

## Dissection of mesoappendix in laparoscopic appendectomy: a comparison of monopolar cautery and bipolar vessel sealing system

Emrah ŞENEL, Fatih AKBIYIK, Halil Faruk ATAYURT, Hüseyin Tuğrul TİRYAKI

**Aim:** Various technique and different instruments like endoscopic stapler, endoscopic clip, monopolar cautery, harmonic scalpel, and bipolar vessel sealer can be used in the dissection of appendix mesentery when performing laparoscopic appendectomy. The aim of this study is to evaluate the effects of using monopolar cautery and bipolar vascular sealing instruments in the dissection of mesentery of appendix on the duration of the operation of pediatric patients.

**Materials and methods:** Sixty three patients, operated laparoscopically for acute appendicitis in between June 2008 and June 2009 at the Pediatric Surgery Clinic of Dışkapı Children's Hospital, are evaluated retrospectively. Monopolar cautery was used in 25 patients and bipolar vessel sealer was used in 38 patients. No intraoperative or postoperative complication was seen in any of the patients. None of the patients required conversion to open surgery due to dissection problems of the appendiceal mesentery.

**Results:** The mean duration of operation was 51.08 min in the monopolar cautery group whereas 36, 68 minutes in the bipolar vessel sealing system group.

**Conclusion:** In children, comparing to monopolar cautery, bipolar vessel sealer can be used effectively and safely in the dissection and hemostasis of appendiceal mesentery and is definitely an effective system in decreasing the operation time.

**Key words:** Monopolar cautery, vascular sealing system, laparoscopy, appendectomy

### Laparoskopik apendektomide mezoapendiks diseksiyonu: monopolar koter ve bipolar damar mühürleme cihazının karşılaştırılması

**Amaç:** Laparoskopik apendektomide appendix mezenterinin diseksiyonu için endoskopik stepler, endoskopik klip, monopolar koter, harmonic skalpel ve damar mühürleme sistemi gibi değişik enstrümanlar ve farklı teknikler kullanılabilir. Bu çalışmanın amacı, çocuk hastalarda, appendix mezenterinin diseksiyonu için monopolar koter ile bipolar vasküler mühürleme enstrümanının ameliyat süresine etkisinin karşılaştırılmasıdır.

**Yöntem ve gereç:** Dışkapı Çocuk Hastanesi Çocuk Cerrahisi Kliniğinde Haziran 2008-Haziran 2009 tarihleri arasında akut apandisit tanısı ile laparoskopik olarak ameliyat edilen 63 hasta retrospektif olarak değerlendirildi. 25 hastada monopolar koter, 38 hastada damar mühürleme sistemi kullanıldı. Hastaların hiç birinde ameliyat sırasında veya sonrasında komplikasyon görülmedi. Appendix mezosunun diseksiyonu nedeniyle hiç bir hastada açık cerrahiye geçilmedi.

**Bulgular:** Ameliyat süresi monopolar koter kullanılan grupta ortalama 51,08 dakika olurken damar mühürleme sistemi kullanılan grupta ortalama 36,68 dakika dakika oldu.

**Sonuç:** Çocuk hastalarda monopolar koter ile kıyaslandığında damar mühürleme sistemi, appendix mezenterinin diseksiyonunda ve hemostazda etkili ve güvenlidir ve ameliyat süresini belirgin olarak kısaltır.

**Anahtar sözcükler:** Monopolar koter, damar mühürleme sistemi, laparaskopi, apendektomi

Received: 03.03.2010 – Accepted: 07.07.2010

Department of Pediatric Surgery Clinic, Dışkapı Children's Hospital, Ankara - TURKEY

**Correspondence:** Emrah ŞENEL, Department of Pediatric Surgery Clinic, Dışkapı Children's Hospital, Ankara - TURKEY

E-mail: dremrah2000@yahoo.com

## Introduction

Laparoscopic appendectomy has been gradually becoming widespread especially in the last decade at the pediatric surgery practice (1). Although laparoscopic techniques are similar, different instruments, such as endoscopic stapler, endoscopic clip, monopolar hook cautery, harmonic scalpel, and vessel sealing instrument, can be used in appendiceal mesentery dissection (1,2). In this study, the effects of using monopolar cautery and vessel sealing system on the operation period in the appendix mesentery dissection in pediatric patients are retrospectively compared.

## Materials and methods

The operations performed for acute appendicitis at Dışkapı Children's Hospital Pediatric Surgery Clinic in between June 2008 and June 2009 are investigated retrospectively using patient medical records. Patients' age, sex, operation period, method of dissection of appendiceal mesentery, complication and duration of hospital stay were noted. Sixty three patients aging between 1 and 15 years and undergoing appendiceal mesentery dissection were separated into 2 groups: monopolar cautery patients (group 1) and bipolar vessel sealer patients (group 2). The time between the skin incision for Veress needle and the end of the skin incision suturing at the end of the operation was accepted as the operation period. Patients with perforated appendicitis and those who were converted to open surgery were excluded. Statistical evaluation was made by SPSS 11.5 and operation period and duration of hospital stay of both groups were compared by Mann Whitney U method. P values less than 0.05 were accepted significant.

