Suture? Staple? Electrosurgery?
How to Decide What is Best For You

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INTRODUCTION

A decision on using stapling devices, electrosurgery —whether monopolar or bipolar—or suturing devices is dependent on the surgical situation and the surgeon's experience and skill. The goal should be a safe, efficient and relatively quick surgical procedure that benefits the patients and the surgeons alike.

Stapling Devices:

Stapling devices can provide an effective method for securing hemostasis. Single, inert, nonreactive titanium clips can be placed on a bleeding vessel with a reusable stainless steel laparoscopic applicator. These clip applicators can also be used in a disposable automatic system. The clips can be applied efficiently and quickly for individual bleeding sites where the application of any other form of energy source would jeopardize adjacent structures.\(^1,2\)

Hemostasis can also be obtained along an entire line of staples with the use of a stapling device which applies 4-6 layers of titanium staples and uses a self-contained knife blade to divide between the staple.\(^3\) Tissue thickness is estimated and a staple cartridge which occludes to 1.5 mm or one which compresses to 1 mm may be used. When using the stapling device care must be taken to ensure that the jaws of the stapler are beyond the cannula and completely free before opening the device. In addition, it is essential to ensure that when the tissue is compressed it does not bunch up, which may result in the tissue being inadequately stapled. The jaws are closed by depressing the handle. Check to ensure that no unintended structures are included in the bite. The safety guard is then disengaged and the handles brought together to fire the staples. The dual staple lines must be carefully inspected to ensure that hemostasis is secured. Persistent bleeding may occur if the device is not correctly applied.\(^4\)

During laparoscopic hysterectomy and oophorectomy, the linear stapling device can be effectively applied to the infundibulopelvic ligaments and ovarian vessels. The staples are particularly advantageous and time saving for securing the round ligament, tube and uterovarian ligament. Staple application to the uterine artery must only be attempted after the ureter has been dissected free.\(^5\)

Stapling techniques offer the advantages of speed in simultaneously securing hemostasis and division of tissue. They are, however, expensive.

Endoscopic Suturing:

The use of sutures in laparoscopic surgery requires patience, persistence and practice. The development of advances in instrumentation have made suturing more accessible to surgeons whose are not comfortable with laparoscopic suturing. The aim of all laparoscopic suture techniques is to approximate tissue and ligate major blood vessels or tissue pedicles with the same degree of security as during open surgery.

The endo-loop is the simplest of suturing devices. In this system a pretied Roeder loop applied to a plastic shaft is positioned around the tissue to be ligated.\(^3\) When correctly positioned the tissue or pedicle is pulled up through the loop, which is then tightened. The ligature is cut after the loop has been applied. This system has been used for organs as large as the uterus in the process of performing supracervical hysterectomies, for vessels as large as the uterine artery and for structures such as the infundibulopelvic ligament after it has been isolated. The use of the endo-loop system requires only that the surgeon develop a knuckle or a pedicle in order to apply the loop.\(^6\)

If it is necessary to pass suture through tissue and then tying it, the simplest method is an extracorporeal suture technique. Endosuture systems consist of a plastic shaft attached to a length of suture material and a straight or skis-shaped atraumatic needle. This system can be used to lig-
ate vessels, reconstruct organs, approximate opposing tissue surfaces and suture anastomoses. The suture is grasped just below the swage point with a 3 mm needle holder and is inserted into an introducer so that the needle follows into the introducer. The introducer containing the needle and suture, is then brought into the body cavity through a 5 mm trocar. The needle is passed through the target tissue and retrieved. A Roeder knot or a square knot is tied and pushed into the abdominal cavity with a knot pusher. The technique for intracorporeal knot tying is very precise and similar to techniques for instrument ties in microscopic surgery.\textsuperscript{6}

Reich developed an extracorporeal method for introducing large curved needles for laparoscopic suturing. To use this technique it is important to ensure that the lower quadrant technique for intracorporeal knot tying is very precise and similar to techniques for instrument ties in microscopic surgery.\textsuperscript{6}

When the needle has been passed through the desired tissue the needle is cut free and removed. The free end of the suture is then picked up with the needle holder and pulled up through the trocar sleeve. An extracorporeal half hitch is formed and pushed down to the operative site with the Clark-Reich knot pusher. A sufficient number of half hitches is placed to ensure integrity of the knot.\textsuperscript{7}

Ingenious devices are being developed to allow surgeons to perform suturing techniques in a very safe and effective manner. Most of these devices require the use of 10 mm or 12 mm trocars reducing the advantage that suturing has over clips and staples in requiring a smaller port site. However, they provide the surgeon with an opportunity to place suture in a simpler manner. One of these devices developed by Laurus Medical and marketed by Ethicon Endosurgery (Somerset, NJ, USA) has been used for the laparoscopic Burch procedure and has been found to be very efficient in passing the needle through both Cooper's ligament and the paravaginal fascia.\textsuperscript{8} This device utilizes conventional needles, which are loaded into it. The device itself provides the rotational motion which is so difficult to produce in a laparoscopic procedure. This rotational effect thrusts the needle through the tissue against which it is applied. Another ingenious device, the Endostitch, has been developed by Auto Suture (U.S. Surgical Corporation, Norwalk, CT, USA). This “sewing machine” like instrument allows for the transfer of a needle from one side of the tissue to the other creating a continuous line of suture. This device is especially useful for approximating tissues, repair of enterotomies and cystotomies, and performance of the laparoscopic Burch procedure.

