

Harmonic Scalpel Versus Monopolar Electrocautery In Abdominoplasty; A Comparative Study

Dina Hany^{1,*}, MD, Wafi Fouad^{2,*}, MD, and Ramy Mikhael Nageeb^{1,*}, MD

* El Demerdash Hospital, General Surgery Department,
Faculty of Medicine, Ain Shams University

¹ Lecturer of General Surgery, Faculty of Medicine, Ain Shams University

² Assistant Professor General Surgery, Faculty of Medicine, Ain Shams University

ABSTRACT

Introduction: Abdominoplasty is one of the most commonly performed aesthetic operations nowadays. The most common indication for abdominoplasty in general surgery is a patient with redundant skin and rectus muscle diastasis or abdominal wall hernia but without morbid obesity. **Aim of the study:** To assess the outcome of using harmonic scalpel in dissection during abdominoplasty in comparison to the use of monopolar diathermy. **Patients and methods:** A prospective randomized single blinded controlled study was conducted in the period from June 2014 to December 2015 consisting of 30 female candidates for abdominoplasty. Patients were divided in 2 groups; group A contained 15 patients underwent abdominoplasty using harmonic scalpel for dissection and group B consisted of 15 patients who underwent abdominoplasty with electrodissection employing spray-coagulation. **Results:** seroma was significantly lower in group A otherwise there was no significant difference between the 2 groups in terms of intra-operative data and intra-operative complications. The short-term postoperative specific and general complication rates showed no significant difference. **Conclusion:** Both harmonic scalpel and monopolar electrocautery are effective methods for dissection in abdominoplasty, yet due to the high cost of harmonic scalpel, we recommend the use of monopolar electrocautery in dissection during abdominoplasty.

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Keywords: Abdominoplasty, harmonic scalpel, electrodissection, monopolar electrocautery.

INTRODUCTION

Abdominoplasty, one of the most commonly performed aesthetic procedures, has undergone a significant evolution over the past several decades.^{1,2,3}

The best indication for abdominoplasty is still a patient with plenty of loose skin, rectus muscle diastasis and without too much fat in the local area.⁴

The pathophysiology of the abdominal deformity includes excess skin and subcutaneous tissue and laxity of the abdominal wall musculature. The most significant area of the defect is around and below the umbilicus, where excess skin over a diastasis of the rectus muscles is most apparent. The most common cause of abdominal deformity is pregnancy, most often multiple pregnancies. Massive weight loss, whether from dieting or after a gastric bypass

surgery, also plays a role in excess skin and laxity of the abdominal wall.¹

The operation is still associated with a significant complication rate, morbidity and prolonged convalescence.⁴⁻⁸

PATIENT AND METHODS

A prospective randomized single blinded controlled study was conducted in the period from June 2014 to December 2015 consisting of 30 female candidates for abdominoplasty. Patients were divided in 2 groups; A and B. In both groups the surgical technique was identical apart from the method of abdominal flap dissection. Group A consisted of 15 patients underwent operation using harmonic scalpel for dissection and group B consisted of 15 patients who underwent operation with electrodissection employing spray-coagulation.

In our study, we included all patients with redundant abdomen with ventral hernia except those who are smokers, patients planning for another pregnancy, patients with BMI > 35, post bariatric surgery patients, patients with upper abdominal incisions and patients with unrealistic expectations

A complete history and physical examination was done for all patients.

History

The medical history of the patient included patient's co-morbidities, risk factors for DVT and chest complications. Patient's history of weight gain and loss and previous pregnancies, previous surgical procedures, occurrence of wound problems and any future plans for pregnancy were documented.

Physical examination

Examination of the abdomen includes assessment of the thickness of fatty panniculus, evaluating the degree of skin ptosis, abdominal muscles tone, presence of rectus diastasis, presence of hernia, previous surgical scars including laparoscopy scars, the position of umbilicus and presence of ptosis of mons pubis. An assessment is then made of the extent of dermolipectomy.

Preoperative planning

Preoperative planning included complete medical evaluation and optimisation of patients with co-morbidities, abdomen scrub with alcohol 70% for 3 days prior to surgery, paying attention to intertriginous areas and umbilicus and pre-anaesthesia evaluation, preoperative photographs were taken, markings were done one day prior the operation with the patient upright to mark the midline, xiphoid and pubic symphysis, proposed incision and estimated dermolipectomy, any hernia sites and diastasis were marked, exercising after the procedure was discussed with patient preoperatively and preparation of 500cc of packed RBCs.

