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Hysteroscopic Management of Early Miscarriage Literature Review

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ABSTRACT

Hysteroscopic management of early miscarriage is a safe and effective technique with positive later reproductive outcomes. A systematic literature review was carried out to evaluate the use of hysteroscopy in the management of early miscarriage. Twenty-four articles were selected and their characteristics and results were analyzed. The different studies demonstrate the advantages of hysteroscopic resection over standard dilatation and curettage. This method can be an innovative treatment for early miscarriage in selected cases such as patients with recent uterine surgery, recurrent pregnancy losses, history of retained products of conception, congenital uterine alformations or intracavitary structural lesions.

Keywords

Early miscarriage, Hysteroscopic management, Hysteroscopic morcellation, Dilatation and curettage, Infertility, Intrauterine adhesions and retained products of conception.

Introduction

Early miscarriage is a first trimester pathology with a high prevalence in women of reproductive age. Conventional treatment is surgical and consists of blind curettage of the uterine cavity under sedation. Subsequently, pharmacological treatment was introduced, avoiding surgical intervention in a high proportion of patients. However, both options present complications such as retained products of conception (RPOC) and intrauterine adhesions (IUA), which can reduce the patient's subsequent fertility.

Hysteroscopic management of early miscarriage, as a direct vision technique, allows a more complete and effective minimal invasive approach to this pathology. Hysteroscopic treatment offers several advantages over traditional methods, including the possibility of performing an embryoscopy to visualize the existence of embryonic malformations and to obtain a biopsy for chromosomal analysis. Hysteroscopy is safe and presents a lower risk of complications and greater accuracy in uterine evacuation.

Objectives

The main objective is to analyze the hysteroscopic management of early pregnancy loss as an effective and safe alternative in obstetric clinical practice.

Secondary objectives of the study are the following: To analyze the advantages and disadvantages of hysteroscopic management compared to the routine management of early miscarriage. To evaluate the efficacy and safety of hysteroscopic management of early miscarriage in terms of success rates, complications and short- and long-term results. To compare the different hysteroscopic techniques for the management of early miscarriage (resectoscope vs. morcellator). To identify the limitations associated with hysteroscopic management of early miscarriage, as well as to propose possible strategies to avoid them. To discuss the potential impact of hysteroscopic management of early miscarriage on patients' quality of life and subsequent obstetric outcomes. To provide recommendations for the appropriate implementation and continuous improvement of this technique in the comprehensive management of early miscarriage.

Methodology

In order to evaluate the use of hysteroscopy in the management of early miscarriage, a systematic literature review was carried out including the following electronic databases: PubMed, Embase,

Science Direct, The Cochrane Library and Google Scholar. This review was carried out including the first references published up to April 2024. To complete the review, a combination of the following keywords was used:
early miscarriage, early pregnancy loss, first trimester miscarriage, missed abortion, hysteroscopy, hysteroscopic treatment, hysteroscopic management, hysteroscopic resection, hysteroscopic resectoscopic treatment, hysteroscopic evacuation, hysteroscopic morcellation, hysteroscopic tissue removal system, dilatation and curettage, compared to curettage, compared to vacuum aspiration, infertility, intrauterine adhesions and retained products of conception, molar pregnancy, ectopic pregnancy, cornual pregnancy, interstitial pregnancy and cesarean scar pregnancy.

Twenty-four articles were selected, and their characteristics and results were analyzed. The studies were analyzed in order from the highest to the lowest number of patients included. We also added those related to molar and ectopic gestations (cornual/interstitial, cesarean scar) treated by hysteroscopic resection (Table 1).

Table 1: Summary of publications on the hysteroscopic management of early miscarriage and ectopic pregnancies.

