Predictors of Donor Site Seroma in Latissimus Dorsi Flap

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Background: *Donor site seroma occurring after latissimus dorsi (LD) reconstruction of the breast is a common complication. The aim of the present study was to identify predictors of donor site seroma requiring aspiration in breast cancer patients undergoing mastectomy with breast reconstruction using either ELD flap, or LD flap with prosthesis, and to compare the frequency of donor site seroma between the two operations.*

Objective: *To identify predictors of donor site seroma in breast cancer patients undergoing mastectomy with breast reconstruction using either ELD flap, or LD flap with prosthesis, and to compare the frequency of donor site seroma between the two operations.*

Material and Method: *Medical records of breast cancer patients treated between January 2013 and September 2015 were reviewed. Univariable and backward stepwise multivariable logistic regression analyses were used to identify predictors of donor site seroma.*

Results: *Fifty-nine breasts in 58 cancer patients underwent breast reconstruction using the LD flap. Forty-five patients (76%) had donor site seroma. There was no significant difference in the frequency of donor site seroma between two operations. Multivariable analysis showed that total donor site drainage volume greater than 340 mL on postoperative days 1 to 3 (OR = 19.2, 95% CI: 1.8 to 204.5), and duration of donor site drain retention of at most 17 days (OR = 12.5, 95% CI: 1.4 to 100) were significant predictor of seroma. Of the 45 patients who had seroma, those with concurrent chemotherapy, whose operative time was more than 250 minutes, and undergoing nipple sparing mastectomy had significantly longer duration of donor site seroma.*

Conclusion: *Significant predictors of donor site seroma included total donor site drainage greater than 340 mL on postoperative days 1 to 3, and duration of donor site drain retention of 17 days or less. There was no significant difference in the frequency of donor site seroma between ELD and LD with prosthesis procedures. To avoid donor site seroma, donor site drain retention of more than 17 days, especially in patients who have total donor site drainage volume greater than 340 mL on days 1 to 3, is recommended.*

Keywords: *Extended latissimus dorsi flap, Latissimus dorsi flap with prosthesis, Flap complication, Breast reconstruction, Donor site seroma*

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The latissimus dorsi (LD) myocutaneous flap is commonly used for breast reconstruction in breast cancer patients undergoing mastectomy. LD flaps can be used for partial breast reconstruction after breast conserving surgery[1], and extended LD flap (ELD), or LD flap with prosthesis, can be used for total breast reconstruction. One study[2] found 28% flap complications and 39% donor site complications among 67 patients with ELD flaps. Donor site seroma is the most common donor site complication, requiring regular seroma aspirations[2-8]. With the advent of less extensively dissected LD flap combined with prosthesis for total breast reconstruction, donor site complications in general and seroma formation might be less likely to occur. However, according to one study in 52 patients[9], LD flap with prosthesis for total breast reconstruction had a similar frequency of donor site seroma, at 20.4%.

Another study[10] reported that the frequency of donor site seroma after breast reconstruction using the ELD flap was much higher, at 69.2%, and identified several risk factors associated with donor site seroma formation, which included higher BMI, larger size of flap, and older age. However, there has been no study

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in which ELD flap and LD flap with prosthesis for breast reconstruction have been directly compared in terms of donor site seroma formation. In addition, risk factors or predictors of donor site seroma formation have never been clearly established. Therefore, the aims of the present study were to identify the predictors of donor site seroma formation and to compare the frequencies of donor site seroma between breast cancer patients undergoing ELD flap and those undergoing LD flap with prosthesis breast reconstructions.

Material and Method

The present study reviewed medical charts of all breast cancer patients who underwent total breast reconstruction using either ELD flap or LD flap with prosthesis between January 2013 and September 2015. Basic data collected included age, weight, height, body mass index (BMI), body surface area (BSA), menopausal status, comorbidities (diabetes mellitus, hypertension, dyslipidemia, and thyroid disease), and smoking history. Breast cancer data collected included the patients' diagnosis, pathology results, immunohistochemistry results, cancer stage, and breast cancer treatment. Surgery-related data consisting of date of operation, breast operative and reconstructive techniques, operative times, and surgeon performing the operation were also collected. Finally, complications of surgery including the primary outcome donor site seroma formation, wound infection, capsular contracture, wound hematoma, flap loss, fat necrosis, delayed wound healing, and wound dehiscence were collected.

All breast reconstructions were performed by four surgeons. In general, the operation proceeded as follows. Preoperative drawings of the planned reconstructive procedure are made (Fig. 1A, 2A). Patients are placed in the supine position. Either skin sparing mastectomy (SSM) or nipple sparing mastectomy (NSM) is performed. Then, the patient is placed in the lateral decubitus position, with the upper arm in 90° abduction. The anterior border of the LD muscle is palpated through the skin and marked. The anterior tip of the flap is placed in front of the LD border at the level of the brassiere line, which is about 10 cm below the axillary crease. The flap is outlined as an ellipse over the LD muscle. Its width will depend on the recipient-site skin requirements.

The initial incision is made at the superior border of the flap to identify the LD muscle and the descending branch of the thoracodorsal artery. For the LD flap, subcutaneous tissue dissection includes the parascapular, scapular and some part of lumbar fat, while

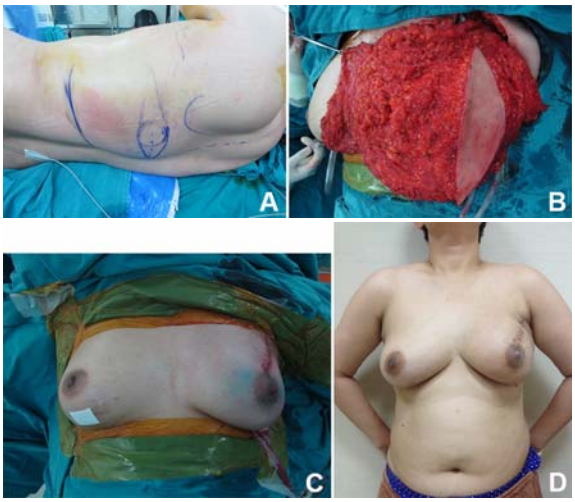

Fig. 1 A 45-year-old woman with left breast cancer. A) Preoperative planning photographs, showing the design of the skin paddle. B) The extended latissimus dorsi (LD) flap is placed on the chest wall, after left nipple sparing mastectomy (NSM). C) Immediate postoperative result after left NSM and extended LD flap, anterior view. D) Results at 3 months after left NSM and extended LD flap, anterior view.

