p=0.999 (0.000) I: p=0.999 (0.000) U: p=0.999 (0.000) Other: p=0.999 (0.000)	Hypertensive disorder: B: p=0.066 (0.851–135.787) I: p=0.999 (0.000) U: p=0.999 (0.000) Other: p=0.999 (0.000) Placental complication: B: p=0.999 (0.000) I: p=0.999 (0.000) U: p=0.999 (0.000) Other: p=0.999 (0.000)

Data are presented as n (%) and p-values with 95% confidence intervals.

DISCUSSION

Main findings

The principal findings of this study show higher rates of subfertility, miscarriages, FGR, placenta praevia, non-progressive labour, assisted vaginal delivery, and both elective and emergency caesarean sections in the adenomyosis population, compared to the general population. In contrast, pre-eclampsia, pregnancy-induced hypertension, gestational diabetes, and LGA infants were less commonly observed in the adenomyosis population. No significant differences were found in relation to SGA infants, preterm birth, postpartum haemorrhage, and other placental complications.

Strengths and limitations

Strengths

One of the key strengths of this study is the use of data from our own hospital population, which makes the findings directly applicable to our specific patient group. This enhances the relevance of the results for clinical practice within our healthcare setting. Additionally, the study incorporates a wide range of variables, providing a comprehensive perspective on obstetric and neonatal outcomes in women with adenomyosis. Furthermore, the study benefits from a broad time frame of nearly 7 years, ensuring a robust representation of our hospital population over recent years. It also reflects the development as a centre of expertise, where increasing vigilance, informed by advancements in the literature, has likely improved both the detection of complications and our preparedness to manage them. As a result, the findings may also highlight the impact of evolving counselling practices and proactive clinical strategies. Finally, this study is one of the first to include the #Enzian classification, providing valuable new insights into this topic.

Limitations

Despite these strengths, there are several limitations that must be acknowledged. First, this study is retrospective in nature, which can introduce biases such as information bias and selection bias. As a retrospective study, it is reliant on existing clinical records, which may lead to incomplete data for some patients. As a result, certain variables had more than 5% missing data, which could limit the generalizability of the findings and introduce the risk of incomplete or skewed interpretations for those specific variables.

A second limitation is the absence of a control group, which would have included a matched cohort of women without adenomyosis. This omission complicates comparisons between our study population and the general population, as it prevents adjustment for confounding variables such as age, BMI, co-morbidities, and other relevant factors. Consequently, it limits our ability to definitively attribute the observed outcomes solely to adenomyosis, as these confounding variables could have influenced the results. Additionally, the lack of a control group restricted the statistical analysis, as comparisons had to be made using numbers from Perined or literature instead of a

matched cohort with complete patient information. This necessitated performing analyses through online analysis tools rather than using statistical software like SPSS, which also precluded the calculation of 95% confidence intervals, thereby reducing the depth of information available on the outcomes. Furthermore, while most findings were compared to general population data from Perined, certain outcomes—such as subfertility, miscarriages, hypertensive disorders, placental complications, and FGR —required comparison with data from other literature sources due to gaps in the Perined database. These comparisons with diverse data sources may affect the applicability and generalisability of our findings.

The small sample size presents a significant limitation, affecting the reliability of the findings. First, the limited sample size makes it more challenging to detect statistically significant differences, particularly for rare conditions such as fetal growth restriction, and specific placental complications. These conditions are less likely to appear frequently within a small cohort, reducing the statistical power needed to identify meaningful associations or trends. Furthermore, the small sample size precluded the possibility of conducting additional subgroup analyses or examining rarer outcomes with more precision. For instance, the small sample size limited our ability to analyse how other variables might influence specific rare complications, as the number of cases was insufficient to draw reliable conclusions. This limitation is particularly relevant for understanding the nuanced effects of adenomyosis on obstetrical outcomes, as smaller sample sizes may mask important variations in these rare events.

