

Original Research

Conservative Laparoscopic Surgery for Intramural Ectopic Pregnancy: A Summary of Twelve Case Reports

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Academic Editors: Andrea Tinelli and Michael H. Dahan

Submitted: 10 November 2022 Revised: 6 February 2023 Accepted: 9 February 2023 Published: 16 May 2023

Abstract

Background: Intramural pregnancy (IMP) is a special type of ectopic pregnancy. The cause of the disorder nor a uniform effective treatment plan, either pharmacological or surgical treatment, has been reported. Pharmacological treatments have been associated with poor clinical outcomes and a higher risk of bleeding during treatment. Laparoscopic surgery for intramural pregnancy has been reported and timely diagnosis and early treatment by laparoscopy can reduce the adverse impact on female fertility. However, the safety and efficacy of laparoscopic treatment of intramural pregnancy has not been adequately evaluated. **Methods:** To evaluate the effectiveness of laparoscopic therapy of intramural pregnancy, we retrospectively selected clinical data from 12 patients with IMP treated by laparoscopy in our gynecology department (From January 2010 to December 2021). We collected clinical data from medical records, including: maternal age, gestational sac location, duration of amenorrhea, clinical symptoms, previous surgical history, pregnancy history, serum β -HCG (human chorionic gonadotropin) level, intraoperative bleeding and time of postoperative hospital stay. **Results:** All patients with intramural pregnancy who underwent laparoscopic surgery had their uterus preserved. Serum β -hCG decreased significantly after the operation and the average intraoperative blood loss was (50.9 ± 5.5) mL. The average length of stay was (5.4 ± 0.6) days resulting in an average hospital cost of $10,487 \pm 548$ RMB. **Conclusions:** Laparoscopic surgery is an effective and beneficial method for treating early intramural pregnancy preserving women's uterus and protecting her future fertility.

Keywords: intramural ectopic pregnancy; laparoscopy; hysteroscopy

1. Introduction

Intramural pregnancy (IMP) is defined as a fertilized egg that has implanted in the myometrium and surrounded by myometrial tissue [1] and not in direct communication with uterine endometrium. The incidence is less than 1/100 of pregnancies [2]. The common types of ectopic pregnancy are tubal pregnancy, cervical pregnancy, cornual pregnancy, ovarian pregnancy whilst intramural pregnancy is an uncommon type of ectopic pregnancy [3]. During intramural pregnancy the gestational sac is located within the muscular wall of the uterus and may present with symptoms of amenorrhea, abdominal pain, vaginal bleeding and hemorrhagic shock. The symptoms can be severe and acute, and can be confused with ectopic pregnancy and trophoblastic disease [4]. Intramural pregnancies are rare but dangerous, early diagnosis and timely treatment can reduce damage to the uterus, decrease the incidence of bleeding and protect a women's fertility [5].

At present there are several therapeutic options for treatment of intramural pregnancy, both surgery and medication are available [6]. Pharmacological interventions include medication with mifepristone and methotrexate, mifepristone antagonizes progesterone and causes degeneration and necrosis of the meconium and chorion, methotrexate inhibits trophoblast cells and also kills the chorion and destroys embryonic tissue [7]. Several surgical methods

have been reported, including transabdominal surgery, hysteroscopic surgery [8] and laparoscopic surgery [9]. Laparoscopic surgery has the benefit of less trauma and rapid postoperative recovery in addition to sutures in the myometrium that will reduce the risk of uterine rupture in a subsequent pregnancy [10]. Hysteroscopy can also be used to treat intramural pregnancy. The hook electrode can cut the endometrial layer and myometrium layer through the sinus tract and electrosurgery can cut the intramural pregnancy tissue. This method reduces the damage to the endometrium and is suitable for patients who wish to maintain fertility as hysteroscopy is also feasible for patients with implantation close to the endometrial layer. This manuscript analyzes the medical records of laparoscopic and hysteroscopic treatment of intramural pregnancy in our institution. A total of 12 patients with intramural pregnancy were collected and the advantages and disadvantages of laparoscopic and hysteroscopic treatment of intramural pregnancy were systematically evaluated.

