

# Plastic & Reconstructive Surgery

Moderator: TBA

Judges: TBA

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## **Plastic surgery-assisted closure of complex posterior spine surgery wounds are associated with rate of readmission and reimbursement**

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Plastic surgery (PS)-assisted wound closure and care following complex spinal reconstruction surgery has popularized in recent years to address the high rate of wound complications in spine surgery. The prophylactic use of PS to assist in wound closure is hypothesized to prevent wound complications by improving the quality of the closure by reducing paraspinal tissue tension and dead space while improving blood flow and oxygen exchange. The objective of this retrospective cohort study is to compare clinical outcomes and reimbursements between PS and SS closure in complex posterior spine reconstruction using a large-volume national database of both private and government insurance claims. Analysis of the 30-day outcomes revealed significant differences in readmission rates and mean reimbursement costs. The readmission rate for the PS group was 19.6%, compared to 12.1% for the SS group ( $p < 0.0001$ ). Mean 30-day reimbursement was lower for the PS group at \$24,072.94 compared to \$31,204.64 for the SS group ( $p < 0.0001$ ). We demonstrated no significant difference in the rate of SSI between the two closure teams, however found that PS-assisted closure correlates with an increased rate of 30-day readmission and decreased reimbursement. Future research should aim to identify the particular causes for readmission and where tolls are taken on reimbursement for PS-assisted closure. Additionally, future directions should determine if specialty-specific trends exist in wound care management and if these practices affect outcomes and patient recovery following complex spine reconstruction.

## **Dercum's Disease**

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**Introduction:** Dercum's disease, also known as Adiposis Dolorosa, is a rare and not well understood disorder characterized by the presence of multiple painful fatty deposits in various parts of the body. The exact cause of Dercum's disease is unknown, but it is thought to be associated with obesity, hormonal imbalance, and a variety of psychiatric disorders (anxiety, depression, sleep disturbances). There is no established management for this disease: liposuction, resection, or lidocaine application have reported successful treatment in numbers of cases. Liposuction is a superior treatment tool when it comes to healing and scarring, especially in patients with multiple tumors, yet recurrence rate is much higher when compared to surgical resection. More superficial lipomatous lesions are debulked and improved with liposuction, but the deeper ones are often not treatable with liposuction alone and due to persistent discomfort, will still require surgical excision. The mechanism of pain reduction after liposuction remains unclear, the proposed theory is destruction of nerve plexuses within the adipose tissue.

**Method(s):** A single descriptive retrospective case study review design was used.

**Results:** We present a case of a 59-year-old female with BMI 27 and past medical history of hypertension, anxiety, right breast cystosarcoma phyllodes s/p lumpectomy and radiation in October 2002. In 2021, patient was diagnosed with Dercum's disease of arms and legs via ultrasound by a lymphedema specialist in California. In 2022, dermatology team at Yale University started following the patient and a lipoma from left thigh was removed then. Pathology was consistent with Dercum's disease. In 2023, masses at the left ischioanal fossa, left upper thigh, and two facial lipomas were removed at different times throughout the year – most performed by a sarcoma surgeon at Memorial Sloan-Kettering. Later that year, patient presented to Hartford Hospital with several painful lipomas, the ones bothering her the most were bilateral inner thighs. Given the chronicity of her pain, patient was managed with Dilaudid, as well as Metformin. On 3/26/24, patient underwent excision of subfascial, intramuscular lipoma of the left inner thigh, 25 cm long by 10 cm wide was removed. On 6/4/24, she underwent excision of subfascial neoplasm of the right medial thigh, roughly 19 cm. On post-operative visit, patient states that she found another mass at the right medial buttock, which she would like to have removed. That surgery was done on 8/27/24.

**Conclusion(s):** In conclusion, we presented a case of Dercum's disease in a patient suffering from chronic pain secondary to lipomatous lesions throughout the body. Our case highlights the challenges in diagnosing and managing patients with Dercum's disease. There are significant gaps in understanding its etiology and long-term treatments. This condition should be recognized and approached in a multidisciplinary manner with rheumatologist, dermatologists, general practitioners, and surgeons included.