Finally, the heterogeneity in adenomyosis presentation and the lack of standardised diagnostic criteria across studies present significant challenges, limiting the generalisability of our findings to other institutions or settings. These diagnostic challenges were evident in our study, where 14.4% of the included cases were classified as 'suspicion of adenomyosis', potentially not representing true adenomyosis. Despite these limitations, it is noteworthy that the literature we compared our findings with faced similar diagnostic issues, underscoring the broader impact of these challenges on research in this field.

Another limitation is that the #Enzian classification was retrospectively determined for cases where it was not explicitly documented in the medical records. However, this was done based on reliable evaluation of reports and imaging studies.

Interpretation

Results In Context of What Is Known

Our study demonstrates an increased frequency of subfertility among patients with adenomyosis relative to the general population. However, the comparison of these findings with existing literature is limited by the diagnostic complexities of adenomyosis and the inconsistent definitions of subfertility across studies. A systematic review and meta-analysis encompassing 21 longitudinal studies estimated the pooled prevalence of isolated adenomyosis in women with subfertility to be 10%.[21] Additionally, adenomyosis is widely recognised for its adverse impact on the success rates of assisted reproductive technologies (ART), emphasising its clinical significance in this context.[22,23] Subfertility in women with adenomyosis is largely attributed to local endometrial inflammation, fibrosis, and impaired uterine contractility. These factors disrupt the uterine environment, alter embryo transport, and create an unfavourable condition for implantation.[4]

In our study, a discrepancy was observed between the number of cases of FGR and SGA-infants, which may seem contradictory. FGR was considered present if explicitly documented in the medical records, whereas SGA was defined as a birth weight at or below the 10th percentile. This discrepancy may be attributed to undetected FGR on biometric assessments during pregnancies that ultimately resulted in SGA infants. It could also be explained by insufficient information in the medical records, potentially leading to an underreporting of FGR cases. The proportion of SGA infants was not found to be significantly different compared to the general population, whereas the occurrence of FGR was. The aforementioned factors may have contributed to this difference. Furthermore, these outcomes were compared against two different reference points: data derived from Perined for SGA and data

obtained from existing literature for FGR, as information on FGR was not available in the Perined database. This may have influenced the conflicting results. Existing literature describes an association between both SGA and FGR and endometriosis.[7, 11, 12] Orozco et al. reported an odds ratio of 1.257 (95% CI: 1.064-1.485) for FGR in adenomyosis patients compared to a control group.[24] Similarly, Komatsu et al. found increased odds for FGR in adenomyosis patients (OR 2.66, 95% CI: 2.00-3.48).[25] The risk of FGR in adenomyosis patients is thought to arise from impaired placental implantation, which leads to placental insufficiency and subsequently results in fetal growth restriction.[13] Impaired placental implantation in adenomyosis patients is thought to arise from a combination of local inflammation, altered uterine receptivity, and increased oxidative stress. Altered uterine receptivity due to inflammatory changes and fibrosis can reduce the ability of the embryo to properly implant, further complicating placental development. This oxidative stress can lead to maternal endothelial dysfunction, disrupting the spiral arteries and impairing placental development, which in turn results in placental insufficiency and fetal growth restriction.[4]

Our study observed higher rates of placenta praevia in women with adenomyosis compared to the general population, although no significant differences were observed for placenta accreta, abruptio placentae, or retentio placentae. The finding regarding placenta praevia is consistent with the existing literature. A recent study investigating the association between adenomyosis and obstetrical outcomes similarly reported an increased incidence of placenta praevia in women with adenomyosis compared to a control group.[31] Further supporting this association, a large-scale propensity score-matched analysis by Mandelbaum et al. demonstrated a significant association between adenomyosis and an increased odds of placenta praevia (aOR 5.08, 95% CI: 4.25-6.06).[32] This study also reported elevated odds for placenta accreta (aOR 3.08, 95% CI: 2.01-4.7) and abruptio placentae (aOR 3.21, 95% CI: 2.60-3.98), which makes our findings inconsistent with these results.