2. Materials and Methods

2.1 General Data

A retrospective study was conducted in the Department of Gynecology in Chongqing Health Center For Women and Children, with the approval of the Institutional Ethics Committee. Twelve patients diagnosed with intra-



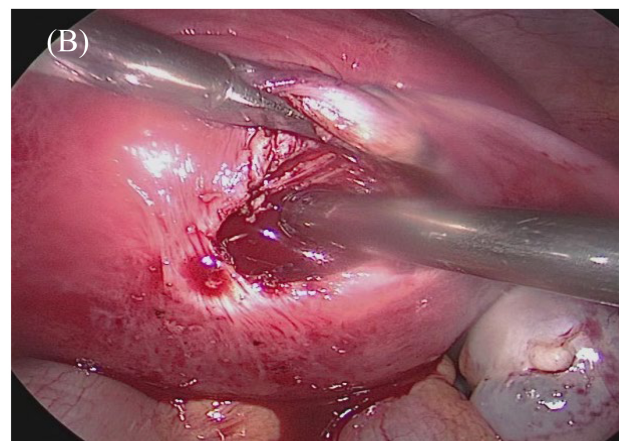
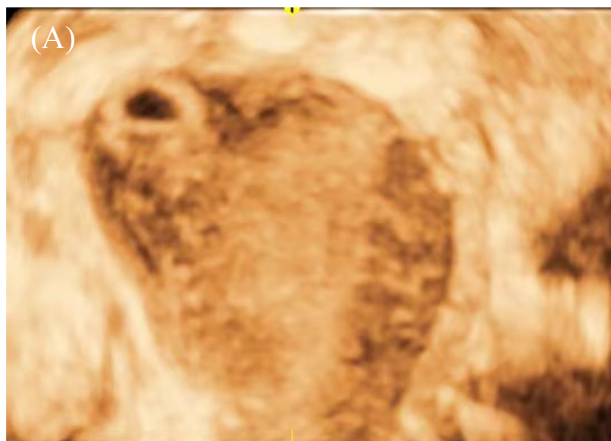


Fig. 1. Ultrasound pictures and surgical pictures. (A) Three-dimensional ultrasound image, demonstrated a gestational sac in myometrium, not connected to the uterine cavity. (B) In laparoscopic surgery, the gestational sac was found to be located in the myometrium.

mural pregnancy from 1st January 2010 to 31st December 2021 at Chongqing Health Center For Women and Children were selected. Data were collected from medical records of the patients. The data collected included maternal age, duration of pregnancy, preoperative ultrasound report, ultrasound gestational sac size, intraoperative sac location, preoperative and postoperative serum β -hCG (human chorionic gonadotropin), length of hospital stay, and hospital costs. These indicators were used to comprehensively assess the effectiveness of laparoscopic treatment of intramural pregnancy.

2.2 Clinical Symptoms

All patients had a history of amenorrhea, 8 patients had vaginal bleeding, 3 patients had lower abdominal pain, 6 patients had undertaken embryo transfer, 10 patients had a history of miscarriages and 2 patients had never been pregnant but had undergone hysteroscopy. All cases collected at our institution had a history of intrauterine surgery (Table 1).

2.3 Accessory Examination

All patients were subjected to a 3D transvaginal ultrasound. In the subsequent report, 6 cases indicated cornual pregnancy with the gestational sac located within the myometrium near the cornu but separate from the endometrial lining as seen by 3D transvaginal ultrasound. The other 6 cases reported gestational sacs located in the lateral wall of uterus. All patients underwent preoperative serum β -hCG which was repeated one day postoperatively (Table 1).

2.4 Surgery

All patients underwent laparoscopy and 5 patients underwent hysteroscopy combined with laparoscopy. No gestational sac was found in the uterine cavity in hysteroscopy, so laparoscopic surgery was performed. Intraoperative laparoscopic findings of a prominent mass in the uterine wall

with no suspicious pregnancy masses in the bilateral fallopian tubes, ovaries or abdominal cavity, we selected representative ultrasound and operation image (Fig. 1).

2.5 Observed Indexes

Clinical indicators included maternal age, pregnancy and delivery history, gestational age, clinical symptoms, location of pregnancy sac as suggested by 3D transvaginal ultrasound, location of pregnancy sac found during surgery, preoperative and postoperative serum β -hCG, intraoperative blood loss, length of hospital stay and hospital costs (Table 1). Intraoperative blood loss is calculated by suction in the measuring cup. The preoperative and postoperative decreases in serum β -hCG were compared, the amount of bleeding, hospital stay and cost were calculated, using these indicators to determine the effectiveness of laparoscopic surgery (Table 2). SPSS22.0 (IBM Corp., Armonk, NY, USA) was used for data analysis.

