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A Novel 450-nm Laser Technique Versus Electrosurgical Excision for Hysteroscopic Endometrial Polypectomy: Efficacy and Safety

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Abstract

Introduction: The use of hysteroscopic laser ablation for intrauterine diseases is a new technology. This study aimed to evaluate the efficacy and safety of a novel 450-nm wavelength laser system for hysteroscopic resection of endometrial polyps.

Methods: This retrospective study included 49 patients with suspected endometrial polyps treated at the Department of Obstetrics and Gynecology, the Second Affiliated Hospital of Xi'an Jiaotong University, between October 2022 and November 2023. The participants were allocated into two groups: the blue laser group (n = 24) and the control group, which underwent traditional hysteroscopic resection (n = 25).

Results: At baseline, no statistically significant differences were observed between the two groups. Both groups achieved a 100% success rate in terms of cutting and hemostatic efficiency for endometrial polyps. The operation time for the blue laser group was marginally shorter than that for the electric resection group (6.63 minutes vs. 7.96 minutes, $P = 0.213$), and the change in hemoglobin level was slightly lower in the blue laser group than in the electric resection group (7.96 g/L vs. 10.4 g/L, $P = 0.643$); however, these differences were not statistically significant. Additionally, there were no significant differences between the two groups in terms of the rate of secondary cervical dilation, length of hospital stay, postoperative complications, or surgeon satisfaction with the surgical system.

Conclusion: Our preliminary findings suggest that blue laser hysteroscopic endometrial polypectomy is both effective and safe. Nonetheless, to comprehensively assess the long-term effects and potential benefits of this novel technology, larger randomized controlled trials are warranted.

Keywords: Hysteroscopy; Lasers; Minimally invasive surgical procedures; Polypectomy.

Introduction

Endometrial polyps (EPs) are prevalent abnormalities observed in women of reproductive age as well as in postmenopausal women who experience abnormal uterine bleeding.[1,2] The advent and widespread utilization of transvaginal ultrasound have significantly increased the detection rates of EPs, with reported prevalence rates ranging from 10% to 40%.[3] In symptomatic cases, particularly among postmenopausal women, surgical intervention is often necessary.[4] Technological advancements have led to the development of numerous innovative techniques for the resection of EPs. Despite these advancements, hysteroscopy remains the gold standard for both the diagnosis and treatment of Eps.[4] Recent progress in the field of gynecological surgery has generated considerable interest in the use of hysteroscopic lasers. Over time, a variety of lasers have been employed, including diode lasers, dual-wavelength laser systems, Versapoint, and Nd:YAG lasers.[5-8] This study retrospectively evaluated the efficacy and safety of a novel laser technology that we have implemented in recent years for the resection of EPs. The latest evidence indicates that a variety of hysteroscopic surgeries, including endometrial polyp resection, myomectomy, and uterine contouring surgery, can all be successfully performed using a diode laser. The combined hysteroscopic and diode laser resection for uterine endometrial polyps offers better safety and clinical efficacy.[9,10] Specifically, we utilized a 450-nm blue laser developed by Blueray Medical Ltd. The system comprises a main unit and a foot switch. The main unit includes a 450-nm semiconductor laser, a laser power supply and control system, a safety protection system, and a cooling system. The laser output power is adjustable from 0 to 30 W, with an operating center wavelength of 450 nm, corresponding to a blue color. Compared to the green laser with a wavelength of 532 nm, the 450-nm blue laser has higher cutting efficiency, lower power settings, and less thermal side effects. The 450-nm wavelength blue

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laser is very effective for removing or healing wounds after surgical incisions.[11] Compared with traditional electroresection, the blue laser demonstrated superior vaporization cutting and coagulation hemostasis efficacy on bladder tumor tissues, allowing for en bloc tumor enucleation with reduced bleeding and no obturator nerve reflex. These findings suggest that this method may serve as a novel, efficient, safe, and easily mastered approach for the surgical management of non-muscle-invasive bladder tumors.[12] To our knowledge, the application of blue laser hysteroscopy for EPs resection has not been previously documented.

This study presents our experience with a series of cases involving EPs resection using blue laser hysteroscopy, compared to traditional electroresection under hysteroscopy. The primary objective of this study was to evaluate the efficacy and safety of a novel surgical technique, specifically focusing on the effectiveness of removing uterine endometrial polyps and the incidence of postoperative complications.