## Enhancement of Ischemic Skin Flap Survival in a Mouse Model by Thioredoxin-1 Overexpression

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**Introduction:** Poor wound healing is one of surgery's most common yet feared complications. Wounds rely on the acute inflammatory response, fibroblast proliferation, and angiogenesis in the early stages of healing. Previous studies have shown improved survival in skin or free flaps with hyperbaric oxygen, hypothermia, extracorporeal shock wave therapy, and various pharmacological agents. We have previously shown that thioredoxin-1 (Trx1), a redox protein, enhanced recovery in ischemic models of myocardial infarction, peripheral vascular disease, and full-thickness wounds. The aim of this study is to examine the enhanced survival effect of ischemic skin flap by Trx-1 overexpression therapy.

**Method(s):** A 3-sided 1.25 x 2.25cm dorsal ischemic skin flap was made, ensuring transection of the long thoracic arteries in 8–18-week-old B6 wild-type (WT) and Trx1 overexpressed (Trx-1<sup>Tg/+</sup>) mice. Silicone was placed under the skin flap to ensure that the wounds would heal by perfusion from the proximal attached end of the skin flap, causing an ischemic gradient. The tissues were monitored for wound creation. Images were taken at post-operative day (POD) 4, 8, and 12 to calculate the degree of necrosis and tissue survivability. Doppler was performed to inspect the degree of perfusion in the skin flap qualitatively. Moreover, quantitatively, histological examination was performed for Trx1 and VEGF staining to determine the angiogenic response.

**Results:** The degree of necrosis calculated from images taken preoperatively and postoperatively showed significantly reduced necrosis percentage in the Trx-1<sup>Tg/+</sup> mice compared to WT mice at POD 4 (29.62 ± 2.88 vs. 53.15 ± 3.88, p<0.001), 8 (18.70 ± 2.39 vs. 48.88 ± 3.44, p<0.001), and 12 (21.35 ± 4.52 vs. 42.44 ± 4.54, p=0.0050, n=9-14). Similarly, skin flap survivability percentage was calculated, and Trx-1 transgenic animals showed significantly better-preserved intact flap than WT mice at POD4 (70.38 ± 2.88 vs. 48.65 ± 3.88, p<0.001), POD8 (81.30 ± 2.39 vs. 51.12 ± 3.44, p<0.001), and POD12 (78.65 ± 4.52 vs. 57.56 ± 4.54, p=0.0050, n=9-14). Laser Doppler imaging of blood perfusion in the flap showed better flap perfusion qualitatively in the Trx-1<sup>Tg/+</sup> group compared to the WT controls. Immunohistochemical analysis showed increased VEGF and Trx-1 expression levels in the Trx-1<sup>Tg/+</sup> group compared to the WT group.

**Conclusion(s):** These data suggest that Trx1 plays an essential role in wound healing by promoting the angiogenic response leading to improved skin flap survivability.

## **Infected Aortic Graft with Aortopulmonary Fistula Treated with Resection and Omental Interposition Flap**

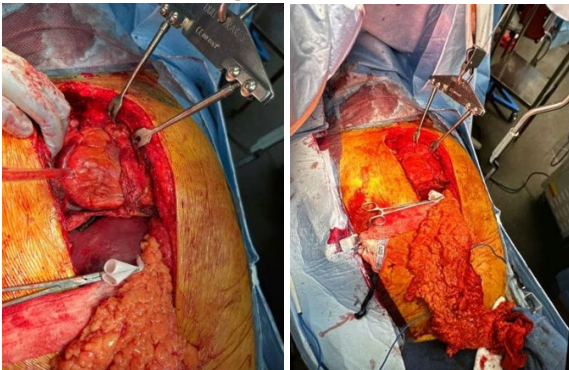
Kristina Kuklova, MD, MBA, Kriti Mittal Agrawal, MBBS, Andrea Watters, MD, Mohiuddin Cheema, MD, Alan Babigian MD  
University of Connecticut