**Technique:** Patients were operated on supine position, when needed Trendelenburg and left lateral position was added to the initial position. Pneumoperitoneum was introduced by Veress needle and CO<sub>2</sub> at 10 mmHg pressure was used. A 10 mm infraumbilically placed port was used for camera. Two 5 mm working ports were placed at the left lower quadrant and suprapubic region. In group 1, appendiceal mesentery dissection was performed using a laparoscopic hook attached to the monopolar cautery. In group 2, mesentery was freed and resected

with a 5 mm bipolar vessel sealer (Liga-Sure™ Valley lab, Tyco, USA). Appendiceal stump was secured by nonabsorbable polymer clips. Afterwards, appendectomy was performed and taken out of the abdomen via the 10 mm umbilical port.

**Findings:** Sixty three patients operated for acute appendicitis in between June 2008 and June 2009 were evaluated. Twenty five patients were in group 1 and 38 patients were in group 2 (Table). No intraoperative and postoperative complication was encountered in any of the patients. None of the patients required conversion to open operation due to a problem of appendiceal mesentery dissection.

The mean operation period was 51.08 min in group 1 and 36.68 min in group II.

## Discussion

Different techniques and instruments are used for appendiceal mesentery dissection at laparoscopic appendectomy operations (1,3,4). Cutting the appendiceal mesentery by laparoscopic scissors and suturing take more time and require intracorporeal experience to tie a knot. On the other hand, endoscopic stapler is expensive. Classical bipolar electro-surgical systems and ultrasonic thermal energy are inadequate for the hemostasis of vessels greater than 2 mm in diameter. Electrothermal Bipolar Vessel Sealer (BVS) (Liga-Sure™, Valley Lab, Boulder, USA) is a bipolar electro-surgical hemostasis instrument, which can be used for hemostasis in open and laparoscopic surgery. These instruments operate with high current and low voltage. However, the standard monopolar or bipolar cauteries run on high voltage and low current. BVS denatures the collagen and elastin on the vessel wall and neighboring tissues with its energy. In addition, it applies pressure to the tissue by its handle forceps. This enhances the refiguration of the denatured tissue resulting in mutual sealing of the vessel wall, which is then cut by scissors. The haemostatic plug is composed of denatured and reformed collagen and elastin of the tissue and blood vessel. Microscopically, vessel walls seal and the lumen obliterates. This tissue is characterized by intrinsic fibrosis and minimal inflammation on day 20. The pressure applied to renal artery in animal models of the instrument was calculated as 900

Table. Patient details.

Monopolar	Cautery	BVS	P
Number of Patients	25	38	
Age(Year)	4-15	1-15	
Male/ Female	15/10	24/14	
Duration of Operation (min)	51.08	36.68	0.003
Duration of Hospitalization (Days)	3.4	3.1	0.641
Intraoperative Complication	-	-	
Postoperative Complication	-	-	

mmHg. This is equivalent to hemoclip and ligation with suture but clearly higher than ultrasonic instruments and monopolar cautery. Energy dispersion distance to the adjacent tissue was found to be 1.5 mm experimentally in BVS whereas it was found to be 1.6 mm in ultrasonic instruments (5). BVS has also been found effective and safe in preclinical studies. It has been widely used in many surgical approaches in several fields, including endocrinology, gastrointestinal system, urology, and gynecology. The calculated operative time benefit differs between 9.8 and 48 min with an average of 26.8 min (6). Our study is in line with the literature Average operating period in BVS usage is approximately 15 min less in respect to monopolar cautery (36.68 and 51.08 min). Marcello et al. calculated the cost of disposable clip and that of BVS at colectomies and reported that BVS provides evidently low costs compared to stapler and clip. In the same study, they also found 9,2% instrument failure in the stapler and clip group in respect to 3% in the BVS group (7). The long term outcome of leaving foreign bodies like stapler or clip in the abdominal cavity is obscure. There are reports that BVS usage abolishes the probability of meeting such a problem (8).

Conventional monopolar cautery scissors have several shortcomings in this type of surgery, including the risk of thermal injury, difficult haemostasis, smoke production, and necessitating the use of additional tools, such as bipolar graspers, sutures, and clips. The advantage of sharp dissection is outweighed by high heat production with thermal spread in surrounding structures and charring.

Potential risks are direct coupling to another metal instrument, direct sparking, and the passage of current from recently coagulated, electrically isolated tissue.

Several shortcomings associated with conventional monopolar cautery, such as thermal injury risk, difficulty in hemostasis, smoke production, the need of use of additional tools, such as bipolar graspers, sutures and clips, have been reported. Sharp dissection has the advantage of high heat production with thermal spread in surrounding structures and charring. It has some risks of direct coupling to another metal instrument, direct sparking, and the passage of current from recently coagulated, electrically isolated tissue (9).

