Lasers in General Surgery

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Laser technology has wide application in general surgery. The CO2 laser functions as a scalpel sealing small blood vessels in the process of dividing tissues. The YAG laser has been especially useful in the performance of liver resection and the coagulation of large vascular tumors. The utility of lasers in various types of general surgical procedures is discussed.

The most commonly used laser in general surgery today is the CO2 laser. It has the ability to cut with the sharpness of a knife. During this application, it seals small blood vessels (1 mm or less) and lymphatics. The CO2 laser may also be used to vaporize lesions, particularly of the mucosa (mouth, genital tract, and anus) and of the skin. At present, it cannot be passed through an endoscope as a flexible fiber, but rather may be applied with a microscope or semiflexible instrument into the aerodigestive tract and into the rectum through a large scope. It is a precise instrument which, with the aid of a microscope, can do very exact dissection. The Argon laser has limited application in general surgery. Its use through the endoscope to treat gastrointestinal bleeding, polyps, and small carcinomas will be described elsewhere. The Nd YAG (Yag) laser also may be used through an endoscope, but is finding increasing application in general surgery for liver resection and coagulation of large vascular tumors. Combinations of lasers such as the NIIC, which combines CO2 and Yag, are being investigated.

A new, bright spot in general surgery is photoradiation. This is a very promising development in cancer therapy and will be described elsewhere. It seems that with other dyes and other lasers, its use will be extended.

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The CO2 laser has been used in many intra-abdominal procedures. Cutting small areas of the liver may be accomplished if the power is 60 to 80 watts. Bleeding will certainly diminish. We have used the laser in extended right hepatic lobectomy but have always used a clamp on the liver. The bleeding is much less, and postoperative drainage is minimal. In the People’s Republic of China, we saw the use of the Yag laser without a clamp. In the laboratory, we have combined the simultaneous use of the CO2 and Argon lasers and noted a substantial reduction in bleeding. We have not applied this technique clinically.

We have had no experience with the use of lasers to control splenic bleeding. The CO2 laser will cut intestine and leave a dry surface that will heal primarily after anastomosis. We prefer its use in the perineal part of an abdominal perineal resection. The laser can be used in open surgery to remove polyps from the gastrointestinal tract.

From Japan, we know of experiences in which the Argon laser was used for impacted common duct stones. It can be used during laparotomy but also postoperatively through a T-tube placed at the time of surgery. The percutaneous insertion of a tube and the use of the Argon fiber can also break the stones.

We have no experience in the use of the laser in pancreatic surgery but know of cases done with it. Experience is being gained in the use of photoradiation during surgery. It is used on inoperable patients but also during surgery for retroperitoneal tumors. We have already made reference to the use of Argon and Yag laser in the gastrointestinal tract. The dye laser with photoradiation is an excellent method of opening a passage in tumors of an obstructed intestine. It would seem that extension of this application will be simultaneous endoscopic application during laparotomy. Certainly, the intraperitoneal use of the laser seems endless.

Many cases of breast cancer are treated in our institution. We have been disappointed with laser
application. While learning to use the laser in Israel, the author was privileged to do reduction mammoplasty. The blood loss was certainly minimal. For local excision of benign tumors, a knife is much faster. We did comparative studies on modified radical mastectomy using laser and scalpel—one fact stood out. If the first assistant was excellent, the procedure was much faster with the laser and bleeding was less. A mediocre assistant forced the use of the scalpel. Drainage was about equal in the two series and flap failure was a few percentage points higher with the laser. Our local recurrence rate was low with either modality. We do not decrease the extent of the procedure when the laser is used. One area in which the laser does important work is "toilet mastectomy." Infected and draining breasts may be removed and a split graft applied afterwards. These have healed well and to date, we have not seen a local recurrence.

Head and neck surgery offers an excellent opportunity to use the laser. The otolaryngologists use the instrument usually with a microscope attachment. The intraoral work is excellent and laryngeal applications are multiple. Some experience has been gained with the dye laser on early laryngeal tumors and this may replace the CO₂ in that application. Both lasers work well in debulking procedures. It seems that the CO₂ could be used for primary debulking and photoirradiation for the remnant, with preservation of larger areas of normal tissue. Our experience has been largely with the CO₂. The raising of flaps for radical neck dissection is similar to our experience with breast surgery. In irradiated or infected tissue, the laser is certainly superior.

The use of the laser intraorally is superb. Leukoplakia of the oral cavity and superficial carcinomas are eliminated with a high success rate and there is rarely a need for graft or prosthesis. Excisional surgery of the tongue, soft tissues, and thin areas of bone are accomplished with much less bleeding. Several patients with "field cancerization" of the oral cavity have been controlled without excision of large areas and subsequent grafting. Here again, the use of photoirradiation has a place. Extensive cavernous hemangiomata of the tongue, lip, and cheek may be removed or coagulated with the CO₂ laser. Extreme caution around the facial nerve and its branches is mandatory. Lymphangioma of the tongue or cheek and other areas of the body may be eliminated. It may be necessary to excise some of the lesion and then vaporize the remnant. Small hemangioma of the tongue or lip may be treated with either the CO₂ or Argon laser.

Excision of sarcoma of the extremities, trunk, or retroperitoneal areas seems to give a better chance of cure if the laser is used. Unfortunately, not enough cases have been accumulated over a long enough period of time. The establishment of a central registry for laser cases is mandatory. No one group can accumulate enough cases in a reasonable length of time to show major trends. This seems to be an excellent project for the International Society of Laser Surgery and Medicine.

Amputations may be done with the laser. The soft tissue is easily divided but large bones are resistant to cutting with the laser.

There are several reports of vascular anastomosis using the Yag laser and, recently, the CO₂. We have no experience with this modality. Reference has already been made to the laser in irradiated and infected tissue. Another area would be in those patients with clotting deficiency. One of our first cases was a patient with intestinal obstruction. This patient had received extensive chemotherapy and had minimal platelets and prolonged bleeding and clotting times. The laser was used with no hemorrhage or oozing. Since then, many patients with low platelet counts have been treated. Some of these were patients with extensive chemotherapy. Others had idiopathic thrombocytopenic purpura. Several cases of Kasabach-Merritt syndrome have given gratifying results. We have not had problems with patients taking anticoagulants since most of these can easily be returned to an acceptable clotting status.

Many general surgical applications of the laser are possible. In some cases, it makes a difficult case much easier. Some cases that have been declared inoperable with conventional methods now can be done. Still, there are some cases in which the laser does not answer all problems. We can only look forward to the many new applications that will be developed in the 1980's.

Résumé

Le laser le plus souvent utilisé en chirurgie est le laser-CO₂. Il coupe avec l'acuité d'un couteau cependant qu'il scelle l'extrémité des vaisseaux sanguins (1 mm ou moins) et lymphatiques sectionnés. Il peut être employé également pour "vaporiser" les lésions de certaines muqueuses (bouche, tractus génital, anus) et de la peau. Pour le moment il ne peut être introduit dans un endoscope comme une fibre flexible mais il peut être utilisé avec un microscope ou un instrument semi-flexible dans le tractus aéro-digestif et à l'aide d'un large endoscope au niveau du rectum; c'est un instrument précis qui avec l'aide du microscope permet une dissection très précise.

Le laser argon n'a que des indications limitées en chirurgie générale. Son utilisation par voie endosco-