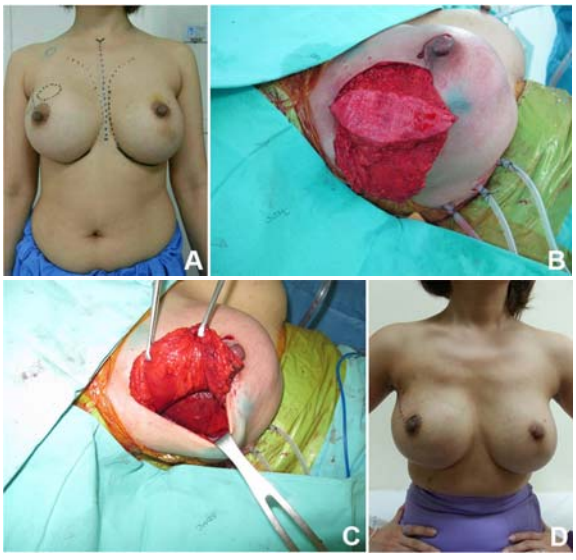

Fig. 2 A 34-year-old woman with bilateral breast augmentation and right breast cancer. A) Preoperative planning photographs, showing the planned skin incisions and the area of tumor. B) The latissimus dorsi (LD) flap after harvested. C) The LD flap is placed above sub-pectoral prosthesis. D) Results at 1 month after right NSM with LD flap.

for the ELD flap group all of the lumbar fat is included. The deep dissection for both the ELD and LD flaps begins near the midline of the back along the suprafascial layer of the LD muscle (Fig. 1B). For the ELD flap, all of the LD muscle is harvested, while for the LD flap only a part of the muscle is harvested, just sufficient for covering the prosthesis and chest wall defect (Fig. 2B).

The thoracodorsal vessels, nerve, and the tendinous insertion of the LD muscle are preserved. All flaps are transferred to the breast pocket (recipient site) through a subcutaneous tunnel. The pivot point of the flaps is at the main pedicle level. The donor site is closed primarily. If the prosthesis is used, it is soaked in betadine solution before being placed either above or underneath the pectoralis major muscle, depending on the surgeon's preference, and then covered with the LD flap (Fig. 2C).

For both the ELD flap and LD flap with prosthesis, the lateral pocket is closed to prevent the flap and the implant from becoming displaced laterally. Two suction drains are placed, one under the flap at the breast or recipient site, and the other at the back or donor site. If an axillary dissection is performed, a suction drain is similarly placed at the axillary site.

All patients receive preoperative and postoperative prophylactic intravenous antibiotics. Patients are hospitalized for two or three days, and subsequently followed weekly at the outpatients department for the first month, and every month or two thereafter. Drains are removed when the volume of the drainage fluid is less than 30 mL per day, for at least 3 days. The definition of donor site seroma is a fluid collection at donor site after removal drainage tube. Examples of post-operative appearance of the reconstructions are presented in Fig. 1D, 2D, 3 and 4.

Quantitative data were summarized using the average (mean) and standard deviation (SD), or median and interquartile range (IQR), as appropriate. Qualitative data were summarized using counts and frequency or percentage. Interval estimates (95% confidence interval, 95% CI) for frequency or percentage were calculated using exact binomial estimation. T-test (or ANOVA, if more than two groups), or Wilcoxon rank-sum test (or Kruskal-Wallis test, if more than two groups), was used to compare means, or medians, between groups, as appropriate. Chi-square test, or Fisher's exact test as appropriate, was used to compare frequencies between groups.

Logistic regression analysis was used to identify risk factors related to donor site seroma formation. Quantitative data was divided into two categories using cut-off values determined by the Yuden Index, or the mean and median, as appropriate. Risk factors with *p*-value smaller than 0.10 from a univariable analysis were entered in a multivariable logistic regression model, with backward stepwise selection, to identify the final best set of independent risk factors.

All analyses were performed using the Stata Statistical Software, version 13.1 (Stata Corp, College Station, TX, USA). Two-tailed *p*-values of less than 0.05 were considered statistically significant, unless otherwise specified.

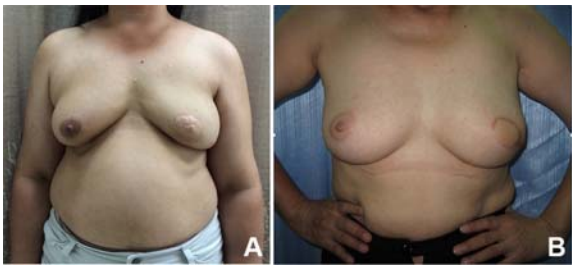

Fig. 3 Postoperative results after extended LD flap in two patient. A) Results at 2 years after left skin sparing mastectomy (SSM) with ELD flap with nipple reconstruction, anterior view. B) Results at 2 years after left SSM with ELD flap, anterior view.