**Introduction:** Aortopulmonary fistulas are rare, but fatal complications that require surgical management. Thoracic aortic graft infection (TAGI) is also infrequent with low incidence. Tissue flaps are used to counteract any mediastinal infection and to cover sternal defects. Omentum is a safe choice as it has antibacterial properties and lies in a favorable anatomical position in order to harvest and use for wound coverage. We present a case of a 58 y/o male with history of coarctation of the aorta s/p multiple interventions over the years. Underwent TEVAR in 2019 for aneurysmal bypass graft at the anastomosis with the subclavian artery. In 2023, patient returned to the hospital with fevers, chills, hemoptysis. CTA revealed perigraft abscess / mycotic aneurysm with aortopulmonary fistula to LUL. He proceeded to the OR for extra anatomic bypass, left upper lobectomy, resection of aortic arch mycotic aneurysm and aortopulmonary fistula, and omental flap creation. Omental flap was tunneled via left upper diaphragm into the left chest and used to cover the bronchial stump draped over the left hilar structures. It appeared entirely viable, it had sufficient length without tension, and great care was taken to ensure that the pedicle was not twisted or compressed.

**Method(s):** A single descriptive retrospective case study review design was used.

**Results:** Reconstructive options are offered for TAGI, muscles vs omentum flaps. Omentum is rearranged via a window created in a diaphragm, which decreases the risk of peritoneal infections, given the omentum's robust blood supply and lymphatic functions. Omentum is superior to muscle flaps due to its compliance and ability to mold to the 3-dimensional spaces of the mediastinum and drape around the aorta, as well as pulmonary structures.

**Conclusion(s):** This is a case of an infected aortic graft with aortopulmonary fistula, treated successfully with explantation of infected graft followed by the omental flap creation. Given its location, inherent vascularity, as well as immunogenic properties, omental flap continues to be a valuable choice in reconstructive efforts for almost all of the anatomic regions.



Intra-operative pictures of the omental flap.

## The Use of Latissimus Dorsi Muscle Interposition Flap in Complex Tracheoesophageal Fistula Repair

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**Introduction:** Tracheoesophageal fistulas (TEFs) are abnormal connections between the trachea and esophagus that can lead to severe complications, such as aspiration, recurrent respiratory infections, and significant nutritional deficits. TEFs may be congenital or acquired, with the latter often being a result of trauma, malignancy, or surgical procedures. Surgical repair is the gold standard of treatment, particularly in complex or recurrent cases. The latissimus dorsi muscle flap has become a preferred method for reconstruction due to its robust vascular supply and ability to effectively separate the trachea and esophagus, reducing the risk of recurrence.

**Method(s):** We report the case of a 50-year-old male with a history of esophageal adenocarcinoma who developed a tracheoesophageal fistula following neoadjuvant chemoradiation and minimally invasive esophagectomy. Initial management included the placement of stents in the bronchus and esophagus, along with venovenous extracorporeal membrane oxygenation (VV ECMO) due to acute respiratory decline. Despite these interventions, the patient's condition deteriorated, and endoscopic evaluation revealed an enlargement of the fistula. Consequently, surgical intervention was undertaken to repair the fistula using a latissimus dorsi muscle flap, which provided a well-vascularized tissue barrier to promote healing and prevent recurrence.

**Conclusion(s):** This case highlights the effectiveness and the utility of the latissimus dorsi flap in managing complex tracheoesophageal fistulas, particularly in situations where initial treatments fail, highlighting its role in achieving favorable clinical outcomes in such challenging scenarios.

