

Outcomes of Calvarial and Soft Tissue Reconstruction with Latissimus Dorsi Rib Osteomyocutaneous Free Flap

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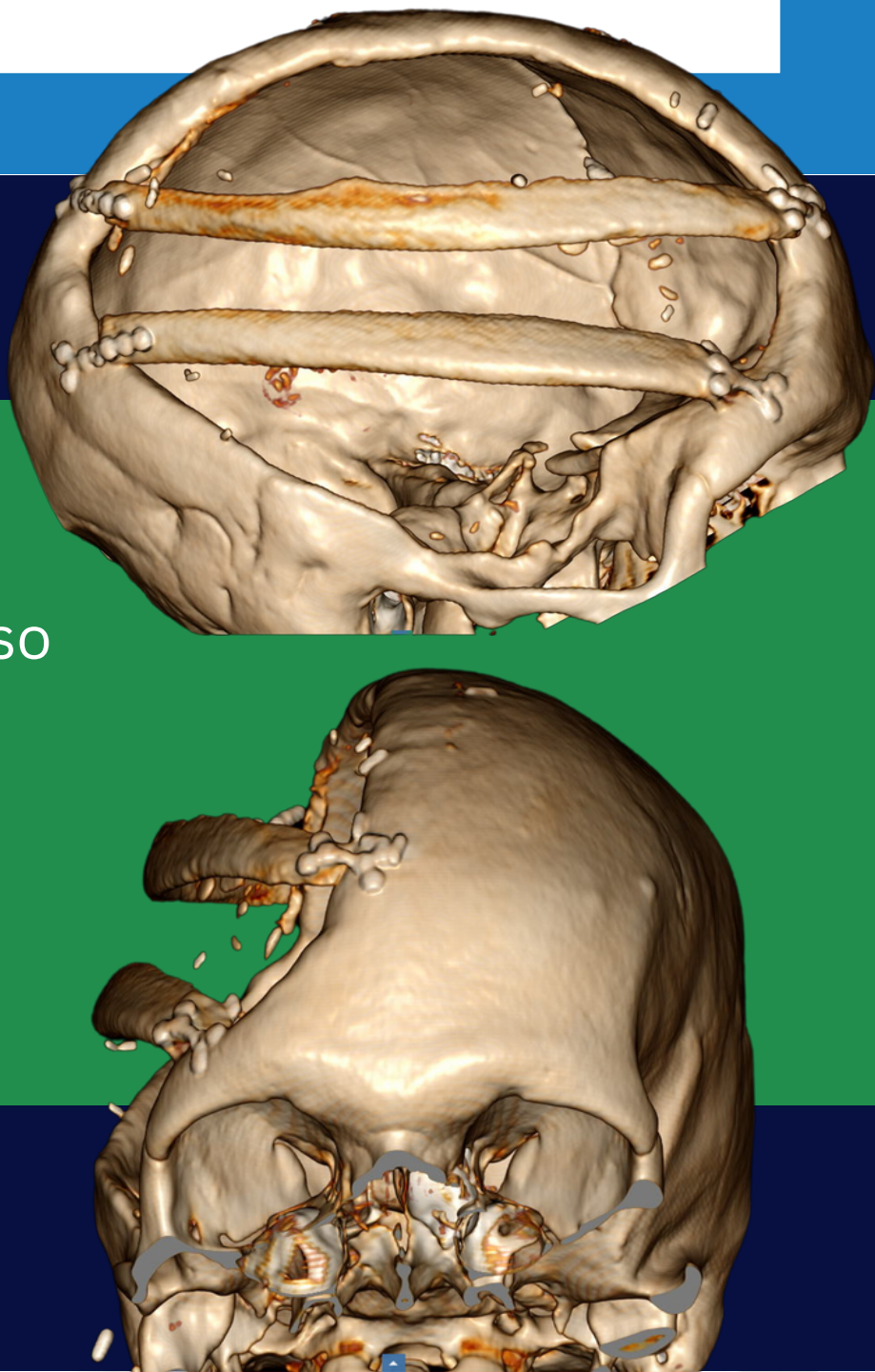
Background



- Large composite scalp and cranial defects are challenging to reconstruct
- The method of choice is mainly based on the size of the defect and quality of the soft tissue envelope
- Large cranial defects can also lead to complications such as herniation of the cortex, subdural effusion, seizure, and syndrome of the trephined