Our findings align with previous studies that have reported an increased frequency of non-progressive labour in patients with adenomyosis compared to a control group.[7] This increased risk may be attributed to several factors, including impaired myometrial contractility caused by disruption of the junctional zone. This disruption may also lead to the observed differences in the mode of delivery between the study population and the general population, including a lower frequency of spontaneous vaginal deliveries and a higher frequency of assisted vaginal deliveries, as well as both elective and emergency caesarean sections. The elevated risk of caesarean sections, both elective and emergency, aligns with findings from previous literature.[31, 33]

Consistent with our study, previous studies have consistently reported higher rates of miscarriage in patients with adenomyosis compared to the general population.[11, 12] Specifically, diffuse adenomyosis appears to negatively impact the miscarriage rate.[26] Additionally, the concurrent presence of endometriosis alongside adenomyosis seems to further increase the risk of miscarriage.[27] Several mechanisms may explain these findings. Adenomyosis is associated with chronic inflammation and disruptions in placental development, which can impair normal pregnancy progression. Local endometrial inflammation caused by adenomyotic lesions may trigger the release of inflammatory mediators, such as cytokines and prostaglandins, alongside increased local estrogen production. These factors can disrupt decidualisation, alter endometrial receptivity, and impair placental implantation, thereby increasing the risk of miscarriage. Moreover, oxidative stress and hypoxic conditions within adenomyotic tissue may exacerbate these complications.[4]

Our study identified a significantly lower frequency of large-for-gestational-age (LGA) infants compared to the general population. Current literature provides no evidence to suggest that adenomyosis directly influences the risk of LGA, either by increasing or decreasing it. However, these findings may imply that adenomyosis leads to a lower birthweight, as previous studies have shown a link between adenomyosis and growth restriction.[11,12,24,25] It can be hypothesised that adenomyosis reduces an infant's genetic growth potential. This downward shift in birthweight may result in infants who might otherwise have been classified as LGA being instead within a normal birthweight range.

Nevertheless, this hypothesis cannot be confirmed based on the present data and warrants further investigation.

The significantly lower frequency of GD in adenomyosis patients observed in our study is inconsistent with existing literature.[11, 30, 35]

Variables where no significant differences were found in our study, but where differences have been reported in the literature, include hypertensive disorders, preterm birth, and postpartum haemorrhage.

Previous studies have provided substantial evidence that adenomyosis may contribute to an increased risk of hypertensive disorders during pregnancy, including pregnancy-induced hypertension (PIH) and pre-eclampsia.[7, 24, 31] Rees et al. found an adjusted odds ratio of 1.37 (95% CI: 1.25-1.50) for hypertensive disorders in pregnancy.[7] Similarly, Orozco et al. reported an odds ratio of 1.177 (95% CI: 1.076-1.288).[24] This association is hypothesised to arise from changes in the myometrial junctional zone, specifically disruption of spiral artery remodelling.[7, 34] Shallow trophoblast invasion, which may result from this disruption, could also contribute to pre-eclampsia.[4] Conversely, our study showed lower frequencies of PIH and pre-eclampsia in patients with adenomyosis, compared to the general population. Is it, however, noteworthy that the frequency of patients with a history of hypertensive disorders during previous pregnancies was significantly higher our study group compared to the general population.

In this study, preterm birth was defined as a birth before 37 weeks of gestation. No significant difference was found compared to the general population. However, based on these data, it is not possible to distinguish between preterm labor and the risk of preterm delivery due to fetal compromise. It is important to note, however, that the number of inductions and elective caesarean sections were significantly higher in the adenomyosis group. Literature reports an increased risk of preterm labor in patients with adenomyosis.[9, 10, 11, 12, 28] A potential explanation lies in the structural and functional alterations of the myometrium. Adenomyosis disrupts the uterine junctional zone, leading to abnormal uterine contractility and hyperperistalsis, which may induce premature labour.[4] In addition, adenomyosis can lead to suboptimal decidualisation, increasing the risk of early delivery.[29]