# Understanding Variation in Bra Cup Sizing Among Leading Manufacturers – A Guide for Patients and Surgeons

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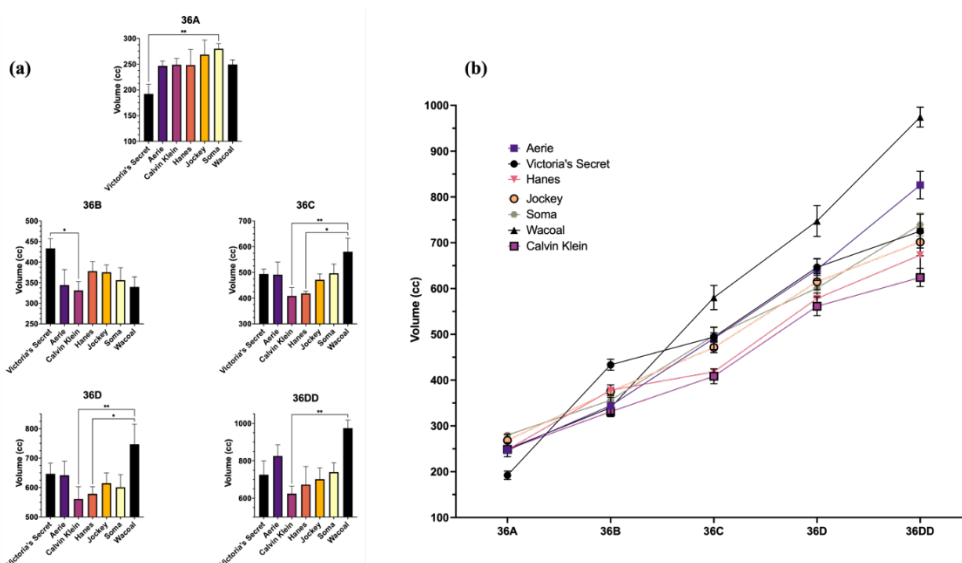
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**Background:** Bra size is a commonly-used metric when patients and plastic surgeons discuss breast augmentation or reduction procedures. Variations in bra sizing between different manufacturers can affect patient-surgeon communication, expectations, and postoperative satisfaction. This study quantifies bra cup volume across a range of alphanumeric sizes and manufacturers to describe the variance and improve preoperative communication for shared decision-making.

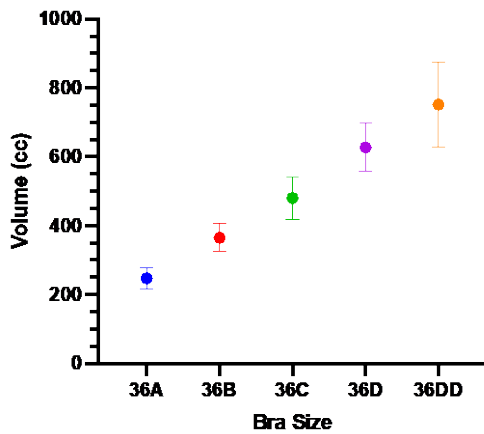
**Methods:** Bras sized 36A-DD from seven popular manufacturers were fit to a flat-chested mannequin and filled using custom breast sizers. The sizers were filled to fit each bra, and then weighed and mathematically converted to volume. Kruskal-Wallis tests with post-hoc Dunn’s test were performed to assess differences in cup volume between manufacturers at each size.

**Results:** Cup volume varied significantly between manufacturers at all sizes, with larger cup sizes showing greater variance. The standard deviation in mean cup volume (cc), across all manufacturers, was A: 30.9, B: 40.1, C: 62.2, D: 69.7, and DD: 122.8. Calvin Klein and Hanes demonstrated a tendency to run small while Wacoal ran larger at sizes C-DD. Wacoal was significantly larger than both Hanes and Calvin Klein at sizes 36C ( $P < 0.05$  &  $P < 0.01$ ) and 36D ( $P < 0.05$  &  $P < 0.005$ ), and was significantly larger than Calvin Klein at 36DD ( $P < 0.005$ ). Variation across manufacturers was still observed at cup sizes A and B, although individual manufacturer trends were less clear in these smaller cup sizes. Soma was significantly larger than Victoria’s Secret at size 36A ( $P < 0.005$ ) and Victoria’s Secret was significantly larger than Calvin Klein at 36B ( $P < 0.05$ ).

