Cephalic-Only Approach to Radial Forearm Free Flap: Simplifying Reconstruction and Reducing Complications

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1. Background

The **fasciocutaneous (RFFF)** and **osteocutaneous (OCRFFF) radial forearm free flaps** are versatile reconstructive options for head and neck subsites.

Success rates range from 96–99.25%, with most failures attributed to venous congestion.

Both **superficial** (cephalic) and **deep** (venae comitans) systems may be used for drainage, and some advocate for dual venous anastomosis when possible.

Debate continues regarding the **optimal venous drainage strategy**:

- Dual drainage (deep + superficial system) may be preferred to optimize amount of venous outflow.
- However, antecubital fossa dissection ("rat's nest") prolongs operative time, increases incision length, dissection, redundant pedicle length, and may increase morbidity.

The **isolated "cephalic-only" technique** avoids additional dissection, optimizes pedicle length geometry, and increases freedom between arterial and venous anastomoses.

Aim: To evaluate the **safety, reliability, and outcomes** of isolated cephalic RFFF compared with traditional venous drainage techniques.

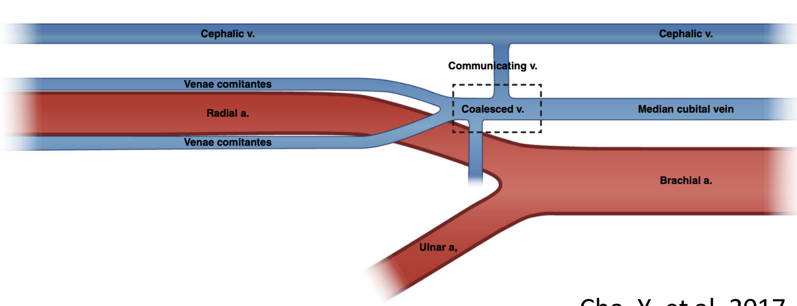

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Figure 2. Vascular anatomy of the radial forearm free flap. The cephalic vein, venae comitantes, and median cubital vein demonstrate the superficial and deep venous systems and their communication around the radial artery.

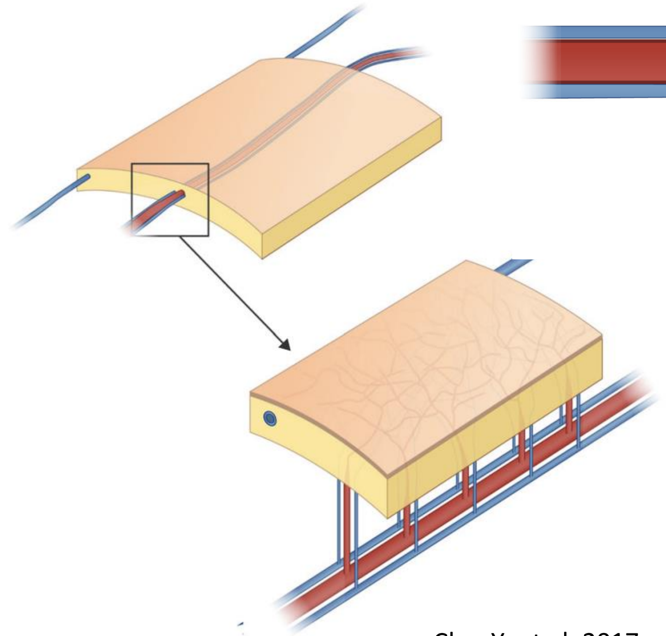

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Figure 1. Schematic structure of the fasciocutaneous radial forearm free flap (RFFF). The cephalic vein runs superficially without major branches, while the radial artery and venae comitantes supply the vascular network through septocutaneous perforators.

2. Methods and Materials

Design: Retrospective cohort study, University of Virginia (April 2013– January 2025).

Patients: 180 total RFFFs (RFFF and OCRFFF).

Groups:

- Isolated "cephalic vein only" anastomosis (n=20)
- Cephalic + vena comitans combination (n=132)
- Separate cephalic and vena comitans (n=7)
- Isolated venae comitans (single vein) (n=21)

Variables collected: demographics, comorbidities, surgical details (technique, dissection type, communicating veins, flap size), and perioperative outcomes.

Outcomes: venous congestion, arterial thrombosis/spasm, return to OR, flap survival, length of stay.

