

Laparoscopic cornuotomy using a temporary tourniquet suture and diluted vasopressin injection in interstitial pregnancy

Young-Ihn Choi, M.D.,^a Dae-Sook Eun, M.D.,^a Jin Choi, M.D.,^a Kwang-Sik Shin, M.D.,^a Ji-Hye Choi, M.D.,^b and Hyoung-Duck Park, M.D.^c

^a Department of Obstetrics and Gynecology, ^b Department of Radiology, and ^c Department of Anesthesiology of Eun Hospital, Kwang-ju, South Korea

Objective: To evaluate the efficiency of laparoscopic cornuotomy.

Design: Retrospective case review.

Setting: An urban medical center.

Patient(s): Eight patients with interstitial pregnancy who have undergone laparoscopic cornuotomy.

Intervention(s): Laparoscopic cornuotomy was performed using a temporary tourniquet suture and the injection of diluted vasopressin around the cornual mass. The tourniquet suture was removed completely after repairing the cornu.

Main Outcome Measure(s): Operating time, hemorrhage, β -hCG levels.

Result(s): The estimated blood loss was 50 ± 22 mL (mean \pm SD), and the operating time was 58 ± 16 minutes. The serum β -hCG level returned to within the normal range approximately 4 weeks postoperatively in all patients. There were no major postoperative complications, such as hemorrhage, and no postoperative adjuvant therapy was required.

Conclusion(s): Laparoscopic cornuotomy is a safe and effective method in interstitial pregnancy, and we believe that it has the advantage of preserving reproductive capacity over cornual resection. (Fertil Steril® 2009;91:1933–7. ©2009 by American Society for Reproductive Medicine.)

Key Words: Interstitial pregnancy, cornual pregnancy, laparoscopy, cornuotomy, tourniquet suture

Interstitial pregnancy is a rare form of ectopic pregnancy that can lead to catastrophic events. As the cornua are the vascular confluence region, a ruptured cornu can trigger a life-threatening hemorrhage and may lead to rupture of the uterus in a subsequent pregnancy (1).

Although interstitial pregnancy accounts for only 2%–4% of all ectopic pregnancies, the incidence is increasing steadily with the increasing use of assisted reproductive technologies, as are other forms of ectopic pregnancy. The factors predisposing to interstitial pregnancy include ipsilateral salpingectomy, pelvic inflammatory disease, tumors, uterine anomalies, a previous ectopic pregnancy, and IVF (1, 2).

The conventional management of interstitial pregnancy is hysterectomy or cornual wedge resection with or without ipsilateral salpingectomy through a laparotomy (1).

In the last two decades, conservative management has been advocated with laparoscopy, hysteroscopy, or medical treatment (3–11).

Although hysterectomy or cornual resection is a perfect method for terminating the pregnancy, they are not desirable

in patients who wish to preserve their fertility. Medical treatment, such as with methotrexate, is noninvasive, but some patients require secondary treatment, and it has some adverse effects (2, 10, 11).

Recently, various minimally invasive techniques have been tried and have obtained satisfactory outcomes. Their impressive outcomes have provided the impetus to clinicians worldwide to investigate safer and simpler methods (2–9). To date, the results have been operator dependent, and some clinicians have questioned the efficacy of the technical aspects and outcomes of laparoscopic management. Nevertheless, the laparoscopic approach is safe and effective when some technical tips are applied. We introduce a modified operative technique.

MATERIALS AND METHODS

Patients

This is an uncontrolled retrospective case review of eight patients with interstitial or cornual pregnancy who have undergone laparoscopic cornuotomy at Eun Hospital. The review examined videotapes, hospital charts, patient interviews, and radiographic images.

Five of the eight patients were referred from primary gynecologic clinics with suspected ectopic pregnancy. The diagnosis of interstitial pregnancy was established using high-resolution transvaginal ultrasound and a sensitive β -hCG assay in all patients.

As shown in Figure 1, transvaginal ultrasound reveals an empty endometrial cavity, an extremely eccentrically located

Received October 9, 2007; revised and accepted February 4, 2008; published online April 18, 2008.

D.-S.E. has nothing to disclose. Y.-I.C. has nothing to disclose. J.C. has nothing to disclose. K.-S.S. has nothing to disclose. J.-H.C. has nothing to disclose. H.-D.P. has nothing to disclose.