Author, year	Study	n	HR	D&C
Young et al., 2022	Literature review Clinical case	**842** HR (463) D&C (379)	Minor IUA Minor RPOC Minor conception time Major conception rates	Major AIU Major ROP Major abnormal placentation
Huchon et al., 2023	Prospective RCT	**574** HR (288) D&C (286)	**Cold loop:** Major surgical time Major hospitalization	NO differences: - RPOC - Surgical complications - Rate of new pregnancies, miscarriages or ectopics
De Codt et al., 2020	Retrospective Cohorts	**358** HR (185) D&C (163)	**Cold loop:** Major pregnancy rate at 6 months post-IVF (39,7%) Uterine anomalies 5,4%	**Eco-guided:** Minor pregnancy rate at 6 months post-IVF (26,7%)
Meshaal et al., 2022	Prospective RCT	**315** HR (105) D&C (105) D&C US (105)	**Cold loop:** Minor RPOC Major pregnancy rate at 2 years (82,7%) Minor conception time (6,9 months) Major surgical time	**Blind:** Major RPOC Minor pregnancy rate at 2 years (57,4%) Major conception time (9,8 months) Major surgical complications
Sasaki et al., 2021	Retrospective Case series	**45** HR	**Morcellation:** Minor RPOC Minor complications	
Moore et al., 2024	Prospective Case series	**40** HSC + D&C	**HSC → D&C → HSC** RPOC 10% IUA 2,5%	
Bar-On et al., 2024	Prospective Case series	**15** HR	**Cold loop:** RPOC 13% NO IUA	
Weinberg et al., 2021	Prospective Case series	**10** HR	**TruClear:** 40% require D&C NO RPOC (US control) NO IUA (4 HSC control)	
De Codt et al., 2023	Retrospective Case series	**36** Molar HR	**Cold loop:** RPOC 16% Complications 30% NO AIU	
Tsagias et al., 2023	Clinical case	**1** Cornual HR	**RH Cold loop + US:** NO RPOC	
Nezhat et al., 2023	Clinical case	**1** Cornual HR	**LPS ("milking") + HR + D&C**	
You et al., 2024	Retrospective Cohorts	**45** Ectopic CS HR	(28) **HR + D&C + US** (17): Minor bleeding and complication Minor surgical time and hospitalisation	
Liu et al., 2024	Clinical case	**1** Heterotopic CS HR	**HR bipolar loop + Bigatti + US** Preservation intrauterine pregnancy	

RCT: Randomized controlled trial; HR: Hysteroscopic resection; D&C: Dilatation and curettage; HSC: Hysteroscopy; US: Ultrasound guided; LPS: Laparoscopy; IUA: Intrauterine adhesions; RPOC: Retained products of conception; CS: Cesarean scar.

Results

The most extensive review we have found was published by Young et al. (Table 2). They found better results with hysteroscopic resection (HR) compared to dilatation and curettage (D&C).

They observed that HR had a lower incidence of IUA and RPOC, higher pregnancy rates (especially in women under 35 years of age) and shorter time to conception. In patients who initially underwent D&C, there was a higher rate of infertility due to IUA and tubal occlusion, 21% required hysteroscopy for RPOC, and there was a higher risk of abnormal placentation in future pregnancies compared to those who underwent HR [1].

Table 2: Summary of studies comparing hysteroscopic resection (HR) with dilatation and curettage (D&C) for the treatment of early miscarriage [1].

