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Case Report

Outpatient Hysteroscopic Treatment of Cervical Ectopic Pregnancy in a Primigravida Using the Ho:YAG Laser: A Case Report and Operative Protocol Evaluation

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Abstract

Background and Clinical Significance: Cervical ectopic pregnancy (CEP) is a rare and potentially serious condition, in which the embryo implants within the cervical canal rather than the uterine cavity and is present in less than 1% of all ectopic pregnancies. There are different treatment options depending on the particular situation and the woman's reproductive desire but conservative approaches as the first line of treatment is preferred in all cases and hysteroscopic resection of the fetus is one of these options. Several types of laser systems are available for use in hysteroscopic surgery, including neodymium:YAG (Nd:YAG) lasers, KTP and Argon lasers, as well as diode lasers. The holmium:YAG (Ho:YAG) laser, although more commonly used in urology due to its ability to cut, coagulate, and vaporize tissue, has gained interest in gynecologic procedures because of its precision and favorable safety profile. **Case Presentation**: We present the case of a 32-year-old woman, pregnant for the first time, who was diagnosed with CEP and successfully treated using a Ho:YAG laser during an outpatient hysteroscopic procedure. As far as we know, this is the first published case using this approach. **Conclusions**: The Ho:YAG laser is a proven tool for outpatient hysteroscopic procedures like septum and adhesion removal. Its ability to both cut and coagulate offers a minimally invasive, fertility-sparing option for managing cervical ectopic pregnancy. With the right patient and proper backup plans in place, this approach could be a promising alternative to more aggressive treatments.

Keywords: cervical ectopic pregnancy; hysteroscopic resection; holmium:YAG (Ho:YAG) laser

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1. Introduction

Cervical ectopic pregnancy (CEP) is a rare and potentially serious condition, in which the embryo implants within the cervical canal rather than the uterine cavity. It is estimated to occur in roughly 1 in 1000 to 1 in 18,000 pregnancies [1–4], accounting for less than 1% of all ectopic pregnancies [5]. The numbers may be climbing due to the growing use of assisted reproductive technologies like IVF [6]. Other risk factors include prior dilation and curettage (D&C), previous ectopic pregnancies, smoking, intrauterine adhesions, advanced maternal age, prior cesarean deliveries, endometritis, IUD use, uterine abnormalities, and fibroids [1,7]. D&C is a particularly common factor, reported in 50–90% of cases [8–10].

Patients with cervical ectopic pregnancy (CEP) are considered at high risk for severe, potentially life-threatening hemorrhage due to erosion of the cervical blood vessels. This

complication can necessitate hysterectomy and result in the loss of fertility. However, because CEP is rare, no standardized therapeutic approach has been established [11]. There are different treatment options depending on the particular situation and the woman's reproductive desire but conservative approaches as the first line of treatment is preferred in all cases [5].

Here, we present the case of a 32-year-old woman, pregnant for the first time, who was diagnosed with CEP and successfully treated using a Ho:YAG laser during an outpatient hysteroscopic procedure. As far as we know, following an extensive literature review, this is the first published case using this approach.

Methodology of the Literature Review

We reviewed the literature and searched for articles published in English, French, and German. regarding laser treatment in cervical EP. A comprehensive computer-based review was conducted using the following databases: Google Scholar, Cochrane Library, SciELO, and publishers' databases, including Elsevier/ScienceDirect, Wiley, Wolters Kluwer/Lippincott, Taylor & Francis, Springer, Sage, Hindawi, Termedia, and Via Medica. The following keywords and Medical Subject Headings (MeSH) terms were used: "cervical pregnancy," "ectopic pregnancy," "holmium:YAG laser," "hysteroscopic resection," and "Ho:YAG laser." References from recent review papers were also scanned to identify additional relevant articles. We primarily included articles published in the 21st century. The final selection of references was made after full-text reading. We included all types of articles (original research, systematic reviews, meta-analyses, narrative reviews, and case reports).