**Conclusions:** This study describes variance in bra sizing across several popular manufactures, and provides a reference for surgeons and patients when discussing goal breast size after augmentation and reduction procedures. This data is especially useful for larger cup sizes, where variation in cup volume across manufacturers is the greatest. The ability to convert alphanumeric sizing to volume for different manufacturers will enable more accurate communication and greater patient satisfaction.



**Figure 1.** (a) Mean cup volume with SD at each size for each manufacturer and (b) mean cup volume with SEM. (\*) indicates  $P < 0.05$  and (\*\*) indicates  $P < 0.01$



**Figure 2.** Mean cup volume with SD for all seven manufacturers together at sizes 36A to 36DD

**Table 1.** Mean cup volume with SD at each size for the seven manufacturers investigated

Manufacturer	Cup Size (Volume $\pm$ SD)				
	A	B	C	D	DD
<i>Victoria's Secret</i>	192.2 $\pm$ 18.55*	433.3 $\pm$ 23.97	494.2 $\pm$ 18.60	646.6 $\pm$ 36.63	725.2 $\pm$ 73.64
<i>Aerie</i>	246.5 $\pm$ 9.54	344.3 $\pm$ 37.37	491.1 $\pm$ 49.11	641.5 $\pm$ 47.75	825.8 $\pm$ 60.21
<i>Calvin Klein</i>	248.4 $\pm$ 12.15*	331.1 $\pm$ 22.05	408.5 $\pm$ 32.72	561.2 $\pm$ 41.41	624.1 $\pm$ 39.84
<i>Hanes</i>	247.9 $\pm$ 30.84*	378.1 $\pm$ 23.03	418.1 $\pm$ 8.33	578.4 $\pm$ 24.2	673.1 $\pm$ 96.38
<i>Jockey</i>	268.5 $\pm$ 28.13*	375.3 $\pm$ 17.82	471.4 $\pm$ 22.96	614.8 $\pm$ 35.13	701.6 $\pm$ 59.92
<i>Soma</i>	280.1 $\pm$ 9.93*	356.1 $\pm$ 30.48	496.7 $\pm$ 35.73	601.0 $\pm$ 42.76	739.6 $\pm$ 50.56
<i>Wacoal</i>	249.3 $\pm$ 8.94*	339.8 $\pm$ 24.56*	580.4 $\pm$ 53.11	747.5 $\pm$ 67.69	974.3 $\pm$ 43.6

\* indicates lightly-lined mid coverage/demi bra. All others were full-coverage, lightly-lined underwire bras



## **Squamous Cell Carcinoma of the Scrotum: A Case Report and Review**

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Squamous Cell Carcinoma (SCC) of the scrotum is a rare and potentially aggressive form of cancer which can be misdiagnosed at presentation. We present the case of a 62-year-old male with poorly controlled diabetes mellitus and active tobacco use who initially presented with Fournier's gangrene requiring multiple sessions of surgical debridement in 2020. Postoperative course was complicated by prolonged poor wound healing eventually leading to a suspicion of malignancy. Biopsy in 2023 revealed a massive squamous cell carcinoma of the scrotum. This was treated by wide local excision and gracilis muscle/local flap coverage. The patient subsequently healed. Review of the literature revealed a single reported case of scrotal SCC arising in a scar from Fournier's gangrene.