Although monopolar cautery is very useful for the dissection of the gall bladder, thermal injury after monopolar cautery application has been described in many studies (10,11). In an experimental study, the least safe method of hemostasis was monopolar cautery causing contained perforations in 20% and free perforation of the gastric wall in 5% of the animals. Bipolar cautery was safer than monopolar cautery. However, it was not as safe as BVS or ultracision (12).

Landmen et al. compared BVS with bipolar-electro surgery, harmonic scalpel, and titanium clip application in animal model studies and reported BVS as the most effective and sufficient method. They determined that the collateral tissue damage was 1-3 mm in BVS and 1-6 mm in standard bipolar instruments and also they found BVS effective in hemostasis of arteries reaching to 6 mm in diameter

and veins reaching to 12 mm in diameter (13). In another study it was found safe in hemostasis of arteries reaching 7 mm in diameter and FDA also reported opinion in this direction (14). Makario et al. compared the studies of BVS, ultrasonic energy, suture ligation, and electro-cauterization in their meta-analysis. Operation period was 28% less in

respect to classical hemostasis method. Also, less blood loss, lower complication, and less postoperative pain were noted in the BVS used operations (15). In conclusion, BVS is an effective and safe system to be used in children at the dissection of appendiceal mesentery and hemostasis and is definitely effective in decreasing the operation period.

## References

1. IPEG guidelines for appendectomy. *J Laparoend Advan Surg Technique*. 2008; 18: vii-ix
2. Yang HR, Wang YC, Chung PK, Jeng LB, Chen RJ: Laparoscopic appendectomy using the Liga-Sure Vessel Sealing System. *J Laparoend Advan Surg Technique A*. 2005; 15: 353-6.
3. Esposito C, Borzi P, Valla JS, Mekki M, Nouri A, Becmeur F et al. Laparoscopic versus open appendectomy in children: a retrospective comparative study of 2,332 cases. *World J Surgery* 2007; 31: 750-5.
4. Grewal H, Sweat J, Vazquez WD: Laparoscopic appendectomy in children can be done as a fast-track or same-day surgery. *JLS* 2004; 8: 151 -4.
5. Heniford BT, Matthews BD, Sing RF, Backus C, Pratt B, Greene FL.: Initial results with an electrothermal bipolar vessel sealer. *Surg Endosc*. 2001; 15: 799 -801.
6. Hope WW, Burns JM, Newcomb WL, Heniford BT, Sing RF.: Safety and efficacy of the electrothermal bipolar vessel sealer in trauma. *Injury*, 2009; 40: 564-566.
7. Marcello PW, Roberts PL, Rusin LC, Holubkov R, Schoetz DJ. : Vascular pedicle ligation techniques during laparoscopic colectomy. A prospective randomized trial. *Surg Endosc* 2006; 20: 263-9.
8. Takada M, Ichihara T, Kuroda Y: Non-clip laparoscopic colectomy using electrothermal bipolar vessel sealer clinical experiences. *Hepatogastroenterology*. 2006; 53: 840 -2.
9. Hubner M, Demartines N, Muller S, Dindo D, Clavien PA, Hahnloser D : Prospective randomized study of monopolar scissors, bipolar vessel sealer and ultrasonic shears in laparoscopic colorectal surgery. *British J Surgery* 2008; 95: 1098-1104.
10. Lantis JC II, Durville FM, Connolly R, Schwaitzberg SD: Comparison of coagulation modalities in surgery. *J Laparoendosc Adv Surg Tech A* 1998; 8: 381- 94.
11. Ata AH, Bellemore TJ, Meisel JA, Arambulo SM: Distal thermal injury from monopolar electrosurgery. *Surg Laparosc Endosc* 1993; 3: 323-7.
12. Diamantis T, Kontos M, Arvelakis A, Syroukis S, Koronarchis D, Papalois A et al. Comparison of monopolar electrocoagulation, bipolar electrocoagulation, ultracision, and ligasure. *Surg Today* 2006; 36: 908-913.
13. Landman J, Kerbl K, Rehman J, Andreoni C, Humphrey PA, Collyer W et al. Evaluation of a vessel sealing system, bipolar electrosurgery, harmonic scalpel, titanium clips, endoscopic gastrointestinal anastomosis vascular staples and sutures for arterial and venous ligation in a porcine model. *J Urol* 2003; 169: 697-700.
14. Harold KL, Pollinger H, Matthews BD, Kercher KW, Sing RF, Heniford BT: Comparison of ultrasonic energy, bipolar thermal energy, and vascular clips for the hemostasis of small-, medium-, and large-sized arteries *Surg Endosc* 2003; 17: 1228-1230.
15. Macario A, Dexter F, Sypal J, Cosgriff N, Heniford BT.: Operative time and other outcomes of the electrothermal bipolar vessel sealing system (LigaSure) versus other methods for surgical hemostasis: a meta-analysis. *Surg Innov*. 2008; 15: 284-91.