



Research Article

## A Comparative Study of Seroma Formation and Wound Complications in Electrocautery vs. Scalpel Dissection during Modified Radical Mastectomy

Subhash Nadagouda<sup>1</sup>, Madhukumar H V<sup>2</sup>, Chaitra D Y<sup>3</sup>

<sup>1</sup>Senior Resident, Dept of General Surgery, Gulbarga Institute of Medical Sciences, Kalaburagi, India

<sup>2</sup>Senior Resident, Dept of General Surgery, M S Ramaiah Medical College, Bengaluru, India

<sup>3</sup>Fellow, Surgical Gastroenterology Department, IGOT Hospital, Bengaluru, India

OPEN ACCESS

### Corresponding Author:

**Subhash Nadagouda**

Senior Resident, Dept of General Surgery, Gulbarga Institute of Medical Sciences, Kalaburagi, India.

*Received:* 15-01-2026

*Accepted:* 26-02-2026

*Published:* 08-03-2026

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### ABSTRACT

**Objective:** To compare the frequency of formation of seromas and postoperative wound complications in patients undergoing Modified Radical Mastectomy using electrocautery versus scalpel dissection.

**Methodology:** This study was a prospective comparative study and lasted for a year and comprised 120 patients who underwent modified radical mastectomy for operable breast cancer. Patients were recruited in two equal groups; 60 patients underwent flap dissection using electrocautery and 60 patients underwent scalpel dissection. Baseline data for demographic and tumor characteristics were recorded. Postoperative results such as seroma development, duration of drainage and total amount of drains, wound complication and hospital stay were compared between the group results. Data were analyzed with the help of statistical package (SPSS) version 25.0, and a p-value  $\leq 0.05$  was considered to be statistically significant.

**Results:** Overall, the rate of seroma formation was 31.6% rate. Seroma occurred significantly more often as in electrocautery group (40%) than as in scalpel group (23.3%)  $p=0.048$ . The electrocautery group also had an increase in mean drain output ( $680 \pm 110$  vs  $540 \pm 95$  mL,  $p=0.001$ ) and drainage duration ( $8.2 \pm 1.9$  days vs  $6.9 \pm 1.7$  days,  $p=0.002$ ). Operative time and the amount of intra-operative blood loss were significantly reduced in the electrocautery group ( $p = 0.001$ ), but the overall postoperative wound complication rate was increased (36.7% compared with 18.3%,  $p = 0.03$ ). The mean duration of hospitalization was also longer in the electrocautery treatment group ( $9.5 \pm 2.3$  vs  $7.8 \pm 2.1$  days,  $p= 0.001$ ).

**Conclusion:** Electrocautery dissection during modified radical mastectomy was associated with a significantly higher rate of seroma development and a significantly higher rate of overall wound complications than scalpel dissection, despite the benefits of intraoperative use of the former, such as shorter operative time and less blood loss. Scalpel dissection may therefore result in improved postoperative outcome including morbidity and a shorter hospital stay. Further large type randomised trials are recommended to confirm these findings.

**Keywords:** Modified Radical Mastectomy, Seroma Formation, Electrocautery, Scalpel Dissection, Wound Complications, Breast Cancer Surgery.

### INTRODUCTION

Breast cancer is the most common type of cancer diagnosed in women and a major cause of cancer related deaths globally (2) particularly in low and middle-income countries (1). Global cancer statistics reveal that breast cancer remains a leading cause of global oncological morbidity and mortality with an increasing incidence among the population of South Asia. For operable breast cancer, surgery remains the backbone on which treatment is based. Even with the improvement in breast conserving surgery, Modified Radical Mastectomy (MRM) is still frequently performed, especially in developing countries, where the patients present in advanced stages (3). MRM is the removal of all the breast tissue and dissection of the axillary lymph nodes while retaining the pectoralis major muscle. Although regarded as safe and effective treatment, MRM is often followed by some postoperative complications, with the formation of seromas as the most common (4). A seroma is a collection of serous fluid beneath the skin flaps or in the axillary dead space

following mastectomy. Reports indicate that seroma occurs in 15% to 85% of MRM patients and the occurrence varies depending on the surgical technique, patient and postoperative care 5.