Postpartum haemorrhage was also found to occur more frequently in adenomyosis patients, contrary to our results.[11, 30] For both preterm birth and postpartum haemorrhage, this risk appears to be particularly elevated in patients with diffuse adenomyosis.[31] A higher frequency of postpartum haemorrhage may be attributed to impaired uterine contractility in adenomyosis patients, resulting from disruption of the myometrium and chronic inflammatory changes. Furthermore, adenomyosis is associated with abnormal placentation, such as placenta accreta, which can increase the likelihood of postpartum haemorrhage.[4]

The discrepancy between our findings and existing literature may be attributed to several factors. Firstly, the relatively small sample size, including 156 live births in total, may have limited our ability to detect (rare) obstetrical outcomes. Additionally, diagnostic challenges could have contributed to this discrepancy, leading to the inclusion of patients with suspected adenomyosis, which may have further influenced the results. Methodologically, the absence of a control group in our study may also have impacted the findings. A prospective follow-up of a pre-specified cohort of adenomyosis patients may solve this problem. Finally, differences in study populations, such as variations in patient characteristics and healthcare settings, could account for the conflicting results observed.

It is noteworthy that 13.9% of patients used low-dose aspirin (ASA) during pregnancy, which could be hypothesised to have positively influenced obstetrical outcomes, considering the established beneficial effects of aspirin on prematurity, hypertensive disorders, and fetal growth restriction.[36, 37]

The logistic regression analysis of the correlation between the #ENZIAN classification and adverse pregnancy outcomes revealed a significantly positive odds ratio for preterm birth when endometriosis was present in domains T3, A1, and A3. However, the confidence intervals for these significant results were very wide, indicating

considerable uncertainty. Additionally, some analyses demonstrated extremely large standard errors, p-values of 0.999, and incomplete 95% confidence intervals (e.g., 0.000), suggesting that the sample size may have been insufficient for reliable analysis. Consequently, these findings must be interpreted with great caution and potentially re-evaluated using a larger and more robust dataset. Despite the wide confidence intervals, several plausible explanations for the association between preterm birth and the presence of endometriosis in domains T3, A1, and A3 can be considered. These include the general effects of endometriosis, such as chronic inflammatory processes—including elevated prostaglandins—and disrupted hormonal pathways, both of which are known to influence the risk of preterm birth.[4]

A T3 score indicates adhesions involving the ovaries, pelvic sidewalls, uterus, bowel, and/or sacrouterine ligaments. It is conceivable that these extensive adhesions influence preterm birth, mainly through mechanical effects. Extensive adhesions may restrict the mobility and normal expansion of the uterus during pregnancy, leading to mechanical stress on the myometrium, which may, in turn, result in premature uterine contractions and/or cervical changes. Additionally, these adhesions could disrupt the vascular connections surrounding the uterus, potentially impairing placentation and fetal condition, and thereby contributing to the onset of preterm birth. However, based on this hypothesis, it might be expected that this T3 score would also significantly influence other adverse obstetrical outcomes. This was not observed, highlighting the need for cautious interpretation of these findings.

The A score refers to endometriosis in the rectovaginal space, vagina, and/or retrocervical space, with an A1 score indicating lesions smaller than 1 cm and an A3 score indicating lesions larger than 3 cm. In both cases, endometriosis in this region may lead to fibrosis and adhesions of surrounding tissues, including the cervix and vaginal wall, which could compromise cervical integrity and contribute to preterm birth. Furthermore, endometriosis in this area may impair blood supply to the uterus, possibly weakening the structural integrity of the cervix and lower uterine segment. Deep pelvic pain caused by endometriosis in this domain could also contribute to preterm birth due to increased pelvic floor tension and subsequent uterine hyperactivity. Notably, no significant correlation was observed between an A2 score and preterm birth, which contrasts with these hypotheses. This discrepancy again underscores the necessity of cautious interpretation of these findings. Given the limited research on this subject, there is no existing literature to which these findings can be directly compared.