3. Results

In this study 12 patients had a history of uterine operations whilst 3 patients had never been pregnant. Two patients had a history of hysteroscopic surgery and the other 10 patients had one or more previous pregnancies. Six patients conceived by embryo transfer. Six cases indicated cornual pregnancy with a gestational sac located within the myometrium near the cornu but separate from the endometrial lining as seen by 3D transvaginal ultrasound. The other 6 cases showed gestational sacs located in the lateral wall of uterus. All patients had successful laparoscopic removal of the chorionic tissue from the uterus. Average blood loss 50.9 ± 5.5 (mL), average hospital stay 5.4 ± 0.6 (days), average hospital cost $10,487 \pm 548$ (RMB) (Table 2).

4. Discussion

The etiology of intramural pregnancy is unclear [11], according to available literature relevant factors include da-

Table 1. Clinical characteristics of the patients with intramural pregnancy.

NO.	Age	Obstetric history	Gestational age (days)	Gestational/mixed Echo mass (cm)	Clinical symptoms	Risk factors	Location of pregnancy (ultrasound)
1	38	G3P1	51	NA/2.6 × 2.2 cm	Vaginal bleeding	History of 2 artificial abortion, cesarean section	Right cornu of uterus
2	29	G0P0	65	2.4 × 2.2 cm/NA	Abdominal pain	Endometrial polyp extraction	Posterior wall of uterus
3	31	G1P0	45	3.0 × 2.0 cm/NA	No	Endometrial polyp extraction	Right posterior wall of uterus
4	34	G4P1	61	NA/1.1 × 0.9 cm	Vaginal bleeding	History of 3 artificial abortion	Right cornu of uterus
5	37	G5P0	43	1.7 × 1.2 cm/NA	No	Hysteroscopic adhesion separation	Right lateral wall of uterus
6	26	G4P0	120 days after ectopic pregnancy	NA/4.9 × 3.7 cm	No	Hysteroscopic adhesion separation	Left lateral wall of uterus
7	30	G0P0	27 days after embryo transfer	NA/2.1 × 1.9 cm	No	Embryo transfer	Left cornu of uterus
8	26	G2P0	27 days after embryo transfer	3.0 × 2.4 cm/NA	No	Embryo transfer	Right cornu of uterus
9	32	G2P0	40 days after embryo transfer	2.3 × 2.0 cm/NA	No	Embryo transfer	Right posterior wall of uterus
10	30	G2P0	28 days after embryo transfer	NA/1.1 × 1.0 cm	No	History of hystero-laparoscopy	Right posterior wall of the uterus
11	29	G1P0	28 days after embryo transfer	1.3 × 1.2 cm/NA	No	Ectopic pregnancy embryo transfer	Left cornu of uterus
12	30	G0P0	28 days after embryo transfer	2.8 × 1.9 cm/2.2 × 2.1 cm	No	embryo transfer	Right cornu of uterus

Table 2. Operative and postoperative clinical characteristics of the 12 patients.

NO.	Surgical method	Intraoperative blood loss	Laparoscopy finding	Hysteroscopy finding	β -HCG before surgery	β -HCG after surgery	Postoperative Hospital stays
1	Laparoscopy	50 mL	Fundal myometrium	–	5824.9	1819.5	5
2	Laparoscopy	50 mL	Posterior wall of the uterus, pelvic hemorrhage 700 mL	–	59,382.4	12,766.4	5
3	Laparoscopy + Hysteroscopy	50 mL	Right cornu within the myometrium	Normal	64,898	2148.4	5
4	Laparoscopy	30 mL	Right cornu within the myometrium	–	2661.3	952.5	8
5	Laparoscopy + Hysteroscopy	50 mL	Right cornu within the myometrium	Normal	14,859.7	3597.8	4
6	Laparoscopy + Hysteroscopy	50 mL	Left cornu within the myometrium	Intimal defect of left uterine cornu	2.2	<1.2	4
7	Laparoscopy	100 mL	Left cornu within the myometrium	–	10,078.6	442.9	7
8	Laparoscopy	50 mL	Right cornu within the myometrium	–	78,968	11,041	5
9	Laparoscopy + Hysteroscopy	30 mL	Right cornu within the myometrium	Right posterior wall of uterus is raised	23,381	1822.4	4
10	Laparoscopy	50 mL	Right cornu within the myometrium	–	6971.6	272	9
11	Laparoscopy	50 mL	Left fundal myometrium	–	33,760.3	32,345.1	5
12	Laparoscopy	50 mL	Right cornu within the myometrium	–	169,810	214,733	5

