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A Comparative Study of Intraoperative and Postoperative Complication in Modified Radical Mastectomy Using Harmonic Scalpel and Electrocautery

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Abstract: ***Background: The dissection in breast surgeries can be done using sharp scalpel and scissor dissection and high frequency electrocautery. Rarely, radiofrequency ablation and laser had been used in some limited trails. This study aims to prove the efficacy of harmonic scalpel over electrocautery in modified radical mastectomy operation. Methods: In this study, we included 40 patients with operable breast cancer. The patients were randomized into two equal groups by closed envelope technique to do modified radical mastectomy either using harmonic scalpel (group A) or using electrocautery (group B). The efficacies of two procedures were compared intraoperatively and postoperatively. The intraoperative parameters used were total time taken for surgery, time taken for axillary dissection, time for raising the flaps and time taken dissection of the breast tissue and the amount of blood loss. The post-operative parameters used were total drainage volume, days of drainage and seroma formation. Results: Our study showed use of harmonic sclalpel in modified radical mastectomy, resulted in reduction in total operating time (t= 4.037, p=0.00) as well as reduction in time taken for axillary dissection (t=3.66, p=0.001) and the amount of blood loss (t=3.02, p=0.00). The total drain volume (t=3.031, p=0.004) and the days of drainage (t=5.97, p=0.00) were also less with the harmonic scalpel dissection as compared to electrocautery. Conclusions: The use of harmonic scalpel in modified radical mastectomy shortens the operating time, axillary dissection time, amount of blood loss and drainage volume and drainage day.***

Keywords: Harmonic scalpel, Modified radical mastectomy, Seroma

1. Introduction

The dissection in breast surgeries can be done using sharp scalpel and scissor dissection and high frequency electrocautery. Rarely, radiofrequency ablation and laser had been used in some limited trails. Ultrascission dissection (harmonic scalpel) and tissue response generation (ligaSure) are just started to be used in this field (1). Energy devices used in surgery include monopolar cautery, bipolar cautrery, harmonic scalpel and ligasure. Monopolar cautery offers an energy source that is excellent for hemostasis of small blood vessels, easy to use during tissue dissection, rapid, accurate and cheap. The major disadvantages of electrocautery are the limitations of the size of vessels (<1mm) 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)

The harmonic scalpel is a recently emerging surgical instrument that converts electrical energy into high frequency (55, 000 Hz) mechanical vibrations that allows intraoperative cutting and coagulation at the same time. The excursion of vibration increases with increased level of activity till it reaches 100 micrometers at level 5where the coagulating power is minimum, while cutting power is maximum (4, 5. This takes place at a relatively low temperature causing a little injury compared with both electrocautery and laser energy (6 - 8). 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 (6). Although it has been extensively used in laparoscopic surgery, experience with the harmonic scalpel in open surgery is limited. It is found to be associated with lower operative time and blood loss (7, 8, 9).

2. Methods

This study included 40 patients with operable breast cancer (stages 1 & 11, TNM classification) during the period from June 2019 to March 2019. The study was carried out in Department of General Surgery at Indira Gandhi Institute of Medical Science, Sheikhpura, Patna, India. To avoid bias, all the surgeries were carried out by a single surgeon in a single unit. All patients submitted theredetailed history taking, complete physical examination, routine laboratory test, mammogram, ultrasound of both the breasts and metastatic work up to exclude its presence. Corecut needle biopsy were done for all patients preoperatively.

Inclusion criteria

- Biopsy - proven operable breast carcinoma (primary or postneoadjuvant chemotherapy) female patients of all age groups, undergoing modified radical mastectomy with axillary lymph node dissection
- Tumor size >4 cm
- Patient who was not a candidate for breast conservation surgery (multicenter or diffuse tumor, tumor size >4 cm, large tumor in a small breast, patient preference)
- Positive margins after breast conservation surgery.

Exclusion criteria

- Patients who did not give informed consent
- Patients who were unfit for general anesthesia
- Patients with inoperable advanced breast malignancies

After taking consent from all patients for modified radical mastectomy (MRM) and their participation in the trial, they were randomized into 2 equal groups randomize computer program either to do modified radical mastectomy using

harmonic scalpel (group A) or using conventional electrocautery (group B).

The total operative time, time taken for axillary dissection, time for raising the flaps and time taken dissection of the breast tissue and the blood loss will be calculated intraoperatively. The post - operative parameters used will be total drainage volume, days of drainage and seroma formation.

Whenever the amount of drain will be less than 30 cc, the drain will be removed. The patients will be followed up for one month post - surgery and early postoperative complications like wound infection, upper limb lymphoedema, seroma, flap necrosis, nerve injuries will be noted. Seroma is defined as any subcutaneous fluid collection after drain removal, which needs aspiration of volume more than 50cc.

