



INCIDENCE OF POSTOPERATIVE SEROMA FORMATION IN PATIENTS UNDERGOING ELECTROCAUTERY VS. SCALPEL DISSECTION TECHNIQUES IN MODIFIED RADICAL MASTECTOMY

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ABSTRACT

Background: Modified radical mastectomy (MRM) is a common surgical procedure for breast cancer, but postoperative complications such as seroma formation and prolonged drainage are significant concerns. Surgical techniques, including electrocautery and scalpel dissection, may influence these outcomes.

Objective: This study aims to compare the effects of electrocautery and scalpel dissection on seroma formation, drainage volume, and postoperative complications in patients undergoing MRM.

Study Design and Setting: A randomized controlled trial was conducted at Al Nafees Medical College and Hospital from January to December 2023.

Methodology: A total of 136 patients diagnosed with operable breast cancer (stages I–III) were randomly assigned to two groups: Group A (n = 68) underwent MRM using electrocautery, and Group B (n = 68) using scalpel dissection. Patients with pre-existing conditions affecting wound healing or prior chemotherapy/radiation were excluded. Seroma formation, drain volumes, and postoperative complications were assessed at multiple time points postoperatively. Data were analyzed using SPSS version 26.0, with chi-square and t-tests employed for categorical and continuous variables, respectively.

Results: Seroma formation was observed more frequently in the Scalpel group, with 47.1% of patients developing seromas compared to 38.2% in the Electrocautery group. The electrocautery group had significantly lower average seroma volume (85.4 ml vs. 102.3 ml, $p < 0.05$) and fewer seroma aspirations compared to the scalpel group.

Conclusion: Electrocautery reduces seroma formation, drainage volume, and postoperative complications compared to scalpel dissection in MRM, suggesting it may be a preferable surgical technique.

Keywords: Modified Radical Mastectomy, Electrocautery, Scalpel Dissection, Seroma Formation, Postoperative Complications.

INTRODUCTION

Breast cancer remains one of the most prevalent malignancies affecting women globally, with modified radical mastectomy (MRM) being a common surgical intervention.¹ As one of the primary approaches for treating advanced or multifocal breast cancer, MRM involves the removal of the entire breast, including axillary lymph nodes, while sparing the pectoral muscles. While this procedure has shown significant success in treating breast cancer, it is not without its complications. One of the most frequent and frustrating postoperative complications is the formation of seroma—an accumulation of fluid in the dead space created by tissue dissection.^{2,3} The incidence of seroma formation can range between 15% and 81% in patients undergoing mastectomy and other breast surgeries.⁴

Various surgical techniques have been employed to minimize seroma formation, with electrocautery and scalpel dissection being among the most commonly used. Electrocautery, a technique that uses heat generated by an electric current to cut tissues and control bleeding, has gained widespread acceptance due to its ability to achieve hemostasis and reduce intraoperative blood loss.⁵ On the other hand, the scalpel dissection technique, which involves the traditional use of a sharp blade to cut through tissues, is often favored for its precision and tissue preservation. However, the differences between these two techniques have sparked ongoing debate among surgeons, particularly regarding their impact on postoperative outcomes, including seroma formation.⁶

The pathophysiology of seroma formation is multifactorial and not fully understood. However, it is generally believed to result from the disruption of lymphatic channels and blood vessels during surgery, leading to the accumulation of lymphatic fluid in the dead space.⁷ The nature of tissue handling, the extent of dissection, and the degree of trauma inflicted during surgery are critical factors that contribute to seroma formation. In this context, it is important to understand whether the surgical technique employed plays a significant role in determining the incidence and severity of seroma formation.⁸ Electrocautery, while effective in reducing bleeding, causes more thermal damage to surrounding tissues, potentially affecting wound healing and lymphatic drainage. In contrast, scalpel dissection, which involves less thermal injury, may preserve tissue integrity better but might be associated with higher rates of bleeding and lymphatic leakage, potentially leading to seroma formation.⁹

Several studies have explored the relationship between surgical technique and seroma formation, but the results remain inconclusive.^{10,11} Some research suggests that electrocautery leads to a higher incidence of seroma due to increased tissue damage, while others argue that the precision of electrocautery may actually reduce the risk by minimizing trauma and blood loss. Similarly, while scalpel dissection is often associated with lower thermal injury, its impact on seroma formation is also debated.¹²

These conflicting findings highlight the need for further research to determine the most effective surgical technique for minimizing postoperative complications such as seroma formation. Given the significant impact that seroma formation can have on patient outcomes and recovery, understanding the role of surgical techniques in its development is crucial. This study aims to investigate the incidence of postoperative seroma formation in patients undergoing MRM using either electrocautery or scalpel dissection techniques. By comparing the outcomes of these two widely used methods, this research seeks to provide valuable insights into the optimal surgical approach for minimizing seroma formation and improving postoperative recovery in breast cancer patients.

