

## Original Article

# An important superficial vein of the radial aspect of the forearm: An anatomical study

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### ABSTRACT

**Introduction:** The superficial veins of upper limbs are seldom talked about. They are always avoided quoting them to be variable in anatomy. Other than the cephalic and basilic veins, no other superficial vein has caught the eyes of anatomists and other health professionals significantly. This article tries to explain the importance of a superficial vein that closely traces the radial vessels and explains its possible use in microvascular reconstruction. **Materials and Methods:** The forelimbs of 26 upper limbs of fresh frozen cadavers were dissected out. The anatomy of the superficial vein that follows the radial vessels was traced out from wrist to cubital fossa. Their relation to the deep venous system and cephalic veins was followed and documented. **Results:** All the 26 upper limbs showed the existence of the superficial vein that follows the radial vessels. The study also revealed the existence of venous perforators which are in turn the communication channels between the deep and superficial venous systems. **Conclusion:** The existence of the surface vein can logically hold an explanation for flap failure or success when one vein anastomosis is contemplated for radial forearm-free tissue transfers.

### KEY WORDS

Radial forearm flap; radial vessels; superficial vein

### INTRODUCTION

The superficial veins of the upper limb are constantly neglected in anatomy literature<sup>[1]</sup> deeming them to be variable<sup>[2,3]</sup> in their position. Apart from the cephalic and basilic veins, they are never described in detail. One often comes across a superficial vein just above the radial artery and vena comitantes while dissecting the volar aspect of the forearm [Figure 1] while harvesting distally based radial forearm flaps.<sup>[4]</sup> This

article aims at studying the vein in particular and notes its relation to radial vessels, cephalic vein and explores their possible use as a teaching tool and for use by plastic and reconstructive surgeons.

### MATERIALS AND METHODS

The study was conducted on cadavers. About 26 upper limbs were dissected from 13 embalmed human cadavers.

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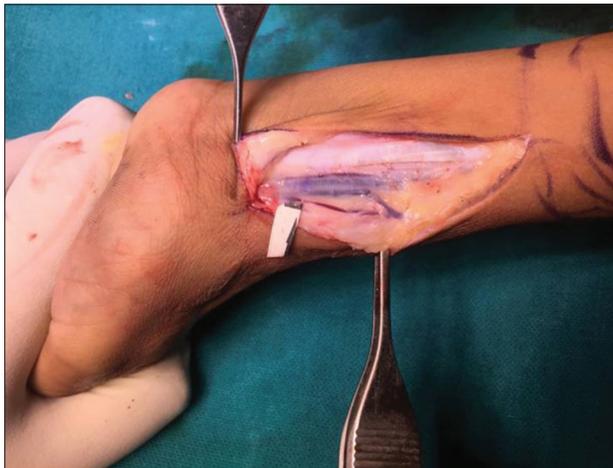
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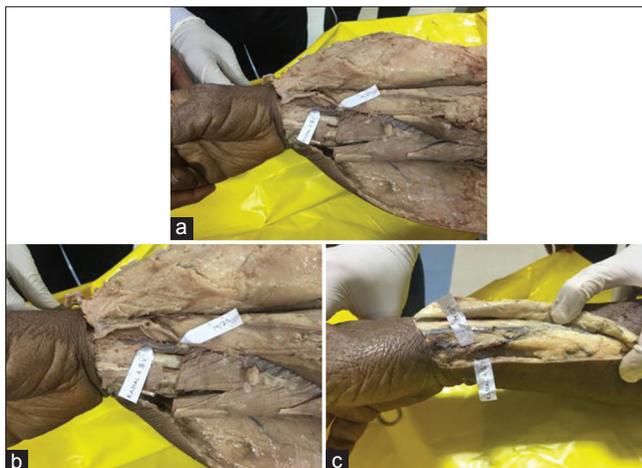
Nine of 13 cadavers were males and the remaining 4 were that of females. Their age varied from 40 to 70 years as from the records. The forearm was dissected in the volar aspect using traditional H-shaped incisions.<sup>[3]</sup> The skin flaps were reflected, and the superficial fat was teased out as gently as possible preventing damage to the superficial venous system. The vein [Figure 2] of interest was identified and traced from the distal wrist crease to cubital fossa. The cephalic vein was also followed from the wrist crease. The relation of the vein was considered with the radial vessels and the cephalic vein. Photographs were taken to analyse, and the findings were recorded.

