RESEARCH ARTICLE

# Holmium:YAG Laser: A Better Tool for Hysteroscopic Septal Transection

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## Abstract

**Aim and objective:** To evaluate the feasibility of the use of Holmium:YAG (Ho:YAG) laser for hysteroscopic transection of uterine septum.

**Study design:** A retrospective study of 36 patients with uterine septum who were treated with hysteroscopic metroplasty using Ho:YAG laser from October 2012 to August 2017.

**Design classification:** Canadian Task Force Classification–III.

**Settings:** A 50-bedded hospital dedicated exclusively to obstetrics, gynecology, infertility, and urology, at a district place in India.

**Materials and methods:** Hysteroscopic transection of the uterine septum with Ho:YAG laser was performed in 36 patients, using a 400-micron bare quartz fiber and energy equivalent to15 W. Normal saline was used as the distending medium. The operative parameters and complications were studied and compared with other studies using other energy sources for the surgery. Postoperative follow-up of 29 patients was done for 18 months to study their reproductive outcome. Relook hysteroscopy was done in eight patients who did not conceive in 8 months of the first surgery.

**Results:** The average time taken for the procedure was 17 minutes (10–25 minutes). There were no intraoperative or immediate postoperative complications. On relook hysteroscopy in eight patients, a residual septum was found in one patient and few intrauterine adhesions were found in two patients, which were cut using Ho:YAG laser.

Of the 29 patients who had been followed, 23 patients (79.3%) conceived. Out of these 23 conceived patients, 3 patients (13.0%) had abortions, two patients (8.7%) had preterm deliveries at 32 and 34 weeks, respectively, and 18 patients (78.3%) delivered after 35 weeks. So, there were a total of 20 live births (86.9% of conceptions).

**Conclusion:** Ho:YAG laser is a precise, simple, effective, and safe tool for the procedure of hysteroscopic transection of the uterine septum.

**Keywords:** Holmium:YAG, Hysteroscopic metroplasty, Laser, Septal resection, Uterine septum.

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## Introduction

Septate uterus is the most common Müllerian duct anomaly. It is classified as the class V disorder according to the American Fertility Society classification[1] and as the class U2 disorder according to the ESHRE-ISGE classification of Mullerian duct anomalies.[2] The septate uterus is associated with some of the poorest reproductive outcomes like spontaneous abortion, preterm labor, or malpresentation.[3–5]

Hysteroscopic metroplasty is now considered the gold standard for the treatment of Uterine septum in women with recurrent miscarriages.[6,7] Several studies have also shown that hysteroscopic septal incision is associated with improved clinical pregnancy rates in women with infertility.[7]

This hysteroscopic surgery is usually done using scissors, monopolar cautery, or bipolar cautery.[6,7] Lasers have also been used in the past for hysteroscopic metroplasty. Choe and Baggish[8] and Donnez and Nisolle[9] have used the neodymium:YAG (Nd:YAG) lasers, while Daniell et al.[10] used the KTP or Argon laser, and Nappi et al.[11] have used diode lasers.

Holmium:YAG (Ho:YAG) laser is a solid-state pulsed laser having a wavelength of 2.1 microns.[12] It can be transmitted through optical quartz fibers and can be used in a liquid medium. This makes it highly suitable for hysteroscopic use. Ho:YAG laser has a shallow penetration depth of just 0.4 mm in the tissues. Thus, it offers precise cutting with minimal damage to adjacent tissues.[13]

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**Conflict of interest:** None

We have not come across any published study using the Ho:YAG laser for hysteroscopic metroplasty though it has been used occasionally by other investigators. The purpose of this study was to evaluate the efficacy and safety of Ho:YAG laser for hysteroscopic metroplasty for the treatment of the uterine septum.

## Materials and Methods

This study includes 36 patients with complete or incomplete uterine septum who have undergone hysteroscopic metroplasty

using Ho:YAG laser from October 2012 to August 2017 at Mamta Hospital, Latur, Maharashtra, India.

### Inclusion Criteria

The patients had presented with infertility and/or previous one or more pregnancy losses. They were diagnosed to have complete or incomplete uterine septum on transvaginal sonography and hysterosalpingography in some cases, and 3D ultrasonography to confirm the diagnosis in nine patients[7] (Fig. 1).

