Laser Application and Nursing in the Field of Gynecology

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The recent development of new surgical techniques using lasers has increased the opportunities for open surgery involving minimal manipulation and faster and more accurate removal of lesions. The increasing use of laser technology requires nurses to play an extensive role. As assistants, nurses play an important role in maintaining the efficacy and safety of the laser device. In addition, they are also responsible for providing pre-and post-operative care to patients. Therefore, nurses should be aware of how to proceed with operative laser treatment for all surgical procedures and the steps for maintaining safety prior to, during, and after laser treatment. This review provides in-depth knowledge for nurses undertaking continuing education on lasers and patient care in the field of gynecology.

Key words

Gynecology; Laser; Nursing

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INTRODUCTION

For the last few years, the medical field has been developing new surgical techniques with lasers.^{1,2} The new technique of laser has many advantages, such as ease of surgery, hemostatic effect, good lesion removal, a shortened surgery time, and a quick recovery period and has found use as a surgical instrument.³ With the advantages mentioned above, lasers are also used in various ways in the gynecological surgeries and treatments.

With the increasing use of lasers, nurses working for the gynecology part must be familiar with the changing areas of these new technologies. Laser technology has revolutionized the field of health and nursing today.⁴⁻⁷ To respond to these new changes, it is essential that nurses understand laser technology to assist during surgical operations.

The reproductive organ for menstruation and pregnancy has a symbolic meaning related to a woman's sexual identity and self-identity. Therefore, when women undergo gynecological surgeries, the clinician and the medical staff need to take care the psychological and emotional responses of their patient not only the surgery results. Whether the surgery or treatment is simple or serious, the patients complain of anxiety and depression not only about surgery, anesthesia, and recovery, but also about loss of fertility, loss of femininity and body image, symptoms of menopause, and changes in their sex life. So nurses as the staff of medical team need to provide accurate and specific information about surgery and education can reduce the anxiety of the patient and her spouse.

Therefore, nurses in the gynecology not only have important roles for maintaining the efficacy and safety of the laser as an assistant in the field but also are responsible for providing pre and post-operative care as a medical team staff. This review would be helping for nurses undertaking continuous education on lasers and patient care in the field of gynecology.

CLINICAL AND NURSING APPLICATION OF LASERS

Intestinal application (in laparotomy) and nursing

The laser requires minimal manipulation and causes minimal damage to the tissue, resulting in less adhesion and faster healing following surgery.⁸ Therefore, it is suitable for precision surgery such as in the field of infertility.

When the laser is used intraperitoneally, it should be operated on the target tissue for its straightness, and a back stop should be used to protect the organs behind it from damage.⁹ Block stop made of titanium can be used

most safely and conveniently by treating the surface so that it is not reflective.

Adhesiolysis

Adhesions around the oviducts and ovaries are the biggest problems. Fix the blocking rod behind the adhesion part, set the focus size to 0.5-1 mm, and peel it off with an output of 15-30 W. Use a laser on areas that may pose possible challenges. If the adhesions are relatively thick, small blood vessels are distributed, so set the focal size to 1.5-2 mm and peel off while stopping bleeding at an output of 5-10 W. If hemostasis is less of an issue, the possible focus can be reduced and high power can be used to reduce the laser beam irradiation time, thus preventing secondary adhesions.

Terminal neosalpingostomy

Implement the following in the case of hydrosalpinx. First, after inflating the oviduct with methylene blue solution, use a laser handpiece to make a cross incision along the adhesion surface of the closed oviduct opening by using a 125-mm focal length lens. Make the focus 0.2 mm size using an output of 20-30 W. Insert a toll bar into the opening and extend the cross incision. When the opening is an ectropion, has a fixed suture, or the curtain surface of the opening is irradiated with an output of 5-10 W at a focal point of 3-5 mm, the water in the shroud is dehydrated and automatically causes ectropion.

Oviduct restoration

Lasers are useful for ligation in permanent uterine tube reconstruction surgeries for infertility. First, the proximal and terminal parts of the ligation site are filled with methylene blue solution. This helps to know the exact site of the incision and prevents laser-induced minor thermal damage to the tunica mucosa of the uterine tube. When used with a micromanipulator (MicroSlad), which is a laser output device for an attached surgical microscope, accurate operation is possible. The focus notation should be 0.2 mm, and the beam should be focused at 30-40 W.

Endometriosis

Endometriosis implanted on the peritoneal surface of the pelvis does not require hemostasis because the blood vessels are not distributed. It is said to be vaporized at a low output of 10-15 W with a focal size of 1-2 mm. Carbon dioxide lasers are most conveniently used. An Nd:YAG laser is also used, but the target is highly permeable, and the laser can damage important organs such as large blood vessels and ureters instead of the peritoneum.