Reprint requests: Young-Ihn Choi, M.D., Department of Obstetrics and Gynecology, Eun Hospital, 882-27 Duam 1-Dong, Buk-Gu, Kwang-Ju, South Korea (FAX: 82-62-269-1516; E-mail: yschoimd@yahoo.co.kr).

gestational sac or hyperechoic mass surrounded by a layer of thin myometrium, and peritrophoblastic blood flow seen as a “solid ring of fire” pattern on color flow Doppler ultrasound, which implies a highly vascular peritrophoblastic implantation (11, 12).

As shown in Figure 2A, the diagnosis was confirmed by a laparoscopic finding of an extremely lateralized, highly vascular protruding cornual mass and confirmed on histopathologic examination.

As all of the patients wished to preserve their fertility, laparoscopic cornuotomy was performed using a temporary tourniquet suture, and sufficient vasopressin, consisting of 20 units diluted in 500 mL 0.9% normal saline, was injected around the cornual mass. The tourniquet suture was completely removed after the cornual repair.

The amount of bleeding was estimated using a vacuum suction collector. Sequential β -hCG assays were obtained in each patient at 1-week intervals.

Intervention

Sufficient dilute vasopressin (20 units in 500 mL of 0.9% normal saline) was injected around the cornual mass using a small-gauge needle to minimize bleeding at the needle penetration points in the next step and to improve visibility.

As shown in Figure 2B, a circumferential intramyometrial tourniquet suture was made using 1-0 chromic catgut around the protruding mass with a 1- to 2-cm safety margin through the anterior fundus and posterior surface of the uterus and over the round ligament, tube, and mesosalpinx. This was facilitated by making efficient use of a carefully inserted balloon-tip uterine elevator.

The suture should not penetrate the broad ligament or mesosalpinx laterally, but should be placed over them; otherwise,

the broad ligament or mesosalpinx might tear while tightening the suture, causing a hemorrhage. Bleeding would reduce the visibility of the surgical field and could lead to formation of a retroperitoneal hematoma. The posterior and anterior uterine surfaces were each penetrated twice to prevent slippage. The suture was kept superficial as much as possible to prevent endometrial injury and entrapment of the collateral circulation. After placement, the two ends of the suture were tightened, and a knot was tied while maintaining tension to produce a tourniquet effect. As shown in Figure 2B, this resulted in a “cornual island” that isolated the region from the blood supply. Chromic catgut is superior to other suture materials as it minimizes the myometrial injury and applies adequate tension.

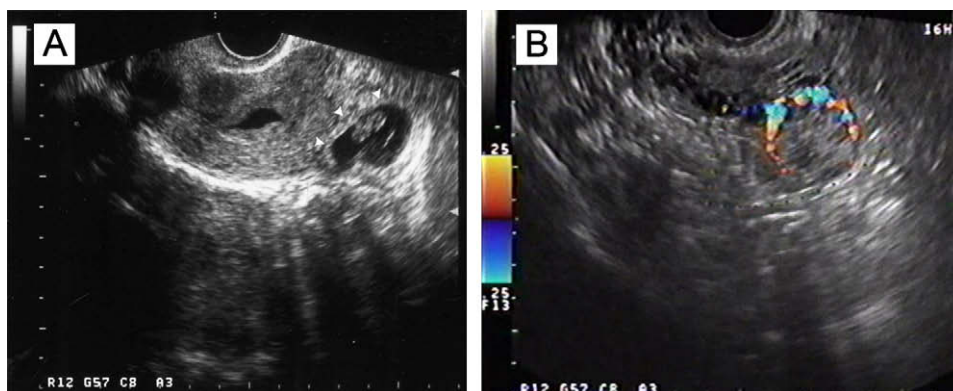
The protruding cornual mass was injected with additional dilute vasopressin solution. Once this step is complete, there is no need to proceed quickly because of the possibility of a life-threatening hemorrhage.

Using laparoscopic endoscissors, a sharp midline transverse incision was made in the cornual mass wide enough to ensure the operation field. A transverse incision has an advantage over a vertical incision as the former can be extended laterally if needed. In addition, it reduces blood vessel injury because the incision parallels the cornual collateral vessels. Nevertheless, excessive extension toward the tube should be avoided because this could lead to an interstitial stricture or obstruction after the repair. Although the incision was somewhat insufficient to expose to the interstitial part, the conceptus could be evacuated through the laparoscope as in cave exploration. As shown in Figure 2C, the conceptus was then evacuated using a suction irrigator and grasping forceps under the magnified view provided by the laparoscope.