Materials and methods

Study Population

This retrospective analysis included 49 patients (no randomization method was employed) who underwent hysteroscopic blue laser and electrosurgical resection of EPs at our hospital between October 2022 and November 2023. The study received approval from the ethics committee of the hospital, and informed consent was obtained from all participants. The inclusion criteria were as follows: women of childbearing age without fertility requirements or postmenopausal women under the age of 75, with diagnosed EPs and indications for hysteroscopic surgery. The exclusion criteria were as follows: patients with severe cardiopulmonary insufficiency; those who were pregnant or lactating; or individuals with other contraindications to surgery, such as fever, abnormal uterine bleeding, or acute reproductive tract inflammation. The following data were collected at baseline: age, body mass index, preoperative hemoglobin levels, number of EPs, and history of intrauterine surgery. The following perioperative outcome variables were documented: operative time, effective rate of endometrial polyp removal, changes in postoperative hemoglobin levels, rate of cervical ripening before surgery, incidence of second cervical dilation, length of hospital stay, postoperative complications, and doctors' satisfaction with the surgical system.

Hysteroscopic blue laser polypectomy

All procedures were conducted by a surgeon with over 30 years of expertise in hysteroscopic surgery. The experimental group utilized a semiconductor blue laser surgical system (450 nm, Blueray Medical Ltd., Xi'an, China), whereas the control group employed an 8.5-mm continuous-flow hysteroscope and bipolar resectoscope loops (Olympus, Tokyo, Japan). The patients were placed under general anesthesia in the lithotomy position, and the hysteroscope and blue laser apparatus were inserted. A routine hysteroscopy was performed to ascertain the location and quantity of the EPs. The blue laser fiber was introduced through the operating channel, and all polyps were excised. The blue laser power was set to 25 W. Saline solution was used to distend the uterine cavity. The semiconductor-based system generated a 450-nm laser, which was effectively absorbed by hemoglobin in the tissue and converted into heat. The surgeon regulated the power density of the blue laser on the tissue, facilitating the tissue absorption of heat, thereby achieving vaporization, cutting, and coagulation. The use of blue laser technology offers several advantages, including minimal thermal damage, high efficiency in tissue vaporization, and effective cutting capabilities. In all the instances, the excised EPs tissues were submitted to a pathologist for histological verification. If necessary, the patients underwent cervical ripening prior to surgery, involving the application of pharmacological or mechanical methods to relax and soften the tissue structure of the nonpregnant cervix, facilitating its dilation and allowing surgical instruments to access the uterine cavity without resistance.

Observed Covariates

The rate of effective removal of EPs is defined as the proportion of patients from whom EPs have been completely excised. The effectiveness of polyp removal is assessed on the basis of the completeness of removal and the efficacy of hemostasis. Complete resection is determined by the ability to excise macroscopic polyp lesions entirely, with complete resection recorded as "yes." The hemostatic effect is evaluated on the basis of the ability to achieve effective coagulation and hemostasis during the procedure, with successful outcomes also recorded as "yes." Both indicators must be marked as "yes" to classify the removal of EPs as effective. Secondary cervical dilation refers to the necessity of further dilating the cervix.

Statistical analysis

Continuous variables were presented as mean values with 95% confidence intervals (CIs), whereas categorical data were expressed as observed frequencies and relative percentages. Data analysis was conducted using SPSS software. To compare differences in baseline and perioperative characteristics between the blue laser group and the control group, Student's t-test or chi-square test was employed. The significance level was set at 0.05.

Results

A total of 49 patients were included in this retrospective study, comprising 24 in the blue laser group and 25 in the control group. The study flowchart is depicted in Figure 1. Table 1 shows the baseline characteristics of the two groups. The mean ages of the blue laser group and the control group were 51.13 years and 46.36 years, respectively, with no significant difference between the groups. Baseline characteristics such as BMI, preoperative hemoglobin levels, number of EPs, and history of intrauterine surgery were not significantly different between the two groups.

Table 2 presents data on the perioperative conditions and postoperative complications of both groups. The cutting and hemostatic efficiency for EPs in both groups was 100%. The duration of surgery for the blue laser group was marginally shorter than that for the electric resection group (6.63 minutes vs. 7.96 minutes, $P=0.213$), and the reduction in hemoglobin levels was slightly less pronounced than that observed in the electric resection group (7.96 g/L vs. 10.4 g/L, $P=0.643$); however, these differences were not significant. Additionally, no significant differences were observed between the blue laser group and the control group in terms of the average length of hospital stay (3.83 days vs. 3.56 days, $P=0.576$), postoperative complications (such as fever and perforation of the uterus), or the level of satisfaction with the surgical system among physicians. Notably, the incidence of second cervical dilatation was significantly lower in the blue laser group than in the control group (20.8% vs. 52.0%, $P=0.024$). No adverse events occurred in any of the cases.