A definitive diagnosis was confirmed on hysteroscopy. Hysteroscopy was supplemented by laparoscopy in 27 patients so as to rule out the bicornuate uterus and for the diagnosis of any other pelvic pathology and tubal patency in cases of infertility.

### Exclusion Criteria

The study does not include those patients of uterine septum who had associated pelvic pathology like pelvic adhesions, tubal blocks, or endometriosis. Patients with age more than 35 years were also excluded from this study.

The operative procedures were done as per the Indian Council of Medical Research (ICMR) ethical guidelines for biomedical research on human subjects[14,15] and with due permission of the Institutional Review Board. Informed consent was obtained from all patients after giving them information on the various other modalities of the treatment.

### Procedures

The operative procedure was done in the proliferative phase of the menstrual cycle.

General anesthesia was given to all patients. We used a 2.9 mm BETTOCHI operative hysteroscope (Karl Storz SE and Co.) through a 5 mm operative sheath with a 5 Fr working channel. Normal saline was used as the distending medium, and the intrauterine pressure was maintained at 80–100 mm Hg with the help of a Karl Storz Hysteromat.

The cavity was first explored hysteroscopically so as to completely visualize the septum and the tubal ostia on either side. A 400-micron quartz fiber was passed through a laser guide into the 5 Fr working channel of the operative hysteroscope. Ho:YAG laser (Auriga XL 50-Watt, Boston Scientific) with power settings of 15 Watts (1500 mJ energy at 10 Hz) was used. Transection of the septum was started at the nadir of the septum in the midline and continued in a horizontal manner from side to side toward the base. Transection was continued till the myometrial fibers were identified and both tubal ostia were visible at the same time in the panoramic view of the uterine cavity from the level of the internal os.

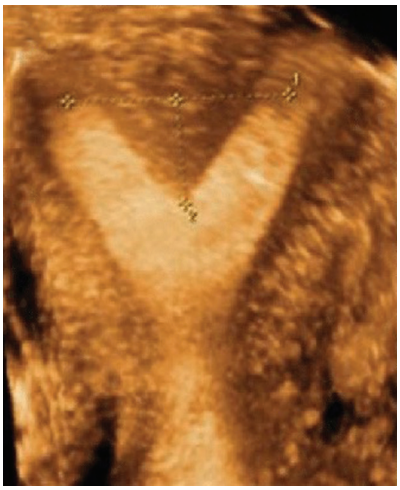

**Fig. 1:** 3D ultrasonography to rule out the bicornuate uterus

Antibiotic therapy (Tab. Cefixime 200 mg ) was given 12 hourly for 5 days. Postoperative estrogen therapy was given for 2 months in the form of a sequential regime with Estradiol Valerate 2 mg (Tab. Progynova, Zydus Cadila), 12 hourly orally for 25 days and Norethisterone 5 mg (Tab. Regestrone, Torrent Pharmaceuticals Ltd), 12 hourly orally for the last 5 days. This facilitates endometrial proliferation and helps to prevent intrauterine adhesions.[16,17] Patients were allowed to conceive after 2 months.[12]

The following parameters were analyzed—operative time was measured from entry of the hysteroscope through the cervical canal to the completion of septal transection. Intraoperative and postoperative complications were noted and compared with other studies using monopolar cautery, bipolar cautery, and Nd:YAG laser. The reproductive outcome was studied for 18 months following the surgery in 29 patients (7 patients were lost to follow-up). Of these 29 patients, relook hysteroscopy was done in 8 patients who failed to conceive after 8 months of the first surgery. The reproductive outcome and the live birth rate were studied in all these patients and compared with other studies at the end of 18 months.

## Result

### Demographics (Table 1)

The mean age of the patients was 24.6 years (21–34 years).

Indications for surgery were as follows: 12 patients (33.3%) were of infertility and 24 patients (63.7%) of previous pregnancy losses.

Five patients had complete uterine septum, and 31 patients had an incomplete uterine septum.

### Operative Parameters

Twenty-eight patients did not need any cervical dilatation. Cervical dilation up to Hegar number 6 was needed in only 8 patients.

The average time taken for the procedure of hysteroscopic transection of the septum using Ho:YAG laser was 17 minutes (10–25 minutes).

Complete incision of the septum was achieved in the first sitting in all patients.

### Complications (Table 2)

There was no intraoperative or postoperative hemorrhage in any patient. None of the patients had any uterine perforation, hemorrhage, or fluid overload.

