

ORIGINAL ARTICLE

COMPARATIVE STUDY BETWEEN USING HARMONIC SCALPEL AND ELECTROCAUTERY IN MODIFIED RADICAL MASTECTOMY

By

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Aim: The harmonic scalpel is a recent surgical instrument that allows intra-operative cutting and coagulation at the same time. The aim of this study was to compare between the usage of harmonic scalpel or electrocautery in modified radical mastectomy operation.

Methods: This study included forty patients with operable breast cancer. They were randomized into two equal groups to do modified radical mastectomy either using harmonic scalpel (group A) or using conventional electrocautery (group B). The total operative time, the time of axillary dissection, the time for raising the flaps and the time of breast dissection were calculated. The days of drainage and the total drainage volume were also recorded.

Results: Calculating the time needed for axillary dissection revealed a significantly shorter time in patients operated on by harmonic scalpel. ($p = 0.004$). The mean total draining volume in group (A) was lower than in group (B). The difference was statistically significant. ($p = 0.02$). 15% of cases in group (A) and 25% of cases in group (B) suffered from postoperative seroma, the difference was statistically insignificant ($p = 0.677$).

Conclusion: The use of harmonic scalpel in MRM shortening the axillary dissection time and decrease drainage volume, drainage day and hospital stay.

Keywords: Cancer breast, Seroma, Dissecting device.

INTRODUCTION

The most common modalities for dissection during breast surgery include sharp scalpel and scissor dissection, blunt dissection and high frequency electrocautery. Rarely, radio frequency ablation and laser beam had been used in some limited trials. Ultracision dissection (harmonic scalpel) and tissue response generation (ligaSure) are just started to be used in this field.⁽¹⁾

The surgeon can use sharp scalpel and scissors in dense and hard tissues. He must be keen to safeguard important structures as they are liable to be injured by this method. Blunt dissection by using either a gauze over an artery forceps or surgeon's finger to separate soft tissues is resorted to during dissection near important neurovascular

structures.⁽¹⁾

The most commonly used form of energy in surgical procedures nowadays is monopolar electrocautery. Monopolar electrocautery offers an energy source that is excellent for homeostasis of small blood vessels, easy to use during tissue dissection, rapid, accurate, and cheap. The major disadvantages of electrocautery are the limitations in size of vessels (<1 mm) to be sealed and the risk of exit site burn injury. Monopolar cautery also produces a large degree of smoke, especially if the tissues are moist, and it is ineffective within a liquid pool.^(2,3)

Unfortunately, general surgeons have underutilized bipolar cautery in their operative tools. Its depth of injury

to surrounding tissues is minimal, and it produces little smoke. But most bipolar instruments have jaws, which are poorly designed for dissection.^(4,5)

The harmonic scalpel is a recently emerging surgical instrument that converts electrical energy into high frequency (55,000 Hz) mechanical vibrations that allows intra-operative cutting and coagulation at the same time. The excursion of vibration increases with increased level of activity till it reaches 100 μm at level 5, where the coagulating power is minimum, while the cutting power is maximum.^(6,7) This takes place at a relatively low temperature causing a little injury ($< 1.5 \text{ mm}$) compared with both electrocautery and laser energy.⁽⁸⁻¹⁰⁾

The harmonic scalpel offers greater precision in tight spaces near vital structures where fewer instrument changes are needed, less tissue charring and desiccation occur and the visibility in the surgical field is improved.⁽¹¹⁾

Although it has been extensively used in laparoscopic surgery, experience with the harmonic scalpel in open surgery is limited. The harmonic scalpel has recently been used in thyroid surgery. It is found to be associated with lower operative time and blood loss.^(8,12,13)

The aim of this study was to compare between the usage of harmonic scalpel & electrocautery in modified radical mastectomy operation.

PATIENTS AND METHODS

This study included forty patients with operable breast cancer (stages I&II, TNM classification) during the period from December 2005 till March 2007. All studied patients were submitted to detailed history taking, complete physical examination, routine laboratory test, mammogram, ultrasound of both breasts & metastatic work up to exclude its presence. Fine needle aspiration cytology (FNAC) or Tru cut needle biopsy was done for all patients preoperatively.

After taking the consent from all patients for modified radical mastectomy (MRM) & for their participation in the trial, they were randomized into two equal groups by closed envelopes method either to do modified radical mastectomy using harmonic scalpel (group A) or using conventional electrocautery (group B).

The total operative time, the time of axillary dissection, the time for raising the flaps and the time of breast dissection were calculated. The method of evaluation of operative blood loss was by using dry packs, which were weighed before the operation with preserving of its sterilization. The same packs were weighed after the operation, using an extremely sensitive weight measurer apparatus. The difference between the postoperative and the preoperative

weight was considered as the blood loss in all operations. No mechanical suction or washing hot water was used during any operation in both groups.