Positioning and preparation

Patient is positioned supine on the table. General anaesthesia was induced. Urinary catheter was inserted for all patients. Just before induction of anaesthesia, 5000 IU of heparin and prophylactic broad spectrum antibiotic were administered; 1g of cephobid IV and elastic stockings were applied.

Steps:

1. The skin incision is placed in the abdominal crease whenever possible or 7-9 cm from the top of vulval commissure for aesthetic result and patient comfort.
2. Using cutting diathermy, incision is deepened to incise Scarpa's fascia but no deeper.
3. The plane of dissection then turns cephalad, using harmonic scalpel in group A (figure 1) and monopolar electrocautery in group B (figure 2) strictly on the undersurface of Scarpa's fascia. The adipose tissue on the external oblique aponeurosis is left intact. Dissection of hernia sac is done. Flap elevation is continued to the level of umbilicus. The umbilicus is circumscribed and the stalk dissected with a thin layer of fat on it. Rectus perforators are pre identified and either secured by harmonic scalpel in group A or securely tied in group B. Supra-umbilical perforators are preserved as far as possible. Flap elevation then proceeds above umbilicus only in the midline and paramedian areas to expose the rectus sheath for an inch beyond the respective medial borders [stretched linea Alba].



Fig. 1. Dissection using the harmonic scalpel



Fig. 2. Dissection using the monopolar electrocautery

3. Midline plication by PDS loop suture is done; repair of ventral hernia was done with no mesh applied. Any increase in intra-abdominal pressure was expressed by increase in the P_{max} ; if P_{max} increased above 32 the sutures are released.
4. The operating table is then flexed about 30 degrees and a trial closure is done to assess the extent of dermolipectomy possible.
5. Maximal dermolipectomy is then performed mirroring the pattern of the lower incision; it is important to plan this carefully to avoid excessive tension on closure. Closure is tested with a few trial sutures.
6. The new umbilical opening is planned 1.5 to 2 cm cranial to the upper border of the projected point of the umbilical stalk. The new site is incised in tri-radiate fashion. The umbilicus is sutured to its final destination by 3-0 polypropylene suture.
7. A closed suction drain 18 is inserted
8. The incision is closed in 3 layers; scarpa's fascia by vicryl 0/0 suture, subcutaneous tissue by 2/0 vicryl suture and skin by 3/0 polypropylene suture.
9. Urinary catheter is removed before extubation

Postoperative

After extubation and postoperative recovery, the patient is assisted into the appropriate postoperative compression garment.

The patient is nursed in the Fowler position and a pillow under the knees to flex the hips. Patients are routinely ambulated the same day and mostly discharged the next day with the drain unless a complication occurred. Since the hospital stay of the patients is only 24 hours postoperative, patients were advised to be on fluid diet for the 1st 3 days postoperative and to avoid constipation. The first postoperative outpatient visit is on the 5th postoperative day. The drain is removed when 24 hours output is < 30ml. Compression garment

is worn for 3 weeks and strenuous exercises are avoided. Guided exercises are begun thereafter.

Follow-up was conducted weekly for the first month then monthly over a period of 6 months after discharge.

Statistical analysis

Continuous variables were expressed as mean \pm standard deviation and analyzed with the Student t test. Categorical ones were expressed as percent value and analyzed with Fischer test or Chi-square test, where appropriate. $P < 0.05$ was considered statistically significant.

RESULTS

Demographics and patients' related data are shown in table 1.

There was no significant difference in term of age, sex, BMI, ASA score, presence of ventral hernia, pervious bariatric surgical operation and previous abdominal surgical history between the two groups.