**Table 1:** Demographics

| | |
|---|---|
| Total number of patients | 36 |
| Age (years) | 24.6 years (21–34 years) |
| Presentation | |
| Infertility | 12 (33.3%) |
| Previous pregnancy loss | 24 (63.7%) |
| Extent of septum | |
| Incomplete | 31 (86.1%) |
| Complete | 5 (16.1%) |

**Table 2:** Comparative study of complications using different energy sources

| | *Monopolar cautery (n = 80)* | *Bipolar cautery (n = 80)* | *Nd:YAG laser (n = 19)* | *Ho:YAG laser (n = 36)* |
|---|---|---|---|---|
| | Intraoperative | | | |
| • Cervical tears/traumas | 3 | — | ___ | __ |
| • Uterine false track | 1 | — | ___ | __ |
| • Uterine perforation | — | — | 1 | __ |
| • Fluid overload | — | — | __ | __ |
| • Thermal injuries | — | — | ___ | __ |
| • Significant blood loss | 2 | 1 | 3 | __ |
| | Postoperative | | | |
| • Intrauterine synechiae | 1 | — | 1 | 2 |
| • Residual septum | 2 | 4 | — | 1 |
| • Uterine rupture in pregnancy | — | — | — | — |
| Total | 9 | 5 | 5 | 3 |

**Table 3:** Comparative study of the reproductive outcome using different energy sources

| *Study* | *Patients followed No.* | *Pregnancies No. (%)* | *Abortions No. (%)* | *Preterm deliveries No. (%)* | *Term deliveries No. (%)* | *Live births No. (%)* |
|---|---|---|---|---|---|---|
| Colacuri et al. (2007)[21*] | 70 | 49 (70.0) | 9 (18.4) | 8 (16.3) | 32 (65.3) | 40 (81.6) |
| Colacuri et al. (2007)[21**] | 65 | 50 (76.9) | 8 (16.0) | 8 (16.0) | 34 (68.0) | 42 (84.0) |
| Choe et al. (1998 )[8***] | 14 | 13 (92.8) | 1 (7.7) | 1 (7.7) | 10 (71.4) | 10 (71.4) |
| Our study[#] | 29 | 23 (79.3) | 3 (13.0) | 2 (8.7) | 18 (78.3) | 20 (86.9) |

[*]Use of monopolar resectoscope; [**]use of bipolar electrode; [***]use of Nd:YAG laser; [#]use of Ho:YAG laser

Relook hysteroscopy done in eight patients showed that one patient had a residual septum that was cut with the Ho:YAG laser. Very few intrauterine adhesions were found and cut in two patients. Two patients conceived after relook hysteroscopy.

### Reproductive Outcome (Table 3)

Of the 29 patients who had been followed for 18 months, 23 patients (79.3%) conceived. One patient had an abortion at 8-10 weeks, and 2 patients had a second-trimester abortion (13.0% abortion rate). Cervical cerclage was done in five patients who were diagnosed to have cervical incompetence on clinical examination or transvaginal sonography. Two patients (8.7%) had preterm deliveries with live babies who were given NICU care. Eighteen patients (78.3%) delivered after 35 weeks, of which 13 (72.2%) were delivered by cesarian section and 5 (27.8%) by vaginal delivery. None of the patients had any complications like placenta accreta or uterine rupture.

## Discussion

Various techniques have been used for the hysteroscopic management of uterine septum, which include the use of cold scissors, monopolar electrode (Collin's knife), bipolar electrode (Versapoint), and lasers. The review of the literature has shown that efficacy with respect to reproductive outcome remains the same with all techniques.[7]

The use of scissors for septal incision requires adequate skills and takes more time. Thick vascular septums are difficult to cut with scissors, and bleeding during incision of such septums may disturb the hysteroscopic vision. 5 Fr scissors are fragile. They become dull easily and have to be replaced frequently.[16]

In monopolar electrosurgery, the current flows through many tissues outside the surgeon's visual control before it returns to the generator.[16] There is a risk of thermal injuries to distant tissues. Also, there is a risk of interference on other electronic equipment simultaneously connected to the patient (e.g., electrocardiogram and pacemaker). Furthermore, there may be stimulation of peripheral nerves, including the obturator nerve leading to severe obturator spasms and injury to surrounding structures.[16]

