

# Comparison of Modified Radical Mastectomy Using Harmonic Scalpel and Electrocautery

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## ABSTRACT

- Objective** To compare the intraoperative and postoperative outcome of modified radical mastectomy (MRM) using harmonic scalpel versus electrocautery.
- Study design** Comparative study.
- Place & Duration of study** Department of Surgery, Jinnah Postgraduate Medical Center (JPMC) Karachi, Surgical ward 26, from December 2010 to June 2012.
- Methodology** This study included fifty females undergoing modified radical mastectomy. Twenty-five were operated with harmonic scalpel and twenty-five with electrocautery. Operative time, blood loss, total drainage volume (axillary and flap drains) and days for which the drains were placed, pain score, volume of seroma, hematoma, frequency of flap necrosis and lymphedema were compared.
- Results** There were no statistical differences between the two groups as regard to operative time ( $p=0.264$ ), seroma ( $p=0.247$ ), hematoma ( $p=0.235$ ), flap necrosis ( $p=1.000$ ) and lymphedema ( $p=1.000$ ). Furthermore there was no statistically significant difference in terms of pain relief ( $p=0.197$ ). There was a highly significant difference ( $p<0.001$ ) in relation to blood loss, drainage volume of flap drain and duration of placement of flap drain only. Hospital stay was not shortened because all patients were routinely discharged after three days following removal of the drains.
- Conclusion** Use of harmonic scalpel in mastectomy significantly reduced blood loss, total drainage volume and days but did not lower operative time, seroma formation, postoperative pain and total hospital stay.
- Key words** Harmonic scalpel, Breast, Modified radical mastectomy.

## INTRODUCTION:

The harmonic scalpel is a new device that has been introduced into surgical practice during the last decade as an alternative surgical tool for the dissection and haemostasis. It has been extensively used in the field of minimally invasive surgery but experience of harmonic scalpel in open surgery is limited.<sup>1</sup> Harmonic scalpel has recently been used in thyroid surgery and is found to be associated with low operative time and blood loss.<sup>2</sup>

Breast cancer management has seen an evolution from the radical extirpation of the previous century, involving loss of the breast, skin and underlying muscle, to current practice which aims at breast preservation.<sup>3</sup> Despite of the emergence of the breast conservation technique, modified radical mastectomy still remains the most commonly performed surgery for the breast cancer today.<sup>4</sup>

The most common modalities for dissection during breast surgery include sharp scalpel and scissors dissection, blunt dissection and high frequency electrocautery. The conventional method using diathermy (electrocautery) is associated with a moderate degree of operative morbidity in 35% to 50% patient.<sup>5</sup> This has been attributed to large postmastectomy raw area, cut lymphatics and use

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of mono-polar electrocautery.

The methods of lymph vessel sealing and hemostasis are clips and suture ligation. However, suture ligation is time-consuming and carries the risk of knot slipping, while clips may become dislodged. Moreover, electrocautery produces thermal injury to adjacent tissues and is considered a risk factor for seroma and other wound complications after mastectomy.<sup>6,7</sup>

The objective of this study was to evaluate the use of the harmonic scalpel in modified radical mastectomy in comparison with the traditional use of electro-cautery (diathermy) for intraoperative and postoperative outcomes.

#### **METHODOLOGY:**

This comparative study was conducted in Ward-26, Surgical Unit-III, JPMC Karachi, from December 2010 to June 2012. A total of 50 patients who underwent modified radical mastectomy were enrolled. Patients had unilateral breast disease, with all indications for modified radical mastectomy with American Society of Anesthesiology Scores 1 and 2. Patients with early breast cancer (T<sub>1</sub>), with history of previous breast surgeries, those on neo-adjuvant therapy and with diabetes mellitus and other co-morbidities were excluded.

The informed consent was taken from all patients before surgery and the operation was performed by same group of surgeons. Patients were enrolled into two groups by random selection; the first group included twenty-five females who underwent modified radical mastectomy using the harmonic scalpel (Ethicon Endo-Surgery, Inc.) and the second group was of twenty-five females who underwent modified radical mastectomy using conventional electrocautery (mono-polar diathermy).

Operative time was calculated (in minutes) for all the cases. Intraoperative blood loss (in milliliters) was estimated by calculating the amount of blood in the suction drain. All patients were followed up with recording of the following parameters: the total amount of drainage fluid till drain removal, days till drain removal (drains were removed when the output was less than thirty milliliters per twenty four hours), postoperative hematoma, seroma, flap necrosis and wound sepsis. Postoperative pain recording was done in both the groups. Both subjective and objective recordings of pain were done using visual analogue scale (VAS), 1, 6, 12, 24 hours after surgery.

The data were entered and analyzed in SPSS version 17. For descriptive statistics of qualitative variables the frequency distribution procedure was run with

calculation of the number of cases and percentages. For descriptive statistics of quantitative variables the mean, range and standard deviation were used to describe central tendency. For analysis of the differences in proportions and differences in means independent two samples "t" test used for the continuous variables, Fisher's Exact and Chi-square tests were used where applicable. P-value <0.05 was considered significant.

#### **RESULTS:**

This study included two groups (A and B) of female patients who were candidate for modified radical mastectomy. Each group included twenty-five females. In group A harmonic scalpel was used and in group B electrocautery was employed. Comparison between the groups is shown in tables I – III.

There was no immediate mortality noted in the two groups. There were no statistically significant differences noted in the two groups in terms of, operative time [group A 100.9 ± 4.9 minute vs group B 105.3 ± 8.1 minute, p=0.264], duration of axillary drains [group A 2.8 ± 0.7 days vs 6.7 ± 10.2 days, p=0.065], frequency of seroma formation [group A 2/25 cases (8%) vs group B 6/25 cases (20%), p=0.247], frequency of hematoma [group A 0/25 (nil) vs group B 3/25 (12%), p=0.235], frequency of flap necrosis [group A 0/25 (nil) vs group B 1/25 (4%), p=1.000] and of lymphedema [group A 1/25 (4%) vs group B 2/25 (8%), p=1.000].