Purpose

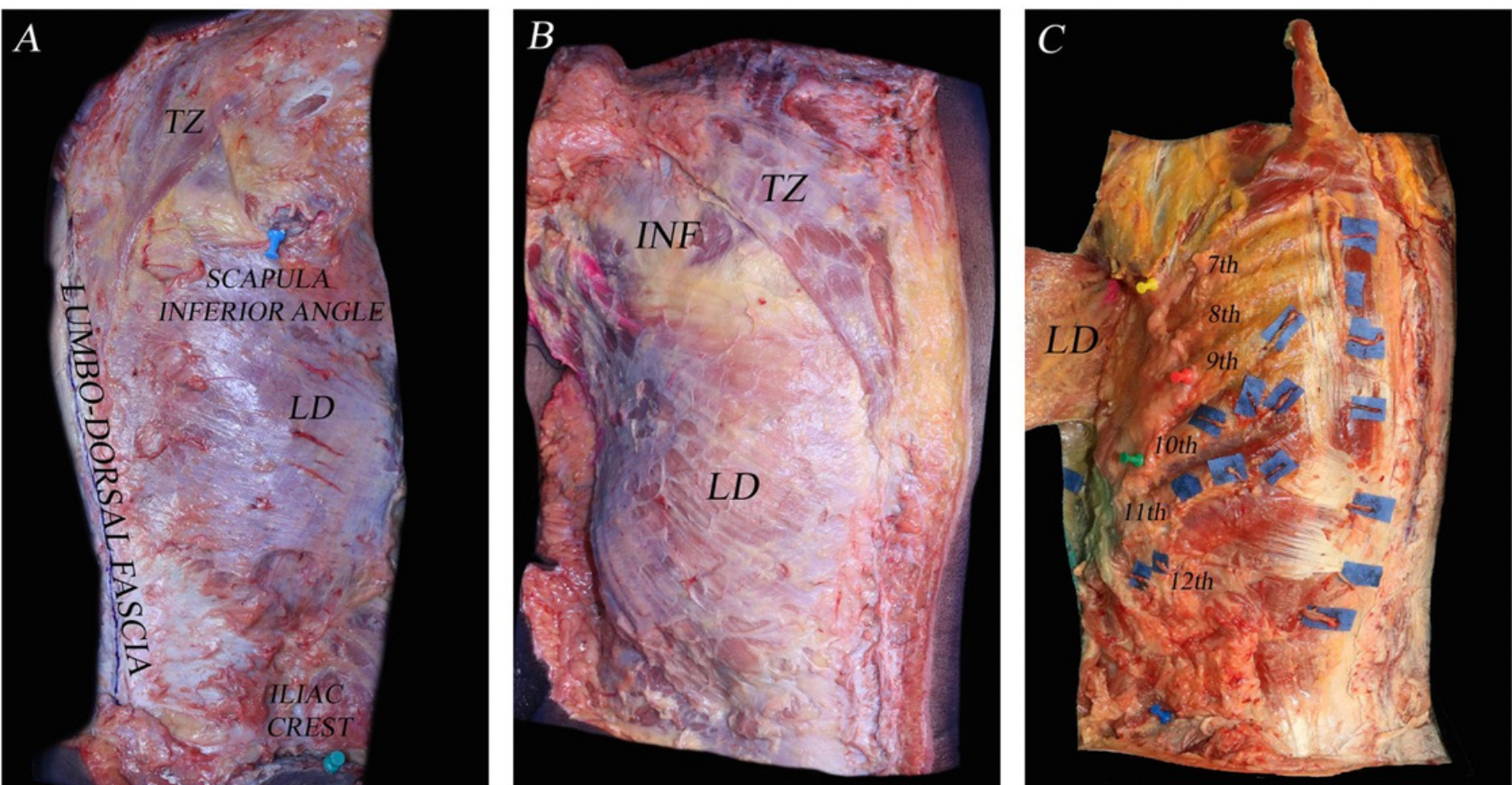
- First described by Gottlieb, the LD-rib flap (LDRF) was used for successful reconstruction of full thickness skin and calvarial defects
- Inclusion of the rib is not only for structure or aesthetics, but may also play an important role for function
- We aimed to present the outcomes of composite scalp and calvarial defect reconstruction using the LDRF and conducted anatomical cadaver dissections to study feasibility, perforator patterns, and to define optimal flap design