The endometrium was approximated using several interrupted stitches. The myometrium and serosa were repaired

FIGURE 1

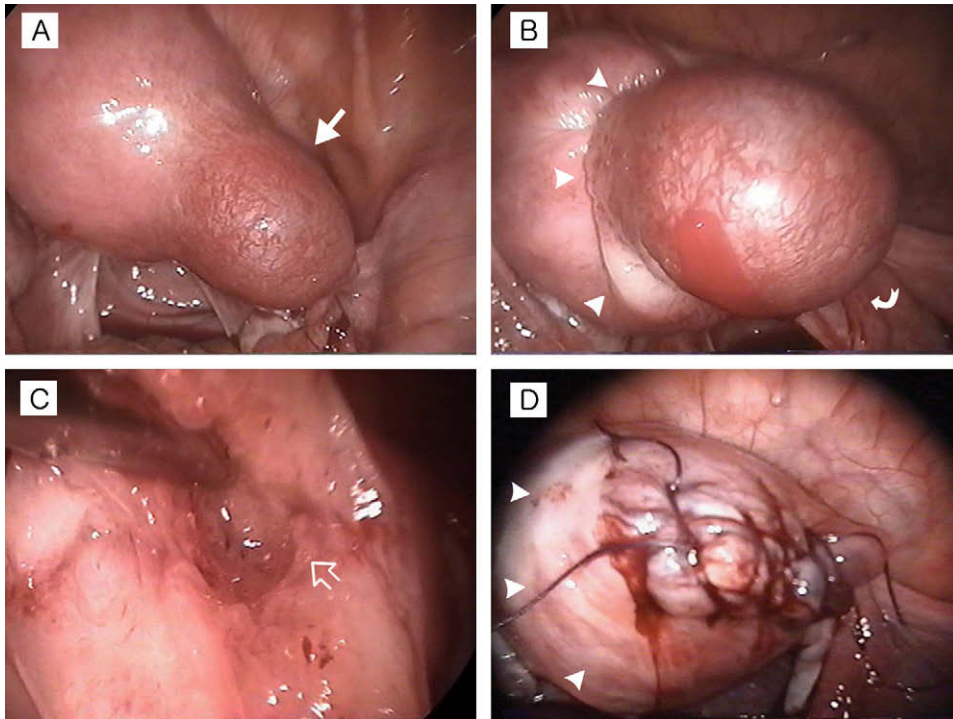
Transvaginal ultrasound findings in interstitial pregnancy. (A) Notice the extremely eccentrically located gestational sac (arrowhead; case no. 2). (B) “Solid ring of fire” pattern is revealed on color Doppler flow, implying peritrophoblastic, highly vascular implantation (case no. 7).



Choi. Laparoscopic cornuotomy. *Fertil Steril* 2009.

FIGURE 2

Laparoscopic findings of surgical procedures in interstitial pregnancy (case no.2). (A) Highly vascular, extremely eccentrically located ectopic mass covered with thin myometrium (straight arrow). (B) The tourniquet suture is applied. Notice the two penetrations on each uterine surface, which are medial (arrowhead) but only placed over without penetration laterally (curved arrow) to make a “cornual island” that isolates the region from its blood supply. (C) Notice that the conceptus was evacuated satisfactorily under the magnification provided by the laparoscope itself (open arrow). (D) A meticulous full-thickness suture is performed on the cornuostomy site. Notice the tourniquet suture is cut and removed entirely after the cornual repair (arrowhead).



Choi. Laparoscopic cornuotomy. *Fertil Steril* 2009.

by meticulous full-thickness suturing using delayed absorbable material with a continuous locking suture. The uterine serosa was approximated using several interrupted stitches at separate points if needed. All ties and sutures were performed intracorporeally.

As shown in Figure 2D, the tourniquet suture was cut and removed completely after the cornual repair. This is a key point in the operation because if the tightened knot was left intact, it would interfere with the blood supply to the surgical site and ultimately might result in a large structural defect.