Author, year	Study	n	HR cohort outcomes: %	D&C cohort outcomes: %	P value
Hooker et al., 2016	S	**339** HR (147) D&C (192)	IUA: 13 Incomplete evacuation: 1 No complications Conception rate: 82.4 Live birth rate: 88 Miscarriage rate: 14.8	IUA: 30 Incomplete evacuation: 29 Complications: 1.4 Conception rate: 81 Live birth rate: 91.6 Miscarriage rate: 14.3	< .001 < .000.1 NS NS NS NS
Rein et al., 2011	P	**95** HR (53) D&C (42)	IUA: 4.2 Time to conception: 27 mo Conception rate: 68.8 Live birth rate: 83.9 Miscarriage rate:9.7	IUA: 30.8 Time to conception: 34 mo Conception rate: 59.9 Live birth rate: 77.3 Miscarriage rate:13.6	< .001 < .05 < .05 NS NS
Cohen et al., 2001	R	**70** HR (46) D&C (24)	Second hysteroscopy: 0 Time to conception: 7.3 mo Conception rate: 82.4 Live birth rate: 71.4 Miscarriage rate: 7.1 No complications	Second hysteroscopy: 21 (for persistent trophoblastic tissue) Time to conception: 11 mo Conception rate: 62.5 Live birth rate: 70 Miscarriage rate: 30 No complications	 < .05 NS NS NS NS
Ben-Ami et al., 2014	R	**177** HR (83) D&C (94)	Infertility: 12 Time to conception: 7.4 mo Conception rate: 92.8 Live birth rate: 87 Miscarriage rate: 20.8	Infertility: 24.5 Time to conception: 12.9 mo Conception rate: 92.6 Live birth rate: 95.4 Miscarriage rate: 12.6	< .05 < .05 NS NS NS
Smorgick et al., 2018	R	**161** HR (134) D&C (27)	Live birth rate: 56 Miscarriage rate: 18.7 Recurrent RPOC: 11.9 Abnormal placentation*: 23.9	Live birth rate: 70.4 Miscarriage rate: 19.7 Recurrent RPOC: 33.3 Abnormal placentation*: 44.4	NS NS < .05 < .05

HR: Hysteroscopic resection; D&C: Dilatation and curettage; S: Systematic review; P: Prospective; R: Retrospective; IUA: Intrauterine adhesions; RPOC: Retained products of conception; NS: Not significant.

Another advantage of HR over D&C is the higher percentage of successful fetal chromosomal testing due to less contamination of the maternal decidua (88.5% vs. 65%, P<0.001) [2].

HR offers the additional advantage of simultaneous evaluation of the uterine cavity to detect uterine malformations (uterine septum, dysmorphic uterus...) and intrauterine pathology (submucous myomas, adenomyosis, endometritis...), which may be the underlying cause of miscarriage and may be associated with an increased risk of RPOC. 22% of women with a history of miscarriage have a congenital or acquired uterine anomaly. HR results in more cases of complete evacuation and lower risk of uterine perforation compared to blind D&C, especially in cases of uterine anomalies [1].

Young and Miller concluded that HR can be successfully applied for surgical treatment of first-trimester miscarriage with better results than D&C.

Huchon et al. conducted a multicenter randomized trial of 574 patients diagnosed with incomplete miscarriage treated by cold loop hysteroscopy (n = 288) and D&C (n = 286) in which no higher subsequent pregnancy rates were associated with HR (62.8%) compared to D&C (67.6%) during 2-year follow-up. The duration of surgical intervention and hospitalization was significantly longer for hysteroscopy. Rates of new miscarriage, ectopic pregnancy, surgical complications, and reoperation for

RPOC did not differ between groups. A possible bias of this study was that most of the women who participated in the trial reported symptoms such as vaginal bleeding, which can make it difficult to study the uterine cavity by hysteroscopy and, therefore, a suboptimal uterine evacuation was performed [3].

De Codt et al. performed a retrospective cohort study of 358 patients with first-trimester miscarriage comparing cold loop HR (185 patients) with ultrasound-guided D&C (163 patients).

In the HR group 59.5% (110) patients had obtained pregnancies by in vitro fertilization (IVF) versus 4% (7) patients in the D&C group. Intraoperative and postoperative complication rates were low in both groups, with a slightly higher risk of hemorrhage in the D&C group.

Intrauterine anomalies were diagnosed during hysteroscopy in 10 patients (5.4%). There was no difference in average time to conception between the two groups. Multivariate analysis of pregnancy at 6 months, adjusted for IVF factor, was 39.7% (52/131) for HR compared to 26.7% (43/161) for D&C. This could represent a significant benefit of HR in the population requiring IVF [4].