There is a risk of fluid overload and hyponatremia during hysteroscopic procedures using monopolar electrosurgery because of the use of hypotonic electrolyte-free solutions like glycine or sorbitol.[17]

Monopolar cautery creates temperatures as high as 400°C, which causes significant collateral and penetrative tissue damage. It is reported to have a depth of penetration of 3–5 mm. Hence, there is poor control of the cut and more possibility of uterine perforation.[18] Nd:YAG laser has been used previously for the treatment of the uterine septum. Nd:YAG laser has a good hemostatic capability but penetrates more deeply and causes deeper thermal damage up to 4 mm, thus more risk of uterine perforation.[19,20] Ho:YAG laser is highly absorbed by water and has a shallow penetration depth of 0.4 mm in tissues. As a pulsed mode laser, the holmium reduces deeper thermal effects and charring, which is seen commonly in continuous wave lasers (e.g., Nd:YAG, diode, and KTP lasers) (Fig. 2). The shallow penetration depth minimizes the coagulation zone and collateral damage to the sensitive surrounding endometrium. It offers a clean and precise incision. Hence, there is a reduction in subsequent postoperative adhesion formation.[13] The precision of Ho:YAG laser also helps in preventing accidental uterine perforation during the surgery and rupture in the subsequent pregnancy.

The outer diameter of a monopolar resectoscope is more than 7.5 mm and hence needs cervical dilatation with a risk of cervical laceration in a nulliparous woman.[21]

The Ho:YAG laser is used in many surgical specialties, especially in urology, orthopedic surgery, and dentistry. Because of its broad range of potential applications, it has been called

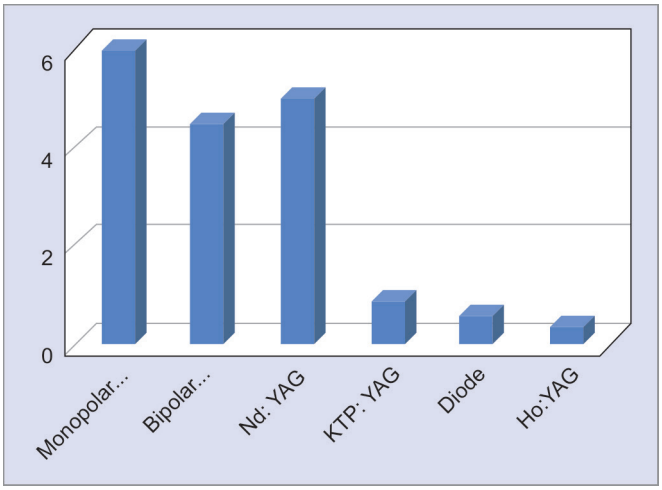


**Fig. 2:** Comparison of depth of tissue destruction of different energy sources

the "Swiss Army Knife" of lasers. The high-powered Ho:YAG laser enables surgeons to work more quickly and cut more smoothly. It also offers good hemostasis by modulating the laser parameters and defocusing the beam.[12]

The Ho:YAG laser can be transmitted through a 400-micron optical quartz fiber that can be passed through the 5 Fr working channel of a 5 mm BETTOCHI's operative sheath. Hence, the procedure does not require cervical dilatation. Hysteroscopic transection of the uterine septum with Ho:YAG laser is a technically easy procedure with a short operative time and requires a shorter learning curve.

The cost of laser equipment is considered a disadvantage for its use, but we share the laser generator with the Urology department and use a reusable quartz fiber, thus making the procedure cost-effective.

Normal saline, used as the distending medium, decreases the risk of hyponatremia.

Out of 29 patients who had been followed, 23 patients (79.3%) conceived, 3 patients had abortions (13.0%), 2 patients (8.7%) had preterm deliveries, and 18 patients (78.3%) of the pregnant patients delivered after 35 weeks. The reproductive outcomes of patients in our study are comparable with other techniques of hysteroscopic metroplasty (Table 3).[8,21]

The pulsed Ho:YAG laser is a promising tool for hysteroscopic surgery because of its precise cutting, reduced charring effects, good hemostasis, and ease of manipulation.

This is a single center, retrospective study of our experiences with the use of Ho:YAG laser for hysteroscopic septal transection. Larger, multicentric, prospective randomized studies are required to establish the superiority of Ho:YAG laser over other modalities for hysteroscopic metroplasty.

## Conclusion

Ho:YAG laser is a precise, simple, effective, and safe tool for the procedure of hysteroscopic transection of the uterine septum.