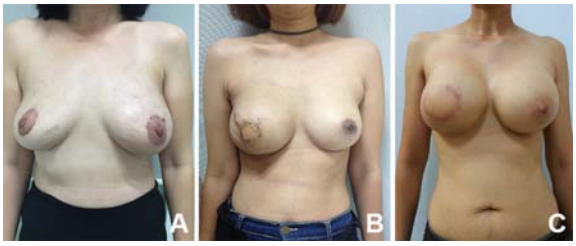

Fig. 4 Postoperative results after LD flap with prosthesis in three patients. A) Results at 1 month after right NSM and LD flap with prosthesis, anterior view. B) Results at 3 months after right SSM and LD flap with prosthesis, anterior view. C) Results at 6 months after right SSM and LD flap with prosthesis, anterior view.

Results

Fifty-nine breasts in 58 patients were included in the study. Of these, 31 breasts (53%) underwent breast reconstruction with ELD flap reconstruction, and 28 breasts (47%) underwent LD flap with prosthesis reconstruction. Almost all reconstructions were

Table 1. Baseline and operative characteristics, and wound complications

	Total n = 59	ELD flap n = 31	LD flap+prosthesis n = 28	*p*-value
Patient characteristics				
Age (years): mean (SD)	44.1 (7.8)	44.2 (8.6)	44.0 (7.1)	0.927[d]
BMI (kg/m^2): median (IQR)	21.6 (20.2, 23.7)	21.5 (20.3, 23.5)	22.2 (20.2, 24.2)	0.616[c]
BSA (m^2): median (IQR)	1.54 (1.46, 1.62)	1.53 (1.44, 1.63)	1.57 (1.49, 1.61)	1.574[c]
Comorbidities, n (%)	6 (10)	3 (10)	3 (11)	0.999[a]
Follow-up time (days): median (IQR)	368 (214, 566)	451 (197, 733)	292 (214, 467)	0.113[c]
Operative time (min): median (IQR)	285 (240, 360)	265 (185, 355)	292.5 (280, 360)	0.073[c]
Operating surgeons: n (%)				
Surgeon I	13 (22)	8 (26)	5 (18)	0.072[a]
Surgeon II	25 (42)	9 (29)	16 (57)	
Surgeon III	13 (22)	7 (23)	6 (21)	
Surgeon IV	8 (14)	7 (23)	1 (4)	
Diagnosis: n (%)				
Breast cancer	51 (86)	26 (84)	25 (89)	0.709[a]
DCIS	8 (14)	5 (16)	3 (11)	
Breast & axilla operation				
Type of mastectomy: n (%)				
SSM	33 (56)	19 (61)	14 (50)	0.383[b]
NSM	26 (44)	12 (39)	14 (50)	
Axillary LN surgery: n (%)				
SLNBx	38 (64)	19 (61)	19 (68)	0.495[a]
ALND	20 (34)	12 (39)	8 (29)	
None	1 (2)	0 (0)	1 (3)	
Number of LNs: median (IQR)	8 (3, 17)	12 (4, 17) (n = 31)	5 (3, 13) (n = 27)	0.229[c]
Therapy				
Neoadjuvant chemotherapy: n (%)	1 (2)	1 (3)	0 (0)	0.999[a]
Post-reconstruction chemotherapy, n (%)	41 (69)	21 (68)	20 (71)	0.759[b]
Post-reconstruction radiation, n (%)	9 (15)	7 (23)	2 (7)	0.150[a]
Pathology				
Pathological staging, n (%)				
Stage 0	8 (14)	5 (17)	3 (11)	0.700[a]
Stage I	19 (32)	10 (32)	9 (32)	
Stage II	22 (37)	10 (32)	12 (43)	
Stage III	9 (15)	6 (19)	3 (11)	
Stage IV	1 (2)	0 (0)	1 (3)	
Drain				
Duration of drain retention (days)				
Breast drain: mean (SD)	12.2 (4.4)	12.7 (4.8)	11.7 (4.1)	0.408[d]
Axilla drain: median (IQR)	10 (10,15)	15 (10, 24) (n = 5)	10 (8, 11) (n = 6)	0.111[c]
Donor site drain: mean (SD)	18.6 (6.5)	20.5 (6.9)	16.4 (5.3)	0.014[d]
Volume of breast drainage (mL)				
Day 1: median (IQR)	75 (50, 92)	60 (35, 90)	79.5 (60, 101)	0.076[c]
Day 2: median (IQR)	77 (50, 105)	70 (40, 110)	83 (57.5, 100)	0.370[c]
Day 3: median (IQR)	53 (32.5, 75)	45 (29, 65)	62.6 (42.5, 80)	0.056[c]
Days 1 to 3: median (IQR)	208.5 (152.5, 266)	173.5 (136, 240)	234 (168.5, 280)	0.080[c]
Volume of donor site drainage (mL)				
Day 1: mean (SD)	202.1 (95.3)	236.5 (92.9)	164.0 (84.0)	0.003[d]
Day 2: median (IQR)	205 (130, 295)	255 (165, 315)	154.5 (115, 222)	0.009[c]
Day 3: median (IQR)	155 (120, 194)	165 (144.5, 235)	132.5 (102.5, 176.5)	0.008[c]
Days 1 to 3: median (IQR)	500.5 (408, 716.5)	603.5 (467.5, 837.5)	432.5 (349, 571.5)	0.002[c]
All complications: n (%)	49 (83)	24 (77)	25 (89)	0.306[a]
Donor site seroma: n (%)	45 (76)	21 (68)	24 (86)	0.105[b]
Time till seroma formation (days[e]): Median (IQR)	24 (21, 31)	30 (24, 32) (n = 21)	22 (18.5, 30) (n = 24)	0.011[c]
Duration of seroma (days[e]): median (IQR)	15 (1, 27)	15 (1, 22) (n = 21)	21.5 (4.5, 35) (n = 24)	0.262[c]

[a] = Fisher's exact test, [b] = Chi-square test, [c] = Wilcoxon rank-sum test, [d] = t-test, [e] = Patient with donor site seroma only
BMI = Body mass index; BSA = Body surface area; DCIS = Ductal carcinoma in situ; SSM = skin sparing mastectomy; NSM = nipple sparing mastectomy; LN = lymph node; SLNBx = sentinel LN biopsy; ALND = axillary LN dissection; ELD flap = extended latissimus dorsi flap; LD flap + prosthesis = latissimus dorsi flap with prosthesis.
No smoker and no recurrent breast cancer patients

immediately performed after total mastectomy (98%). Four surgeons performed all the operations during the study period. There were no significant differences in patients' baseline and operative characteristics, and breast cancer staging, between those who underwent ELD flap and those who underwent LD flap with prosthesis breast reconstructions (Table 1). Patients were followed for a median duration of approximately one year.