Understanding these dynamics can inform surgical decision-making, enhance patient care, and contribute to the ongoing evolution of breast cancer surgery techniques.

MATERIALS AND METHODS

This randomized controlled trial (RCT) was conducted at Department of General Surgery Al Nafees Medical College and Hospital. The sample consisted of 136 patients, calculated based on an estimated seroma incidence of 50%, with a 95% confidence interval and a margin of error of $\pm 10\%$.¹² The patients were randomly assigned to two groups: one undergoing surgery using the electrocautery technique and the other using the traditional scalpel dissection method. Ethical approval for the study was obtained from the Institutional Review Board, and informed consent was obtained from all participants prior to enrollment.

The study included patients diagnosed with breast cancer who underwent MRM at our institution between January and December 2023. Inclusion criteria included patients aged 18-75 years with operable breast cancer (stages I to III). Patients with pre-existing conditions that could influence wound healing, such as diabetes mellitus, autoimmune disorders, and chronic steroid use, were excluded from the study. Patients who had previously undergone radiation therapy or chemotherapy before surgery were also excluded to minimize confounding variables. Patients were randomly assigned to two groups using a simple randomization method. Group A comprised 68 patients who underwent MRM using the electrocautery technique, while Group B included 68 patients who underwent the procedure using scalpel dissection. The surgical procedures were performed by experienced surgeons following standard protocols. In both groups, a closed suction drain was placed in the axillary region postoperatively to manage fluid accumulation. For the electrocautery group (Group A), an electrosurgical unit was used to perform the entire tissue dissection. Electrocautery settings were standardized for all patients to ensure consistency, with the coagulation and cutting modes set according to the manufacturer's guidelines. The scalpel dissection group (Group B) underwent tissue dissection using a conventional scalpel and surgical scissors. Hemostasis in this group was achieved using ligatures and conventional methods, avoiding the use of electrocautery for tissue dissection to maintain comparability between the two techniques. Postoperative management was standardized across both groups, with all patients receiving prophylactic antibiotics, standard wound care, and monitoring for complications. The primary outcome measured was the incidence of seroma formation, which was defined as a clinically significant collection of serous fluid in the wound area, requiring aspiration or other intervention. Seroma formation was assessed on postoperative days 3, 7, and 14, and additional assessments were made during follow-up visits.

Data analysis was performed using SPSS software (version 26.0). Data collection was carried out by a dedicated team of researchers who were blinded to the surgical technique used. Patient demographics, tumor characteristics, surgical details, and seroma formation data were recorded in a standardized format. Seroma incidence was compared between the two groups using statistical analysis, and categorical variables were analyzed using the chi-square test. Continuous variables, such as the volume of seroma collected, were analyzed using the independent t-test. To control for potential confounding factors, multivariate analysis was conducted, adjusting for age, tumor size, and other relevant patient characteristics. Statistical significance was set at $p < 0.05$ for all tests.

STUDY RESULTS

The demographic characteristics of the patients in both groups are fairly comparable. The mean age for the Electrocautery group was 52.3 years, while the Scalpel group had a mean age of 54.1 years. Most patients fell within the 41-60 age range, making up 61.7% of the total sample (Table 1). Gender distribution heavily favored females, as expected in breast cancer studies, with 95.6% of patients being female and only 4.4% male. The groups were well-matched in terms of age and gender. Additionally, the average body mass index (BMI) was slightly higher in the Scalpel group (27.4) compared to the Electrocautery group (26.1), although both are within the overweight range.

Smoking history was reported in 13.2% of the total cohort, slightly higher in the Scalpel group (14.7%) given in table 1.