Discussion

EPs are prevalent benign gynecological conditions encountered in clinical practice. The field of gynecological hysteroscopic surgery has undergone substantial advancements, including the introduction of smaller and more flexible hysteroscopes and the development of bipolar electrosurgical systems.[13] The implementation of novel technologies necessitates evidence-based validation to ensure that patients derive optimal benefits from such advancements. In this study, we employed an innovative blue laser system to conduct EPs resection and compared the surgical outcomes with data from conventional hysteroscopic EPs resection. Our findings demonstrated that the use of a blue laser for hysteroscopic resection of EPs is safe and the operation time is slightly shorter.

The advent of laser technology has conferred additional advantages to both surgeons and patients in the pathological management of the endometrium. Various lasers possess distinct wavelengths and exhibit unique physical and biological characteristics.[14-16] The blue laser, a recent addition to clinical practice, operates at a wavelength of 450 nm and is characterized by high cutting efficiency without inducing wound carbonization. It exhibits superior cutting and hemostatic efficacy across various cavity organs and soft tissues. In the field of gynecology, there is a notable lack of reports concerning the application of blue lasers. Our study aimed to address this gap. A pioneering randomized controlled trial conducted by Wu K et al involving 174 participants, was the first to utilize a novel 450-nm blue laser for the treatment of patients with non-muscle-invasive bladder cancer. These findings indicated that both the blue laser and plasmakinetic electrocautery were effective in excising visible bladder tumors. Although the operation duration for patients in the blue laser group was longer,

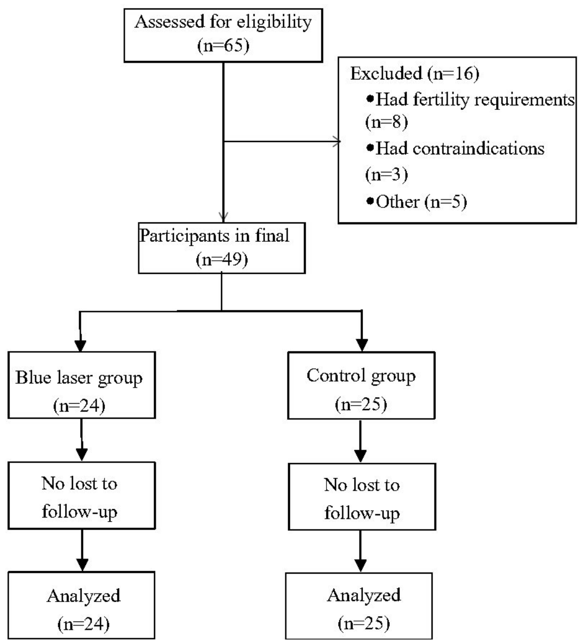

Figure 1. the flow chart of the study

Table 1. Baseline characteristics of participates.

Characteristics	Blue laser group (n = 24)	Control group (n = 25)	*P*-value
Age (years)	51.13 (46.33, 55.92)	46.36 (41.93, 50.79)	0.138
BMI(kg/m^2)	23.56 (22.15, 24.97)	23.60 (22.20, 24.99)	0.972
Overweight[a]			
No	13 (54.2)	16 (64.0)	0.567
Yes	11 (45.8)	9 (36.0)	
Preoperative hemoglobin (g/L)	119.4 (109.9, 128.8)	119.1 (112.2, 125.9)	0.959
Number of endometrial polyps			
1	18 (75.0)	17 (68.0)	0.546
2	3 (12.5)	6 (24.0)	
3	3 (12.5)	2 (8.0)	
>3	0 (0)	0 (0)	
History of intrauterine surgery			
No	22 (91.7)	21 (84.0)	0.667
Yes	2 (8.3)	4 (16.0)	

Continuous variables were presented as weighted mean values (95% confidence interval) and categorical variables are presented as numbers (percentages).

[a]Overweight was classified as BMI ≥ 24 based on Guidelines for the Diagnosis and Treatment of Obesity in China (2024).