The average (SD) durations of donor site drain retention in the ELD flap group and the LD flap with prosthesis group were 20.5 (6.9) days and 16.4 (5.3) days, respectively ($p = 0.014$). The median (IQR) total volumes of donor site drainage on days 1 to 3 after operation, in the ELD flap group and the LD flap with prosthesis group, were 603.5 mL (467.5 to 837.5 mL) and 432.5 mL (349 to 571.5 mL), respectively ($p = 0.002$). The overall frequency of complication, including donor site seroma, surgical site infection, flap loss, hematoma, fat necrosis, donor site necrosis, and wound dehiscence, were 77% in the ELD flap group and 89% in the LD flap with prosthesis group, which were not significantly different (Table 1).

By far the most common complication was donor site seroma formation, occurring in approximately three out of four patients (76%). The frequencies were 68% and 86% in the ELD and LD flap with prosthesis groups, respectively, but this difference was not statistically significant. However, the median time to occurrence of seroma formation was faster for the LD flap with prosthesis group, at 22 days, versus 30 days for the ELD flap group ($p = 0.011$).

Four patients (7%) had surgical site infection, occurring between one week and one month after reconstruction. Only three patients (5%) experienced fat necrosis, hematoma, donor site necrosis, or dehiscence. There was no flap loss rate and no capsular contracture in this series.

Univariable logistic regression analysis showed that type of breast reconstruction (ELD flap vs. LD flap with prosthesis), operating surgeon, age, body mass index (BMI), and prior breast cancer treatment did not significantly affect the occurrence of donor site seroma. However, longer operative time (longer than 250 minutes), larger volume of recipient (breast) drainage on day 3 (more than 55 mL), volume of donor site drainage on day 3 (more than 105 mL), and a total volume of donor site drainage on days 1 to 3 of more than 340 mL were significantly related to seroma formation, at the 5% level (Table 2).

A multivariable logistic regression analysis using backward stepwise selection, with five candidate risk factors with p-values smaller than 0.10 taken from the univariate analysis (Table 2), was performed. These risk factors included operative time, volume of recipient site drainage on day 3, volume of donor site drainage on day 3, total volume donor site drainage on days 1 to 3 of more than 340 mL, and duration of donor site drain retention (17 days or less versus more than 17 days). Only two risk factors were selected in the final model, i.e., total volume of donor site drainage on Days 1 to 3 of more than 340 mL, and duration of donor site drain retention of 17 days or less, with adjusted odds ratios OR = 19.2 (95% CI: 1.8 to 204.5) and OR = 12.5 (95% CI: 1.4 to 100), respectively.

The duration of donor site seroma, in addition to the occurrence of seroma, was another, secondary, outcome of the present study. The median duration donor site seroma, in 45 patients, was 15 days (IQR: 1 to 27 days). A univariable analysis of risk factors for longer duration of donor site seroma showed that NSM, concurrent chemotherapy, and longer operative time were significantly associated with longer duration of donor site seroma (Table 3).

Discussion

The present study found a high frequency of donor site seroma formation after either ELD flap or LD flap with prosthesis reconstructions of the breast after total mastectomy for breast cancer. The 76% rate was higher than those reported in previous studies (20 to 34.3%)[2,4,5,9,11] but was similar to that (69.2%) of a South Korean study[10]. However, there has been no previous study that compared ELD flap and LD flap with prosthesis in terms of seroma formation. A previous study[11] compared ELD flap with muscle sparing LD (MSLD) flap with prosthesis and found a significantly lower frequency of seroma formation in the MSLD group (5.6% versus 62.2%). The present study did not find significant differences between ELD flap and LD flap with prosthesis reconstructions in terms of both seroma formation and duration of seroma.

The frequency or incidence of seroma formation depends on the definition of seroma used. In the present study, seroma was defined as a collection of serous fluid at the area of surgical site requiring needle aspiration for treatment, which is context-specific. In our practice, the need for aspiration depends entirely on the operating surgeon and the patient, and if the threshold for aspiration is low, then the frequency of seroma will be high. Nonetheless, the absolute frequency of seroma formation should not affect the