**Electrosurgery:**

Both bipolar electrosurgical and monopolar electrosurgical energy can be used for coagulation. Bipolar coagulation techniques are preferred for large vessels. Monopolar techniques can also be used to coagulate large vessels if the vessel is first occluded with a grasper and monopolar current is then directed to the grasper coagulating the vessel.

Bipolar electrosurgery is an effective and inexpensive method of coagulating tissue prior to dissection.\textsuperscript{9} Bipolar coagulation has been applied effectively to vessels as large as the infundibulopelvic ligament and the uterine artery. The possibility of thermal spread must be considered when using either monopolar or bipolar unit. When a monopolar electrode was applied to rat bladder, under test conditions, there was an average increase of tissue temperature 19.9° C above core temperature. This increase is enough to cause protein denaturation. When bipolar energy was used, a rise of only 3.5° C was found.\textsuperscript{10} However, it has also been found that with 8 seconds of application of 50 watts power bipolar energy to the uterine artery, a temperature of 100° C can be detected 1 cm away from the application point.\textsuperscript{11} When bipolar electrocoagulation is applied to tissue, several stages are observed: blanching, boiling begins, boiling ceases, carbonization, and charring. The proper time to remove bipolar forceps from the tissue is the point at which boiling stops and before carbonization begins. The entire process is quite rapid and the window between these two critical stages is only a few seconds. For larger blood vessels apply bipolar electrocoagulation with Kleppinger forceps, which encircle, compress and fuse the vessel with the lowest degree of heating and least volume of fusion. Use 20-25 watts of high frequency electrodesiccation and determine by visual inspection when desiccation is complete.\textsuperscript{12} For larger vascular pedicles such as the infundibulopelvic ligament, the application of bipolar current is sequential, with repeated partial desiccation, and partial incision of the coagulated tissues. This method ensures minimum thermal spread through surrounding pelvic tissues and avoids inadvertent incision of incompletely coagulated tissues. Proper hemostasis is further ensured by viewing the field after the pneumoperitoneum pressure is decreased. It is also possible to reduce the incidence of thermal spread by passing fluid such as glycine down the cleaning channel of the bipolar coagulator to provide for cooling of the bipolar tips. It is most important
that the stability of the vessel coagulum not be jeopardized by excessive heating.\textsuperscript{13}

**CONCLUSION**

The advantages of bipolar coagulation are 1) easy availability; 2) relative safety; 3) ease of use. The major advantages of endoscopic suturing techniques are the precision of application and its inherent stability and security. The major advantages of stapling systems are the rapidity of application and the ease of use.

The disadvantages of bipolar electrocoagulation for larger vessels are the risk inherent in overheating and forming an unstable coagulum or underheating which incompletely coagulates the vessel. In addition, bipolar coagulation techniques, when improperly used, may cause thermal damage because of the spread of the energy to adjacent structures.\textsuperscript{11,14}

The advantages of unipolar electrosurgery are its ease of use and ready availability. Disadvantages include the possibility of thermal injuries to remote locations out of view of the surgeon.\textsuperscript{15-17}

The disadvantages of suturing techniques are the inherent bunching of tissues that occurs with all suture techniques, the possibility of incorporating tissue that is not desired into the knot and the time required for laparoscopic suturing techniques.

The inherent disadvantages of clips are the possibility of dislodgment and misplacement.

Disadvantages of stapling devices are the high price of these devices as well as the danger inherent in the size of the devices themselves. The width of the stapling devices is 1.2 cm and the average distance of the ureter from the uterine artery is only 2 cm at their point of crossing. Instances of ureter ligation have been reported when using the stapling device in the region of the uterine artery and cardinal ligament. In addition, a number of instances of retroperitoneal hematoma and vascular pedicle bleeding have been reported with the use of the stapling devices.

Each system for ensuring coagulation, for tissue division or for ensuring hemostasis has its advantages and disadvantages. It would be simple to state that the less experienced surgeon should use stapling devices until suturing techniques are mastered. However, the risks of stapling devices demand that surgeons with adequate skill apply these devices. In the same fashion, it would be simple to state that bipolar coagulation is "easier to use" than suturing techniques. However, bipolar coagulation techniques require a very careful surgical approach and very conscious awareness of the effects of bipolar energy on the tissue.

The particular choice of a device to be used should be made with an awareness of the dangers and limitations of that device as well as its applicability to a particular surgical situation. Each of these modalities has its place in the surgeon's armamentarium and the laparoscopic surgeon needs to be proficient with all of them.

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