imaged or defective endometrium, induced abortion and cesarean delivery that can lead to endometrial injury [12]. The fertilized egg implants in the muscular wall or uterine scar of the damaged endometrium with the formation of a sinus tract and false canal due to previous uterine surgery. Many patients have a history of cesarean section and induced abortion [13]. Other causes include adenomyosis where the ectopic endometrium deep in myometrium produces metaphase morphology through estrogen and progesterone which becomes a potential site for egg implantation and the embryo enters the myometrium by an ectopic endometrial sinus [14]. In addition a defective uterine serous membrane as result of pelvic surgery and serious inflammation leads to the destruction of serous membrane. Once the zygote is free from the fallopian tube it travels in the pelvic cavity and is implanted in the uterine membrane defect and into the myometrium. During *in vitro* fertilization (IVF), a “false path to implantation” may be formed in the myometrium if the embryo transfer is difficult [15]. This allows the fertilized egg to implant in the myometrium and in our report, we identified 6 patients with a history of *in vitro* fertilization. Finally there is a hypothesis that trophoblast cell activity is enhanced and decidual defense is weakened resulting in ectopic pregnancy. All 12 patients in this study had at least one of the above risk factors, 6 patients had experienced an embryo transfer.

In the past, because of the special location of intramural pregnancy, it was not diagnosed until the occurrence of uterine rupture. In recent years with the development of ultrasound, especially the use of transvaginal ultrasound, it is possible to reach a timely diagnosis of this condition before surgery. We determined the following ultrasound features of intramural pregnancy: (1) the gestation sac was completely surrounded by the myometrium; (2) the endometrial cavity and fallopian tube were not connected. Three-dimensional ultrasound shows the relationship between the gestational sac and endometrial cavity, as well as the association of endometrial and uterine myometrium that allows a clear visualization of endometrial myometrial junction, and Color Doppler flow imaging shows abundant blood flow with low resistance [16].

There are several treatments for intramural pregnancy, including conservative treatment with methotrexate drug therapy, surgical methods including laparotomy, hysteroscopic and laparoscopic surgery, laparotomy which is rarely used due to the severity of the trauma and slow recovery [17]. For gestational sacs with small gestational age, small mass and thin serosal layer, laparoscopic removal of intrauterine pregnancy can be safely performed. Laparoscopic surgery is characterized by minimal trauma, rapid postoperative recovery, and the possibility of suturing the myometrial wound to reduce the risk of subsequent pregnancy rupture. Auer-schmidt reported hysteroscopic treatment for intramural pregnancy [8], as the hook electrode can cut the mucosa and muscle of uterus by the false tract,

and gradually cut the pregnancy tissue between the muscle tissue walls, thus reducing the damage to the endometrium in those with future fertility needs. Hysteroscopic surgery is characterized by less trauma, less bleeding and faster recovery for those with pregnancy sac implantation close to the mucosa. In this paper, 5 patients were first selected for hysteroscopy, but the location of the gestational sac was not found during the procedure, so they were converted to laparoscopic surgery to open myometrium and successfully locate the sac and remove the chorionic villi.

5. Conclusions

We describe 12 extremely rare cases of ectopic pregnancy. According to statistics of the 12 patients, the average blood loss is 50.9 ± 5.46 (mL), average hospital stay is 5.36 ± 0.59 (days), and the average hospital cost is $10,487 \pm 548$ (RMB). Postoperative β -hCG values decreased significantly in all patients, with a decrease of more than 50%. For pregnancy sac with small gestational age, laparoscopy and hysteroscopy is a reliable treatment method with less trauma and faster postoperative recovery, the laparoscopic procedure allows for suturing of the myometrial wound, reducing the risk of uterine rupture in another pregnancy [18]. The uterus and reproductive function were preserved in all patients, and postoperative recovery was faster. Laparoscopic treatment of early intramural pregnancy is a safe and reliable procedure. Patients with fertility issues were not included in the statistics for this article. Future studies should include the fertility conception interval, and mode of delivery of these women in order to comprehensively evaluate the effectiveness of laparoscopy in the treatment of intramural pregnancy.

Availability of Data and Materials

The datasets used during the current study are available from the corresponding author on reasonable request.

Author Contributions

HX conceived of the study and wrote the article. JH collected the data and analyzed the data; BL conceived the topic of the article, design the paper structure, interpreted and analyzed the data, and edited the article. All authors contributed to editorial changes in the manuscript. All authors have participated sufficiently in the work and agreed to be accountable for all aspects of the work. All authors read and approved the final manuscript.

Ethics Approval and Consent to Participate

The study was conducted in accordance with the Declaration of Helsinki, and the protocol was approved by the Ethics Committee of 044(2021). All participants gave written informed consent prior to entering the study.

Acknowledgment

We would like to express my gratitude to all those who helped me during the writing of this manuscript.