3. Results

Both groups had a matching age and body mass index. Out of 40 patients studied, only one was male and rest were females. The total operative time was longer in group B, it ranged from 45 to 145 minutes with a mean of 79 minutes. In group A it ranged from 40 to 72 minutes with a mean of 55 minutes. This difference was significant. (t=4.03, p=0.00) (Table 1).

Table 1: Total operative time in group A and group B (in minutes) t =4.03, p=0.00 (significant).

Total operative time	Group A (n=20)	Group B (n=20)
Range	40 - 72	45 - 135
Mean	55	79
Standard deviation	9.2	24.6
Skewness	0.18	0.80

The time consumed in flap raising and breast dissection in group A was shorter as compared to group B (Table 2). Similarly, time taken for axillary dissection in group A using harmonic was shorter than that of group B using electrocautery. Both the above parameters showed statistical significance (Table 3).

Table 2: Total time taken for flap raising and breast dissection in group A and group B (t=4.2, p=0.00 (significant)

Total time taken (minutes)	Group A (n=20)	Group B (n=20)
Range	10 - 45	20 - 60
Mean	27	39
Standard deviation	6.6	10.5
Skewness	- 0.12	- 0.26

Table 3: Total time taken for axillary dissection in group A and group B. (t=3.66, p=0.001 (significant)

Total time taken (minutes)	Group A (n=20)	Group B (n=20)
Range	13 - 42	18 - 45
Mean	20	29
Standard deviation	5.6	8.9
Skewness	3.3	0.56

The amount of blood loss in group A was lesser compared to group B. In group A mean blood loss was 450 ml where as in group b it was 970 ml and the difference was statistically significant. (t=3.02, p=0.00). The drainage days in group A ranged from 2 to 6 days with a mean of 4 days, while in group B it ranged from 4 to 11 days with a mean of 7 days. The difference was statistically significant (Table 4).

The total drainage volume in group A ranged from 160 to 780 ml with a mean of 450 ml while drainage volume in group B ranged from 230 to 1350 ml with a mean of 980 ml and the difference was statistically significant (Table 5).

Table 4: Number of days of drainage in group A and group B (t=5.9, p=0.00 (significant).

Number of days of drain	Group A (n=20)	Group B (n=20)
Range	2 - 6	4 - 11
Mean	4	7
Standard deviation	1.1	1.7
Skewness	0.15	0.59

Table 5: Total drainage volume in group A and group B (t=3.03, p=0.004).

Volume of drain in ml	Group A (n=20)	Group B (n=20)
Range	75 - 600	150 - 900
Mean	246	415
Standard deviation	131	212
Skewness	1.39	0.73

The postoperative complications encountered were seroma formation and wound infection.2% of group A suffered from postoperative seroma and 10% of group B suffered from same complication, the difference was significant. Out of 20 cases in group A, 2 cases had postoperative wound infection and 3 out of 20 in group B had the same complication, however there was no statistical significance between the two groups taking wound infection as a postoperative complication into consideration.

4. Discussion

Modified radical mastectomy using electrocautery is associated with moderate degree of morbidity. Recent studies have shown that cautery is associated with thermal tissue injury that causes damage of subdermal vacular plexus and incomplete occlusion of vascular and lymphatic channels, leading to increased morbidity.15, 16 The harmonic scalpel uses ultracision waves that disrupts the protein hydrogen bonds within the tissue leading to the formation of denatured protein. The denatured protein then disrupts with the intracellular and interstitial fluids to form a coagulum, which is a glue - like substance that seals off the vessels and the lymphatics leading on to decreases blood loss and lymphatic leakage. This takes place at a lower temperature as compared to both electrocautery and laser energy thus causing less tissue burns.17 Harmonic is a better haemostatic tool than electrocautery. It has an added advantage that it is multifunctional and avoid frequent instrument change and use of sutures. It provides a better presicion and clear surgical field as the smoke generated by the device is minimum. There is no electrical energy passed to the patient and hence no hazards of electric shock.18 The operative time, axillary dissection and the amount of operative bleeding is less with harmonic cautery as compared with electrocautery. The post - operative hospital stay in MRM is mainly due to presence of drains. The pain

and irritation caused by the drains add on to patient discomfort. Since harmonic scalpel is associated with less damage to tissue, vessels and lymphatics, the is less drainage volume and hence less hospital stay. In present study, we found that use of harmonic scalpel was less associated with seroma formation as compared to eletrocautery, however the difference was statistically significant. This was the same finding of Deo et al and Galatius et al.17, 19

5. Conclusion

The use of harmonic scalpel may be costly if we look the price of the instrument, but the total cost may decrease if we consider shortening of the operating time and hospital stay. Also, ligatures and sutures weren't required at any point of time in our study as compared with electrocautery. In conclusion use of harmonic cautery for dissection in modified radical mastectomy is always efficacious in terms of both intraoperative and postoperative complications as compared to electrocautery.

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