Table 1: Demographics of All Patients (N = 136)

Variable	Electrocautery Group (n = 68)	Scalpel Group (n = 68)	Total (N = 136)
Mean Age (years)	52.3±1.14	54.1±1.83	53.2±1.31
Age Group 30-40	12 (17.6%)	9 (13.2%)	21 (15.4%)
Age Group 41-50	19 (27.9%)	22 (32.4%)	41 (30.1%)
Age Group 51-60	22 (32.4%)	21 (30.9%)	43 (31.6%)
Age Group 61-75	15 (22.1%)	16 (23.5%)	31 (22.8%)
Gender (Female)	65 (95.6%)	65 (95.6%)	130 (95.6%)
Gender (Male)	3 (4.4%)	3 (4.4%)	6 (4.4%)
Mean BMI (kg/m ²)	26.1	27.4	26.7
Smoking History (%)	8 (11.8%)	10 (14.7%)	18 (13.2%)

Table 2 shows the comparison of drain volumes and drainage-related outcomes between the two groups. The Scalpel group had a higher average drain volume of 310 ml compared to 250 ml in the Electrocautery group. Furthermore, a higher proportion of patients in the Scalpel group (42.6%) had drainage lasting more than 7 days compared to the Electrocautery group (30.9%), indicating prolonged fluid accumulation in Scalpel patients. Additionally, 19.1% of patients in the Scalpel group had total drainage volumes exceeding 400 ml, compared to 11.8% in the Electrocautery group. Hematoma formation, though infrequent, was slightly higher in the Scalpel group at 4.4% compared to 2.9% in the Electrocautery group. This suggests that the electrocautery technique may result in less fluid accumulation and shorter drainage durations postoperatively.

Table 2: Drain Volume and Postoperative Drainage Outcomes

Variable	Electrocautery Group	Scalpel Group	Total
Average Drain Volume (ml)	250 ml	310 ml	280 ml
Drain Volume Range (ml)	150-400 ml	180-450 ml	150-450 ml
Drainage Duration > 7 days (%)	21 (30.9%)	29 (42.6%)	50 (36.8%)
Total Drainage Volume > 400 ml (%)	8 (11.8%)	13 (19.1%)	21 (15.4%)
Hematoma Formation (%)	2 (2.9%)	3 (4.4%)	5 (3.7%)

As shown in Table 3, seroma formation was observed more frequently in the Scalpel group, with 47.1% of patients developing seromas compared to 38.2% in the Electrocautery group. The average volume of seroma was also higher in the Scalpel group (102.3 ml) compared to the Electrocautery group (85.4 ml). Aspiration to remove seroma fluid was needed in 33.8% of patients in the Scalpel group and 26.5% of patients in the Electrocautery group. The average number of aspirations needed was higher in the Scalpel group at 2.1 compared to 1.6 in the Electrocautery group, indicating more extensive seroma management was required for the Scalpel group. Postoperative infections were slightly higher in the Scalpel group (4.4%) versus the Electrocautery group (2.9%).

Table 3: Frequency and Characteristics of Seroma Formation

Variable	Electrocautery Group (n = 68)	Scalpel Group (n = 68)	Total (N = 136)
Seroma Formation (Yes) (%)	26 (38.2%)	32 (47.1%)	58 (42.6%)
Seroma Formation (No) (%)	42 (61.8%)	36 (52.9%)	78 (57.4%)
Average Volume of Seroma (ml)	85.4 ml	102.3 ml	93.8 ml
Aspiration Needed (%)	18 (26.5%)	23 (33.8%)	41 (30.1%)
Postoperative Infection (%)	2 (2.9%)	3 (4.4%)	5 (3.7%)

Table 4 highlights the comparison of additional variables such as hospital stay, surgery duration, and complications. The average hospital stay was longer in the Scalpel group, averaging 6.2 days compared to 5.4 days in the Electrocautery group. Hospital stays exceeding 7 days were observed in 22.1% of Scalpel group patients and 17.6% of Electrocautery patients. The surgery duration was also slightly longer for Scalpel procedures, averaging 2.8 hours, while Electrocautery surgeries averaged 2.5 hours. Blood loss exceeding 200 ml occurred more frequently in the Scalpel group (20.6%) compared to the Electrocautery group (13.2%), which correlates with the longer surgery duration. Postoperative complications were more prevalent in the Scalpel group (14.7%) than in the Electrocautery group (10.3%). Rehospitalization rates were low overall but slightly higher in the Scalpel group (2.9%) compared to the Electrocautery group (1.5%).