Table 2. Univariate analysis of factors related to donor site seroma formation

	Donor site seroma, n (%)		OR (95% CI)[a]	*p*-value [a]
	No (n = 14)	Yes (n = 45)		
Patient characteristics				
Age (years): Mean (SD)	43.7 (8.7)	44.3 (7.7)	1.00 (0.93-1.09)	0.816
Age group (years)[c]: n (%)				
Age ≤45	9 (64%)	27 (60%)	Reference	0.773
Age >45	5 (36%)	18 (40%)	1.2 (0.34-4.17)	
BMI (kg/m^2)[b]: n (%)				
BMI ≤21	4 (29%)	20 (44%)	Reference	0.284
BMI >21	10 (71%)	25 (56%)	0.50 (0.14-1.83)	
BSA (m^2)[c]: n (%)				
BSA ≤1.55	7 (50%)	23 (51%)	Reference	0.942
BSA >1.55	7 (50%)	22 (49%)	0.96 (0.29-3.17)	
Operative time (minutes): mean (SD)	250 (77.6)	307.3 (75.6)	1.01 (1.00-1.02)	0.014
Operative time[b]: n (%)				
≤250 min	8 (57%)	9 (20%)	Reference	0.010
>250 min	6 (43%)	36 (80%)	5.33 (1.47-19.30)	
Primary surgeon: n (%)				
Surgeon I	4 (29 %)	9 (20%)	Reference	0.163
Surgeon II	3 (21 %)	22 (49%)	3.23 (0.60-17.59)	
Surgeon III	3 (21 %)	10 (22%)	1.48 (0.26-8.50)	
Surgeon IV	4 (29%)	4 (9%)	0.44 (0.07-2.74)	
Breast & axilla operation				
Type of mastectomy: n (%)				
SSM	10 (71%)	23 (51%)	Reference	0.174
NSM	4 (29%)	22 (49%)	2.39 (0.65-8.76)	
Axillary LN surgery[d]: n (%)				
SLNBx	7 (54%)	31 (69%)	Reference	0.322
ALND	6 (46%)	14 (21%)	0.53 (0.15-1.86)	
Number of LNs[c,d]: n (%)				
≤8 LN	6 (46%)	24 (53%)	Reference	0.6482
>8 LN	7 (54%)	21 (47%)	0.75 (0.22-2.59)	
Breast Reconstruction				
Type of reconstruction: n (%)				
ELD flap	10 (71%)	21 (47%)	Reference	
LD flap with prosthesis	4 (29%)	24 (53%)	2.85 (0.78-10.47)	0.100
Therapy				
Neoadjuvant chemotherapy: n (%)				
No	13 (93%)	45 (100%)	NA	0.237[f]
Yes	1 (7%)	0 (0%)	NA	
Postop chemotherapy: n (%)				
No	14 (100%)	37 (82%)	NA	0.179[f]
Yes	0 (0%)	8 (18%)	NA	
Pathological staging: n (%)				
Stage 0	2 (14%)	6 (13%)	Reference	0.422
Stages I-II	8 (57%)	33 (74%)	1.38 (0.23-8.13)	
Stages III-IV	4 (29%)	6 (13%)	0.50 (0.07-3.85)	

[a] = odds ratio (95% CI) and *p*-value from univariate logistic regression analysis, [b] = categorized using Yuden index, [c] = categorized using mean or median, [d] = one patient without axillary surgery was excluded from analysis, [e] = Wilcoxon rank-sum test, [f] = Fisher 's exact test

BMI = Body mass index; BSA = Body surface area; DCIS = Ductal carcinoma in situ; SSM = skin sparing mastectomy; NSM = nipple sparing mastectomy; LN = lymph node; SLNBx = sentinel LN biopsy; ALND = axillary LN dissection; ELD flap = extended latissimus dorsi flap; LD flap+prosthesis = latissimus dorsi flap with prosthesis

Table 2. Cont.

	Donor site seroma, n (%)		OR (95% CI)[a]	*p*-value [a]
	No (n = 14)	Yes (n = 45)		
Drain				
Volume of breast drainage (mL) [c]				
Day 1: mean (SD)	76.8 (46.1)	75.5 (36.9)	1.00 (0.98-1.01)	0.911
≤75	7 (50%)	23 (51%)	Reference	0.942
>75	7 (50%)	22 (49%)	0.96 (0.29-3.17)	
Day 2: median (IQR)	63 (43, 80)	80 (55, 105)	NA	0.240[e]
≤75	9 (64%)	20 (44%)	Reference	0.193
>75	5 (36%)	25 (56%)	2.25 (0.65-7.79)	
Day 3: median (IQR)	50 (35,51)	60 (35,75)	NA	0.332[e]
≤55	9 (82%)	20 (44%)	Reference	
>55	2 (18%)	25 (56%)	5.63 (1.09-29.03)	0.021
Days 1 to 3: median (IQR)	200 (140,227)	225 (115,275)	NA	0.483[e]
≤205	6 (55%)	20 (44%)	Reference	
>205	5 (45%)	25 (56%)	1.50 (0.40-5.64)	0.548
Volume of donor site drainage (mL)				
Day 1: mean (SD) [c]	212.4 (93.9)	198.9 (96.5)	1.00 (0.99-1.00)	0.641
≤200	7 (50%)	26 (58%)	Reference	0.610
>200	7 (50%)	19 (42%)	0.73 (0.22-2.43)	
Day 2: mean (SD) [c]	201.6 (96.7)	218.2 (101.6)	1.00 (1.00-1.01)	0.580
≤205	7 (50%)	24 (53%)	Reference	0.827
>205	7 (50%)	21 (47%)	0.88 (0.26-2.91)	
Day 3: median (IQR) [b]	130 (85,232)	155 (125,193)	NA	0.445[e]
≤105	5 (45%)	6 (13%)	Reference	0.026
>105	6 (55%)	39 (87%)	5.42 (1.25-23.45)	
Days 1 to 3: median (IQR) [b]	480 (330,715)	521 (425,718)	NA	0.353[e]
≤340	4 (36%)	4 (9%)	Reference	0.034
>340	7 (64%)	41 (91%)	5.86 (1.18-29.04)	
Duration of drain retention (days)				
Breast[c]: n (%)				
≤10	8 (57%)	24 (53%)	Reference	0.802
>10	6 (43%)	21 (47%)	1.17 (0.35-3.91)	
Axilla (n = 11)[c]: n (%)				
≤10	1 (50%)	5 (56%)	Reference	0.887
>10	1 (50%)	4 (44%)	0.80 (0.04-17.20)	
Donor site[b]: n (%)				
≤17	5 (36%)	28 (62%)	Reference	
>17	9 (64%)	17 (38%)	0.34 (0.10-1.18)	0.081

[a] = odds ratio (95% CI) and *p*-value from univariate logistic regression analysis, [b] = categorized using Yuden index, [c] = categorized using mean or median, [d] = one patient without axillary surgery was excluded from analysis, [e] = Wilcoxon rank-sum test, [f] = Fisher 's exact test

BMI = Body mass index; BSA = Body surface area; DCIS = Ductal carcinoma in situ; SSM = skin sparing mastectomy; NSM = nipple sparing mastectomy; LN = lymph node; SLNBx = sentinel LN biopsy; ALND = axillary LN dissection; ELD flap = extended latissimus dorsi flap; LD flap+prosthesis = latissimus dorsi flap with prosthesis

identification of risk factors for seroma, since only differences in frequencies are required to identify these risk factors.