## Bit By an Electric Bike: Utilization of Peroneus Brevis Muscle Flap In A Pediatric Patient, a Case Report

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**Introduction:** Soft tissue defects in the ankle are reconstructive challenges given the paucity of tissue available for local flaps. While free flaps may be practical in adult patients, they are more technically demanding in children due to smaller microanatomy and risk of growth disruption at the donor site. The pedicled peroneus brevis muscle flap has been utilized to repair soft tissue defects in adults since 2001 (Eren et al.). However its use in pediatric patients has not been reported. As electronic bikes skyrocket in popularity with pediatric patients, the incidence of extremity trauma with soft tissue defects requiring complex reconstruction has increased, necessitating evaluation of current reconstructive techniques and their application to pediatric patients. Here we present a case utilizing the peroneus brevis muscle flap successful reconstruction of a soft tissue defect with exposed Achilles tendon and calcaneal osteomyelitis in an 11-y.o. old boy with a peroneus brevis muscle flap.



**Methods:** Retrospective single patient case report.

**Results:** 11-y.o. male presented with right heel avulsion after his foot was caught in the wheel of an electric bike traveling 17MPH with exposure of Achilles tendon and calcaneus. He had preserved plantar flexion and limited dorsiflexion due to pain but was neurovascularly intact. The wound was primarily repaired in the emergency department and he was discharged on 10 days of antibiotics and crutches. He returned to the emergency department 14 days later and was admitted for wound swelling with a quarter-size dehiscence and was found to have fungal and bacterial osteomyelitis and desiccated tendon necessitating debridement however the skin defect over the Achilles tendon could not be closed primarily. A distal pedicle peroneus brevis muscle flap and split thickness skin graft was performed to reconstruct the defect. Immediately postoperatively he was allowed forefoot only weight bearing utilizing crutches and no pressure on the heel. 5 days later the wound VAC was removed: muscle flap was viable and skin graft showed full take. At post-op 3 week, he was cleared for full weightbearing including the heel and he was weaned from crutches. At post-op 6 weeks, he was walking without assistance. At post-op 11 weeks, he was healed and cleared to wear all footwear, including shoes and sandals with fabric over the posterior heel.

### **Conclusion:**

Pedicled peroneus brevis muscle flap is a reliable technique for reconstruction of soft tissue defects of the ankle in pediatric patients.

## Judicious Fluid Administration in the Setting of Abdominally-Based Free Flaps

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**Introduction:** The aim of this study is to evaluate fluid administration trends in the setting of abdominally-based free flaps for breast reconstruction. Drawing upon insights from recent studies and practical experiences, we aim to explore the impact of goal-directed fluid therapy on patient outcomes, complications, and recovery trajectories in microsurgical breast reconstruction at our institution. These data will lend to the discussion surrounding best practices in perioperative care for breast reconstruction patients.

**Method(s):** A single institution retrospective review was conducted for adult (>18 years of age) patients who underwent abdominally-based free flaps for breast reconstruction following mastectomy for breast cancer between the dates of 2010 and 2020. Patient demographics, including age, sex, body mass index (BMI), tobacco use, and medical comorbidities (hypertension, diabetes mellitus, cardiac or pulmonary history, clotting disorders, and timing of radiation for treatment of breast cancer) were recorded in a standardized Microsoft Excel spreadsheet.

**Results:** In this study, 115 patients with a mean age of 51.3 years and a mean BMI of 30.2, undergoing 188 abdominally-based free flaps for breast reconstruction, were reviewed. Most patients (56.5%) had prior radiation therapy, and 34.2% experienced medical complications, with acute blood loss anemia (ABLA) being the most common. The study found that perioperative fluid administration greater than 8841 mL was significantly associated with higher odds of ABLA (OR = 13.46) and other medical complications (OR = 13.93). Additionally, higher fluid volumes and increased BMI were linked to more frequent flap complications during hospitalization, though fluid volume did not significantly affect long-term flap failure.