There was no statistically significant difference noted in terms of postoperative pain which was measured on the VAS scale ranging from 0 – 10 (categorized as VAS scale mild pain = 0-4, moderate pain = 5-7 and severe pain = 8-10). Furthermore a highly significant statistical difference (p < 0.001) was noted between the two groups in terms of blood loss [group A 82.0 ± 9.5ml vs group B 176.8 ± 41.5 ml], axillary drain volume [group A 113.7 ± 15.2 ml vs group B 179.2 ± 45.9 ml], flap drain volume [group A 94.8 ± 14.2 ml vs group B 145.6 ± 37.3 ml] and duration of flap drain in days [group A 2.2 ± 0.6 days vs group B 3.8 ± 0.8 days].

#### **DISCUSSION:**

The harmonic scalpel is an innovative device designed as an alternative to conventional vessel sealing technique. It has emerged as an alternative surgical tool for the dissection and hemostasis. The most commonly used form of energy in surgical procedures nowadays is monopolar diathermy which is easy to use cheap and effective for small vessels control. The major disadvantages of electrocautery

Table I: Patient Record				
Patient Record	Harmonic Scalpel Group (N=25) (Mean ± SD)	Monopolar Diathermy Group (N=25) (Mean ±SD)	Mean Difference	p-Value
Age (year)	43.8 ± 6.7	43.9 ± 7.1	-0.16	0.935
Operative time (min)	100.9 ± 4.9	105.3 ± 8.1	-4.4	0.264
Blood loss (ml)	82.0 ± 9.5	176.8 ± 41.5	-94.8	0.000
Axillary drain volume (ml)	113.7 ± 15.2	179.2 ± 45.9	-65.5	0.000
Flap drain vol. (ml)	94.8 ± 14.2	145.6 ± 37.3	-50.8	0.000
Duration of axillary drain (days)	2.8 ± 0.7	6.7 ± 10.2	-3.9	0.065
Duration of flap drain (days)	2.2 ± 0.6	3.8 ± 0.8	-1.6	0.000

Table II: Wound Complications			
Wound Complications	Harmonic Group	Monopolar Diathermy Group	p-Value
Seroma	2	6	0.247
Hematoma	0	3	0.235
Flap necrosis	0	1	1.000
Lymphodema	1	2	1.000

Table III: Visual Analogue Score of Pain				
VAS SCORE	Mild (1-4)	Moderate(5-7)	Severe(8-10)	p-Value
Harmonic group	10	9	6	0.197
Monopolar diathermy group	6	7	12	

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.<sup>8</sup>

The harmonic scalpel converts electrical energy into high frequency (55.000 Hz) mechanical vibrations that cuts and coagulate the tissue at the same time.<sup>9,10</sup> The ultrasonic energy generated by the harmonic scalpel causes break down of hydrogen bonds and the formation of denatured protein coagulum which seals off the vessels and lymphatics thus decreasing blood loss and lymphatic drainage.<sup>11</sup> The harmonic scalpel offers greater precision in tight spaces near vital structures where fewer instrument changes are needed and less tissue charring and desiccation occur. Furthermore the visibility in the surgical field is improved.<sup>12,13</sup>

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.<sup>14</sup> The study by Galatius et al reported that there was no significant difference in the use of both the techniques in terms of operative time, perioperative bleeding and wound complications. Furthermore they reported higher incidence of seroma formation in both the groups.<sup>15</sup>

A study conducted by Kontos et al also showed encouraging results.<sup>16</sup> Deo and Shukla used harmonic scalpel for dissection in MRM and reported encouraging results in terms of operative time, intraoperative blood loss, lymphatic drainage and seroma formation.<sup>17</sup> It was comparable with our study. Adwani and Ebbs also reported encouraging results that supports our study.<sup>18</sup>

One of the important issues regarding the use of

harmonic scalpel is extent of lateral thermal injury spread and associated tissue injury. Several experimental studies showed that this extent of lateral thermal injury spread was limited to 2-3 mm.<sup>6,19</sup> There was no significant intraoperative blood loss, post-operative hemorrhage nor hematoma formation. Lumachi et al correlated axillary drainage with the patient's body mass index, lymph node status, number of lymph nodes removed, type of operation (greater in modified radical mastectomy than in breast-conserving surgery), and technique of axillary dissection (greater with the conventional scalpel than with the harmonic scalpel).<sup>20</sup> Seroma formation can be associated with other more serious complications such as infection, lymphedema, skin flap necrosis and delayed wound healing and may result in a prolonged hospital stay.<sup>21,22</sup>

None of our patients in whom MRM was performed using harmonic scalpel had flap necrosis as compared to one case (4%) in patient operated via electrocautery. Furthermore, only one out of twenty-five (4%) cases of group A, upper limb lymphedema observed. We label patient having lymphedema if pre and postoperative arm circumference difference was greater than 2 cm between the affected and non-affected arms.<sup>23,24</sup> However, this results should be carefully evaluated as lymphedema takes longer interval to develop after surgery.<sup>25</sup> The follow up period should be at least four years or more to evaluate the frequency of lymphedema. Our study was limited because of shorter period of follow-up, so we can not comment on the frequency of lymphedema in both the groups.

#### CONCLUSIONS:

The use of harmonic scalpel in MRM was not as cost effective as it did not lower the operative time and the volume of seroma formation. The hospital stay remained comparable with electrocautery technique. On the other hand the main advantage of its use like hemostasis, handy and ease to use made it one of the favourite surgical devices.

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