Despite some surgeon that are against long duration of drain retention because they think that long duration of drain retention increases the rate of infection and cannot reduce the incidence of donor site seroma. However, the present study identified only two

Table 3. Univariate analysis of factors related to donor site seroma duration (n = 45)

	n = 45	Median duration, days (IQR)	*p*-value
Patient characteristics			
Age (years)[c]			
≤45	27	13 (1,25)	0.347[a]
>45	18	16 (6,40)	
BMI, (kg/m^2)[b]			
≤21	20	14 (1,22.5)	0.154[a]
>21	25	16 (1,40)	
Operative time (minutes)[b]			
≤250	9	1 (1,15)	0.037[a]
>250	36	18.5 (4.5,37)	
Primary surgeon			
Surgeon I	9	6 (1,22)	0.566[c]
Surgeon II	22	18.5 (1,34)	
Surgeon III	10	14 (8,56)	
Surgeon IV	4	9 (1,21)	
Breast & axilla operation			
Type of mastectomy			
SSM	23	6 (1,23)	0.024[a]
NSM	22	22 (13,40)	
Axilla LN surgery			
SLNBx	31	15 (1,27)	0.627[a]
ALND	14	15.5 (1,34)	
Number of LNs[c]			
≤8	24	12.5 (1,24.5)	0.248[a]
>8	21	16 (8,34)	
Breast reconstruction			
Type of reconstruction			
ELD flap	21	15 (1,22)	0.262[a]
LD flap with prosthesis	24	21.5 (4.5,35)	
Chemotherapy[d]			
Concurrent chemotherapy (during donor site seroma event)	20	22.5 (15,41.5)	0.001[a]
No chemotherapy	12	1 (1,12.5)	
Pathology			
Pathological staging			
Stages 0-II	39	15 (1,27)	0.498[a]
Stages III-IV	6	7 (1,34)	

[a] = Wilcoxon rank-sum test, [b] = categorized using Yuden index, [c] = categorized using mean or median, [d] = patient without chemotherapy treatment were excluded from the analysis, [e] = Kruskal-Wallis test
BMI = Body mass index; SSM = skin sparing mastectomy; NSM = nipple sparing mastectomy; LN = lymph node; SLNBx = sentinel LN biopsy; ALND = axillary LN dissection; ELD flap = extended latissimus dorsi flap; LD flap+prosthesis = latissimus dorsi flap with prosthesis

independent risk factors for seroma formation, i.e., total volume of donor site drainage on days 1 to 3 (greater than 340 mL versus 340 mL or less), and the duration of donor site drain retention (17 days or less versus more than 17 days). This would suggest that retaining the donor site drain for longer than two to three weeks in patients with total volume of donor site drainage on days 1 to 3 greater than 300 to 400 mL might reduce the incidence of seroma formation. It might be interesting to investigate the pathophysiology of drainage fluid

Table 3. Cont.

	n = 45	Median duration, days (IQR)	*p*-value
Drain			
Volume of breast drainage (mL)[c]			
Day 1			
≤75	23	17 (1,25)	0.511[a]
>75	22	11 (1,34)	
Day 2			
≤75	20	14 (1,26)	0.693[a]
>75	25	15 (1,30)	
Day 3			
≤55	20	18 (1,30.5)	0.602[a]
>55	25	13 (1,24)	
Days 1 to 3			
≤205	20	14 (1,24)	0.516[a]
>205	25	15 (1,34)	
Volume of donor site drainage (mL)			
Day 1[c]			
≤200	26	14 (1,24)	0.632[a]
>200	19	17 (1,34)	
Day 2[c]			
≤205	24	12.5 (1,23)	0.258[a]
>205	21	17 (6,40)	
Day 3[b]			
≤105	6	5.5 (1,80)	0.697[a]
>105	39	15 (1,27)	
Days 1 to 3[b]			
≤340	4	11 (1,50.5)	0.777[a]
>340	41	15 (1,27)	
Duration of drain retention (days)			
Breast[c]			
≤10	24	19 (9,28.5)	0.139[a]
>10	21	11 (1,24)	
Donor site[b]			
≤17	29	15 (1,30)	0.810[a]
>17	16	16 (1,24.5)	

[a] = Wilcoxon rank-sum test, [b] = categorized using Yuden index, [c] = categorized using mean or median, [d] = patient without chemotherapy treatment were excluded from the analysis, [e] = Kruskal-Wallis test
BMI = Body mass index; SSM = skin sparing mastectomy; NSM = nipple sparing mastectomy; LN = lymph node; SLNBx = sentinel LN biopsy; ALND = axillary LN dissection; ELD flap = extended latissimus dorsi flap; LD flap+prosthesis = latissimus dorsi flap with prosthesis

formation at the donor site after flap surgery, in terms of acute inflammatory exudate and fibrinolytic activity in response to surgical trauma[12,13], which could shed some light on how to prevent these complications in a more specific and rational way.