**Conclusion(s):** High levels of perioperative fluid administration (>8841 ml) was associated with flap complications in breast reconstruction patients undergoing abdominal free-flaps. Likewise, high fluid administration was associated with ABLA and overall medical complications during the hospital stay. Hospital length of stay was noted to be nearly 2 days longer with administration of greater than 8841ml of fluid in the perioperative setting. These data make a strong argument for the implementation of protocols to prevent unnecessarily high administration of fluid in this critical period. Furthermore, the authors recommend a conservative fluid strategy in order to promote high-quality outcomes in this patient cohort.

Table 2: Univariate Analysis Comparing Fluid Administration and Outcomes

	Low (total fluid volume < 8841 mL) (N=73)	High (total fluid volume ≥8841 mL) (N=42)	Total (N=115)	p value
<b>Age (yrs)</b>				0.84
Mean (SD)	51.18 (10.08)	51.57 (11.30)	51.32 (10.50)	
<b>BMI</b>				0.39
Mean (SD)	29.88 (5.16)	30.74 (5.02)	30.19 (5.11)	
<b>Tobacco</b>				0.98
Former	23 (31.5%)	14 (33.3%)	37 (32.2%)	
Never	48 (65.8%)	27 (64.3%)	75 (65.2%)	
No	2 (2.7%)	1 (2.4%)	3 (2.6%)	
<b>HTN (Yes)</b>	18 (24.7%)	8 (19.0%)	26 (22.6%)	0.49
<b>DM (Yes)</b>	6 (8.2%)	3 (7.1%)	9 (7.8%)	0.84
<b>Cardiac Diagnosis (Yes)</b>	4 (5.5%)	0 (0.0%)	4 (3.5%)	0.12
<b>Pulmonary Diagnosis (Yes)</b>	4 (5.5%)	3 (7.1%)	7 (6.1%)	0.72
<b>Radiation</b>				0.22
No	28 (38.4%)	16 (38.1%)	44 (38.3%)	
Postop	2 (2.7%)	0 (0.0%)	2 (1.7%)	
Preop	42 (57.5%)	23 (54.8%)	65 (56.5%)	
Preop and postop	0 (0.0%)	2 (4.8%)	2 (1.7%)	
Unknown	0 (0.0%)	1 (2.4%)	1 (0.9%)	
Yes	1 (1.4%)	0 (0.0%)	1 (0.9%)	
<b>LOS (days)</b>				< 0.001
Mean (SD)	4.77 (1.42)	6.10 (1.45)	5.25 (1.56)	
<b>Surgery length (hrs)</b>				0.46
Mean (SD)	9.11 (2.23)	9.31 (2.08)	9.18 (2.17)	
<b>Medical complications (Yes)</b>	12 (16.4%)	27 (65.9%)	39 (34.2%)	< 0.001
<b>Complication: ABLA (Yes)</b>	7 (9.6%)	23 (54.8%)	30 (26.1%)	< 0.001
<b>Flap complication or failure (Yes)</b>	11 (27.5%)	12 (36.4%)	23 (31.5%)	0.42

Table 3: Univariate and Multivariate Regression, Medical Complications in Relation to Independent Variables

Variable	Comparison	Univariate analysis				Multivariable analysis			
		OR	LL	UL	p-value	OR	LL	UL	p-value
<b>Fluid volume</b>	≥ 8841 vs. < 8841	9.80	4.01	23.98	0.00	13.93	4.10	47.37	<0.001
<b>Age</b>	Per 5 years older	0.94	0.78	1.13	0.52				
<b>BMI</b>	Per 5 units increase	0.90	0.61	1.33	0.60				
<b>Tobacco</b>	Yes vs. No	1.51	0.67	3.40	0.32				
<b>HTN</b>	Yes vs. No	1.38	0.55	3.44	0.49				
<b>Radiation</b>	Yes vs. No	1.83	0.79	4.22	0.16	1.83	0.56	5.96	0.31
<b>EBL (ml)</b>	Per 100 mL increase	1.48	1.01	2.16	0.04	1.54	0.94	2.50	0.09
<b>Surgery length</b>	Per 1 hour longer	1.07	0.89	1.28	0.49				