Uterine myoma extraction

It is applied to the intramural type, subserosal type and pedunculated myoma that develop toward the curtain of the uterus. Diluted Pitressin is injected around the fibroid to reduce bleeding during surgery and to clear the field of vision. An incision is made on the fibroid process with a focal point of 2-3 mm and a 10-20 W output. It is easy for film to form up to the surface of the fibroid, and the fibroid can be peeled off and removed along the surgical surface. Sometimes there is a blood vessel at the base of the fibroid, which is removed with the fibroid while stopping bleeding at a 5-10 W low output. A double-flap suture (U-shaped incision, double suture) is used to prevent adhesion of the sutured surface following surgery.

Nursing

1) Preparation and nursing before surgery

- Provide information and education to patients and their spouses to help them understand the operation
- Make sure the primary care physician got a written consent for surgery from the patient.
- To reduce problems with anesthesia, encourage the patient to quit smoking if necessary.
- A low-fiber diet should be recommended to the patient a few days before surgery. In addition, on the day before the operation, the patient should have a light dinner and refrain from drinking water after 12 am.
- Give the patient a laxative to clear the bowel and perform an enema if necessary.
- Bathing is performed the evening before surgery, if necessary.
- Prepare the skin to clean the surgical site.
- Insert an indwelling catheter. A distended bladder can cause accidental trauma during surgery by applying pressure to the surgical site. The nurse should explain to the patient the purpose and use of the indwelling catheter insertion and how long the insertion should be maintained after surgery.

2) Nursing assessment immediately after surgery

- If the patient is receiving intravenous infusion, check the type and amount of infusion and follow the doctor's prescription for the infusion rate. Adequate hydration prevents dehydration and hypotension.
- Check the patient every 15-30 minutes until vital signs (respiration, pulse, body temperature and blood pressure) and the patient's condition stabilize, and every 4 hours when they are stable. If abnormal findings are observed in the patient's pulse, skin color, and respiration, blood pressure should be measured immedi-

ately and evaluated for signs of shock.

- Carefully determine whether secretions have accumulated during auscultation of breath sounds.
- Observe skin color and appearance.
- Observe the abdominal wound and the perineal pad.
- Observe carefully as there may be bleeding from the vaginal stump for 3 to 4 hours immediately after surgery.
- If a drainage tube is inserted, observe every 1 to 2 hours and record the characteristics of the amount of drainage.
- Record the input and output volumes and adjust the infusion rate according to the systemic condition. Observe the needle insertion site frequently to assess whether the solution leaks into the surrounding tissue.
- Evaluate frequently for bleeding or foul-smelling discharge.

3) Psychological comfort care

- Describe the changes in the body and physiology after surgery.
- Explain the surgical outcome and prognosis described by the doctor, if necessary.
- Help the patient with the discharge plan by notifying the time of removal of the suture at the surgical site and the expected discharge date.
- Accept the patient's request in a kind and respectful manner, and if the request cannot be accepted, explain it well so as not to hurt the patient's self-esteem.

4) Respiratory complication prevention nursing

- When the patient's consciousness is restored, have the patient take a deep breath, discharge sputum, and change the position. Perform this procedure at first every 30 minutes and once the patient's condition is stable, perform every 2 hours.
- Demonstrate first so that the patient can do it on their own, and then check if the patient is doing well.
- Encourage frequent sitting up to promote lung expansion.
- Measure and auscultate respiratory rate to check for accumulation of airway secretions.
- Support the surgical site with both hands while the patient breathes deeply and coughs. High-risk patients with weakened respiratory function, such as the elderly and obese patients, require special attention.
- Pulmonary embolism should be suspected when the patient complains of sudden shortness of breath and chest pain.