Risk factors for seroma formation in the published literature included, for example, high BMI (greater than 23 kg/m^2), larger flaps (greater than 450 g), and older age (older than 45 years), in a study of 120 ELD flaps[10]. Another study[4], on 174 consecutive cases of ELD flaps, also found high BMI (greater than 23 kg/mg^2) and older age (older than 50 years) to be significant risk factors, but type of breast surgery was significant as well. One study[2] found high BMI (30 kg/m^2 or more) and radiation therapy to be significant risk factors for increased overall donor site

complications, but did not separate the types of donor site complication. The present study was similar to that of Kim H et al[11], which did not find higher BMI, older age, or radiation therapy to be significant factors related to donor site seroma formation. Unfortunately, in the present study, the information on the harvested flap size was not available in the medical records, so a confirmation or refutation of flap size as a risk factor could not be made.

Although univariable analysis in the present study found longer operative time (more than 250 minutes) to be a significant risk factor for donor site seroma formation, this was not significant in the multivariable analysis due to collinearity with drainage volume and duration of drain retention. Longer operative times could result in increased blood and lymphatic vessels damage as well as inducing more acute inflammatory response, leading to increased volume of serum drainage[14,15].

The present study found that the donor site seroma formation occurred faster in the LD flap with prosthesis group, with a difference of about one week. However, since there was no difference in the frequency of donor site seroma, or the duration of seroma, between the two groups, the donor site seroma event might occur earlier in LD flap with prosthesis group because of the shorter duration of drain retention at the donor area.

One study[2] found chemotherapy to be a risk factor for flap complications. In the present study, concurrent chemotherapy (given during seroma formation) was not a risk factor for donor site seroma formation, but was instead a risk for longer seroma duration. This could be due to the effect of delay wound healing induced by chemotherapy[13,16]. Since this association in the present study was found, despite the small sample size and small number of events, further, more substantive, investigations to determine the risk factors for longer seroma duration could be interesting and useful[17,18].

The result of the present study seemed to suggest that to prevent the occurrence of donor site seroma, the donor site drain should be kept in place for at least two to three weeks, especially in patients with total volume of donor site drainage during days 1 to 3 of at least 300 to 400 mL, after breast reconstruction using the LD flap. Because of the small sample size, the present study could only provide wide interval estimates. In addition, some important predictive information could not be obtained from the medical records, such as the flap volume, flap weight, range of flap dissection, serum albumin level, and so on. A prospective study with a larger sample size should be conducted.

Conclusion

Significant risk factors for donor site seroma formation after breast reconstruction using LD_flaps were total volume of donor site drainage on days 1 to 3 of more than 340 mL, and the duration of donor site drain retention of 17 days or less. Thus, to prevent donor site seroma formation, a donor site drain should be retained for more than 17 days, especially in patients who have a total volume of donor site drainage on days 1 to 3 greater than 340 mL.

What is already known on this topic?

1) There was no previous study that compared extended latissimus dorsi (ELD) flap with prosthesis in terms of seroma formation. A previous study of Kim H, et al compared ELD flap with muscle sparing LD (MSLD) flap with prosthesis and found a significantly lower frequency of seroma formation in the MSLD group (5.6% vs. 62.2%).

2) Previous published study of Jeon BJ, et al found that risk factors for seroma formation was high BMI (greater than 23 kg/m^2), larger flaps (greater than 450 g), and older age (older than 45 years), in ELD flaps.

What this study adds?

This study did not find significant differences between ELD flap and LD flap with prosthesis reconstructions in terms of both seroma formation and duration of seroma.

However, this study identified two independent risk factors for seroma formation, total volume of donor site drainage on days 1 to 3 (greater than 340 mL versus 340 mL or less), and the duration of donor site drain retention (17 days or less versus greater than 17 days). This study found the risk factors for longer duration of donor site seroma.

The finding support that retaining the donor site drain for longer than two to three weeks in patients with total volume of donor site drainage on days 1 to 3 greater than 300 to 400 mL reduces the incidence of seroma formation.

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Potential conflicts of interest

None.

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การพยากรณ์การเกิดภาวะคั่งน้ำเหลืองที่แผลผ่าตัดด้านหลังในการผ่าตัดเสริมสร้างเต้านมใหม่ด้วยเนื้อเยื่อกล้ามเนื้อแลตทิสสิมุส ดอว์ไซ

ประกาศิต จิรัปปภา, ชญานุตม์ รัตตติลก, ภาณุวัฒน์ เลิศสิทธิชัย, มนตชัย ลีสมบัติไพบูลย์, ธงชัย ศุกรโยธิน, เยาวนุช คงด่าน, ปัญญา ทวีปวรเดช

ภูมิหลัง: *ภาวะคั่งของน้ำเหลือง (seroma) ที่แผลผ่าตัดในผู้ป่วยที่ทำการผ่าตัดเสริมสร้างเต้านมใหม่ด้วยเนื้อเยื่อ และกล้ามเนื้อแลตทิสสิมุส ดอว์ไซ (Latissimus dorsi flap) เป็นภาวะแทรกซ้อนที่พบได้บ่อย ซึ่งงานวิจัยนี้ต้องการที่จะศึกษา ภาวะคั่งของน้ำเหลือง (seroma) ในผู้ป่วยมะเร็งเต้านมที่ได้รับการผ่าตัดเต้านมร่วมกับการผ่าตัดเสริมสร้างเต้านมใหม่ด้วยเนื้อเยื่อ และกล้ามเนื้อแลตทิสสิมุส ดอว์ไซ (Latissimus dorsi flap) เพียงอย่างเดียว หรือการผ่าตัดเสริมสร้างเต้านมใหม่ด้วยเนื้อเยื่อ และกล้ามเนื้อแลตทิสสิมุส ดอว์ไซ (Latissimus dorsi flap) ร่วมกับการใช้ซีลีโคน ว่ามีความแตกต่างกันหรือไม่ และปัจจัยใดที่มีผลต่อการเกิดภาวะคั่งของน้ำเหลือง (seroma) ในผู้ป่วยกลุ่มดังกล่าว*