Table 2. Perioperative Surgical Outcomes

Surgical outcomes	Blue laser group (n = 24)	Control group (n = 25)	*P*-value
Operative time (minutes)	6.63 (5.38, 7.87)	7.96 (6.25, 9.67)	0.213
Effective removal of EP			-
Yes	24 (100)	25(100)	
No	0 (0)	0 (0)	
Second dilatation of the cervix			
Yes	5 (20.8)	13 (52.0)	0.024
No	19 (79.2)	12 (48.0)	
Hemoglobin change (g/L)	7.96 (6.17, 9.74)	8.52 (6.88, 10.16)	0.643
Operative complications			-
Postoperative fever	0 (0)	0 (0)	
Others	0 (0)	0 (0)	
Hospitalization days (days)	3.83 (3.11, 4.56)	3.56 (2.86, 4.26)	0.576
Doctor' satisfaction with system	24 (100.00)	25 (100.00)	-

Data are presented as mean (95% confidence interval) or n (%).
EP endometrial polyp

the associated blood loss was lower than that in the control group. No significant differences were observed in terms of hospital stay duration or other adverse events between the two groups.[17] A small-sample study on the effect of hysteroscopic laser surgery for the removal of endometrial polyps mainly evaluated the complete removal rate, operation time, incidence of complications, and intraoperative pain conditions.[6] This study showed that there was no significant difference in intraoperative pain and polyp removal time between the two groups. The laser group achieved polyp clearance at a higher rate after incomplete removal. Compared with Versapoint, diode laser polypectomy can reduce the recurrence rate and improve patient satisfaction. Another study on laser polypectomy for endometrial polyps indicates that in 225 surgeries, 219 cases (97.3%) successfully underwent laser polypectomy. No major complications occurred during the surgery or after the operation.[7] Studies have proved that the laser hysteroscopic endometrial polypectomy is safe and effective. These results were similar to ours. Our research revealed that the laser group experienced shorter operation times and less bleeding than did the control group, although these differences were not statistically significant. This discrepancy may be attributed to variations in disease characteristics and surgical procedures. The 450-nm blue laser, characterized by its relatively short wavelength and high absorption rate in soft tissues, facilitates tissue and blood vessel ablation and coagulation upon absorption, potentially minimizing intraoperative bleeding.[14] In our surgical experience, we observed that the novel laser system effectively maintains the integrity of the surgical plane and is capable of treating polyps in challenging locations, such as the opening of the fallopian tube. The laser system offers dual advantages: it possesses excellent hemostatic properties and the ability to cut and vaporize tissue. These features render it a highly effective hemostatic tool in hysteroscopic surgery, potentially reducing both the risk and operative time. However, blue lasers have not yet received clinical approval for hysteroscopic surgery. Consequently, we analyzed our prior experimental data and compared them with those of standard bipolar resection techniques. This technology has not been tested in patients with fertility concerns, and our understanding of its efficacy and safety remains preliminary. The effects of this technology on endometrial receptivity and reproductive outcomes are still unknown. Furthermore, our study has some limitations. First, the sample size is relatively small. Second, there is a lack of long-term follow-up data on the surgical outcomes, such as data on postoperative recurrence rates and reproductive outcomes.

Conclusion

Our preliminary findings seem to support that the hysteroscopic endometrial polypectomy with a 450-nm blue laser is a feasible and safe alternative to resectoscope techniques. This technique causes less thermal damage to the endometrium, which is particularly important for women of childbearing age with fertility needs. Moreover, laser energy can achieve precise and continuous removal of the lesion site, thereby immediately producing a visible effect without any bleeding. Nonetheless, rigorously designed, large-sample randomized controlled trials are necessary to assess its feasibility in comparison with commonly employed unipolar and bipolar techniques and to confirm the safety of this novel technology.

Authors' Contribution

Conceptualization: Pinjun Gong, Xiang Xue.
Data curation: Hui Mao, Haiyan Wang, Tingting He, Li Bai, Zheng Ma.
Formal analysis: Pinjun Gong, Jinyan Zhao.
Investigation: Pinjun Gong, Hui Mao, Haiyan Wang, Tingting He, Li Bai, Zheng Ma.
Methodology: Pinjun Gong, Xiang Xue.
Project administration: Pinjun Gong, Xiang Xue.
Resources: Pinjun Gong, Xiang Xue.
Software: Jinyan Zhao.
Supervision: Pinjun Gong.
Validation: Pinjun Gong, Xiang Xue.
Visualization: Pinjun Gong, Jinyan Zhao.
Writing–original draft: Jinyan Zhao.
Writing–review & editing: Pinjun Gong, Jinyan Zhao.

Availability of Statement

The data of this study are available on request from the corresponding author.