5) Prevention nursing for circulatory complications

- If the patient takes a semi-sitting position after waking from anesthesia, have the patient in a supine position for 10 minutes every 2 hours.
- Do not place a pillow under the patient's knee.
- Perform lower extremity exercises while the patient is lying on the bed.
- Actively encourage the patient to self-initiate early ambulation.
- Early ambulation should be done gradually. When the patient wakes up from anesthesia, start by having the patient rise from the bed and sit down. A strap is tied to the end of the bed so that the patient can hold it or press the surgical site with their hands and, if worn, support the band and get the patient to stand up. The patient's time outside the bed should be gradually increased, and in the case of open surgery, after gas out, the patient is allowed to sit at the table and eat. If possible, allow the patient to take several steps up and down stairs before discharge.
- Patients should avoid sitting for long periods of time, lying with their legs crossed, sitting or bending their knees for a long time, as these may cause circulation disorders. After pelvic surgery, thrombophlebitis of the pelvis can result from venous congestion and impaired circulation of the lower extremities. Blood clots can be increasingly produced due to venous circulation stagnation due to damage to the veins during surgery or continuous bed rest after surgery. In particular, thrombus formation is promoted by continuous compression of the gastrocnemius (calf muscle) of the lower extremities. If the patient complains of pain and tenderness in the gastrocnemius, or pain in the gastrocnemius occurs when the foot is dorsiflexed with the knee extended (Homan's sign), it can be considered as an early symptom of thrombophlebitis.

6) Nursing urination

- If there are no problems with the bladder and urinary system, remove the indwelling catheter the day after surgery and encourage self-voiding within 4 hours.
- Patients can also use methylene blue to see blue urine. It should be explained to the patient that such a phenomenon is normal and disappears after a few days.
- In the presence of prolonged urine retention, plan and implement bladder training to support spontaneous urination.
- If urine retention persists for a long time, bladder training should be planned and implemented to aid spontaneous urination.

- After bladder training, the indwelling catheter should be removed, and the patient is asked to urinate every 3 to 4 hours, and the residual urine volume is measured.
- If the amount of urine remaining in the bladder is more than 100 ml, it is considered residual urine and intermittent catheterization is required. Clinically, if residual urine volume is less than 50-100 ml, the patient can be discharged.

Laparoscopic surgery and laser nursing

The introduction of operative laparoscopy, which can treat intraperitoneal lesions without laparotomy, has revolutionized the gynecological field.^{10,11} Here, we decided to utilize the noncontact and remote surgery. These advantages are characteristic of laser use in laparoscopic surgery.

Laser abdominal surgery is usually performed by inserting surgical instruments and a laser probe into the abdominal cavity with the double- or triple-punch technique.^{12,13}

A laparoscope is inserted into the lower perforation to secure the field of view, and surgical instruments, such as the forcep are inserted into the 2nd puncture hole in the upper part of the pubis. Make a third puncture for the laser probe at the center point or one-third of the midline connecting points one and two.

Tubal pregnancy

Laser laparoscopy can be attempted as a conservative treatment for nonruptured tubal pregnancy. First, the blood in the abdominal cavity is completely washed out and aspirated, and diluted Pitressin is injected into the difficult mesentery to reduce the amount of bleeding, while using a 1-30 W output along the opposite side of the mesentery. After making a 1-2 cm incision, the difficult pregnant tissue and hematoma are removed. In addition, laparoscopic surgery can be performed using a laser for adhesion band removal surgery, endometriosis, and salpingoneostomy, which can be performed using operative laparoscopy.

Nursing

Nursing patients prior to undergoing laser laparoscopy are not particularly different from nursing patients with open surgery. The nurse observes vital signs and the patient's condition for 2-4 hours in the recovery room following surgery. Except in special cases, outpatient treatment can be performed without hospitalization. If there is blood loss due to intra-abdominal bleeding in tubal pregnancy or if there is an inflammatory disease in the pelvis and requires continuous broad antibiotic treatments, or if severe intestinal adhesion dissection have been

performed, they should be hospitalized. Nurses should encourage early activity and recommend food intake and oral medications 12 hours following surgery. They should inform the patient that there may be scapulargia or surgical section pain stimulated by the carbon dioxide remaining in the abdominal cavity. If the patient complains of pain, administer an oral analgesic. Coitus should be possible after seven days. But in cases of uterine surgery, tuboplasty, salpingostomy, tubectomy following two to three months of condom use, a confirmatory secondary laparoscopic surgery or hysterosalpingography should be done before clearing the patient for contraception use.

An adequate level of general anesthesia is required that can provide sufficient muscle relaxation. By doing so, complications and accidents can be prevented, and sophisticated surgical operations are possible. Usually, general anesthesia is induced with a handheld mask, and endotracheal intubation is performed during laparoscopic operation with anesthesia being continued.

Laser colposcopy and nursing

Unlike intra-abdominal surgery, intrauterine surgery is performed in a very small space.¹⁴ In the case of a carbon dioxide laser, a smoke plume is violently generated and no optical fiber is used.¹⁵ This makes it difficult to remove lesions from the side wall of the uterus. Therefore, Nd:YAG lasers are frequently used.