2. Case Report

A 32-year-old woman, gravida 1 para 0, was referred to our clinic at six weeks gestation with a suspected ectopic pregnancy. She had previously undergone hysteroscopic surgery to remove a uterine septum 3 years ago. A transvaginal ultrasound showed a 0.44 mm pseudogestational sac in the uterus (Figure 1).

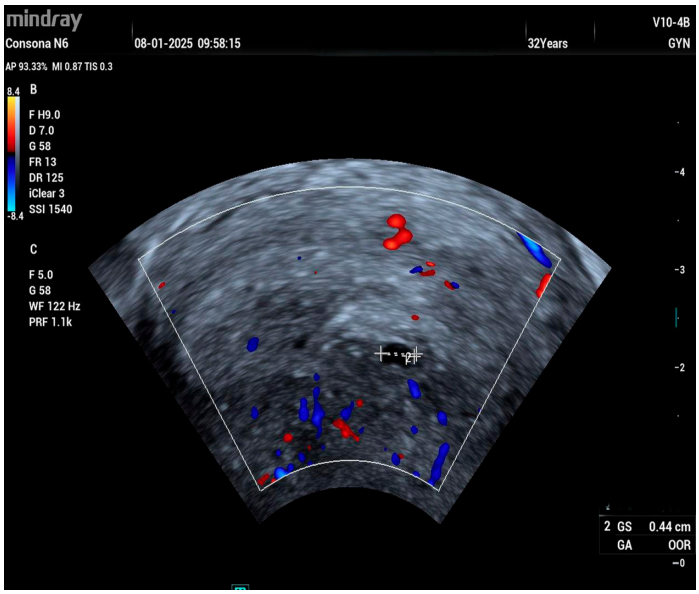

Figure 1. Pseudo sac in the uterine cavity.

A follow-up scan confirmed a cervical pregnancy with a visible heartbeat and a crown-rump length (CRL) of 2.7 mm, consistent with a gestation of 5 weeks and 6 days (Figure 2).

The patient had no major symptoms, was stable, and reported only light brown spotting. Blood tests were normal, and her β-hCG level was 5119 mIU/mL.

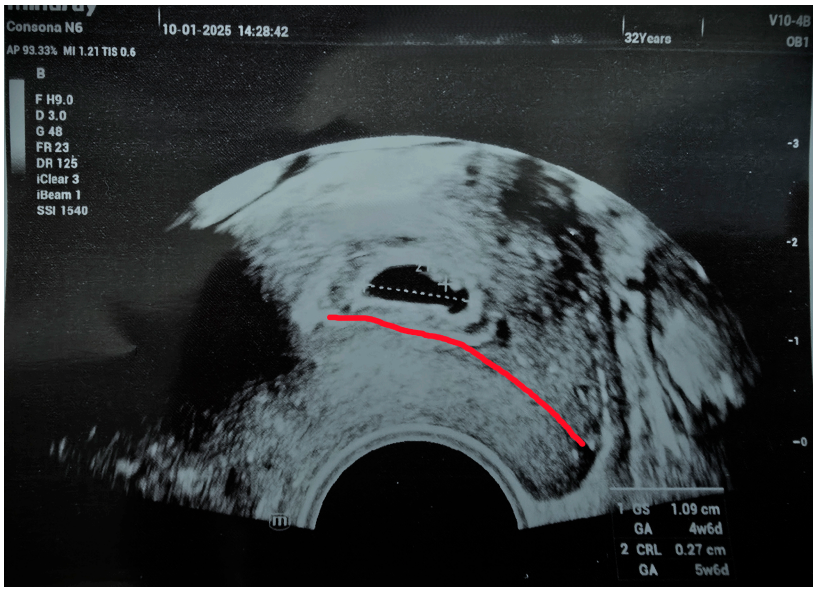

Figure 2. Vital cervical pregnancy (with the red line is marked cervical canal).