## RESULTS

All the 26 upper limbs showed the presence of this vein.



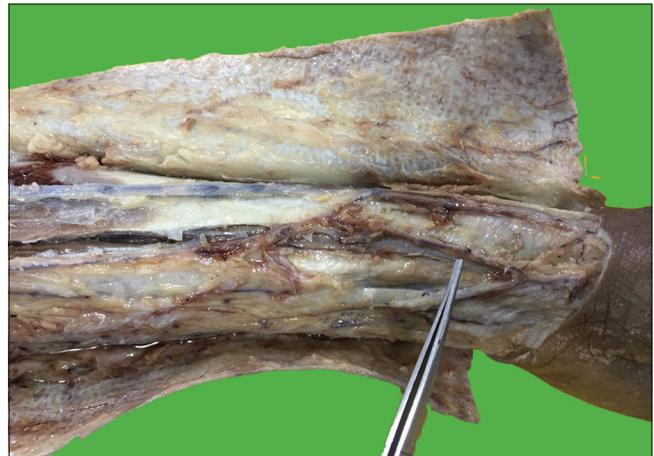
**Figure 1:** Photograph of the vein demonstrated while harvesting a reverse radial forearm flap in a live Patient. The vein is marked with an arrow (white)



**Figure 3:** Dissection showing the relation of the surface vein to the radial vessels. (a) Relationship of surface vein (lateral white arrow) with the radial vessels (medial white arrow). (b) magnified image of 3a. (c) surface vein (lateral white arrow) communicating with cephalic vein (lateral most) and closet related to the radial vessels (medial white arrow)

The vein belonged to the superficial venous system of the upper limb. It lies medial to the cephalic veins. It is present just above the radial vessels and seems to surface mark<sup>[5]</sup> it [Figure 3]. It begins from the proximal palm region and then starts tracing the radial vessels from the wrist crease. At the distal third or the mid-forearm level, it drains into the cephalic vein. They communicate with vena comitantes of the radial vessels at two places – one at their commencement at the level of the wrist crease [Figure 4] and the other – just before draining into the cephalic vein [Figure 5] after piercing the deep fascia in the form venous perforators.

Minor variations of the vein have been noted in four upper limbs belonging to two female cadavers where the vein instead of a single entity begins as two smaller calibre veins and then at the distal third again joins the



**Figure 2:** Cadaveric dissection tracing the vein from the wrist crease to the cubital fossa. The pointer shows the surface vein communicating with cephalic vein recently and closely related to the radial vessels medially.



**Figure 4:** Venous perforator between the surface vein and the venacomitantes at the level of the distal wrist crease. Perforator between the surface vein and the radial vessels in the bed



**Figure 5:** venous perforator between the surface vein and the venacomitantes at the level of its confluence with cephalic vein. Surface vein and radial artery and venacomitantes are marked

cephalic vein. The perforators were noted in them also again the distal crease region as well as just before joining the cephalic vein.

Furthermore, in four upper limbs belonging to two male cadavers, the vein continues as accessory cephalic vein even after the confluence with the cephalic vein.

However, ultimately all the limbs exhibited this venous communication between superficial and deep venous systems at the distal forearm level as one form or the other.