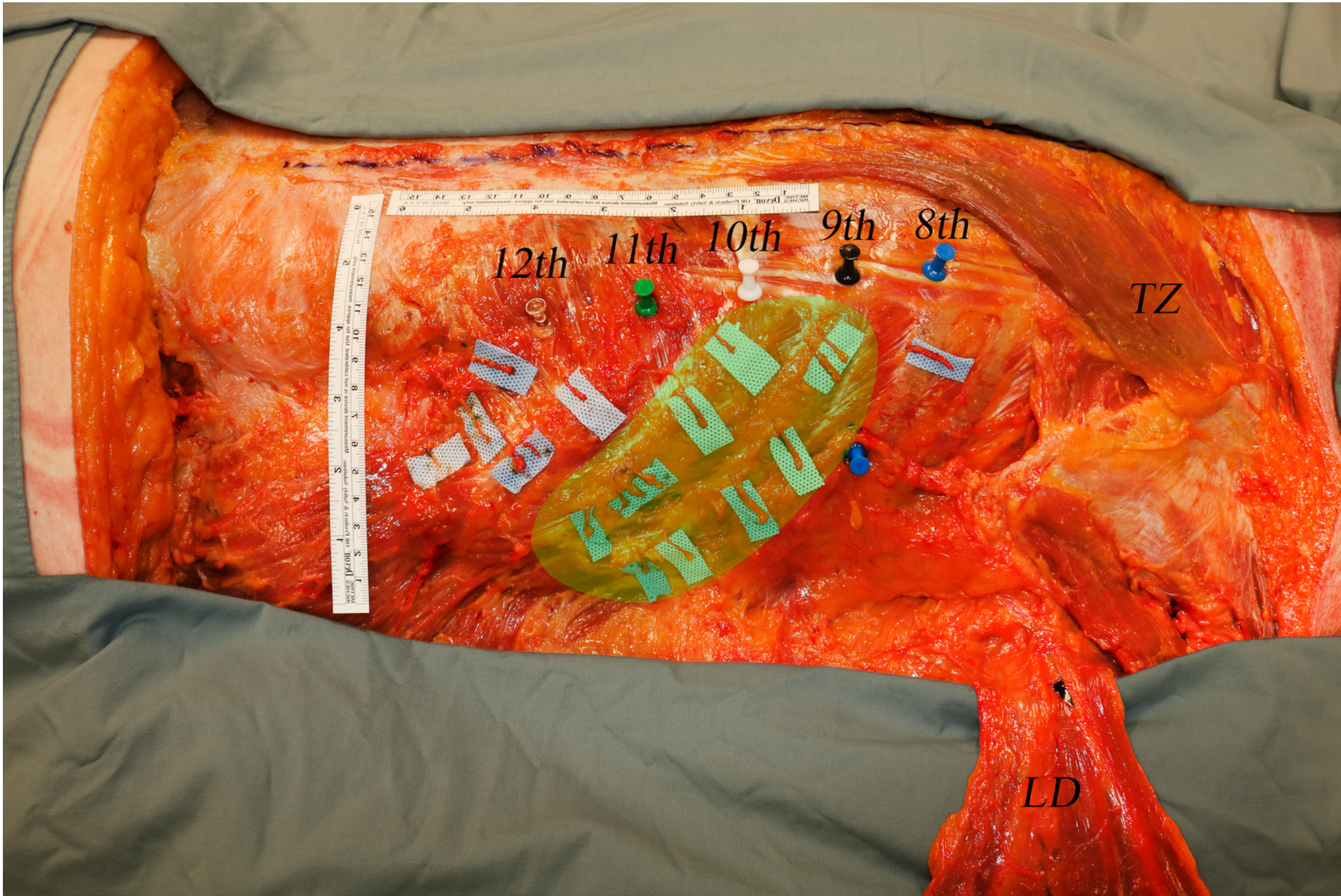
Methods

- An anatomical study was conducted to evaluate the connecting perforators between thoracodorsal vessels (LD branch) and lateral branch of posterior intercostal vessels
- Perforators were identified and exposed from the 12th rib to the 7th rib
- An IRB-approved retrospective review of ten patients who underwent LDRF and one or two ribs for treatment of cranial defects was conducted
- Patient-reported outcomes regarding quality of life, neurological and functional status were evaluated using validated surveys