Clinical Implications

These findings provide valuable insight into the occurrence of obstetrical outcomes in our specific patient population with adenomyosis. Our study confirmed several adverse obstetrical outcomes previously described in the literature, including placenta praevia, FGR, and the increased frequencies of assisted vaginal deliveries and caesarean sections. However, other variables were not found to be significant in our study or suggested an opposite relationship to that previously described in the literature. Due to the limitations of this study, these results should be interpreted with caution. The non-significant or inconsistent findings compared to the existing literature cannot be dismissed on the basis of our research alone, especially given the robust evidence supporting these associations in previous studies. Further research is warranted to investigate these associations in more detail.

The current management strategy for adenomyosis patients includes a preconception counselling, based on risk assessment and, when indicated, additional biometric monitoring and the use of low-dose aspirin. Preconception counselling focuses on the risks of preterm birth, pre-eclampsia, caesarean section, malpresentation, placental complications, SGA-infants and postpartum haemorrhage. Specifically, the risks of placenta praevia, FGR and the increased risk of caesarean section appear to be confirmed by our study. However, it remains essential to discuss the other risks during the preconception counselling, taking into account the previous evidence in the literature.

Given the established risk of fetal growth restriction (FGR) in adenomyosis, it is recommended to routinely perform growth scans at 28, 32, and 36 weeks' gestation in patients with adenomyosis.

Frequent biometric assessments are also necessary to detect the downward shift in birthweight. These shifts can be more challenging to identify with routine biometric monitoring, as affected infants may still present with a birthweight within the normal range. The current policy of administering aspirin in the presence of two minor risk factors that increase the risk of pregnancy complications (e.g., advanced maternal age and adenomyosis) appears to be a justified approach.

Considering the findings on subfertility, it is crucial to inform patients with adenomyosis who wish to conceive about their fertility potential, enabling timely intervention if subfertility is identified.

Research Implications

A study on obstetrical outcomes in adenomyosis would be valuable, using a large sample size and a prospective design to ensure the completeness of pregnancy outcome data collection. Additionally, follow-up research in the form of a randomized controlled trial on the use of aspirin during pregnancy could provide important insights, to further investigate its effect on adverse obstetrical outcomes with a sufficient sample size and prospective design. This RCT is planned to be conducted at HMC.

Furthermore, it would be valuable to conduct further research into the correlation between the #Enzian classification and obstetrical outcomes in patients with endometriosis, with or without adenomyosis. Such studies could help elucidate the exact impact of the location and extent of endometriosis on adverse pregnancy outcomes. The uncertainty in the results on #Enzian classification of this study highlights the need for a larger sample size to improve the reliability of future analyses.

CONCLUSION

In conclusion, our study highlights several key findings regarding obstetrical and neonatal outcomes in women with adenomyosis. The results confirm an increased risk of adverse outcomes such as miscarriages, fetal growth restriction, placenta praevia, and a higher frequency of induction of labour, assisted vaginal deliveries and caesarean sections compared to the general population. However, our findings also challenge or do not fully align with some previously reported associations, including the incidence of preterm birth, postpartum haemorrhage, and other placental complications. These discrepancies may be attributed to the limitations inherent in our study, including the small sample size and the absence of a control group. Despite these limitations, the findings underscore the clinical significance of adenomyosis in pregnancy, highlighting the importance of appropriate preconception counselling and prenatal care. Further research is needed to explore the role of adenomyosis in obstetrical and neonatal outcomes more comprehensively, including the extent and location of endometriosis using #Enzian classification, as well as the role of ASA.

DECLARATION

Author Contributions

KB conceived and designed the study. TvI and HdB developed the study protocol, collected the data, and performed the data analysis. KB, JE, MvdZ, and AN supervised the project, provided expert input for data interpretation, and contributed to the critical revision of the manuscript. All authors reviewed and approved the final version of the manuscript.

Ethical Approval

This study was deemed not subject to the Dutch Medical Research Involving Human Subjects Act (WMO) by the Medical Ethics Committee of Leiden-The Hague-Delft (METC-LDD), under reference number N22.079, dated 25 July 2022. The study protocol was approved by the institutional Board of Directors of Haaglanden Medical Centre, under reference number 2022-047, dated 24 August 2022.

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