Meshaal et al. conducted a study of 315 women with first-trimester miscarriage dividing them into three groups. Group 1 underwent blind D&C, group 2 underwent ultrasound-guided D&C and group 3 underwent cold loop hysteroscopic treatment. Surgical complications, RPOC, need for further treatment and occurrence of pregnancy after D&C were evaluated during 2 years of follow-up. The rate of complications during and after surgery, RPOC and the need for additional treatment was significantly higher in group 1 compared to groups 2 and 3 (4.8% vs. 0% vs. 0%, $P = 0.012$). The conception rate within 2 years was significantly lower in group 1 compared to groups 2 and 3 (57.4% vs. 73.2% vs. 82.7%, $P = 0.002$). Women who underwent HR required significantly less time to conceive than those who underwent D&C and ultrasound-guided evacuation (6.9 vs. 9.8 and 8.3 months, $P = 0.006$). HR required longer surgical time compared with blind D&C and ultrasound-guided technique ($P < 0.001$) [5].

Sasaki et al. performed hysteroscopic morcellation on 45 patients with first-trimester miscarriage. 6.6% (3) of patients had intraoperative complications due to excess fluid absorption. Chromosomal analysis was performed, and an abnormal karyotype was found in 40% (18) of the cases. Ultrasound control at 3 months was normal in 77% (35), 17.7% (8) were not performed, 6.6% (3) patients were pregnant and 4.4% (2) presented pathological findings.

In the two ultrasound scans with pathological findings a diagnostic hysteroscopy was performed, one was normal and the other had an endometrial polyp removed [6].

Moore et al. conducted a prospective study with 40 patients diagnosed with early miscarriage with a mean gestational age of 8.9 ± 1.6 weeks in whom a diagnostic hysteroscopy was performed to locate the area of implantation of the gestational sac, followed by an ultrasound-guided aspiration curettage, and after completion a hysteroscopy was performed again to verify complete evacuation of uterine cavity. In 4 (10%) patients RPOC was observed and evacuated. After six months a control hysteroscopy was performed in 9 patients diagnosing one case of mild IUA and eight patients with abnormal cavity. A subsequent pregnancy was reported at the time of follow-up in 15 cases, 12 patients refused hysteroscopic control and 4 were lost [7].

Bar-On et al. recruited 15 patients with delayed miscarriage under 12 weeks of gestational age who underwent cold loop hysteroscopic evacuation with general anesthesia. The mean duration of the procedure was 14.3 ± 3.7 minutes. Complete evacuation was recorded in all cases and no adverse events were reported during the procedure. Follow-up after 6 weeks was hysteroscopic in 10 women and ultra-sonographic in 4 women. One woman had conceived before the scheduled follow-up visit. Two (13.3%) cases of RPOC were diagnosed during office hysteroscopy where they were removed. No intrauterine adhesions were detected [8].

Weinberg et al. enrolled 10 patients with delayed miscarriage under 10 weeks gestational age in whom hysteroscopic evacuation was performed with the Truclear Elite morcellator preceded by embryoscopy. 40% (4) of the patients required aspiration curettage immediately after the hysteroscopic procedure due to poor visibility or abnormal ultrasonography at the end of the procedure. RPOC was found in only 1 of these 4 aspiration specimens (25%) with poor visibility or abnormal ultrasonography at the end of the procedure. In all cases, a normal uterine cavity without evidence of RPOC was documented on follow-up ultrasound. Four patients underwent a follow-up office hysteroscopy that demonstrated a normal cavity without IUA [9].

De Codt et al. published a series of 36 cases of molar pregnancy treated by hysteroscopy. Histological analysis showed 77.8% (22) partial molar and 22.2% (8) complete molar pregnancy. The main surgical complications were uterine perforation in 1 patient (2.8%) and glycine reabsorption in 10 patients (27.8%), with 2 cases of hyponatremia corrected by standard treatment. A possible cause of the high rate of hydric overload may be the increased vascularization of the trophoblastic tissue in this pathology, which requires greater distension.

Monthly ultrasound monitoring was performed in 19 patients (52.8%), who presented a slow decrease in B-HCG or persistent bleeding, finding RPOC in 6 patients (16.7%). Of the 6 patients, one had a spontaneous expulsion of the trophoblastic tissue and in five a new hysteroscopy was performed (2 surgical and 3 ambulatory). None of these five new procedures showed intrauterine adhesions. Three studies in the existing literature describe the rate of RPOC after D&C in molar gestations: 33.3% (17/51) in the series of Sato et al. [10], 41% (71/173) in the series of Yomamoto et al. [11] and

13.3% (160/1206) in the series of Padron et al. [12,13].