Analysis: Categorical (Chi-square/Fisher), continuous (Wilcoxon for LOS). $P < 0.05$ = significant.

3. Results

Demographics: Majority male (65.6%), predominantly White (89.4%).

Comorbidities: 21.1% current smokers, 20.5% diabetes, 15.6% vascular disease, 58% prior radiation, 62% prior chemotherapy.

Indications: 93% cancer-related, 4.4% fistula repair, 2.2% other.

Surgical factors:

- Suprafascial dissection common in combo group; subfascial in isolated cephalic/venae groups.
- Communicating veins present in 27 cases (majority in combo group).
- Paddle size **comparable** across groups. Mean paddle size: isolated cephalic 163.1 cm² vs. others ~178 cm².

Outcomes:

- Length of stay: lowest in isolated cephalic group (57.5 hrs), longest in separate cephalic–vena group (65.8 hrs).

Complications:

- None in isolated "cephalic only" group.
- Combination group: 18 (7 venous congestion, 3 arterial thrombosis, 1 arterial spasm).
- Separate cephalic–vena: 1 arterial thrombosis.
- Isolated venae: 2 (1 venous congestion, 1 arterial spasm).

Flap survival was maintained across all groups.

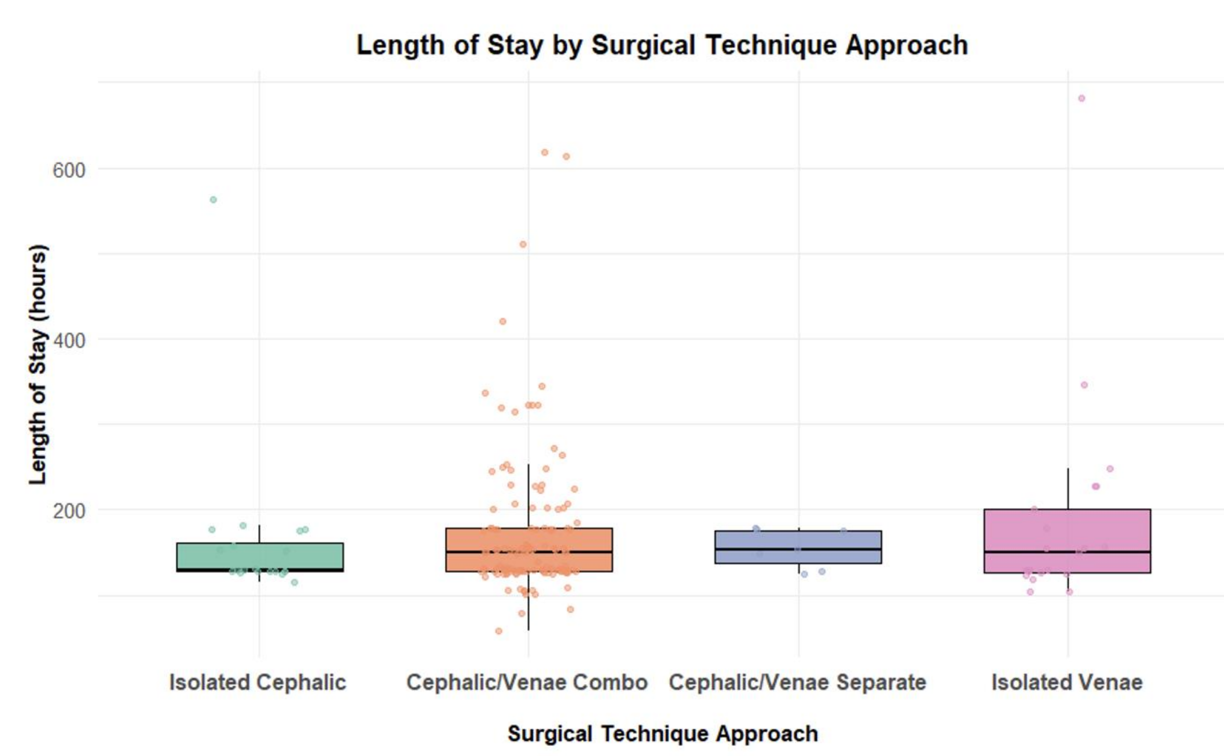

Figure 3. Box-and-whisker plot of hospital length of stay (LOS) by venous drainage technique: isolated cephalic vein anastomosis, cephalic–venae comitans combination, separate cephalic/venae comitans, and isolated venae comitans. Median LOS was lowest for isolated cephalic, though differences were not statistically significant (Kruskal–Wallis, $p = 0.71$). Boxes show interquartile range (IQR), whiskers = 1.5× IQR, and outliers = individual points.