The patient was nulliparous and desired future fertility. Alternative treatment options were evaluated. Methotrexate therapy was excluded as the pregnancy was viable and systemic treatment would require more time. The alternative option of using a 24-Fr hysteroscope was excluded due to the need for cervical dilatation and the associated risk of uncontrolled bleeding. Mono- or bipolar 5-Fr instruments were not available in our clinic.

A diagnostic hysteroscopy with laser-assisted incision of the gestational sac was scheduled. All potential intra- and postoperative risks were explained to the patient, and informed consent was obtained.

A 2.9 mm BETTOCCHI-style hysteroscope with a 5 mm sheath was used, with saline solution as the distending medium at 80 mmHg pressure. During the procedure we did not enter the uterine cavity; the total fluid deficit was 10 mL, which likely reflected minor calculation inaccuracies without clinical relevance. The patient was under IV propofol anesthesia.

Using a no-touch vaginoscopic technique, we visualized an intact gestational sac in the cervical canal, measuring 60 × 50 mm. A 200 µm quartz laser fiber was inserted through the 5-Fr working channel. With a SphynxX Jr Ho:YAG laser, we set the energy to 15 W (1500 mJ at 10 Hz).

We made an incision on the left side of the sac, extending down to its base where we could see chorionic tissue. We continued cutting along the left side while coagulating small bleeding vessels. The entire procedure lasted 15 min. The procedure was uneventful, with no complications or adverse events. Immediately afterward, only minimal bleeding was noted on a sanitary pad.

The next day, the patient's β-hCG dropped to 1922 mIU/mL, confirming a successful outcome. She was prescribed a month of combined oral contraceptives (gestodene 75 µg/ethinylestradiol 30 µg). Pathology confirmed chorionic villi with edema and necrotic decidual tissue (Figure 3).

Figure 3. Macroscopic view of the specimen.

An ultrasound on day 11 post-op showed normal healing with no abnormalities (Figure 4).

Figure 4. Normal ultrasound view of endometrial cavity and cervical canal.

The need for a second-look hysteroscopy after 3–6 months was discussed with the patient, but she did not attend follow-up evaluation.

3. Discussion

First reported in 1817 and officially named in 1860 [12], cervical ectopic pregnancy is rare but dangerous, mostly because of the potential for severe bleeding. It is important to distinguish it from incomplete miscarriages. In 1911, Rubin laid out pathological criteria for CEP: the presence of endocervical glands near placental tissue, chorionic villi invading the cervix, and the placenta implanted below the uterine vessels or peritoneal reflection [13].

Later, Paalman and McElin added clinical criteria such as painless bleeding after a missed period, an hourglass-shaped uterus, a dilated external os with a closed internal os, and the gestational sac entirely inside the cervix [14]. In 1996, Jurkovic et al. described two helpful ultrasound features: the absence of the "sliding sign" and visible blood flow around the gestational sac [13].

There are both medical and surgical treatment options. Medical treatments include systemic or locally injected methotrexate, potassium chloride, mifepristone, and misopros-

tol. To help control bleeding, balloon tamponade or uterine artery embolization might be used [13]. Surgical options range from D&C and hysteroscopic removal [15–17] to ultrasound-guided laser therapy [18], or even uterine artery ligation [19] or hysterectomy in severe cases.

Several types of laser systems are used in hysteroscopic surgery, including neodymium: YAG (Nd:YAG) lasers [20,21], potassium titanyl phosphate (KTP) and Argon lasers [22], and diode lasers [23–25]. Despite the large number of publications and the widespread use of lasers in gynecological hysteroscopic and laparoscopic procedures, this approach is not yet included in the clinical guidelines of major international societies.

The holmium:YAG (Ho:YAG) laser, although more commonly used in urology due to its ability to cut, coagulate, and vaporize tissue [26], has gained interest in gynecologic procedures because of its precision and favorable safety profile.

Compared to electrosurgical instruments and other laser systems, the Ho:YAG laser is associated with a shallower depth of tissue penetration, resulting in less thermal injury and reduced collateral damage [27–30]. This is particularly beneficial in procedures such as hysteroscopic metroplasty, where minimizing the risk of uterine perforation is critical, especially in women desiring future fertility. The limited lateral thermal spread also supports faster endometrial healing and may help reduce the risk of postoperative intrauterine adhesions (Figure 1) [31].