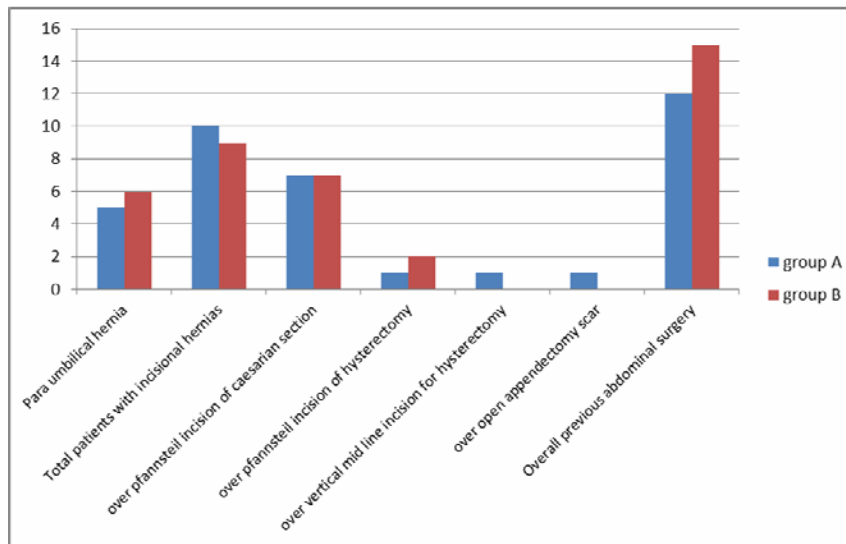
A total of 12 patients had co-morbidities; 3 patients has diabetes only; 2 in group A and 1 patient in group B, 6 patients had hypertension only; 2 patient in group A and 4 patients in group B, 2 patients had both diabetes and hypertension, both were in group A, 1 patient had bronchial asthma in group A.

In group A; 5 patients had paraumbilical hernia and 10 patients had incisional hernias. 8 patients had incisional hernia over pfannesteil incision scar; 7 of them for caesarian section and 1 for hysterectomy, 1 patient had incisional hernia over a lower midline incision for hysterectomy and 1 patient had patients had incisional hernia over a right iliac fossa appendectomy scar. In group B, 6 patients had paraumbilical hernia and 9 patients had incisional hernias. 9 patients had incisional hernia over pfannesteil incision scar; 7 of them for caesarian section and 2 for hysterectomy (figure 3).

Table 1. Demographics and patients' related data

Variables	Group A	Group B	P value
Number of patients	15	15	
Age (mean \pm SD)	38.4 \pm 13.57	35.73 \pm 10.11	0.551629
Sex F:M	15:0	15:0	
BMI	29.6 \pm 4.91	30.47 \pm 4.53	0.631137
Comorbidities			
Diabetes only	2 (13.33%)	1 (6.67%)	0.542802
Hypertension only	2 (13.33%)	4 (26.67%)	0.36131
Diabetes and hypertension	2 (13.33%)	0 (0%)	0.143235
Bronchial asthma	1 (6.67%)	0 (0%)	0.309108
Overall co-morbidities	7 (46.67%)	5 (33.33%)	0.456057
ASA score			
I	2 (13.33%)	4 (26.67%)	0.36131
II	7 (46.67%)	5 (33.33%)	0.456057
III	6 (40%)	6 (40%)	1
IV	0 (0%)	0 (0%)	
V	0 (0%)	0 (0%)	
Para umbilical hernia	5 (33.33%)	6 (40%)	0.704786
Incisional hernia			
Total patients with incisional hernias	10 (66.67%)	9 (60%)	0.704786
Incisional hernia over pfannsteil incision of caesarian section	7 (46.67%)	7 (46.67%)	1
Incisional hernia over pfannsteil incision of hysterectomy	1 (6.67%)	2 (13.33%)	0.542802
Incisional hernia over vertical mid line incision for hysterectomy	1 (6.67%)	0 (0%)	0.309108
Incisional hernia over open appendectomy scar	1 (6.67%)	0 (0%)	0.309108
Overall previous abdominal surgery	12 (80%)	15 (100%)	0.67889

F: Female, M: Male, BMI: Body Mass Index, ASA: American Society Of Anesthesiologists

**Fig. 3:** Types of hernia in both groups

Operative data

Operative data are shown in table 2. Regarding operative data, there was no statistical difference between the two groups as regard the mean operative time which was 178.53 ± 17.48 minutes in group A versus 180.33 ± 15.15 minutes in group B; not significant (NS), estimated blood loss 65.67 ± 16.82 ml in group A versus 64.33 ± 16.42 ml in group B (NS), excised

tissue weight 6.33 ± 1.07 kg in group A versus 5.3 ± 0.77 kg in group B (NS) (figure 4) and overall intra-operative complications (figure 5). There was no need for blood transfusion.

Overall umbilical sacrifice in both groups was done in 3 patients due to associated paraumbilical hernia which couldn't be repaired unless umbilical sacrifice was done.

