An Innovative Bipolar Instrument for Laparoscopic Surgery

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ABSTRACT

Objective: Bipolar electrosurgery is an excellent method for obtaining hemostasis at laparoscopy. The present study describes and evaluates a bipolar device that can be more versatile and cost effective in advanced operative procedures than the traditional instrumentation.

Methods: This was a retrospective, case-controlled analysis of bipolar instrumentation with a design classification of II–2. A single surgeon in a private practice setting performed all procedures. Sixteen patients, matched for age and pathology were evaluated by videotape review to determine the comparative efficiency of the BiCOAG bipolar dissector/grasper versus traditional Kleppinger bipolar forceps. Efficiency here is defined as comparative operating times in each group.

Results: The number of instrument changes per case was counted because this appeared to be the only variable other than time that differentiated the 2 groups. The BiCOAG bipolar dissector/grasper device group had 4 times fewer instrument changes and significantly decreased operating room times when compared with that of the Kleppinger forceps group. Because cost per unit of operating room time was a constant figure, the decrease in cost that resulted due to the decrease in operating time is considered a cost-effective measure.

Conclusions: The BiCOAG bipolar dissector/grasper is a cost-effective, efficient instrument for use in operative laparoscopic procedures.

Key Words: Laparoscopy, Bipolar forceps, Hemostasis.

INTRODUCTION

Bipolar electrosurgery has been a mainstay of laparoscopic surgery technology almost since the inception of operative procedures. Bipolar energy was originally utilized to coapt fallopian tubes for sterilization procedures and then to fulgurate superficial vessels utilizing the cutting current between the blades of the Kleppinger forceps. As more complex operative laparoscopic procedures (ie, hysterectomy) were developed, the need for large-vessel occlusion became obvious. The use of clips and sutures for this purpose was helpful, but faster and more efficient methods of occlusion were needed. The Kleppinger forceps met this need by enabling the surgeon to coapt large vessels with an electrical weld that was sound and reproducible. At this time, most of the large-vessel occlusions (>2 mm) performed in gynecologic endoscopy are accomplished using bipolar energy.

From the standpoint of operating efficiency, however, a need existed for an instrument that could accomplish the large-vessel occlusion, fulgurate superficially with bipolar safety, and grasp tissue as well as dissect like conventional grasping/dissector hand instruments do. This instrument would allow for significantly fewer instrument changes, thereby reducing operative time and, consequently, surgical costs. The bipolar dissector/grasping forceps is a multifunctional instrument incorporating several separate actions into 1 instrument. The bipolar forceps securely grasp tissue, precisely dissect, and are able to effectively coagulate small as well as very large blood vessels (2 mm to 20 mm), alleviating the need for surgical clips or staples. This instrument was designed by the present author in 1992, first evaluated in 1994, and subsequently utilized as integral to all operative laparoscopic procedures, advanced or not. The results that follow summarize the comparative experience using the bipolar dissector/grasper (BiCOAG dissector/grasper, Gyrus Medical Inc., Maple Grove, MN) in the performance of laparoscopic supracervical hysterectomy (LSH). This procedure was chosen because it has a sufficient complexity, requiring the instrument to perform all the basic tasks for evaluation (large-vessel sealing, fulguration, and dissection/grasping). Additionally, the technique for performing LSH was, at that time in the present author’s clinic, standardized so...
that for comparable pathology the results could be evaluated in a retrospective manner, changing only the variable of the use of a different device for these bipolar tasks.

**METHODS**

Sixteen patients undergoing LSH were evaluated from retrospective videotape review (8 in each arm). The patients were matched for age, uterine size, and pathology. Because of the attendant complexity variables associated with the disease entity, patients with severe endometriosis or other severe adhesive disease were excluded. The number of instrument changes per procedure from the initiation of the procedure until the removal of the specimen was counted, and the procedure duration until the beginning of specimen removal was noted. Simple comparison of the number of instrument changes and operative times in the 2 groups was made. All other variables were controlled by the standardization of the technique used. Conclusions were made relative to operating time and the known costs involved in this variable. Operative times compared were measured from the videotapes, and hospital costs were obtained from itemized bills of those patients. Anesthesia charges were obtained from the department of anesthesia at the surgical facility.

LSH was performed in the manner described by Lyons. All large-vessel occlusions (>2 mm) were accomplished using bipolar electrosurgical techniques. The cutting device used was the contact Nd:YAG laser (Surgical Laser Technologies, Montgomeryville, PA). The same operator performed all procedures, and the technique was identical otherwise except for the use of a Kleppinger forceps (Wolf Medical Instruments, Germany) or the BiCOAG dissector/grasper (Gyrus Medical Inc., Maple Grove, MN). The generators used for bipolar energy were the Wolf bipolar generator (Wolf Medical Instruments, Germany) (setting, 5 of 6) or a Valleylab Force II (Valleylab, Inc., Boulder, CO) (setting, 40 watts). The uterine vasculature as well as the infundibulopelvic ligaments or the utero-ovarian ligaments were occluded using the bipolar device. These devices were also used to coagulate smaller vascular sites as needed during the course of the procedure.

