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Tumescent technique in modified radical mastectomy - Does it differ?

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ABSTRACT

Introduction: Breast cancer is the most common cancer among women, accounting for approximately 26% of all incident cancers among women. Surgery is the main treatment of breast cancer either breast conserving surgery (BCS) or modified radical mastectomy (MRM). The aim of this study is to compare between the effect of using the tumescent technique and the conventional electrocautery technique in patients undergoing modified radical mastectomy (MRM).

Patients and Methods: This study was conducted on 60 female patients admitted to the Surgical Oncology Unit, Alexandria Main University Hospital, and were indicated to modified radical mastectomy (MRM) during a period from April 2014 till October 2015, the patients were randomly divided into two equal groups; group A (30 patients had MRM in which the tumescent fluid is injected to help elevation of the skin flaps using the scalpel or scissors), and group B (30 patients had MRM using the electrocautery during the procedure).

Results and Conclusions: It was found that tumescent technique may provide a safe alternative method to electrocautery technique causing easier dissection of tissues without direct thermal injury. It significantly decreases the operative time and the time needed for raising the skin flaps. In addition, it significantly decreases the amount of intra-operative bleeding and the amount of seroma in the drain post-operative leading to early removal of the drain.

Key words: *Tumescent technique modified radical mastectomy breast cancer*

Introduction

Breast cancer is the most common cancer among women, accounting for approximately 26% of all cancers among women. Each year, 40,000 women die of breast cancer, making it the second-leading cause of cancer deaths after lung cancer [1].

Surgery is the main line of treatment of breast cancer either breast conserving surgery (BCS) or mastectomy. There are some contraindications to breast conservation for which mastectomy is the main line of treatment. According to the National Comprehensive Cancer Network (NCCN) guidelines, contraindications of breast conservation include: [2,3] prior radiation therapy to the breast or chest wall, radiation therapy contraindicated as in pregnancy (except patients in the third trimester who can receive radiation postpartum), inflammatory breast cancer, diffuse suspicious or malignant-appearing microcalcifications, widespread disease that is multicentric, located in more than one quadrant, and cannot be removed through a single inci-

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sion with negative margins, positive pathologic margin after repeat re-excision and suboptimal cosmetic outcome.

Common complications after modified radical mastectomy include seroma which represent the most frequent complication of mastectomy, developing in approximately 30% of cases [4], wound infection, hemorrhage which can be classified into primary complications, which is bleeding that occurs during the operation, reactionary which is bleeding that occurs within the first 24 hours after the operation, and secondary which is bleeding that occurs 7-10 days post-operative [5]. Other complications include flap necrosis, lymphedema, injury to the thoracodorsal nerve that innervates the latissimus dorsi muscle or injury or transaction of the long thoracic nerve of Bell ,which supplies the serratus anterior muscle , produces instability and unsightly prominence of the scapula (winging of the scapula) [6]. Current surgical technique of mastectomy often employs the use of electrocautery dissection. Electrocautery is the passage of high-frequency alternating current through the body to produce a localized heating effect. Electrocautery uses direct thermal energy that can diffuse into deeper tissues [7].

Tumescent technique is administered by a delivering a large volume of dilute anesthetic solution to the subcutaneous adipose tissue until the tissue is firm and swollen or truly "tumescent". It is performed by injection of local anesthetic and crystalloid mixed with epinephrine into the subcutaneous tissue to aid in establishing a bloodless plane for dissection [8,9].

Tumescent technique was initially developed in 1987 by doctor Jeffery Klein in an attempt to perform liposuction procedures with the use of local anesthesia [10].

The delivery of epinephrine to the tissue results in profound vasoconstriction of capillaries and substantially decreases the potential for blood loss during the procedure and also reduces the bruising postoperative [11].

The aim of our study was to compare between the effect of tumescent technique and conventional electrocautery technique in patients undergoing modified radical mastectomy (MRM).

Patient and Methods

The study was conducted on 60 female patients with breast cancer admitted to the Surgical Oncology Unit, Alexandria Main University Hospital and were indicated to modified radical mastectomy(MRM) during a period from April 2014 till October 2015. After consent, all patients were randomized to do MRM using the tumescent technique or the classical electrocautery technique.