RESULTS

As shown in Table 1, the mean \pm SD of the estimated ectopic age, largest diameter of the ectopic mass, and β -hCG titer at surgery were 7.6 ± 1.1 weeks, 33 ± 6.7 mm, and $36,556 \pm 25,731$ mIU/mL, respectively. Of the eight patients, five had ectopic cardiac activity, and all eight patients had an unruptured cornu at the time of surgery. Previously, two patients had undergone dilatation and evacuation, two patients

had undergone ipsilateral salpingectomy for tubal pregnancy, and one patient had undergone reversal of tubal ligation.

The estimated blood loss and operating time were 50 ± 22 mL and 58 ± 16 minutes, respectively. There were no major postoperative complications, such as hemorrhage, and no postoperative adjuvant therapy was required.

The serum β -hCG level returned to within the normal range approximately 4 weeks postoperatively in all patients (mean \pm SD, 26.5 ± 7 days).

DISCUSSION

With regard to minimally invasive approaches to interstitial pregnancy, Tanaka et al. (13) introduced medical treatment with methotrexate in 1982, Reich et al. (14) reported the first case of laparoscopic management in 1988, and Meyer et al. (15) introduced hysteroscopic management in 1989 (2).

With the advances in high-resolution transvaginal ultrasound and the sensitive β -hCG assay, it is now possible to diagnose interstitial pregnancy at an earlier date than in the

TABLE 1

Summary of the clinical characteristics of the patients who underwent laparoscopic cornuotomy.

| Case no. | Estimated ectopic age, weeks | Largest diameter of ectopic mass, mm | β -hCG titer at surgery, mIU/mL | Ectopic cardiac activity | Cornual status at surgery | Previous gynecologic surgery | Estimated hemorrhage, mL | Operating time, mm | Resolution of β -hCG, days |
|----------|------------------------------|--------------------------------------|---------------------------------------|--------------------------|---------------------------|------------------------------|--------------------------|--------------------|----------------------------------|
| 1 | 8.5 | 34 | 55,020 | Present | Unruptured | D&E | 85 | 80 | 28 |
| 2 | 7.0 | 33 | 35,018 | Present | Unruptured | | 65 | 75 | 25 |
| 3 | 6.0 | 22 | 3400 | Absent | Unruptured | TR | 35 | 45 | 15 |
| 4 | 9.2 | 45 | 74,060 | Present | Unruptured | D&E | 60 | 60 | 33 |
| 5 | 7.0 | 30 | 5920 | Absent | Unruptured | | 25 | 35 | 17 |
| 6 | 7.2 | 28 | 62,815 | Present | Unruptured | Salpingectomy ^a | 30 | 55 | 36 |
| 7 | 7.0 | 33 | 30,796 | Present | Unruptured | | 35 | 45 | 27 |
| 8 | 9.0 | 37 | 25,420 | Absent | Unruptured | Salpingectomy ^a | 65 | 70 | 31 |
| Mean | 7.6 | 33 | 36,556 | Present: 5 | Unruptured: 8 | D&E: 2, TR: 1 | 50 | 58 | 26.5 |
| SD | 1.1 | 6.7 | 25,731 | Absent: 3 | ruptured: 0 | Salpingectomy: 2 | 22 | 16 | 7.4 |

Note: D&E = dilatation and evacuation; TR = reversal of tubal ligation.

^a Previous ipsilateral salpingectomy for tubal pregnancy.

Choi. *Laparoscopic cornuotomy*. *Fertil Steril* 2009.

past. Furthermore, with technical improvements in laparoscopy, there is a great deal of potential for conservative management. Nevertheless, hemorrhage remains a major problem and is the main cause of frustration in the laparoscopic management of interstitial pregnancy.

In the last two decades, various hemostatic techniques have been tried and improved. These include diluted intramyometrial vasopressin injection, electrocauterization, fibrin glue, an ultrasonic cutting and coagulating surgical device (Harmonic Scalpel, Ethicon Endo-Surgery; Cincinnati, OH), and ascending uterine artery ligation (2–5).

However, these techniques are not always sufficient to control hemorrhage. Recently, a number of suture methods have been introduced, including the square suture, encircling suture, endoloop, and automatic stapler (Endo GIA stapler; Covidien Ltd., Mansfield, MA) (2, 6–8). These suture methods are more effective and reliable at controlling bleeding than the above-mentioned techniques.

