Breast Vascular Perfusion Patterns by Intraoperative Indocyanine Green Angiography in Skin and Nipple-Sparing Mastectomy Patients

Di Como J.A, Weaver M, Edmonson D, Pandya S, Stuckey A, Gass J.

The Program in Women's Oncology
Warren Alpert Medical School of Brown University, Women & Infants Hospital of Rhode Island

Introduction

The viability of mastectomy skin flap is an important factor for a successful breast reconstruction. Complications include necrosis of the mastectomy skin flaps, infection, delayed wound healing and exposure of the implant. The incidence of these complications is predominantly associated with malperfusion of mastectomy skin flaps. The aim of this study was to identify and classify the blood supply to the breast intraoperatively using indocyanine green (IC-GREEN™, ICG) and a specialized infrared camera–computer system (SPY Elite™) in females undergoing skin and nipple-sparing breast surgery for malignancy.

Methods

In a single center, pre-incision baseline and postmastectomy skin perfusion studies were performed intraoperatively using indocyanine green and a specialized infrared camera–computer system. The number of dominate vessels were identified and marked. Breasts that failed to map a dominate vessel were categorized as having a diffuse vascular pattern. BMI, tobacco use, previous breast surgery, tumor size and nodal status were recorded.

Results

Variable	Total	Number of vessels					P-value
		Diffuse	1	2	3	4	
Total	49	8 (16.3%)	3 (6.2%)	14 (28.6%)	14 (28.6%)	10 (20.4%)	
BMI, mean (SD)	27.1 (6.2)	31.1 (8.7)	27.4 (2.7)	27 (6.1)	24.4 (3.4)	27.7 (6.9)	0.19
Mastectomy type, n (%)							
SSM	25 (51.0%)	6 (75.0%)	1 (33.3%)	10 (71.4%)	3 (21.4%)	5 (50.0%)	0.083
NSM	23 (46.9%)	2 (25.0%)	2 (66.7%)	4 (28.6%)	10 (71.4%)	5 (50.0%)	
Mastectomy not specified	2 (2.0)	0	0	0	1 (7.1%)	0	
SLNB, n (%)	27 (55.1%)	3 (37.5%)	2 (66.7%)	7 (50.0%)	6 (42.9%)	9 (90.0%)	0.11
T-stage, n (%)							
N/A	8 (16.3%)	1 (12.5%)	0	2 (14.3%)	5 (35.7%)	0	0.13
Recurrent DCIS	1 (2.0%)	0	0	0	1 (7.1%)	0	
Recurrent breast cancer	2 (4.1%)	0	0	0	2 (14.3%)	0	
T0	1 (2.0%)	0	1 (7.1%)	0	0	0	
T1	1 (2.0%)	0	0	0	1 (7.1%)	0	
T1a	1 (2.0%)	1 (12.5%)	0	0	0	0	
T1b	5 (10.2%)	1 (12.5%)	1 (33.3%)	1 (7.1%)	0	2 (20.0%)	
T1c	9 (18.4%)	1 (12.5%)	0	5 (35.7%)	2 (14.3%)	1 (10.0%)	
T2	4 (8.2%)	2 (25.0%)	0	1 (7.1%)	0	1 (10.0%)	
T3	4 (8.2%)	1 (12.5%)	0	0	1 (7.1%)	2 (20.0%)	
Tis	13 (26.5%)	1 (12.5%)	1 (33.3%)	5 (35.7%)	2 (14.3%)	4 (40.0%)	
N-stage, n (%)							
N/A	8 (16.3%)	1 (12.5%)	0	2 (14.3%)	5 (35.7%)	0	0.29
Recurrent DCIS	1 (2.0%)	0	0	0	1 (7.1%)	0	
Recurrent breast cancer	2 (4.1%)	0	0	0	2 (14.3%)	0	
N0	34 (69.4%)	6 (75.0%)	3 (100%)	11 (78.6%)	5 (35.7%)	9 (0.0%)	
N1	4 (8.2%)	1 (12.5%)	0	1 (7.1%)	1 (7.1%)	1 (10.0%)	
Smoking, n (%)							
No	38 (77.6%)	5 (62.5%)	2 (66.7%)	13 (92.9%)	11 (78.6%)	7 (70.0%)	0.22
Former	9 (18.4%)	2 (25.0%)	1 (33.3%)	0	3 (21.4%)	3 (30.0%)	
Yes	2 (4.1%)	1 (12.5%)	0	1 (7.1%)	0	0	
Current/former smoker, n (%)	11 (22.5%)	3 (37.5%)	1 (33.3%)	1 (7.1%)	3 (21.4%)	3 (30.0%)	0.42
Previous breast surgery, n (%)	14 (28.6%)	3 (37.5%)	0	2 (14.3%)	6 (42.9%)	3 (30.0%)	0.42

Results

From 47 patients, 49 breasts were suitable for inclusion. The most commonly observed vascular distribution was two or three dominate arteries (n = 14, 28.6%, n = 14, 28.6%), followed by four dominate arteries (n = 10, 20.4%), a diffuse pattern (n = 8, 16.3%), and one dominate artery (n = 3, 6.2%). No significant difference between perfusion patterns was seen among patients based on BMI, tobacco use, previous breast surgery, tumor size or nodal status.

Conclusions

We suggest that breast SPY angiography can provide valuable information about breast blood supply to aid customized mastectomy skin flaps and avoid dominate vasculature during surgery. This may be useful in patients who are at high risk for flap necrosis. Individual patient characteristics may be associated with different vascular patterns and warrant additional study.