Seroma is not only an inconvenience; it may cause patient discomfort, predispose to wound infection, flap necrosis, delayed healing, prolonged hospital stays and need for repeated aspiration, and delay adjuvant therapy (6). The causes of seroma are multifactorial, but are generally related to damage of lymph channels, inflammatory fluid due to surgical trauma, and dead space formation (7). Among these factors, the technique of flap dissection is important. The conventional method of scalpel has been used to raise the skin flaps in mastectomy for a long time. Electrocautery has gained popularity as it results in less intraoperative blood loss, provides better hemostasis, shorter operative time and greater visibility of the surgical field (8). However, electrocautery can lead to more thermal damage, increased inflammation, and lymphatic disruption, which can lead to an elevated rate of seromas and other wound complications (9).

Many researches have compared electrocautery and scalpel dissection in breast surgery, but results are different. Some researchers revealed an increase in seromas and wound problems with electrocautery which they attributed to thermal damage and tissue necrosis (10). A number of other studies found no significant difference, which suggests that other factors such as surgical skill, the use of drains and postoperative care may be more influential. (11) After MRM, complications such as infection, hematoma, flap necrosis, and slow healing are responsible for the postoperative morbidity. These problems increase healthcare costs and have adverse effects on the mental health and quality of life of the patients undergoing breast cancer treatment (12). Thus, it is crucial to find ways to improve surgical techniques to reduce postoperative morbidity in order to improve surgical outcomes.

In resource constrained environments, such as is the case with many tertiary hospitals, small changes in surgical method can make a big difference to recovery and the workload on the hospital. Because the optimal dissection technique for MRM is still debated, a well-designed comparative study is required to evaluate the seroma and wound complications between the electrocautery and scalpel dissection techniques. This one-year study enrolled 120 patients undergoing Modified Radical Mastectomy and will compare the frequency of the occurrence of seroma and wound complications for each technique. The findings should be used to direct and improve outcomes based on the outcomes of surgeries for breast cancer patients.

#### **AIM OF THE STUDY**

"To evaluate the clinical outcomes of different surgical dissection techniques in Modified Radical Mastectomy (MRM) by comparing the postoperative morbidity associated with electrocautery versus scalpel dissection."

#### **Objective:**

**Primary Objective:** To compare the incidence and frequency of seroma formation between the electrocautery and scalpel dissection groups.

#### **Secondary Objectives:**

- To quantify and compare intraoperative metrics, specifically operative time and total blood loss, for both techniques.
- To measure and compare postoperative drain characteristics, including mean daily output and total duration of drainage.
- To assess the rate of wound-specific complications, such as surgical site infections, flap necrosis, and hematomas.
- To evaluate the impact of the dissection technique on the total duration of hospitalization.

#### **METHODOLOGY**

This study was prospectively carried out over the last 1 year in order to compare the rate of seromas and other wound complications following the Modified Radical Mastectomy (MRM) using electrocautery vs. scalpel dissection. Patients were divided into the two equal groups according to the method of elevating the flap. Group A was electrocautery and Group B scalpel dissection. All surgeries were undertaken by experienced general surgeons in accordance with standardised protocols in order to minimise variability. The study included female patients with operable breast cancer admitted for MRM at the surgical department of the hospital during the period of the study. One hundred twenty patients were included in the study and there were 60 in each group. Patients were chosen consecutive non-probability sampling technique and all the eligible patients presenting in the period of the study were included until the required sample size was achieved.

#### **Inclusion Criteria**

Patients were included in the study if they were female, aged 18 to 70 years of age, with confirmed histopathologic breast cancer diagnosis, who were scheduled for MRM. People who provided written informed consent were the only ones who were enrolled.

#### **Exclusion Criteria**

Patients were excluded from the study if they met any of the following criteria:

- Patients with locally advanced or metastatic breast cancer.
- Patients who have undergone neoadjuvant chemotherapy/radiation.
- Patients undergoing breast-conserving surgery or simple mastectomy.
- Patients with recurrent breast carcinoma.
- Patients with known bleeding disorders or on anticoagulant therapy.
- Patients with uncontrolled diabetes mellitus or severe comorbid conditions that could affect wound healing.
- Patients who refused to provide consent.