Cases of interstitial/cornual ectopic pregnancy treated with hysteroscopy have been described.

This gestation is associated with high morbidity and mortality. Low serum B-HCG levels are predictors of the success of conservative treatment [14]. In case of high B-HCG levels and clinical symptoms, surgical treatment of cornual resection increases the risk of uterine rupture in future pregnancies. Hysteroscopy is an option that combines efficient and complete removal of the gestational sac without severely affecting the uterine anatomy. The first hysteroscopic resection was published by Meyer and Mitchell [15] and performed under laparoscopic guidance. Sanz and Verosko [16] performed hysteroscopy under ultrasound control and Pal et al. [17] performed hysteroscopic resection of the gestational sac and posterior removal of the excised remains by aspiration under a combination of ultrasound and laparoscopic guidance. Tsagias et al. published a 7-week cornual gestation, diagnosed by ultrasound and magnetic resonance imaging, treated with loop resectoscopy avoiding the use of energy [18], without intraoperative or postoperative complications, preserving the uterine anatomy and without RPOC in the subsequent control. Nezhat et al. combined hysteroscopy and laparoscopy in the management of a 5-week interstitial ectopic gestation.

Starting with laparoscopy, the interstitial pregnancy was gently pushed into the uterine cavity by atraumatic graspers using a "milking" technique. The pregnancy could then be visualized by histeroscopy and the residual tissue was detached and removed with graspers, after which aspiration curettage was performed. Blood loss was minimal, and the patient was hospital discharged on the same day of surgery. A hysterosalpingogram performed 2 months after the procedure showed bilateral tubal patency. This allows early continuation of the attempt to achieve pregnancy, as opposed to medical treatment with methotrexate [19].

You et al. have recently published a retrospective cohort study on the efficacy of hysteroscopic treatment of pregnancy on cesarean scar. Of the 521 patients diagnosed over six years, 45 were treated with hysteroscopy, of which 28 (62.2%) underwent direct hysteroscopic excision and 17 (37.8%) underwent hysteroscopy combined with ultrasound-guided aspiration. They found that hysteroscopy with ultrasound-guided aspiration was more suitable as a treatment because it had less bleeding, minor complications, and shorter operative and hospitalization time [20].

Liu et al. describe a combined hysteroscopic treatment using bipolar resectoscope and hysteroscopic morcellator (Bigatti shaver IBS) under transabdominal ultrasound guidance for the treatment of a heterotopic pregnancy in a 7-week previous cesarean scar, preserving the intrauterine gestational sac, with minimal blood loss and short operative time [21].

Hysteroscopic management of delayed miscarriage therefore offers numerous advantages over standard treatment (Table 3). First of all, it has a lower incidence of IUA and RPOC, with the resulting impact on fertility, with higher pregnancy rates and shorter time to conception, compared to D&C. The technique does not require cervical dilatation as it uses small caliber devices (6 mm), thus reducing the risk of uterine perforation. It is a direct vision technique that allows evaluation of the uterine cavity to diagnose anomalies (uterine septum, dysmorphic uterus, submucous myomas, adenomyosis...) that may go unnoticed in the two-dimensional ultrasound and may be the cause of miscarriage. In addition, an embryoscopy can be performed in which the morphological evaluation of the embryo is performed to rule out malformations and allows obtaining direct and precise samples of the embryonic tissues for chromosomal analysis, avoiding maternal contamination [22]. For the patient it involves a shorter intervention compared to pharmacological miscarriage treatment and with the possibility of finding a cause of the pregnancy loss, which makes the process psychologically more bearable.

Table 3: Advantages and disadvantages / limitations of hysteroscopic management of early miscarriage.