Uterine synechiae

Laser can be used if there is no adhesion detachment due to hysterosalpingography or if there has been diagnostic cervical positioning and then curettage. In the case of a noncontact Nd:YAG laser, the adhesion is peeled off with an output of 20-30 W. With penetration up to 5 mm, the effect of lateral scattering is great. So, if it is peeled off too thoroughly, this will damage normal intimal tissue and will raise the risk of uterine perforation. When using the contact method with a sapphire attached, cut with an output of 3-5 W. Because of shallow penetration, there is less damage to the surrounding tissue.

Uterine septum

When uterine plastic surgery is performed, unnecessary laparotomy can be avoided. This surgery cuts at an output of 20-30 W from the bottom of the uterine septum and gradually moves upward. The extent of the cut can be seen in the line connecting the start of the bilateral fallopian tubes, but at the border of the lower one-third of the uterine septum, a relatively small amount of bleeding becomes visible. But if there is more than this, only cut a little.

Nursing

It is possible to perform the surgery on an outpatient basis, avoiding hospitalization. The nurse observes and records the patient's condition in the recovery room for about 2-4 hours following surgery. Patients can experience seizures due to the release of prostaglandins. These can be regulated by oral analgesics. The nurse explains to the patient that she may have secretions and some bleeding and informs her that after a week, her symptoms will be alleviated. Patients are usually able to perform normal activity after 2-3 days.

Cervical intraepithelial neoplasia (CIN) surgery and nursing

Cervical intraepithelial neoplasia often occurs in the squamocolumnar junction of the cervical canal.^{16,17} Most occur within 1 cm in the ectocervix and rarely occur above 2 cm. Use a surface-treated colposcope to prevent accidents during the procedure.

Laser vaporization

CIN with dome-shaped vaporization centered on the cervical canal should only be done for ectocervix. Vaporize it at an output of 5-10 W at a focal point of 1.5-2 mm. In this case, tissue specimens cannot be obtained, and a thorough diagnosis must be made in advance by cytology, tissue biopsy, and colposcopy. Vaporization is easily done with sufficient local anesthesia and can be performed on an outpatient basis.

Laser conization

Ectocervix is performed when a lesion cannot be detected and CIN of the endocervical canal is suspected, and histological examination is required or there is a possibility of invasive cancer. Under general anesthesia or paracervical block, place a #0 catgut suture on both lateral fornices to stop bleeding and pull the uterus to widen the field of view. Diluted Pitressin is injected into the neck at 12, 3, 6, and 9 o'clock to reduce bleeding. Conization with an output of 20-30 W at a focal point of 0.5-0.8 mm should be done. Make a cone to a height of 2 cm, 6 mm deep on the surface. At this time, if a hooked skin retractor or 3-prong retractor is used, excision is easy. Bleeding on the cut surface can be stopped by pressing with a cotton swab or using an output laser with a focal point of 2-3 mm.

Combination conization and vaporization

Perform this if a lesion is present in the ectocervix and is connected to the endocervical canal. Do a new conization with a laser focused at 0.5-0.8 mm and an output of 20-30 W. Make a cone 6 mm deep from the endocervical

surface to a height of 1 cm. Vaporization is performed at a focal point of 1.5-2 mm with a 5-10 W output to vaporize at a depth of 6 mm to the outside of the ectocervical lesion. The vaporized tissue loses its specimen, but conization of endocervical tissue can be examined in parallel to determine the presence or absence of a lesion extension.

Nursing

Pain that commonly occurs following laser treatment is easily controlled with oral analgesics. The nurse informs the patient that she can sit in salt water and then air-dry it to have a sense of stability. This procedure is mainly performed in the outpatient clinic. Patients should be dressed in loose clothing that does not tighten and should be educated in advance that post-surgical secretions will be produced. She should also avoid sexual intercourse and visit the outpatient department two weeks later.

CONCLUSION

Lasers can be an appropriate and useful surgical tool. They increase the opportunities for various techniques in the surgery including treatments and involve minimal manipulation and removal of lesions. Whether the surgery or treatment is simple or serious, the patients complain of anxiety and depression not only about surgery itself, anesthesia, and recovery, but also about loss of fertility, loss of femininity and body image, symptoms of menopause, and changes in their sex life. Therefore the medical team needs to take care the psychological and emotional responses of their patient not only the surgery results. Therefore, nurses in the gynecology not only have important roles for maintaining the efficacy and safety of the laser as an assistant in the field but also are responsible for providing pre and post-operative care as a medical team staff. Nurses must undertake continuous education on lasers and patient care in order to better outcome.

CONFLICT OF INTEREST

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