Funding

This research was funded by Women and Children's Hospital of Chongqing Medical University, grant number 2020YJMS10. This research was funded by Chongqing Science and Technology Commission, grant number CSTB2022NSCQ-MSX0907.

Conflict of Interest

The authors declare no conflict of interest.

References

- [1] Wang Y, Yu F, Zeng LQ. Ectopic Pregnancy in Uncommon Implantation Sites: Intramural Pregnancy and Rudimentary Horn Pregnancy. *Case Reports in Obstetrics and Gynecology*. 2015; 2015: 536498.
- [2] Memtsa M, Jamil A, Sebire N, Jauniaux E, Jurkovic D. Diagnosis and management of intramural ectopic pregnancy. *Ultrasound in Obstetrics & Gynecology*. 2013; 42: 359–362.
- [3] Biffi A, Damiani GR, Pellegrini AM, Quartucci A, Di Gennaro D, Boca GD. Cornual Pregnancy. *Journal of Minimally Invasive Gynecology*. 2022; 29: 327–328.
- [4] Chen B, Liu Y, Obstetricsamp DO, Gynecology, Hospital C. A case report of intramural ectopic pregnancy on its diagnosis and treatment with literature review. *Journal of China-Japan Friendship Hospital*. 2018; 5: 13–16.
- [5] Bernstein HB, Thrall MM, Clark WB. Expectant management of intramural ectopic pregnancy. *Obstetrics and Gynecology*. 2001; 97: 826–827.
- [6] Noguchi S, Adachi M, Konishi H, Habara T, Nakatsuka M, Kudo T. Intramural pregnancy in a previous cesarean section scar: a case report on conservative surgery. *Acta Obstetrica et Gynecologica Scandinavica*. 2005; 84: 493–495.
- [7] Katano K, Ikuta K, Matsubara H, Oya N, Nishio M, Suzumori K. A case of successful conservative chemotherapy for intramural pregnancy. *Fertility and Sterility*. 1999; 72: 744–746.
- [8] Auer-Schmidt MM, Rahimi G, Wahba AH, Schmidt T. Hysteroscopic management of intramural ectopic pregnancy. *BMJ Case Reports*. 2021; 14: e244514.
- [9] YeKuang, Chen XH, Si Y, Kong XC. Preoperative diagnosis and successful laparoscopic management of intramural pregnancy: case report. *European Journal of Obstetrics, Gynecology, and Reproductive Biology*. 2013; 171: 385–386.
- [10] Nabeshima H, Nishimoto M, Utsunomiya H, Arai M, Ugajin T, Terada Y, *et al.* Total laparoscopic conservative surgery for an intramural ectopic pregnancy. *Diagnostic and Therapeutic Endoscopy*. 2010; 2010: 504062.
- [11] Di Gennaro D, Damiani GR, Muzzupapa G, Stomati M, Cicinelli R, Gaetani M, *et al.* Ectopic Pregnancy: An Overview. *Clinical and Experimental Obstetrics & Gynecology*. 2022; 49: 262.
- [12] Liu Y, Nan F, Liu Z, Wei S, Liu Y, Zhao G, *et al.* Intramural pregnancy: a case report. *European Journal of Obstetrics, Gynecology, and Reproductive Biology*. 2014; 176: 197–198.
- [13] Neiger R, Weldon K, Means N. Intramural pregnancy in a cesarean section scar. A case report. *The Journal of Reproductive Medicine*. 1998; 43: 999–1001.
- [14] Kirk E, McDonald K, Rees J, Govind A. Intramural ectopic pregnancy: a case and review of the literature. *European Journal of Obstetrics, Gynecology, and Reproductive Biology*. 2013; 168: 129–133.
- [15] Choi DH, Kwon H, Kim YS, Kim JH. Intramural pregnancy associated with adenomyosis after in vitro fertilization and embryo transfer: a case report. *The Journal of Reproductive Medicine*. 2009; 54: 255–258.
- [16] Liu NN, Han XS, Guo XJ, Sun LT, Kong XC. Ultrasound diagnosis of intramural pregnancy. *The Journal of Obstetrics and Gynaecology Research*. 2017; 43: 1071–1075.
- [17] Wu PJ, Han CM, Wang CJ, Lee CL. Early detection and minimally invasive management of intramural pregnancy. *Journal of Minimally Invasive Gynecology*. 2013; 20: 123–126.
- [18] Shen Z, Liu C, Zhao L, Xu L, Peng B, Chen Z, *et al.* Minimally-invasive management of intramural ectopic pregnancy: an eight-case series and literature review. *European Journal of Obstetrics, Gynecology, and Reproductive Biology*. 2020; 253: 180–186.