## References


1. Buttram Jr VC, Gomel V, Siegler A, De Cherney A, Gibbons W, March C. The American Fertility Society classifications of adnexal adhesions, distal tubal occlusion secondary to tubal ligation, tubal pregnancies, Mullerian anomalies and intrauterine adhesions. *Fertil Steril*, 1988; 49, 944–955.
2. Grimbizis GF, Gordts S, Sardo AS, Brucker S, Angelis C, Gergolet M,. The ESHRE/ESGE consensus on the classification of female genital tract congenital anomalies. *Hum Reprod* 2013; Vol.28, p 2032-2044.
3. Raga F, Bauset C, Remohi J, Bonilla-Musoles F, Simon C, Pellicer A. Reproductive impact of congenital mullerian anomalies. *Hum Reprod* 1997;12:2277-228.
4. Homer HA, Li TC, Cooke ID. The septate uterus: a review of management and reproductive outcome. *Fertil Steril* 2000; 73:1-14.
5. Fedele L, Bianchi S. Hysteroscopic metroplasty for septate uterus. *Obstet Gynecol Clin North Am* 1995; 22:473-489. https://doi.org/10.1016/S0889-8545(21)00198-4
6. Rock J A, Breech L L. Surgery for anomalies of the mullerian ducts. *Telinde's Operative Gynecology. Eleventhth Edition*. Philadelphia-PA: Lipincott- Williams and Wilkins, 2015; p-539–583.
7. Practice committee of the American Society for Reproductive Medicine. Uterine Septum: a guideline. *Fertility and Sterility*. 2016; 106, No.3, 0015–0282
8. Choe JK, Baggish MS. Hysteroscopic treatment of septate uterus with Neodymium: YAG laser. *Fertil Steril* 1992;57:81–84.
9. Donnez J, Nisolle M. Endoscopic laser treatment of uterine malformations. *Hum Reprod* 1997;12:1381–1387.
10. Daniell JF, Osher S, Miller W. Hysteroscopic resection of uterine septi with visible light laser energy. *Colposc Gynecol Laser Surg* 1987; 3: 217–220.
11. Nappi L, Pontis A, Sorrentino f, Greco P, Angioni S. Hysteroscopic Metroplasty for the Septate Uterus with Diode Laser: a pilot study. *Eur J Obstet Gynecol Reprod Biol*. 2016; 32-35.
12. *Holmium YAG surgical lasers. Health devices*. (No Authors listed). 1995 Mar; 24(3): 92–122
13. Bhatta N, Isaacson K, Bhatta K M, Anderson R R. Comparative study of different laser systems. *Fertil Steril*. Apr 1994; p 581–591.
14. National Ethical Guidelines for Biomedical and Health Research Involving Human Participants. Indian Council of Medical Research. 2017.
15. Fedele L, Bianchi S, Frontino G. Septums and synechiae: approaches to surgical correction. *Clin Obstet Gynecol*.2006; 49:767–788
16. Valle R F. A *Manual of Clinical Hysteroscopy*. 1998 p–62.
17. Kudela M, Lubuský D, Dzvincuk P. Risk of fluid overload syndrome during hysteroscopy procedures. Ceska Gynekol. 1996 Oct; 61(5):291-3. Czech. PMID: 9004974.
18. Mencaglia, L., Lugo, E., Consigli, S. et al. Bipolar resectoscope: the future perspective of hysteroscopic surgery. *Gynecol Surg* 6, 15 (2009). https://doi.org/10.1007/s10397-008-0400-3
19. Yang J, Yin T, Xu W M, Lian G X, Li A B. Reproductive outcome of septate uterus after Hysteroscopic treatment with Neodymium:YAG laser. *Photomedicine and Laser Surgery*. 2006; 24: 625–629
20. Jourdain O, Dabysing F, Harle T, Lajus C, Roux D, Dallay.(1998) *Management of septate uterus by flexible hysteroscopy and Nd:YAG laser*. Int Jour of Gynecol & Obstet. 1998; 63:159–162.
21. Colacuri N, De Franciscis P, Mollo A, Litta P, Perino A, Cobellis L, et al. Small diameter hysteroscopy with Versapoint versus resectoscopy with a unipolar knife for the treatment of septate uterus; a prospective randomized study. *J Minim Invasive Gynecol* 2007, 14: 622–7.