Competing Interests

The authors have no conflicts of interest

Ethical Approval

The study received approval from the Second Affiliated Hospital of Xi'an Jiaotong University ethics committee

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References

1. Munro MG. Uterine polyps, adenomyosis, leiomyomas, and endometrial receptivity. Fertil Steril. 2019;111(4):629-40. doi: 10.1016/j.fertnstert.2019.02.008
2. Fagioli R, Vitagliano A, Carugno J, Castellano G, De Angelis MC, Di Spiezio Sardo A. Hysteroscopy in postmenopause: from diagnosis to the management of intrauterine pathologies. Climacteric. 2020;23(4):360-8. doi: 10.1080/13697137.2020.1754387
3. Lieng M, Istre O, Qvigstad E. Treatment of endometrial polyps: a systematic review. Acta Obstet Gynecol Scand. 2010;89(8):992-1002. doi: 10.3109/00016349.2010.493196
4. Vitale SG, Haimovich S, Laganà AS, Alonso L, Di Spiezio Sardo A, Carugno J. Endometrial polyps. An evidence-based diagnosis and management guide. Eur J Obstet Gynecol Reprod Biol. 2021;260:70-7. doi: 10.1016/j.ejogrb.2021.03.017
5. Etrusco A, Buzzaccarini G, Laganà AS, Chiantera V, Vitale SG, Angioni S, et al. Use of diode laser in hysteroscopy for the management of intrauterine pathology: a systematic review. Diagnostics (Basel). 2024;14(3):327. doi: 10.3390/diagnostics14030327
6. Lara-Domínguez MD, Arjona-Berral JE, Dios-Palomares R, Castelo-Branco C. Outpatient hysteroscopic polypectomy: bipolar energy system (Versapoint®) versus diode laser - randomized clinical trial. Gynecol Endocrinol. 2016;32(3):196-200. doi: 10.3109/09513590.2015.1105209
7. Nappi L, Sorrentino F, Angioni S, Pontis A, Litta P, Greco P. Feasibility of hysteroscopic endometrial polypectomy using a new dual wavelengths laser system (DWLS): preliminary results of a pilot study. Arch Gynecol Obstet. 2017;295(1):3-7. doi: 10.1007/s00404-016-4232-5
8. 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;206:32-5. doi: 10.1016/j.ejogrb.2016.08.035
9. Ren H, Duan H, Wang S, Chang Y. Hysteroscopy combined with laser vaporesection for endometrial polyps. J Invest Surg. 2022;35(10):1772-8. doi: 10.1080/08941939.2022.2116134
10. Vitale SG, Mikuš M, De Angelis MC, Carugno J, Riemma G, Franušić L, et al. Diode laser use in hysteroscopic surgery: current status and future perspectives. Minim Invasive Ther Allied Technol. 2023;32(6):275-84. doi: 10.1080/13645706.2023.2247483
11. Jiang DL, Yang Z, Liu GX, Wu K, Fan J, Wu D, et al. A novel 450-nm blue laser system for surgical applications: efficacy of specific laser-tissue interactions in bladder soft tissue. Lasers Med Sci. 2019;34(4):807-13. doi: 10.1007/s10103-018-2668-5
12. Zheng P, Jiang D, Zhang J, Li L, Fan J, Wu K, et al. Efficacy and safety of blue laser en bloc enucleation in the treatment of non-muscle invasive bladder cancer: report of 50 cases from a single center. Journal of Modern Urology. 2023;28:115-8.
13. Vitale SG, Giannini A, Carugno J, van Herendael B, Riemma G, Pacheco LA, et al. Hysteroscopy: where did we start, and where are we now? The compelling story of what many considered the “Cinderella” of gynecological endoscopy. Arch Gynecol Obstet. 2024;310(4):1877-88. doi: 10.1007/s00404-024-07677-x
14. Xu X, Jiang D, Liu G, Mu L, Zeng J, Yang L, et al. In vitro evaluation of the safety and efficacy of a high-power 450-nm semiconductor blue laser in the treatment of benign prostate hyperplasia. Lasers Med Sci. 2022;37(1):555-61. doi: 10.1007/s10103-021-03297-y
15. Jiang D, Liu G, Yang B, Niu H, Fan H, Ren Z, et al. 450-nm blue diode laser: a novel medical apparatus for upper tract urothelial lesions. World J Urol. 2023;41(12):3773-9. doi: 10.1007/s00345-023-04647-x
16. Liu G, Jiang D, Ren M, Lu X, Chang Y, He S, et al. High-power 450 nm blue diode laser for endoscopic mucosal resection/endoscopic submucosal dissection in the stomach: preliminary results on a porcine model with a modified flexible endoscope. Lasers Surg Med. 2022;54(7):1002-9. doi: 10.1002/lsm.23561
17. Wu K, Jiang D, Zhang L, Jiang S, Lin T, Luo Y, et al. Efficacy and safety of a novel 450 nm blue diode laser versus plasmakinetic electrocautery for the transurethral resection of non-muscle invasive bladder cancer: the protocol and result of a multicenter randomized controlled trial. Front Oncol. 2022;12:1065735. doi: 10.3389/fonc.2022.1065735