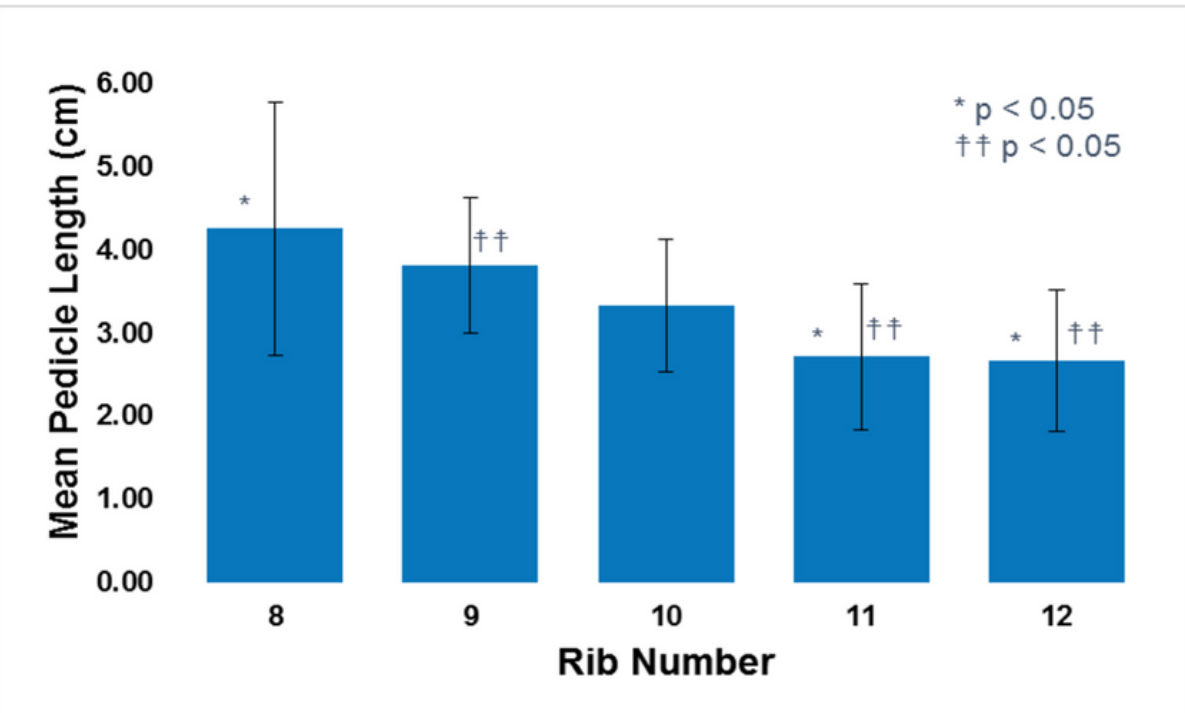
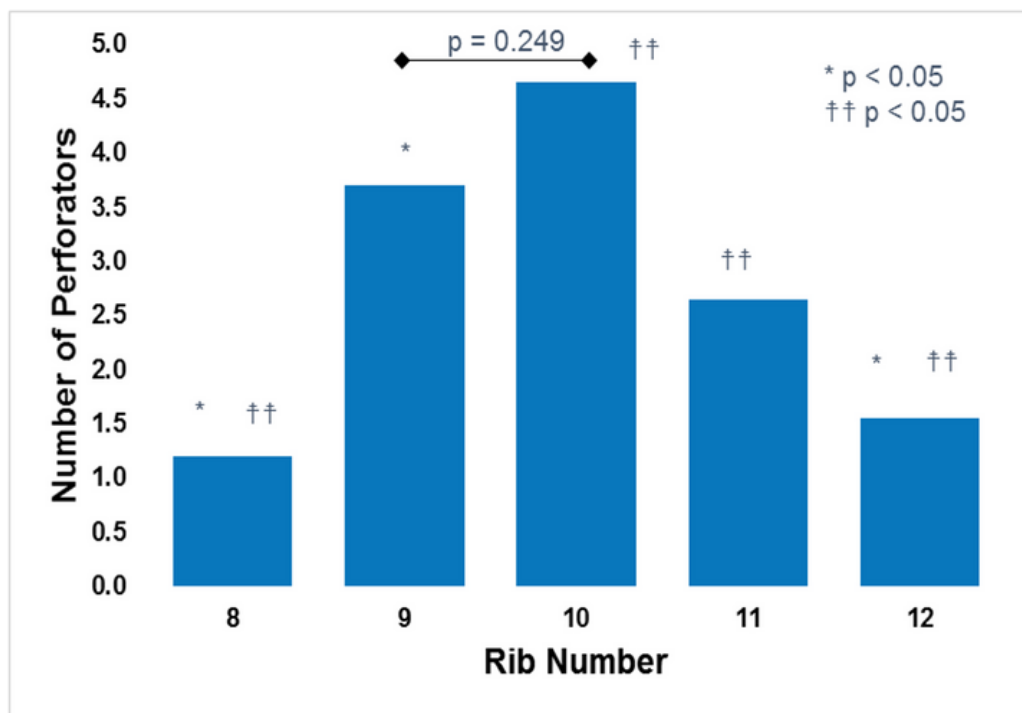
Series illustrating superficial-to-deep dissection of the dorsal region. (A) Removal of the skin and fascial panniculus to display the underlying epimysium of the trapezius (TZ) and latissimus dorsi (LD) muscles. (B) The epimysium of the LD has been removed to display the underlying muscles; infraspinatus (INF). (C) The perforators.