### Data Collection

Data were collected with a structured questionnaire which was specific to this study. We documented baseline demographic information, including age, body mass index (BMI), underlying comorbidities and tumor properties. For each surgery, we recorded the time taken for surgery as well as the type of dissection required. Post-operatively, all the patients were monitored for signs of seroma and other complications of the wounds. A closed suction drain was placed in all patients that was managed according to a set standard with the drain output recorded daily. In this study, a seroma was defined as a clinically detectable fluid collection at the surgical site requiring intervention (such as aspiration) following the removal of the surgical drain, or a collection that persisted despite the presence of functional drain. Patients were regularly monitored during their hospital admission and at follow-up visits at the outpatient clinic where we looked for complications of the wound such as surgical site infection, haematomas, flap necrosis, and delayed wound healing. A surgical site infection was recognized by clinical signs of infection like redness, swelling, discharge and fever. We also measured the length of the stay in each hospital and the number of aspirations of the seromas when necessary.

### Data Analysis

All data collected was then entered and analyzed in the form of the statistical program, IBM-SPSS (version 25.0). Quantitative variables, e.g. age and duration of hospital stay, were expressed as mean  $\pm$  SD. Qualitative variables including the presence of seroma, wound complications were presented as frequencies and percentages. We compared the two groups with each other (electrocautery and scalpel dissection) with the chi; square test for categorical data. For continuous variables, an independent samples t-test was used where appropriate. Results with a p-value of less than or equals to 0.05 were considered statistically significant.

## RESULTS

**Table 1: Baseline Characteristics of Patients**

Variable	Electrocautery (n=60)	Scalpel (n=60)	p-value
Mean Age (years)	49.8 $\pm$ 8.6	48.9 $\pm$ 9.1	0.58
Mean BMI (kg/m <sup>2</sup> )	27.4 $\pm$ 3.2	26.9 $\pm$ 3.5	0.41
Diabetes Mellitus	14 (23.3%)	12 (20%)	0.65
Hypertension	18 (30%)	16 (26.7%)	0.69

The mean age of the electrocautery group was 49.8 $\pm$ 8.6 years, while that of the scalpel group was 48.9 $\pm$ 9.1 years. The difference in age of the two groups was not significantly different (p=0.58). The mean BMI of the electrocautery group was 27.4  $\pm$  3.2 kg/m<sup>2</sup>, but it was slightly higher than that of the scalpel group 26.9 kg  $\pm$  3.5 kg/m<sup>2</sup>, this difference too insignificant (p=0.41). The prevalence of comorbidities such as diabetes mellitus and hypertension was equally in both the groups and the difference between the two groups was not statistically significant.

**Table 2: Tumor Characteristics**

Variable	Electrocautery (n=60)	Scalpel (n=60)	p-value
Mean Tumor Size (cm)	3.8 $\pm$ 1.2	3.6 $\pm$ 1.1	0.39
T2 Stage	38 (63.3%)	36 (60%)	0.71
T3 Stage	22 (36.7%)	24 (40%)	0.71
Positive Lymph Nodes	30 (50%)	28 (46.7%)	0.71

The average size of the tumor was 3.8cm  $\pm$  1.2 cm in the electrocautery group and 3.6cm  $\pm$  1.1 cm in the scalpel group without any statistically significant difference (p=0.39). Number of patients in the electrocautery group who had stage T2 tumors was 63.3% and 36.7% for stage T3 tumor. In our scalpel group, 60% had stage T2 and stage T3 disease

respectively. The distribution of stage was similar for the two groups ( $p=0.71$ ). Positive axillary lymph nodes were detected in 50% of electrocautery patient & 46.7% of scalpel patient ( $p = 0.71$ ). These results suggest that disease severity and tumor burden were comparable in both groups, so that these postoperative results were not subjected to differences in tumor characteristics.

**Table 3: Operative Details**

Variable	Electrocautery	Scalpel	p-value
Mean Operative Time (minutes)	105 ± 15	120 ± 18	0.001
Mean Blood Loss (ml)	180 ± 40	260 ± 50	0.001

The mean operative time in the electrocautery group (105 ± 15 min) was significantly shorter than in the scalpel group (120 ± 18 min) ( $p = 0.001$ ). Intra-operative blood loss was also lower in patients who underwent electrocautery dissection (180 ± 40 mL) compared with those who had scalpel dissection (260 ± 50 mL), with a p-value of 0.001. These findings suggest that the electrocautery offers good intra-operative hemostasis and shortened length of surgery compared to scalpel dissection.