Table 2: Operative data

Variables	Group A	Group B	P value
Operative time (minutes)	178.53 ± 17.48	180.33 ± 15.15	0.773144
Estimated blood loss (ml)	65.67 ± 16.82	64.33 ± 16.42	0.833446
Excised tissue weight in grams (gm)	6.33 ± 1.07	5.3 ± 0.77	0.104623
Intra-operative complications			
Bleeding	0 (0%)	0 (0%)	
Umbilical sacrifice	1 (6.67%)	2 (13.33%)	0.542802
Overall intra-operative complications	1 (6.67%)	2 (13.33%)	0.542802

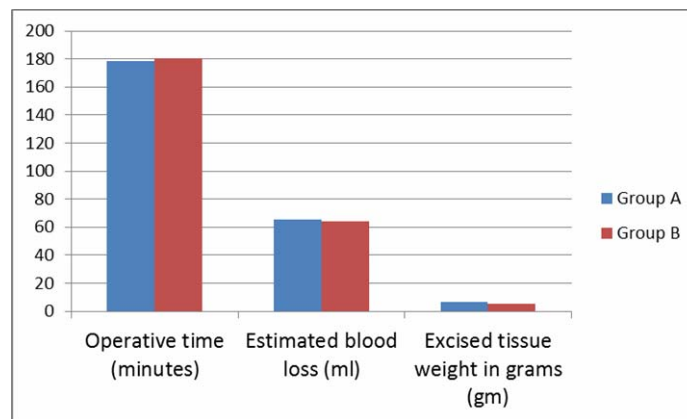


Fig. 4. Intra-operative data

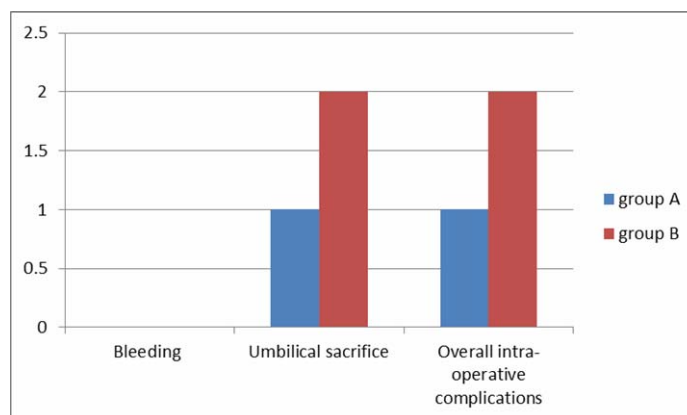


Fig. 5. Intra-operative complications

Postoperative data

Postoperative data are summarized in table 3. Postoperative data included length of hospital stay, postoperative complications, time of drain removal and readmission (figure 6). There was no significant difference between both groups in the postoperative data except that the incidence of postoperative seroma was significantly higher in group B. No seromas were clinically detected in both groups but ultrasound examination for

seroma detection was done during follow up. 7 patients had seromas 1(6.67%) in group A and 6 (40%) in group B, these seromas didn't manifest clinically and all were managed conservatively and disappeared during the first month of follow up. The mean length of hospital stay was 1.07 ± 0.25 days in group A and 1 day in group B; not significant. There were no major wound problems or infections or aesthetic dissatisfaction requiring later interventions.

Table 3: Postoperative data

Variables	Group A	Group B	P value
Length of hospital stay (LOS) (days)	1.07 ± 0.25	1	0.36
Postoperative complications			
Seromas	1 (6.67%)	6 (40%)	0.030902 (significant)
hematomas	2 (13.33%)	0 (0%)	0.143235
Wound infection	0 (0%)	2 (13.33%)	0.143235
Flap necrosis	0 (0%)	1 (6.67%)	0.309108
Umbilical slough	0 (0%)	1 (6.67%)	0.309108
Impaired skin sensation	4 (26.67%)	3 (20%)	0.665984
Total number of patients with complications	7 (46.67%)	12 (80%)	0.05818
Total suction tube volume (ml)	116 ± 66.95	128.67 ± 56.8	0.580794
Removal of drain (days)	4.13 ± 0.74	3.93 ± 0.59	0.422319
Readmission	0 (0%)	1 (6.67%)	0.309108
Need for secondary correction	0 (0%)	0 (0%)	