All patients were subjected to history taking, clinical examination, and investigations including bilateral mammosonography and metastatic work up in the form of US abdomen, CT chest and bone scan if needed, in addition to biopsy; either fine needle aspiration cytology (FNAC) , core needle biopsy .

Patients were randomized to either group A or group B.

Group A (Patients underwent mastectomy using tumescence technique).

Our tumescent technique utilized a solution made by combining 30–50 ml of 1% lidocaine with 3-5 ml of 1 mg/ml epinephrine, mixed with 300–500 cm of normal saline or lactated Ringer solution, the amount injected was modified according to the size of the breast.

This solution was injected into the subcutaneous tissue of the planned mastectomy flaps with a 20-gauge long spinal needle. MRM was performed using sharp dissection by scissors and/or a scalpel.

Group B Patients underwent mastectomy using conventional electrocautery method.

We compared between the two groups as regard to total operative time and time of skin flap raising, amount of intra operative bleeding (weight of post-operative soaked towels to pre-operative dry ones), total amount of fluid that emerged via the drain, duration till removal of the drain, and post-operative complications such as wound dehiscence and infection, seroma formation, hematoma, flap necrosis and bleeding.

Results

The mean age of the studied patients was 51.6 years old ; ranging from 24 years old to 85 years old, the majority of patients were between 40 to 60 years of age (66.7%).

The mean body mass index was 31.21kg/m^2, ranging from 24 kg/m^2 to 38.5 kg/m^2, the majority of cases had body mass index between 30 and 35 kg/m^2 (48.3%).

As regards to the breast size, bra cup size was used to assess the size of the breast. Most of the studied pa-

tients had breast cup sizes B and C.

The amount of solution injected in the tumescent group was depending generally on the size of the breast and it ranged from 100 to 400 cc according to the breast size.

As regards to the operative time there was a significant reduction in the operative time in the tumescent group in comparison to the electrocautery group. (Table 1)

We included the size of the breast in our comparison as it is an important factor which may affect the mean time of operation, to compare between the two studied groups within the same size of the breast, and we found that there was a significant reduction in the operative time in the tumescent group in comparison to the control group for patients with breast cup sizes B and C which represent most of the studied cases. (Table 2)

There was also a significant reduction in the time of skin flap raising in the tumescent group in comparison to the control group.

As regards to the amount of intra-operative bleeding, we found there was a significant reduction in the amount of intra-operative bleeding in the tumescent group in comparison to the control group. (Table 3)

Table 1. Comparison between the two studied groups according to operative time.

Operative time	Tumescent (n=30)		Control (n=30)		χ2	P
	No.	%	No.	%		
<90	16	53.3	2	6.7	18.978*	<0.001*
90 – 120	12	40	16	53.3		
>120	2	6.7	12	40		

χ2: Chi square test, *: Statistically significant at p ≤ 0.05

Table 2. Comparison between the 2 studied groups according the operative time for each cup size.

Breast size	Operative time	Tumescent (n=30)		Control (n=30)		χ2	P
		No.	%	No.	%		
Cup A (n=4)	<90	1	50.0	0	0.0	1.333	MCp=1.000
	90 – 120	1	50.0	2	0.0		
	>120	0	0.0	0	100		
Cup B (n=17)	<90	7	70.0	1	14.3	5.756*	MCp=0.037*
	90 – 120	3	30.0	4	57.1		
	>120	0	0.0	2	28.6		
Cup C (n=28)	<90	6	46.2	1	6.7	8.047*	MCp=0.022*
	90 – 120	6	46.2	7	46.7		
	>120	1	7.7	7	46.7		
Cup D (n=11)	<90	2	40.0	0	0.0	3.135	MCp=0.433
	90 – 120	2	40.0	3	50.0		
	>120	1	20.0	3	50.0		

χ2: Chi square test, *: Statistically significant at p ≤ 0.05

Table 3. Comparison between the two studied groups according to intra operative bleeding.