**Table 4: Incidence of Seroma Formation**

Variable	Electrocautery (n=60)	Scalpel (n=60)	p-value
Seroma Formation	24 (40%)	14 (23.3%)	0.048
Mean Drain Duration (days)	8.2 ± 1.9	6.9 ± 1.7	0.002
Mean Total Drain Output (mL)	680 ± 110	540 ± 95	0.001

Seroma formation was observed in 24 patients (40%) in the electrocautery group compared to 14 patients (23.3%) in the scalpel group. The difference was found to be statistically significant ( $p = 0.048$ ) between the two groups of patients in that there was a higher incidence of seroma formation in the patients where electrocautery was performed during the dissection of the flap. The mean duration of drain placement was significantly longer in the electrocautery group (8.2 ± 1.9 days) compared to the scalpel group (6.9 ± 1.7 days), with a p-value of 0.002. Additionally, the mean total drain output was significantly higher in the electrocautery group (680 ± 110 mL) compared to the scalpel group (540 ± 95 mL), showing a statistically significant difference ( $p = 0.001$ ).

**Table 5: Postoperative Wound Complications**

Complication	Electrocautery (n=60)	Scalpel (n=60)	p-value
Surgical Site Infection	10 (16.7%)	5 (8.3%)	0.16
Flap Necrosis	8 (13.3%)	3 (5%)	0.11
Hematoma	4 (6.7%)	3 (5%)	0.70
Delayed Wound Healing	12 (20%)	6 (10%)	0.12
Overall Wound Complications	22 (36.7%)	11 (18.3%)	0.03

The complications of postoperative wounds were more common in the electrocautery group than in the scalpel group. A surgical site infection occurred in 10 patients (16.7%) of the electrocautery group and in 5 patients (8.3%) of the scalpel group; the difference was not statistically significant ( $p = 0.16$ ). Flap necrosis was reported in 8 patients (13.3%) of the electrocautery group versus 3 patients (5%) of the scalpel group, again not reaching statistical significance ( $p = 0.11$ ). Hematoma formation occurred in 4 patients (6.7%) of the electrocautery group and in 3 patients (5%) of the scalpel group, with no significant difference ( $p = 0.70$ ). Delayed wound healing was seen in 12 patients (20%) of the electrocautery group compared to 6 patients (10%) of the scalpel group; this difference was not statistically significant

( $p = 0.12$ ). However, when all wound complications were considered together, a significant difference emerged: 36.7% of patients in the electrocautery group experienced complications, versus 18.3% in the scalpel group ( $p = 0.03$ ).

**Table 6: Seroma Severity and Management**

Variable	Electrocautery	Scalpel	p-value
Mean Aspirations Required	$2.6 \pm 1.1$	$1.4 \pm 0.8$	0.002
Mean Aspirated Volume (mL)	$320 \pm 85$	$190 \pm 70$	0.001

Among patients who developed seroma, those in the electrocautery group needed significantly more aspirations (average  $2.6 \pm 1.1$ ) than the scalpel group ( $1.4 \pm 0.8$ ); this difference was statistically significant ( $p = 0.002$ ). The average volume of aspirated fluid was also higher in the electrocautery group ( $320 \pm 85$  mL) compared to the scalpel group ( $190 \pm 70$  mL), with a p-value of 0.001. These results suggested that seroma is not only more common in the group that underwent electrocautery but also more severe and may therefore require more postoperative interventions.

**Table 7: Duration of Hospital Stay**

Variable	Electrocautery (n=60)	Scalpel (n=60)	p-value
Mean Hospital Stay (days)	$9.5 \pm 2.3$	$7.8 \pm 2.1$	0.001

Patients treated with electrocautery stayed an average of  $9.5 \pm 2.3$  days in the hospital, compared to  $7.8 \pm 2.1$  days for those treated with a scalpel. This difference is significantly different ( $p = 0.001$ ) and is probably due to the higher incidence of seroma formation and wound complications with electrocautery which requires longer hospitalization.