But, unlike our method, these suture methods have the shortcoming that the salpinx and cornu are sacrificed anatomically or functionally. In addition, attenuation of the myometrium may result in a predisposition to uterine rupture in a subsequent pregnancy (16, 17).

Therefore, proper repair of the cornu is very important in conservative management. We performed meticulous full-thickness laparoscopic suturing of the cornu after conceptus evacuation and preserved the cornu and salpinx, and we believe that it has the advantage of preserving reproductive capacity in interstitial pregnancy.

Further investigations of uterine integrity, tubal patency, and the incidences of preterm delivery and uterine rupture should be performed to confirm the truth of preserving the reproductive capacity.

This method requires a high level of laparoscopic skill. If the surgeon is reluctant to perform this method laparoscopically, it can be attempted through a laparotomy.

REFERENCES

1. Damario MA, Rock JA. TeLinde's operative gynecology. 9th ed. Philadelphia: Lippincott-Williams & Wilkins, 2003:507–33.
2. Lau S, Tulandi T. Conservative medical and surgical management of interstitial ectopic pregnancy. *Fertil Steril* 1999;72:207–15.
3. Tulandi T, Al-Jaroudi D. Interstitial pregnancy: results generated from the Society of Reproductive Surgeons Registry. *Obstet Gynecol* 2004;103:47–50.
4. Morita Y, Tsutsumi O, Momoeda M, Taketani Y. Cornual pregnancy successfully treated laparoscopically with fibrin glue hemostasis. *Obstet Gynecol* 1997;90:685–7.
5. Dalkalitsis N, Stefanidis K, Paschopoulos M, Navrozoglou I, Mouzakioti E, Lolis D. Laparoscopic treatment of interstitial pregnancy using the harmonic scalpel. *Clin Exp Obstet Gynecol* 1998;25:49–50.
6. Huang MC, Su TH, Lee MY. Laparoscopic management of interstitial pregnancy. *Int J Gynecol Obstet* 2005;88:51–2.
7. Moon HS, Choi YJ, Park YH, Kim SG. New simple endoscopic operations for interstitial pregnancies. *Am J Obstet Gynecol* 2000;182:114–21.
8. Yoo EH, Chun SH, Kim JI. Endoscopic treatment of interstitial pregnancy. *Acta Obstet Gynecol Scand* 2003;82:189–91.
9. Katz DL, Barrett JP, Sanfilippo JS, Badway DM. Combined hysteroscopy and laparoscopy in the treatment of interstitial pregnancy. *Am J Obstet Gynecol* 2003;188:1113–4.
10. Fisch JD, Ortiz BH, Tazuke SI, Chitkara U, Giudice LC. Medical management of interstitial ectopic pregnancy: a case report and literature review. *Hum Reprod* 1998;13:1981–6.
11. Hafner T, Aslam N, Ross JA, Zosmer N, Jurkovic D. The effectiveness of non-surgical management of early interstitial pregnancy: a report of ten cases and review of the literature. *Ultrasound Obstet Gynecol* 1999;13:131–6.
12. Ackerman TE, Levi CS, Dashefsky SM, Holt SC, Lindsay DJ. Interstitial line: sonographic finding in interstitial (cornual) ectopic pregnancy. *Radiology* 1993;189:83–7.
13. Tanaka T, Hayashi H, Kutsuzawa T, Fujimoto S, Ichinoe K. Treatment of interstitial ectopic pregnancy with methotrexate: report of a successful case. *Fertil Steril* 1982;37:851–2.
14. Reich H, Johns DA, DeCaprio J, McGlynn F, Reich E. Laparoscopic treatment of 109 consecutive ectopic pregnancies. *J Reprod Med* 1988;33:885–90.
15. Meyer WR, Mitchell DE. Hysteroscopic removal of an interstitial ectopic gestation: a case report. *J Reprod Med* 1989;34:928–9.
16. Weissman A, Fishman A. Uterine rupture following conservative surgery for interstitial pregnancy. *Eur J Obstet Gynecol Reprod Biol* 1992;44:237–9.
17. Downey GP, Tuck SM. Spontaneous uterine rupture during subsequent pregnancy following non-excision of an interstitial ectopic gestation. *Br J Obstet Gynecol* 1994;101:162–3.