Whenever the amount of suction drain reached 30 cc or less per day, the drain was removed. The days of drainage and the total drainage volume were recorded for comparison. Each patient was observed weekly for one month to record occurrence of any early complication like seroma formation, wound infection, flap necrosis, early lymphoedema, upper limb complications or nerve injuries. Seroma was defined as any subcutaneous fluid collection after drainage removal, which needs aspiration of volume more than 50 CC.

Student t-test was used to compare two arithmetic means. Chi-square test was used to compare two proportions or percentages. Five percent was taken as the level of statistical significance (p). t-test: the test used to compare between two sample means. In this study, the critical t° for total number of 40 patients was 2.021, so when t test was > 2.021 , the difference between the two means was considered significant and when the t test was < 2.021 , the difference between the two means was considered insignificant.⁽¹⁴⁾ Chi-square (X^2)test: used to study whether there is a relation between certain condition and certain character. The critical value of X^2 in this study for total number of 40 patients was 3.84, thus when X^2 was > 3.84 , the relation was considered significant, and when the X^2 was < 3.84 , the relation was considered insignificant.⁽¹⁴⁾

RESULTS

Both groups had a matching age & body mass index (BMI). Seventy five percent of patients in group (A) and 80% of patients in group (B) were premenopausal.

The size of the breast ranged in group A from 700 to 900 cc with a mean of $825 \pm 70 \text{ cc}$, while in group B it ranged from 680 to 870 cc with a mean of $780 \pm 100 \text{ cc}$, the difference was statistically insignificant between the two groups. ($t = 1.6, p = 0.07$) (Fig. 1).

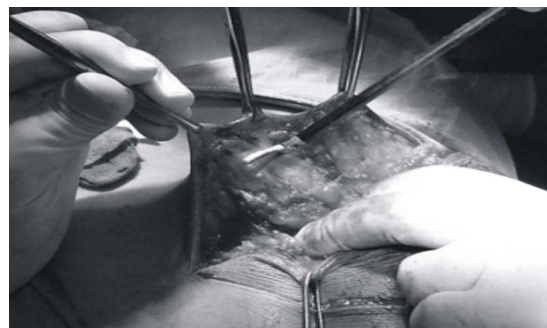


Fig 1. Raising of the skin flap using the harmonic coagulating shear.

The total operative time was longer in group (A). It ranged from 75 to 140 minutes with a mean of 106.5 ± 20.53 minutes, while in group B, it ranged from 60 to 120 minutes with a mean of 85.75 ± 17.4 minutes. This difference was significant. ($t=3.4$, $p = 0.001$). However, the mean total operative time, in the last 10 cases operated on by harmonic scalpel was 93 ± 20 minutes. That was statistically insignificant compared to group B operative time. ($t=1.02$, $p = 0.65$), Table 1. (Fig. 2).



Fig 2. Removal of the breast with pectoral fascia from the pectoralis major muscle using the harmonic coagulating shear.

Table 1. Total operative time in the last 10 cases of group A and the whole group B (in minutes) $t = 1.02$, $p = 0.65$ (insignificant).

Total operative time	The last cases group (A) (n = 10)	All group (B) (n = 25)
Range	75-130	60- 120
Mean	93	85.75
Standard deviation	20	17.4

The time consumed in breast dissection and flaps rising in group (A) was significantly longer than in group (B). ($t = 3.3$, $p = 0.002$, Table 2. Calculating the time needed for axillary dissection revealed a significantly shorter time in patients operated upon by harmonic scalpel. ($t=2.8$, $p=0.004$, Table 3. The operative blood loss in group (A) was significantly less than the operative blood loss in group (B). ($t=3$, $p=0.003$), Table 4.

Table 2. Time of flaps raising and breast dissection in both groups (minutes) $t = 3.3$, $p = 0.002$ (significant).

Breast dissection time	Group A (n = 25)	Group B (n = 25)
Range	54-127	28-73
Mean	75	55
Standard deviation	21	16.9

Table 3. Time of axillary dissection in both groups (minutes) $t = 2.8$, $p = 0.004$ (significant).

Axillary dissection time	Group A (n = 25)	Group B (n = 25)
Range	14-23	17-27
Mean	18	21
Standard deviation	3.11	3.54

Table 4. Operative bleeding in both groups (ml) t test = 3, $p = 0.003$ (significant).

Operative bleeding	Group A (n = 25)	Group B (n = 25)
Range	75-460	130-760
Mean	212.75	357
Standard deviation	117.24	172.71

The draining days in group (A) ranged from 4 to 12 days with a mean of 7.3 ± 2.15 days, while in group (B) it ranged from 4 to 14 days with a mean of 8.65 ± 2.89 days. The difference was statistically insignificant ($t = 1.68$, $p = 0.07$). The total draining volume in group (A) ranged from 230 to 1930 ml with a mean of 838 ± 473.93 ml, while the draining volume in group (B) ranged from 110 to 3130 ml with a mean of 1312.75 ± 823.79 ml. The difference was statistically significant. ($t=2.23$, $p=0.02$)

The number of dissected axillary lymph nodes in group (A) ranged from 5-15 with a mean of 11.35 ± 3.79 lymph nodes, while in group (B) it ranged from 4-14 with a mean of 8.5 ± 2.98 lymph nodes. The difference was significant. ($t=2.65$, $p=0.005$). (Fig. 3).