Intra operative bleeding	Tumescent (n=30)		Control (n=30)		χ2	P
	No.	%	No.	%		
<200	23	76.7	6	20.0	19.438*	<0.001*
200 – 300	4	13.3	16	53.3		
>300	3	10.0	8	26.7		

χ2: Chi square test, *: Statistically significant at p ≤ 0.05

Also, we included the size of the breast in our comparison as it is an important factor which would affect the amount of intra-operative bleeding, and we found that there was a significant reduction in the amount of intra-operative bleeding in the tumescent group in comparison to the electrocautery group for patients with cup sizes B and C which represent most of the studied cases. (Table 4)

As regards to the average amount of fluid that emerges via the drain per day, we found that there was a significant reduction in the amount of fluid that emerges via the drain per day in the tumescent group in comparison to the control group (Table5). This significantly affected the duration required till drain removal,which was significantly shorter in the tumescent group. (Table 6)

Regarding the complications, the overall complication rate was 25%; 7 patients (23.3%) experienced a complication in the tumescence group and 8 patients (26.67%) in the electrocautery group. The complications were in the form of seroma (most frequent complication), wound dehiscence, infection, hematoma, flap necrosis, and bleeding. There were no significant differences in the rate of these individual complications

Table 4. Comparison between the 2 studied groups according to the amount of intra-operative bleeding for each cup size.

Breast size	Intra operative bleeding	Tumescent (n=30)		Control (n=30)		χ2	MCp
		No.	%	No.	%		
Cup A (n=4)	<200	2	100	0	0.0	4.000	0.333
	200-300	0	0.0	2	100		
	>300	0	0.0	0	0.0		
Cup B (n=17)	<200	9	90.0	2	28.5	6.503*	0.017*
	200-300	1	10.0	4	57.0		
	>300	0	0.0	1	14.5		
Cup C (n=28)	<200	9	69.2	1	6.7	11.761*	0.002*
	200-300	3	23.1	9	60.0		
	>300	1	7.7	5	38.5		
Cup D (n=11)	<200	3	60.0	3	50.0	1.029	1.000
	200-300	0	0.0	1	16.4		
	>300	2	40.0	2	33.3		

χ2: Chi square test, *: Statistically significant at p ≤ 0.05

Table 5. Comparison between the 2 studied groups according the average amount of fluid that emerges via the drain per day.

Average amount per day	Tumescent (n=30)		Control (n=30)		χ2	MCp
	No.	%	No.	%		
<100	6	20.0	2	6.7	6.742*	0.033*
100 – 200	13	43.3	7	23.3		
>200	11	36.7	21	70.0		

χ2: Chi square test, *: Statistically significant at p ≤ 0.05

Table 6. Comparison between the two studied groups according to duration till removal of the drain.

Duration	Tumescent (n=30)		Control (n=30)		χ2	MCp
	No.	%	No.	%		
<7	5	16.7	0	0.0	23.204*	<0.001*
7 – 10	16	53.3	3	10.0		
>10	9	30.0	27	90.0		

χ2: Chi square test, *: Statistically significant at p ≤ 0.05

Table 7. Comparison between the two studied groups according to the complications.

Complications	Tumescent (n=30)		Control (n=30)		χ2	P
	No.	%	No.	%		
Seroma	2	6.67	5	16.67	1.456	FEp=0.424
Wound dehiscence and infection	1	3.3	1	3.3	0.0	FEp=1.000
Hematoma	0	0.0	1	3.3	1.017	FEp=1.000
Flap necrosis	0	0.0	1	3.3	1.017	FEp=1.000
Intra-operative bleeding	2	6.67	0	0.0	4.286	FEp=0.112
Post-operative (reactionary) bleeding	2	6.67	0	0.0	4.286	FEp=0.112
Total	7	23.3	8	26.67	0.089	1.000

χ2: Chi square test, *: Statistically significant at p ≤ 0.05

between the two groups. (Table 7)

Four cases in the tumescent group out of 30 experienced rebound bleeding (13.3% of the tumescent group); two of them had rebound bleeding intra-operative, of which one of them continued also post-operative after control of the intra-operative bleeding, and two cases had rebound bleeding only post-operative manifested by large amount of blood in the drain (more than 500 cc blood) on the same day of operation. All cases of rebound bleeding were treated conservatively, and none of them required operative intervention.