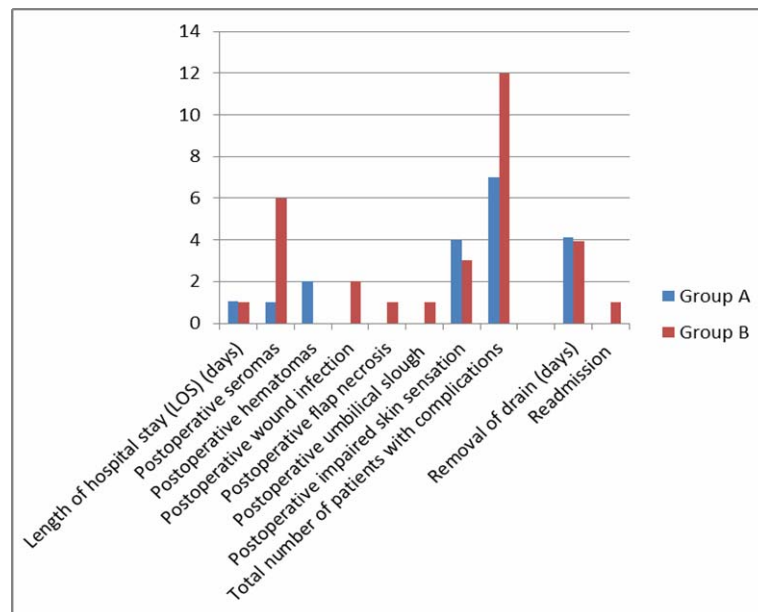


Fig. 6. Postoperative data

DISCUSSION

The objectives of abdominal hernial repair are to reconstruct the structural integrity of the abdominal wall while minimizing morbidity. Techniques for abdominoplasty include the use of the transverse lower abdominal incision and the resection of excess skin. By incorporating these aspects into hernial repairs, the procedures are made safer and the results are improved.⁹

In our practice as general surgeons, patients present to us complaining of abdominal wall hernias. While examining those patients we find that they don't just need hernial repair, but also they need an additional procedure for there redundant pendulous abdomen.

In a Sudanese study carried on 2014 on 44 patients undergoing abdominoplasty, 77% of patients (34 patients) presented with hernia as the main complain. This common indication in our environment is uncommon as in western populations, that range between 12% to 35%.¹⁰⁻¹⁴

Since the combination of abdominoplasty to hernial repair procedure is now increasingly indicated our practice, we carried this study to evaluate the effect of harmonic scalpel in comparison to the monopolar electrocautery in dissection of the subfascial plane during the dermolipsectomy part of abdominoplasty regarding the intraoperative and short term postoperative outcome. While many studies now are comparing the use of harmonic scalpel and electrocautery in different operations, there's only one study carried on the USA; sponsored by Ethicon Endo-Surgery with investigator of the study Drik F Richter from 2006¹⁵, comparing the use of harmonic scalpel and electrocautery in dissection during abdominoplasty; the results of this study were not announced till now.

In our study, the mean operative time was 178.53±17.48 minutes in group A versus 180.33±15.15 minutes in group B which is not significant.

In Mousavi and Mahdikhah study on 100 consecutive female candidates for abdominoplasty by electrodissection employing spray-coagulation the duration of abdominoplasty ranged from 55 to 190 min (mean: 113 min).¹⁶

Our estimated blood loss was 65.67 ± 16.82 ml in group A versus 64.33 ± 16.42 ml in group B which is not significant.

In Mousavi and Mahdikhah study, range of intraoperative bleeding was 25–160ml.¹⁶

Excised tissue weight was 6.33±1.07 kg in group A versus 5.3±0.77 kg in group B.

In the study published by Rangaswamy on 120 patients who underwent lipoabdominoplasty, the excised tissue weight ranged from 50g to 12Kg (mean 1596g).⁴

Overall umbilical sacrifice in both groups was done in 3 patients due to associated paraumbilical hernia which couldn't be repaired unless umbilical sacrifice was done.

There are complications with any major surgery, and abdominoplasty procedure is no exception.¹⁰ Our postoperative complications included seroma (6.67% in group A and 40% in group B, hematoma (13.33% in group A and 0% in group B; NS), Wound infection (0% in group A and 13.33% in group B; NS), Flap necrosis (0% in group A and 6.67% in group B; NS), Umbilical slough (0% in group A and 6.67% in group B; NS) and impaired skin sensation (26.67% in group A and 20% in group B; NS). We had no cases complicated by DVT nor recurrent hernias.