วัตถุประสงค์: *ต้องการที่จะศึกษาภาวะคั่งของน้ำเหลือง (seroma) ในผู้ป่วยมะเร็งเต้านมที่ได้รับการผ่าตัดเต้านมร่วมกับการผ่าตัดเสริมสร้างเต้านมใหม่ด้วยเนื้อเยื่อ และกล้ามเนื้อแลตทิสสิมุส ดอว์ไซ (Latissimus dorsi flap) เพียงอย่างเดียว หรือการผ่าตัดเสริมสร้างเต้านมใหม่ด้วยเนื้อเยื่อ และกล้ามเนื้อ แลตทิสสิมุส ดอว์ไซ (Latissimus dorsi flap) ร่วมกับการใช้ซีลีโคนว่ามีความแตกต่างกันหรือไม่ และปัจจัยใดที่มีผลต่อการเกิดภาวะคั่งของน้ำเหลือง (seroma)*

วัสดุและวิธีการ: *ทบทวนเวชระเบียนของผู้ป่วยมะเร็งเต้านมที่มารับการผ่าตัดเต้านมร่วมกับการผ่าตัดเสริมสร้างเต้านมใหม่ด้วยเนื้อเยื่อ และกล้ามเนื้อ แลตทิสสิมุส ดอว์ไซ (Latissimus dorsi flap) ในช่วงเดือนมกราคม พ.ศ. 2556 ถึง เดือนกันยายน พ.ศ. 2558*

ผลการศึกษา: *ในการศึกษามีผู้ป่วยมะเร็งเต้านมที่ได้รับการผ่าตัดเต้านมร่วมกับการผ่าตัดเสริมสร้าง เต้านมใหม่ด้วยเนื้อเยื่อ และกล้ามเนื้อแลตทิสสิมุส ดอว์ไซ (Latissimus dorsi flap) ทั้งหมด 58 ราย (59 เต้านม) พบว่าผู้ป่วยกลุ่มดังกล่าวเกิดภาวะคั่งของน้ำเหลือง (seroma) จำนวน 45 ราย (ร้อยละ 76) ซึ่งพบว่าการเกิด ภาวะคั่งของน้ำเหลือง (seroma) ในผู้ป่วยมะเร็งเต้านมที่ได้รับการผ่าตัดเต้านมร่วมกับการผ่าตัดเสริมสร้างเต้านมใหม่ ด้วยเนื้อเยื่อ และกล้ามเนื้อแลตทิสสิมุส ดอว์ไซ (Latissimus dorsi flap) เพียงอย่างเดียวหรือการผ่าตัดเสริมสร้างเต้านมใหม่ด้วยเนื้อเยื่อ และกล้ามเนื้อแลตทิสสิมุส ดอว์ไซ (Latissimus dorsi flap) ร่วมกับการใช้ซีลีโคน ไม่พบว่ามีความแตกต่างกัน และเมื่อนำมาวิเคราะห์ ปัจจัยในการเกิดการคั่งของน้ำเหลือง (seroma) ในผู้ป่วยกลุ่มดังกล่าวพบว่ามีอยู่ 2 ปัจจัย คือ จำนวนของน้ำเหลืองที่มากกว่า 340 ซีซี ที่มีออกมาในช่วงที่ผู้ป่วยนอนพักรักษาตัวในโรงพยาบาลหลังผ่าตัดวันที่ 1 ถึง 3 (OR = 19.2, 95% CI: 1.8 to 204.5) และระยะเวลาของ การคาสายระบายน้ำเหลืองที่น้อยกว่า 17 วัน (OR = 12.5, 95% CI: 1.4 to 100) และในผู้ป่วยทั้ง 45 รายที่มีภาวะคั่งของน้ำเหลือง (seroma) นั้น พบว่ามี 3 ปัจจัย ที่มีผลต่อการเกิดภาวะคั่งของน้ำเหลือง (seroma) เป็นระยะเวลานาน คือ ผู้ป่วยที่ได้รับการรักษาด้วยยาเคมีบำบัดต่อ, ผู้ป่วยที่ได้รับการผ่าตัดโดยมีระยะเวลาการผ่าตัดนานมากกว่า 250 นาที และผู้ป่วยที่ได้รับการผ่าตัดเต้านมแบบเก็บหัวนมอยู่ (nipple sparing mastectomy)*

สรุป: *ปัจจัยที่มีผลต่อการเกิดภาวะคั่งของน้ำเหลือง (seroma) คือ จำนวนของน้ำเหลืองที่มากกว่า 340 ซีซี ที่มีออกมาในช่วงที่ผู้ป่วยนอนพักรักษาตัวในโรงพยาบาลหลังผ่าตัดวันที่ 1 ถึง 3 และระยะเวลาของการคาสายระบายน้ำเหลืองที่น้อยกว่า 17 วัน และการเกิดภาวะคั่งของน้ำเหลือง (seroma) ในผู้ป่วยมะเร็งเต้านมที่ได้รับการผ่าตัดเต้านมร่วมกับการผ่าตัดเสริมสร้างเต้านมใหม่ด้วยเนื้อเยื่อ และกล้ามเนื้อแลตทิสสิมุส ดอว์ไซ (Latissimus dorsi flap) ทั้ง 2 วิธี ไม่พบว่ามีความแตกต่างกันด้วยเหตุนี้ในผู้ป่วย ที่ได้รับการผ่าตัดด้วยวิธีการดังกล่าว หากจำนวนของน้ำเหลืองที่ออกมาในช่วงที่ผู้ป่วยนอนพักรักษาตัวในโรงพยาบาลหลังผ่าตัดวันที่ 1 ถึง 3 มีมากกว่า 340 ซีซี แนะนำให้ควรคาสายระบายน้ำเหลืองมากกว่า 17 วัน*