Results



Perforator vessels traversing the latissimus dorsi (LD) undersurface. Smaller caliber arteries perforating the LD down to the inferior border of the ribs to anastomose with the intercostal vessels. Note that these perforators were only present at ribs 8-12.



- The 10th rib (4.65± 2.01) followed by 9th rib (3.7±1.63) had the highest number of perforators
- A combination of the 9th and 11th ribs exhibited maximal perforator number and pedicle length



- Median clinical follow-up was 48 [34-70] months postoperatively
- All patients ultimately had stable LDRF reconstructions



Patient 2 taken before (left) and 82 months after (right) LDRF reconstruction. The patient underwent partial excision of the flap and soft tissue rearrangement 25 months after the initial reconstruction.

Patient-Reported Outcome Measure (PROM)		Preoperative scores		Postoperative scores		p	No. completed total
		Avg.	SD	Avg.	SD		
RAND-36	Physical functioning	26.9	30.0	47.0	32.4	0.19	8
	Role limitations due to physical health	6.3	17.7	32.5	47.2	0.13	8
	Role limitations due to emotional problems	25.0	46.3	70.0	48.3	0.06	8
	Energy/fatigue	33.1	25.3	37.5	29.0	0.74	8
	Emotional well-being	54.5	25.4	71.6	26.2	0.18	8
	Social functioning	35.9	34.4	50.0	38.2	0.42	8
	Pain	46.9	42.0	47.0	35.3	0.99	8
	General health	53.8	27.0	57.5	30.3	0.79	8
	Daily Activities	62.1	35.9	44.5	35.9	0.32	8
	Emotional Status	45.4	21.4	37.8	21.9	0.47	8
SMFA	Arm and Hand Function	32.6	32.7	21.0	28.6	0.44	8
	Mobility	47.6	33.9	31.2	34.9	0.33	8
	Function Index	50.8	25.3	33.5	26.1	0.18	8
	Bothersome Index	41.8	25.9	32.1	24.7	0.43	8
	Karnofsky	62.5	20.5	76.3	22.0	0.22	7
	FIM	59.4	29.7	71.9	25.6	0.42	7
FIM	Cognitive	30.4	3.6	31.9	5.0	0.55	7
	Barthel Index	13.3	6.1	17.6	4.9	0.13	8
UW-QoL	Physical	80.5	16.1	88.3	9.7	0.26	8
	Social/Emotional	45.7	29.1	57.7	24.1	0.36	8
	Headache Disability Index	25.4	33.5	12.6	19.0	0.38	7
	DASH	45.4	28.7	33.0	29.9	0.40	8
PDQ	Functional	2.5	4.3	25.1	25.1	*	6
	Psychosocial	1.0	2.2	20.0	15.1	*	5

The minimum clinically important difference (MCID) was surpassed, demonstrating improvement of function for 71% of patients on the Barthel Index and 63% on the Selective Functional Movement Assessment test (SFMA). *Only 6 pts filled out PDQ functional, 5 psychosocial precluding statistical comparison.

Conclusions

- Reconstruction of the calvarium with 1-2 ribs, and scalp with the overlying muscle and skin paddle, is both anatomically feasible and clinically sufficient to achieve stability with soft tissue healing
- Based on both cadaver dissections and clinical experience, a combination of the 8th and 10th or 9th and 11th ribs were preferable for maximal perforator number and pedicle length
- Patient-reported outcomes align with clinical improvement after LDRF
- Reconstruction of composite scalp and skull defects is important for not only restoration of calvarial contour, but also for recovery of cognitive function and prevention of further decline

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