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Incidence of Fat Necrosis Associated with Compromised Subdermal Plexus of DIEP Flaps for Breast Reconstruction

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Introduction

The deep inferior epigastric perforator flap (DIEP) is a widespread option for autologous breast reconstruction.

Fat necrosis is still a complication that has varied severity (6-17.4%).

Prevention of fat necrosis includes maximizing the perforasome of the flap through preservation of direct (linking vessels) and indirect linking vessels (subdermal plexus) in addition to taking into account other considerations: location of main perforator, patient body mass index (BMI), flap thickness and venous outflow.

A previous animal study has demonstrated significant decrease in the vascular supply to the flap with complete excision of the subdermal plexus (Laungani et. al, 2015). This has not been explored in a clinical setting.

The subdermal plexus may be damaged if part or all of the flap is de-epithelialized before burial under a mastectomy flap.

Methods

- A retrospective study was conducted with data collection performed by two authors (AY and JR). All patients undergoing autologous breast reconstruction within multiple hospitals affiliated with Louisiana State University (LSU) were analyzed.
- Exclusion criteria: use of stacked flaps or bi-pedicled flaps, previous autologous breast reconstruction, hybrid reconstruction with flaps and implants
- Patients were grouped into two categories: (1) complete de-epithelialization of the flap via excision of the epidermis and dermis and (2) none or partial de-epithelization of the flap.
- Fat necrosis was recorded if detected during post-operative physical exam ("clinically significant") or if excised during the second stage operation ("operative").
- The incidence of fat necrosis was only followed until the second stage operation since patients would receive fat grafting during this procedure.

Discussion

- In contrast to previous animal studies which demonstrate significant decrease in vascular supply to the DIEP flap with excision of the subdermal plexus, our study demonstrates the safety of flap de-epithelialization.
- Limitations of the study: retrospective nature, lack of uniformity in definition of fat necrosis, diversity within study groups, diversity in surgeon techniques, inability to assess true damage to subdermal plexus, absence of true "undamaged subdermal plexus" group
- Future plans: SPY studies to assess for possible dynamic changes to flap after de-epithelialization

Conclusion

De-epithelialization and inevitable damage to the subdermal plexus does not appear to increase the rate of fat necrosis. This may indicate that linking vessels may have more significant contribution to vascular supply of adipose tissue. Complete flap de-epithelialization would appear to be a reasonable technique for breast reconstruction without fear of adverse consequences. Further study is necessary to explore these findings.

Results

- Fat necrosis rate of 14.8% with any degree of de-epithelialization is comparable to fat necrosis rates reported in literature. The initial decrease in fat necrosis rate associated with complete de-epithelialization of flaps was attributable to surgeon technique and flap weight. In an adjusted analysis there was no difference in fat necrosis between study groups

Table 1. Demographic and medical history of patients undergoing breast reconstruction by DIEP flap

CHARACTERISTIC	SAMPLE	SUBGROUPS		
	N =	PARTIAL	COMPLETE	*p-value*
N	232	71.1% (165)	28.8% (67)	
AGE *(YRS)*	51.0 ±10.2	50.8 ±10.4	51.5±9.5	0.68
RACE				0.60
BLACK	32.8% (77)	34.2% (56)	31.3% (21)	
WHITE	60.6% (140)	59.8% (98)	62.7 (42)	
OTHER	6.0% (14)	6.1% (10)	6.0% (4)	
ASA CLASSIFICATION				0.23
I	3.5% (8)	2.4% (4)	6.3% (4)	
II	65.8% (150)	68.3% (112)	59.4% (38)	
III	30.7% (70)	29.3% (48)	34.4 (22)	
SMOKING STATUS				
CURRENT SMOKER	0.9% (2)	0.6% (1)	1.5% (1)	0.49
EVER SMOKER	20.7% (48)	18.8% (31)	25.4% (17)	0.25
BMI (KG/M^2)	30.8±5.4	30.7±5.2	31.0±5.9	0.78
DIABETES, TYPE II	12.7% (30)	13.9% (23)	10.5% (7)	0.41

Table 2. Description of sample patients' reconstructed breasts by DIEP flaps characterized by relevant preoperative and operative conditions

CHARACTERISTIC	SAMPLE	EXTENT OF FLAP BURIAL		
	N =	PARTIAL	COMPLETE	P-VALUE
	356	66.0% (235)	33.9% (121)	
CHEMOTHERAPY	15.1% (53)	17.3% (40)	10.9% (13)	0.11
RADIATION[†1]	19.5% (69)	23.6% (55)	11.6% (14)	0.006
RECONSTRUCTION TIMING[†]				0.0003
IMMEDIATE	57.9% (206)	51.1% (120)	71.1% (86)	
DELAYED	42.13% (150)	49.0% (115)	28.9% (35)	
FLAP WEIGHT (G) [†]	696.5±251.7	725.3±247.0	628.3±250.7	0.002
NUMBER OF PERFORATORS[†]				0.002
1	40.5% (134)	34.2% (77)	53.8% (57)	
2	46.5% (154)	50.7% (114)	37.7% (40)	
3	11.8% (39)	14.2% (32)	6.6% (7)	
4+	1.2% (4)	0.9% (2)	1.9% (2)	
PERFORATOR LOCATION				0.19
MEDIAL	73.5% (147)	76.1% (118)	64.4% (29)	
LATERAL	21.0% (42)	18.2% (28)	31.1 % (14)	
COMBINATION	5.5 (11)	5.8% (9)	4.4% (2)	
NUMBER OF RECIPIENT VEINS				0.46
1	65.2% (232)	63.8% (150)	7.8% (82)	
2	34.8% (124)	36.2% (85)	32.2% (39)	
DIAMETER OF RECIPIENT VEINS (MM)				
1°[†]	2.5±0.4	2.6±0.4	2.4±0.4	<0.0001
2°[†]	2.3±0.4	2.4±0.4	2.1±0.2	<0.0001

Table 3. Incidence of surgical complications among sample patients

COMPLICATION	SAMPLE	EXTENT OF FLAP BURIAL		
		PARTIAL	COMPLETE	P-VALUE
FAT NECROSIS				
OPERATIVE	14.8% (50)	18.7% (43)	6.5% (7)	0.004
CLINICAL	16.67 (59)	20.1% (47)	10.0% (12)	0.02
FLAP NECROSIS	15.2% (54)	17.9% (42)	9.9% (12)	0.048
FLAP LOSS				
PARTIAL	2.0% (3)	6.1% (2)	0.8% (1)	0.12
TOTAL	5.7% (9)	5.7% (5)	0	<0.0001
TAKEBACK	8.8% (31)	8.9% (21)	8.4% (10)	0.86
HEMATOMA	5.1% (18)	4.3% (10)	6.6% (8)	0.34
SEROMA	1.4% (5)	1.3% (3)	1.7% (2)	0.99
INFECTION	1.1% (4)	0.9% (2)	1.7% (2)	0.61
BREAST DEHISCENCE	2.0% (7)	2.1% (5)	1.7% (2)	0.99

Table 4. Estimates of relative risk of operative fat necrosis.

PREDICTORS	UNIVARIABLE MODELS			ADJUSTED MODEL		
	RR	*CI 95%*	*P*	*RR*	*CI 95%*	*P*
FLAP BURIAL	2.86	1.32, 6.14	0.007	1.90	0.82, 4.42	0.131
INSTITUTION	2.84	1.73, 4.67	<0.0001	2.07	1.22, 3.52	0.006
FLAP WEIGHT (100 G)	1.12	1.02, 1.2	0.022	1.1	1.00, 1.20	0.045

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