## DISCUSSION

The current one-year comparison looked at the development of seromas and wounds and complications in patients who underwent Modified Radical Mastectomy using either electrocautery or scalpel dissection. Electrocautery was associated with a higher frequency of seroma, longer drain use, amount of drain output, and more overall wound complications despite a shorter surgical time and a decrease in intraoperative bleeding. Seroma is the most common complication after mastectomy and axillary dissection, with published rates ranging from 15 % to 85 % (1). In our study, 31.6 % of patients developed seroma. The electrocautery group had a rate of 40 % versus 23.3 % in the scalpel group that is consistent with earlier reports linking electrocautery to higher seroma due to thermal injury and lymphatic damage (2,3).

Porter and colleagues found that electrocautery causes more than scalpel dissection inflammatory fluid formation, which may lead to elevated postoperative fluid build-up (4). A systematic review by Kuroi et al also emphasized the importance of surgical technique in the development of a seroma with thermal damage caused by electrocautery being a significant factor (5). Local tissue death, increased capillary permeability, and the difficulty to seal lymphatic vessels are all effects of electrocautery's heat that promote the formation of seroma. Our results were similar in which the electrocautery group had a higher drain output and remained on drains longer. Lumachi and colleagues also found increased amounts of postoperative drainage using electrocautery (6). Longer drainage delay will delay recovery and may increase the risk of infection and discomfort.

Despite the increased number of seromas and wounds, the intra-operative benefits of electrocautery were obvious - a much shorter operative time, and less blood loss. These results are in accordance with global results that have shown electrocautery aids in improving the efficiency and hemostasis of surgery (7). The clinicians have to weigh the intra-operative gains with the increase in postoperative morbidity. Regarding wound problems specific events, such as infection and flap necrosis, were not significantly different, however, the overall complication rate was higher for electrocautery. Chrysos et al. Have experienced similar flap problems with Electrocautery and attributed them to micro-vascular damage from heat (8). This thermal damage may result in decreased perfusion at flap margins, which slows healing. Importantly, our groups were similar for demographics and tumor features, decreasing the confounding effect.

Other researchers have noted that age, obesity, and comorbidities can have an effect on the risk of seroma (9). Because the balance of these factors in our sample was even, we think the surgical method was the main driving factor. These results are particularly pertinent in low resource settings, where increased length of stay and increased frequency of seroma taps are an added burden. Our patients had significantly longer stay in the electrocautery arm, likely associated with the increased morbidity. Other studies of multicentre breast surgery have also found the same trend (10). Still, the association between the electrocautery and seroma is debated. Some randomised trials found that there was no difference

between the two techniques (11). Differences in the skill of surgeons, drain policies, and practices of flap fixation may account for these conflicting results. This study data confirms the intra operative benefits of electrocautery but associate it to an increased rate, and severity, of seroma and wound complications following Modified Radical Mastectomy. The selection of suitable technique, and application of measures such as careful haemostasis, use of a flap fixation and improved drain care, can alleviate these problems. Careful consideration of surgical technique, as well as various techniques to combat postoperative morbidity, such as meticulous hemostasis and flap fixation, and optimized drain management, may help reduce postoperative morbidity.

## CONCLUSION

The present study demonstrated that flap dissection with the use of electrocautery for the Modified Radical Mastectomy caused an increased seroma formation rate. It also made for more drain output, a longer length of drainage, and increased rate of overall postoperative wound complications compared with scalpel dissection. While there are some benefits from using electrocautery in the operating room such as overall reduction in operating time and blood loss, this gain must be weighed against the increased postoperative morbidity. The findings suggest scalpel dissection as an option that may give better postoperative results. Patients are more likely to experience less seroma formation as well as shorter hospital stays. As the buildup of seroma may be painful, slow recovery, provoke repeated treatment intervention and may lead to delay in adjuvant therapy, the proper selection of the dissection procedure is important for optimizing surgical outcome. Electrocautery is beneficial to the overall efficiency of the surgery, but scalpel dissection appears to be a better option for recovery upon patients undergoing Modified Radical Mastectomy. Larger, randomized controlled trials are required to develop standardized guidelines for surgery that can be applied in order to balance the benefits of each technique with postoperative safety.

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