Discussion

In our study, we included the size of the breast in our comparison as it is an important factor which may affect the mean time of operation, the time of raising of skin flaps, and amount of intra-operative bleeding to compare between the two studied groups within the same size of the breast.

We found that there was a significant reduction in the operative time in the tumescent group in comparison to the electrocautery (control) group with a significant shorter time in skin flap raising. Kurtz and Frost found in a study comparing 86 patients who underwent mastectomy via tumescent technique to 110 patients who had dissection with electrocautery that there was a statistically significant difference in reduction of the operation times in the tumescent group (93.5 vs. 111.0 min, P\0.008) [11]. Shoher et al. proved in a study of 53 patients that tumescent technique was faster [12]. While Rousseau et al. reported that electrocautery dissection remains superior in terms of the rapidity when surgery can be performed during dissecting large areas [13].

In the assessment of the amount of intra-operative bleeding, we found that that there was a significant reduction in the amount of intra-operative bleeding in the tumescent group in comparison to the control group. Four cases in the tumescent group out of 30 experienced rebound bleeding. Maxwell et al. reported that infiltration causes significant vasoconstriction of the perforating branches of the internal mammary artery and vein (most notably the second to the fifth perforator) [14]. Folwaczny et al. documented in a study that higher concentration of epinephrine has a favorable effect on the prevention of bleeding [15]. Black et al. reported that because tumescent vasoconstriction is only temporary, there may be a subsequent increase in postoperative bleeding following tumescent mastectomy [16].

As regards to the average amount of fluid emerging via the drain ,we found that the average was about 200 cc because the amount was more on the first 3 or 4 post-operative day then they decrease gradually , till reaching negligible amount before removal and by comparing both groups; there was a significant reduction in the average amount of fluid that emerged via the drain per 24 hours in the tumescent group in comparison to the control group, this significantly affected the duration required till drain removal which was shorter in the tumescent group.

Kuroi et al. [17] documented that there is increase in the incidence of postoperative seroma with the use of electrocautery because of increased thermal injury. This was also proved by Abbott et al. and Porter et al. [18,19] who reported that the use of electrocautery for dissecting flaps is significantly associated with in-

creased seroma formation when compared to that of scalpel dissection, while Seth et al reported that the use of tumescent solution also had no effect on the rate of postoperative hematoma and seroma when compared with electrocautery [20].

In our study, the overall complication rate was 25%; the most common complications were seroma, wound dehiscence, infections, hematoma, flap necrosis, and bleeding. Overall, there were no significant differences in the rate of complications between the two groups. Miller et al. stated that electrocautery has been found to increase the seroma and other wound complications such as cellulitis, infection, and necrosis in comparison to scalpel dissection [21]. In a study made by Abbott et al, 134 patients underwent mastectomy; it was documented that the overall complication rate was 21.6%. Overall there was no significant difference in the rate of complications between the two groups. He also stated that electrocautery has been demonstrated to result in significant tissue damage and elevated temperatures in surrounding tissues which may result in increase the risk wound dehiscence, infection, flap necrosis or burning of the skin [16]. Seth et al. reported in a retrospective review of 897 patients who underwent mastectomy by tumescent or electrocautery technique that patients that underwent tumescent technique had a higher rate of overall complications including major flap necrosis. There was no significant difference in hematoma, infection, and seroma rates between tumescent and non-tumescent groups [14]. Chun et al. reported in a retrospective review of 380 patients who underwent mastectomy with either electrocautery or tumescent technique, an increased risk of flap necrosis in patients who had tumescent technique. This is most likely through the vasoconstrictive effects of its epinephrine component which may potentially create vascular compromise [22].

Conclusion

Tumescent technique may provide a safe alternative method to electrocautery technique causing easier dissection of tissues without direct thermal injury. It significantly decreases the operative time and the time needed for raising of the skin flaps, also it significantly decreased the amount of intra-operative bleeding and the amount of seroma in the drain post-operative leading to early removal of the drain.

Conflict of interest statement

The authors have no conflicts of interest to declare.

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