Figure 5 shows the optical penetration depth of common lasers used in dermatology that have been reported previously (adapted by Sardana et al.) [32].

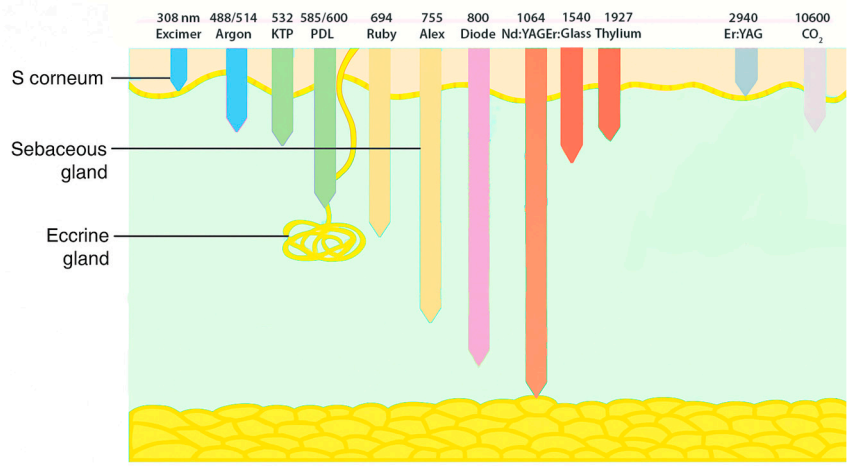

Figure 5. The optical penetration depth of common lasers used in dermatology (adapted by Sardana et al.) [32].

The laser energy is absorbed within a depth of less than 0.5 mm, enabling effective soft tissue ablation while minimizing the risk of deep tissue injury or uncontrolled necrosis.

Saline, which is commonly used as a distension medium in hysteroscopy, does not transmit the Holmium laser wavelength well. Instead, each pulse of the Ho:YAG laser creates a small steam bubble at the tip of the fiber. This bubble acts like a temporary channel that carries the laser energy directly to the tissue it is in contact with—a phenomenon known as the Moses effect. Only the tissue touched by the leading edge of that bubble is affected, which makes the laser extremely precise. In procedures such as Holmium Laser Enucleation of the Prostate (HoLEP), the expanding steam bubble, composed of superheated vapor, facilitates tissue separation along natural anatomical planes, while the thermal energy simultaneously coagulates small blood vessels, minimizing bleeding. It is important to note that the separation of tissue is driven by the expanding steam bubble—not by the laser beam itself.

The holmium:YAG (Ho:YAG) laser is a solid-state, pulsed laser with a wavelength of 2.1 microns [27]. Its energy can be efficiently transmitted through optical quartz fibers and is compatible with use in fluid environments, making it particularly well-suited for hysteroscopic procedures. With a tissue penetration depth of approximately 0.4 mm, the Ho:YAG laser allows for highly precise tissue incision while minimizing thermal injury to surrounding structures [26,33]. Hysteroscopic laser resection of cervical ectopic pregnancy (CEP) aims to remove the bulk of the gestational sac without requiring complete excision of all tissue. This approach helps preserve cervical anatomy and reduces the risk of long-term complications, such as cervical diverticulum [34].

To the best of our knowledge, this is the first reported use of the Ho:YAG laser for treating CEP. We chose it because the patient was stable, had no children yet, and we were confident in the laser's safety. The result was a smooth, successful procedure with a quick recovery.

4. Conclusions

The Ho:YAG laser is a proven tool for outpatient hysteroscopic procedures like septum and adhesion removal. Its ability to both cut and coagulate offers a minimally invasive, fertility-sparing option for managing cervical ectopic pregnancy. With appropriate patient selection and proper backup plans, this approach could serve as an alternative to more aggressive treatments.

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