Table 4: Comparison of Additional Variables (Hospital Stay, Surgery Duration, and Complications)

Variable	Electrocautery Group (n = 68)	Scalpel Group (n = 68)	Total (N = 136)
Average Hospital Stay (days)	5.4 days	6.2 days	5.8 days
Hospital Stay > 7 days (%)	12 (17.6%)	15 (22.1%)	27 (19.9%)
Average Surgery Duration (hours)	2.5 hours	2.8 hours	2.65 hours
Blood Loss > 200 ml (%)	9 (13.2%)	14 (20.6%)	23 (16.9%)
Postoperative Complications (%)	7 (10.3%)	10 (14.7%)	17 (12.5%)
Rehospitalization Rate (%)	1 (1.5%)	2 (2.9%)	3 (2.2%)

DISCUSSION

The incidence of postoperative seroma formation is a common complication following modified radical mastectomy. Studies comparing electrocautery and scalpel dissection techniques suggest a higher seroma incidence with electrocautery due to increased tissue damage and thermal injury. Scalpel dissection, while associated with less seroma formation, may result in greater blood loss. The choice of technique may impact postoperative morbidity and recovery.¹³ In the present study, we compared the incidence of postoperative seroma formation between electrocautery and scalpel dissection techniques in patients undergoing modified radical mastectomy. The findings highlight the potential impact of the chosen dissection method on postoperative outcomes, particularly in relation to seroma formation and associated complications.

. Our study found that the demographic characteristics of the patients in both the Electrocautery and Scalpel groups were comparable, with a mean age of 52.3 years and 54.1 years, respectively, which aligns closely with the findings of Mansour Mohamad Kabbash et al., who reported a mean age of 49.6 years (SD 8.46).¹⁴ Similarly, the majority of patients in both studies fell within the 41-60 age range. In comparison, the study by Umm-e-Rabab Sandano et al. exclusively included 217 female patients, reinforcing the gender distribution heavily favoring females, as observed in our study.¹⁵

In terms of surgery duration and blood loss, our study found that Scalpel procedures were longer (2.8 hours vs. 2.5 hours) with more blood loss (20.6% vs. 13.2%). This aligns with Din et al. (2023), who reported longer surgery times for scalpel dissection (109.9 vs. 105.1 minutes). The longer hospital stay in our Scalpel group (6.2 vs. 5.4 days) is also supported by Din et al., who found similar trends.¹⁶

Our study comparing electrocautery and scalpel techniques in modified radical mastectomy found that the Scalpel group had higher rates of seroma formation (47.1% vs. 38.2%), larger seroma volumes (102.3 ml vs. 85.4 ml), and more frequent aspirations (33.8% vs. 26.5%) than the Electrocautery group. These results are consistent with Archana et al. (2020), who reported higher seroma incidence (34.2% vs. 21.7%) and drainage volume (937.5 ml vs. 470 ml) in the scalpel group.¹⁷ Both studies confirm that electrocautery results in less fluid accumulation and quicker recovery. Contrastingly, Bashir et al. (2023) and Zahid et al. (2022) found higher seroma formation rates in their Electrocautery groups (28% and 36.7%, respectively) compared to the Scalpel groups (16% and 16.7%), which differs from our findings.¹⁸ These discrepancies may be due to variations

in surgical techniques and patient factors. However, differences in seroma rates between studies, such as those by Bashir et al. (2023) and Zahid et al. (2022), highlight the need for further research to standardize surgical techniques and optimize outcomes in modified radical mastectomy.^{19, 20, 21}

The strength of our study lies in the well-matched demographic characteristics between the groups and the comprehensive comparison of surgical outcomes using detailed drainage, seroma, and complication data. However, limitations include a relatively small sample size and potential variations in surgeon experience, which may influence the generalizability of the results.

CONCLUSION

Our study suggests that the electrocautery technique results in lower seroma formation, reduced drainage duration, and shorter recovery times compared to the scalpel technique in modified radical mastectomy. Electrocautery may be the preferred method for minimizing postoperative complications and improving patient outcomes.

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