**RESULTS**

The results of the 2 groups are shown in Table 1. The clinical outcomes of the 2 groups when compared for bleeding; infection; and injury to ureter, bladder, or bowel; and the need for transfusion, hospital readmission, or conversion to open procedures did not differ because neither group had any of these complications. The average hospital stay for both groups was 11.8 hours and return to work was 9.4 days. However, the operative times in the Kleppinger group were significantly longer than those in the BiCOAG group, which correlates directly with the number of instrument changes and also directly with overall operative costs. No attempt was made to amortize the Kleppinger instrument because it was on the standard laparoscopic tray for all laparoscopic surgeries. The BiCOAG device is disposable and the fixed additional cost per procedure for this instrument was $90.00.

**CONCLUSION**

In the past, Kleppinger style forceps have been used for bipolar instrumentation; however, often times the forceps have been unable to finely dissect, firmly grasp, or precisely desiccate vessels and have also been difficult to use in hard to reach anatomic locations. This resulted in a need to change instrumentation that can be a major component in increased operating times in operative laparoscopic procedures. The BiCOAG bipolar dissector/grasping forceps are designed as atraumatic with serrated jaws, a tapered cone graduating to a wider proximal jaw giving an overall jaw length of 20 mm for coagulation of larger blood vessels. The tip is rounded for atraumatic dissection with a slight curve. The 33-cm length is routinely used; however, a 45-cm length is also available and useful when desired through the operating channel of the laparoscope. The forceps can rotate up to 360 degrees to make difficult angles more accessible (Figure 1).

The present author began using the BiCOAG device in 1994. At that time, I had been performing LSH for 4 years with experience in >200 cases. I was immediately pleased with the multifunctional capability of this instrument. Of course, the initial concern was to be sure that these forceps could coagulate efficiently, particularly the uterine vessels, when doing a laparoscopic hysterectomy. Once it was evident that the device was an excellent coagulator, even in the most difficult situations, I began using it instead of the Kleppinger forceps in every case. I soon

| Table 1. Clinical Outcomes |
|---------------------------|
|                           | Group 1 (BiCOAG) | Group 2 (Kleppinger) |
| Instrument changes        | 4.5 (3–7)*       | 20.2 (15–26)        |
| Operative time (minutes)  | 40.7 (25–50)*    | 55.3 (40–65)        |
| *P>0.001.                 |                  |                    |
realized as a result of the multiple task functions facilitated by one simple 5-mm instrument that I no longer had to change instruments as frequently or to shift instruments from one trocar to another. I began to keep track of how many instrument changes were made during a laparoscopic hysterectomy when using the bipolar dissector/grasping forceps. Subsequent to this study, which was performed using retrospective analysis in 1999, I concluded that during a laparoscopic supracervical hysterectomy, an average of 4.5 instrument changes per case were needed when the dissector was used as compared to the use of a traditional Kleppinger bipolar device where the number of changes were 20.2. To any operator who routinely performs operative laparoscopy, it is evident that decreasing the number of instrument changes can significantly decrease the length of the procedures. This fact was confirmed in this case by comparing operative times between groups having LSH performed using Kleppinger style forceps and the BiCOAG grasper/dissector. The single difference in technique between the 2 groups was the use of this instrument. After counting instrument changes and operative times, it was concluded that the number of instrument changes significantly impacts the time in surgery and, therefore, the cost of surgery. Accordingly, it was felt that a cost analysis of this instrument was needed. After accomplishing this analysis, our clinic concluded that even though the cost of this disposable instrument may be $90.00 per procedure, the cost is easily offset by the decrease in operating time (Table 2). All of the comparisons generated in this analysis were statistically significant, \( P > 0.001 \). Although the number of patients included is small, the results are sufficiently significant to make reasonable conclusions regarding cost effectiveness. It is this operator’s observation that this finding is further magnified in more complex cases although those cases were excluded in this analysis.

This study was an attempt to compare the cost efficiency of 2 methods of performing LSH using specific instrumentation. It is felt that in an era when the use of disposable instruments is in question specifically with respect to cost that such an analysis can be helpful. In this case, the prior assumption of greater cost efficiency was confirmed while clinical efficacy (morbidity, complications, patient satisfaction) was unchanged. Currently, a number of new devices use bipolar energy to accomplish vessel sealing, all of which must be evaluated in a like manner to assure the best instrument value to the surgeon.

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### Table 2.

| Time and Cost Savings Associated With Use of BiCOAG* |
|-----------------------------------------------------|
| Average time saving/case                             | 15 minutes                     |
| Dollars of operating room savings                    | $300                           |
| Dollars of anesthesia savings                         | $150                           |
| Dollars saving/case                                  | $450                           |

*Operating room cost was $20.00 per minute.