ADVANTAGES	DISADVANTAGES / LIMITATIONS
- Minor incidence of IUA	- High cost of equipment
- Minor incidence of RPOC	- Major surgical time
- Major pregnancy rates	- Major surgeon experience (complex technique)
- Minor conception time	- Performance in the operating room under general anaesthesia
- No dilatation (minor risk of perforation)	- Risk of fluid overload
- Diagnosis of uterine anomalies (malformations, fibroids, adenomyosis)	- Risk of bleeding clouding hysteroscopic vision
- Embryoscopy (fetal morphology and biopsy for chromosomal analysis)	- Pregnancy losses under 10 weeks
- Shorter than pharmacological abortion (better psychological acceptance)	- Excludes voluntary abortions

IUA: Intrauterine adhesions; RPOC: Retained products of conception.

However, it also has disadvantages or limitations that make hysteroscopic treatment more difficult to implement as a first option (Table 3). One of them is the increased cost of using electrical devices or single use morcellators. The procedure time is longer compared to D&C. It is performed in the surgical room under general anesthesia, since performing it in the outpatient clinic with the patient awake is complicated due to the emotional and psychological impact on the patient, in addition to requiring greater pressure to optimize visualization of the uterine cavity and reduce bleeding or remains that may interfere with the image. It is a complex technique due to the vascularization of the gestational tissue, for this reason it is limited to first trimester miscarriages (less than 10 weeks) and it excludes voluntary termination of pregnancy. It requires an expert surgeon who must control the risks of hydric overload of hysteroscopy, which do not occur in standard aspiration curettage. However, considering the short mean time and the low volume of distention medium infused, these adverse events are extremely rare.

Hysteroscopic treatment of early miscarriage would be indicated

especially when there is a risk of IUA formation, such as in patients with a history of previous uterine interventions (curettage, myomectomy...), infertility or recurrent miscarriages.

Hysteroscopic management is also recommended in patients with a history of RPOC, congenital uterine malformations or intracavitary structural lesions (myomas, adenomyosis...) in order to reduce the risk of uterine perforation and incomplete evacuation of the tissue (Table 4) [23].

Table 4: Indications for hysteroscopic management of early miscarriage.

INDICATIONS
1. Risk of IUA
2. Previous uterine surgeries (curettage, myomectomy...)
3. Infertility
4. Repeated miscarriages
5. History of RPOC
6. Congenital uterine malformations
7. Intracavitary structural lesions (fibroids, adenomyosis)

IUA: Intrauterine adhesions; RPOC: Retained products of conception.

Conclusions

Hysteroscopic management of early miscarriage is a safe and effective technique with good subsequent reproductive outcomes. Since it is a technique under direct vision, it allows minimizing endometrial trauma and achieving more selective and complete evacuations, reducing the rate of IUA and RPOC, which can compromise fertility. The possibility of diagnosing uterine anomalies and a previous embryoscopy allows us to evaluate the possible causes of miscarriage.

Hysteroscopy can be an innovative treatment for miscarriage in selected cases such as patients with recent uterine surgery, recurrent pregnancy losses, history of RPOC, congenital uterine malformations or intracavitary structural lesions. Different studies demonstrate the advantages of hysteroscopic resection over D&C, but there are no publications comparing the different hysteroscopic techniques (resectoscope vs morcellator), this depends on the availability of the devices and the surgeon's experience. Nevertheless, both techniques have been shown to be superior to conventional curettage.

Further studies are needed to evaluate the possible advantages of hysteroscopic treatment, the long-term fertility and pregnancy outcomes, to evaluate the indications and surgical technique, as well as a cost-benefit analysis.

Hysteroscopy is considered the gold standard for the evaluation and treatment of intrauterine pathology. In addition, a recent consensus statement published by the European Society for Gynecologic Endoscopy (ESGE), the Global Congress on Hysteroscopy (GCH) and the American Association of Gynecologic Laparoscopists (AAGL) states that blind intrauterine procedures for diagnostic and therapeutic purposes should be avoided, and that intrauterine surgical procedures should be performed under direct visualization when this technology is available. In particular, the treatment of RPOC has evolved from blind curettage to hysteroscopic procedures. We believe that in a short period of time, hysteroscopy can become part of the treatment protocol for early miscarriage as a safer, more complete and effective option, and that economic reasons will not be an impediment to implementing this technique in daily obstetric practice [24].

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