Complications of abdominoplasty have included flap necrosis, seroma, haematoma, infections, fat necrosis, dehiscence of wound and delayed healing. There is also a high incidence of aesthetic flaws and need for secondary correction, rates as high as 27.9 % being reported.⁵

From 1975, Regnault reports hematomas and/or seromas in 3% of patients, skin necrosis in 0.5%, hypertrophic scars in 3%, and scar revisions in 4%.¹⁷

The most common postoperative complications were decreased skin sensation (25%), infection (22.7%), seroma (9.1%), Recurrent hernia (2.2%), VTE 0(0%), Hematoma 0(0%), and cutaneous necrosis (6.8%) in a recent Sudanese study.¹⁰

In 2001, van Uchelen et al reported a series of 86 patients (14 male, 72 female) who underwent abdominoplasty.¹⁸ Complications were classed as wound complications (ie, infection, dehiscence, seroma and/or hematoma, marginal necrosis) or "complications after surgery" (ie, deep vein thrombosis, pulmonary embolism, ileus, nerve damage, death). Of the 14 male patients, 9 (64.3%) had a wound complication and 2 (14.3%) had a postoperative complication. Of the 72 female patients, 11 (15.3%) had a wound

complication and 10 (13.9%) had a postoperative complication.¹⁸

The risk factors that have been shown to lead to higher rates of complications include smoking, diabetes, malnutrition, excess body weight, and male sex.^{1,19,20}

Seroma in literature is often cited as the most common complication, incidence varies greatly from 10% to 42%^{21,22,23,24} and 5-30% of patients in other studies.²⁵⁻²⁹ Our study showed comparable results since seroma occurred in 6.67% in group A and 40% in group B.

Extensive undermining causes denervation and reduction in the vascularity of the flap.^{4,7,8} This accounts for ischemia related complications. The lower abdominal skin also remains permanently numb.^{4,30} The traditional technique also results in several lymphatics being divided. Despite routine use of drainage, a high rate of postoperative seroma is still accepted as unavoidable.^{4,31}

Seroma is defined as the serous fluid collection under the skin flaps and dead space, which can eventually result in flap necrosis, wound dehiscence, delay in recovery, and adjuvant treatment, and usually requires repeated needle aspirations. Seroma fluid contains immunoglobulin, granulocytes, and leukocytes, but few lymphocytes, suggesting that it is a wound exudate rather than lymphatic fluid.^{16,32}

Seroma formation remains a significant problem in abdominoplasty surgery, the cause of which is likely to be multifactorial. Elevation of a large flap of abdominal tissue leaving two raw tissue surfaces either side of a potential space, disruption of the lymphatic drainage, haematoma formation and instruments used for tissue dissection have all been proposed as potential causes for seroma formation.

Numerous evidences on the role of electrocautery in wound complications, especially seroma formation, have been reported.^{16,33-35} Both experimental and clinical deleterious effects of electrocautery on wound healing and infection have been frequently reported.^{16,36,37}

We had a case of umbilical slough in group B in a patient with a large paraumbilical hernia, this was accepted complication since when the hernia is periumbilical, then complication (eg, umbilical necrosis) associated with the umbilicus is increased if the surrounding vascularity is compromised.¹

One patient was readmitted in group B, she was 62years old, diabetic and hypertensive, she had flap necrosis; admission for 48hours for IV antibiotic with bedside debridement was done.

We don't have any cases of recurrent hernias but our duration of follow up was short (3-6 months), that was not enough to accurate estimate recurrence rate.

CONCLUSION

Both harmonic scalpel and monopolar electrocautery are effective methods for dissection in abdominoplasty. Meanwhile the use of harmonic scalpel resulted in significantly less seroma than the use of electrocautery, yet since these seromas didn't hinder the patients' normal activities nor worsen the postoperative course of the operation, so we can't consider the harmonic scalpel use is significantly superior to the use of electrocautery. Although cost effectiveness was not an item in our study, the cost of the harmonic device increased the immediate cost of the operation in group A. Yet, due to the high cost of harmonic scalpel and the non significant difference between the use of harmonic scalpel and electrocautery, we recommend the use of monopolar eletrocautery in dissection during abdominoplasty.

Limitations:

This study should be done in a larger population so that the results become more reliable. Cost effectiveness and long term follow up should be included in the study.

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