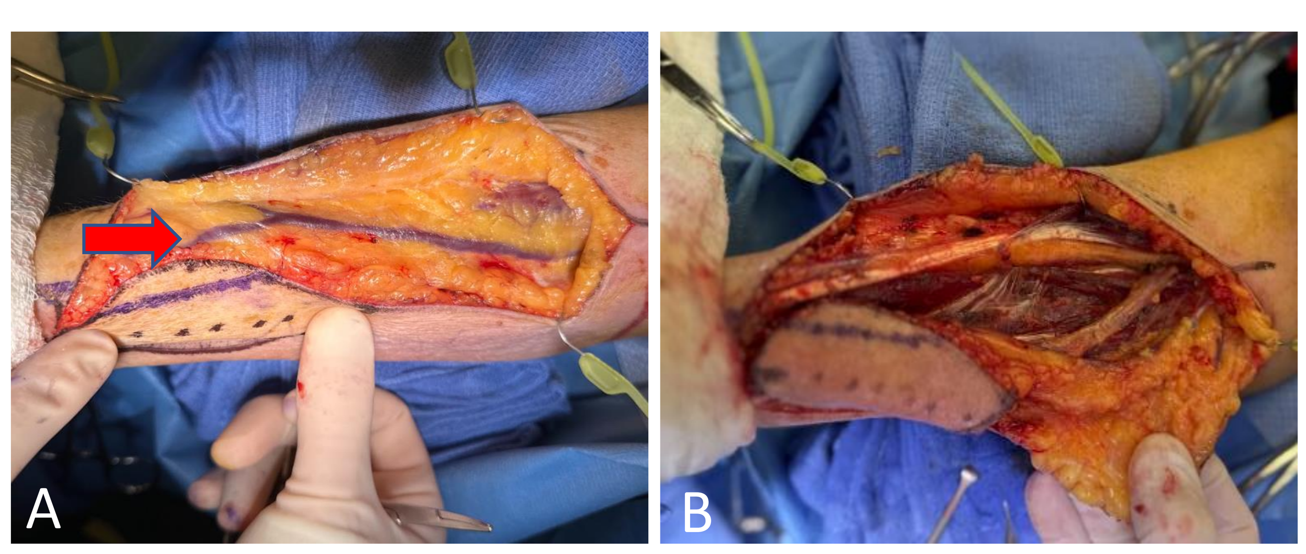

Figure 4. Image A shows the cephalic vein with a large vein (red arrow) draining the skin paddle directly into the cephalic vein. This is optimal for "cephalic only" harvest.
Image B shows the proximal dissection where the radial artery (with venae comitans) is separate from the cephalic vein. Enough pedicle length is demonstrated to halt the dissection and use this flap with limited incision. In addition, the cephalic vein has freedom from the arterial pedicle. This can be trimmed to optimize venous geometry if needed.

4. Discussion

The **isolated cephalic approach** is a **safe, reliable harvest modification** for RFFF and OCRFFF.

Advantages include:

- Avoids antecubital fossa venous dissection → reduced harvest duration, redundant pedicle length and incision size.
- Increased freedom between artery and vein
- Optimized pedicle geometry, especially in vessel-depleted necks (decreased risk of artery & vein 'crossing' or tethering)
- Increased recipient vessel flexibility.
- Non-inferior flap survival and complication rates.
- Venae comitans can still be utilized as a additional option if venous drainage requires revision or does not appear robust enough.

Additional Findings: Smaller average skin paddle size and coupler size in cephalic-only cases—reconstructive demands rather than case selection bias.

Limitations: Retrospective design, smaller isolated cephalic subgroup, lack of long-term functional outcomes, single volume center

5. Conclusion

The "**cephalic only" RFFF** is a safe, reliable venous drainage option and harvest technique for head and neck free flap reconstruction.

Offers advantages in optimizing vascular geometry, reducing harvest/tourniquet time, incision length, and potential improvement in pedicle geometry

Our cohort reinforces the concept of non-inferiority compared to using a "communicating vein" between the cephalic and venae comitans (deep system) veins.

6. References

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