Fig 3. Appearance after dissection of the axilla using the harmonic coagulating shear with preservation of the long thoracic nerve, thoracodorsal nerve and the intercostobrachial nerve.

The only postoperative complication encountered was seroma formation; 15% of cases in group (A) suffered from post-operative seroma and 25% of cases in group (B)

suffered from the same complication, the difference was statistically insignificant ($X^2 = 0.625$; $p = 0.677$).

DISCUSSION

Modified radical mastectomy using electrocautery is associated with a moderate degree of morbidity. Tejler et al reported a post mastectomy morbidity rate of 35% in a series of 385 breast cancer patients and found that 17% of the total hospital stay was due to post mastectomy morbidity. Recent studies have shown that cautery associated thermal tissue injury causes damage of sub dermal vascular plexus and incomplete occlusion of vascular and lymphatic channels, leading to increased morbidity.⁽¹⁵⁻¹⁷⁾

Some surgeons made different methods trying to decrease the morbidity of MRM operation, the recent of which is using the harmonic scalpel for dissection and coagulation in MRM.⁽¹⁸⁾

The ultracision waves disrupts protein hydrogen bonds within the tissue leading to the formation of denaturant protein, that mixes with the intercellular and the interstitial fluids to form glue like substance, which is known as the coagulum. This coagulum seals off the vessels and lymphatics resulting in decreased blood loss and lymphatic leakage. This takes place at a relatively low temperature causing a little injury (< 1.5 mm) compared with both electrocautery and laser energy.^(8,9,18)

Besides being a better haemostatic tool than electrocautery, the harmonic scalpel has an added advantage of multi-functionality, avoiding frequent instrument changes and use of sutures. Also, the harmonic scalpel provides a clear surgical field with minimal smoke that allows better precision during dissection and coagulation. No electrical energy is passed to or through the patient, thus no hazards of electric shock or electric burn to the patient or to the surgeon is present with harmonic scalpel surgery.⁽¹⁹⁾

The operative time was longer in the first group using the harmonic scalpel because it is a new dissecting device, which needs time to adapt its usage. But the time of axillary clearance alone was shorter in the same group indicating that the harmonic scalpel is better than the traditional method in axillary dissection. Moreover, the operating time decreased with experience and the mean harmonic operating time was comparable with electrocautery towards the end of the study. Our result was similar to study conducted by Deo et al.⁽¹⁸⁾ They found that the mean operative time in harmonic scalpel patients was longer.

Operative bleeding, is an important factor as some surgeons believe that blood transfusion intra operatively in MRM decreases the survival of the patient and worsens the prognosis.⁽²⁰⁾ In our study, the harmonic scalpel presented

a marvelous power of haemostasis in some cases. The mean operative blood loss was significantly less in the group operated on by harmonic scalpel than that operated on by electrocautery. This result is similar to that found by Deo et al who found that the haemostatic power of the harmonic scalpel was better than that of electrocautery.⁽¹⁸⁾

The postoperative hospital stay in MRM is mainly due to presence of drains. In addition, the irritation and pain caused by the drain adds to the discomfort of the patients. It is known that the harmonic scalpel provides a better haemostasis with less lateral thermal injury, thus undesirable extra injury is avoided when the harmonic scalpel is used. Moreover, the inflammatory reaction in the operative field is reduced, less lymphatics are injured and less oozing surface is produced in the operative field.⁽²¹⁾ All these factors reduce the postoperative drainage volume & consequently may reduce the postoperative hospital stay.

Porter et al,⁽²²⁾ found that the use of electrocautery was significantly associated with increased seroma formation in a randomized controlled trial. On the other hand, Lumachi et al⁽²³⁾ found that the use of ultrasonic shears has significantly reduced seroma formation in a randomized controlled trial. In our study, we found that the harmonic scalpel decreases the rate of occurrence of seroma than electrocautery; however, the difference was statistically insignificant. This was the same finding of Deo et al and Galatius et al.^(18,24)

In our study, the harmonic scalpel was found to harvest a significantly more number of axillary lymph nodes than the electrocautery. A logical explanation of this is not clear, however, harmonic scalpel dissection may provide more adequate axillary dissection.

In conclusion: The use of harmonic scalpel may be costly if we look to the price of instrument, but the total cost may decrease if we consider shortening of operating time & hospital stay. We did not investigate that point in our study, but it is worth full to mention that, no ligature was needed during operations where the harmonic scalpel was used. That may decrease the operative cost by saving ligature suture materials cost.

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