## DISCUSSION

The importance of superficial veins has been restricted to cephalic and basilica veins owing to their large calibre and relative constant anatomy. Conventionally, the smaller vein that has been the subject of interest in this study has been neglected even in standard anatomy books.<sup>[1-3]</sup> Although the importance of these veins has not been realised earlier, it has been the usual practice to include the cephalic vein when we harvest wider forearm radial flaps.<sup>[6]</sup> In this manner, we not only harvest the cephalic vein but also might be well including these communicating veins that are more essential for the survival of the dorsal component of the flap. They might even have a role in very small islanded radial forearm flaps (pedicled, reverse and free) that are planned around the axis of the radial vessels.

These veins can serve as important surface markers for the deeper vessels and can form a teaching tool.

Furthermore, by serving as mediators, they serve as important communications between the cephalic veins and the deeper vena comitantes accompanying the radial artery. The survivability of the dorsal part of the wider radial forearm flap by including the cephalic vein may be explained because of this but might warrant a functional study to prove this. The communications of these veins with deep vena comitantes have been mentioned as perforators<sup>[7]</sup> in some studies in the past though they were not described pertaining to the vein considered in our study.

Although the radial forearm flaps were described quite early both as pedicled and their use in free tissue transfer, the debate regarding single versus dual vein anastomosis as the best solution of venous drainage is ongoing. Series of meta-analysis review still give varied consensus regarding the same. Studies by Bai *et al*, 2015,<sup>[8]</sup> suggested that the venous anastomosis of both the superficial and deep venous system confers a better survival rate of these flaps. Ahmadi *et al*, 2014,<sup>[9]</sup> quoted a reduction in flap failure of 34% owing to venous failure when veins of both the systems are used for anastomosis. In spite of such wide series of literature, the exact mechanism of flap failure in single venous anastomosis has not been anatomically analysed.

Valentino *et al*, 1996.<sup>[10]</sup> and Cha *et al.*, 2017<sup>[11]</sup> have elaborated on a communicating vein in the cubital fossa that appears to function as a conduit between the superficial and deep venous system. This communicating vein has been isolated in 95% of patients by Cha *et al.* Cha *et al.*'s research on the use of radial forearm flap in penile reconstruction revealed flap oedema and congestion when only superficial vein is used for anastomosis. Their study uses this vein as the vein for venous anastomosis as it offers as a single conduit to involve both the superficial and deep venous systems. The major disadvantage of this is the lengthy dissection and the long conduit that has to be accommodated while inseting of the flap. The study though makes one realise the existence of a communicating system between the superficial and deep venous system in the proximal forearm but fails to provide evidence of a similar system in the distal forearm.

Razzano *et al.*, 2016<sup>[12]</sup> in 2013 have described the 'vena comitantes clipping test'. Here, the authors dissect the vena comitantes and the cephalic vein at the level of cubital fossa and then clips the vena comitantes to test the venous drainage sufficiency in the skin paddle

of the radial forearm flap. If the flap does not show venous congestion, then they only perform cephalic vein anastomosis. If venous compromise is observed, then they use the vena comitantes with the larger calibre for venous anastomosis. Again, this study does not provide any anatomic basis for the test but simply reinforces the plexus communications between the superficial and deep venous systems. It has been conventionally accepted by all the reconstructive and microsurgions that the fascial plexus is the chief mechanism of communication between the dorsal and the ventral system of veins and the superficial and deep venous systems. Now that this vein has been isolated in all the 26 forelimbs, it would be logical to ascertain the role of such veins in the venous drainage of these flaps indeed instead of relying on the tiny calibre fascial plexus vessels. It would be useful to look for this vein pre-operatively. The vein if found in a larger study might also enable one to understand the reason for the failure of some radial forearm flaps that have been used for microvascular reconstruction using only a single vein anastomosis, especially cephalic vein.

Whether these veins play a role in the survivability of the dorsal component of radial forearm flaps would need to be substantiated by a physiological study using fluorescent dyes or dynamic infrared thermography<sup>[13]</sup> in living tissues. Further studies of the vein are planned on live individuals using vein viewer or other techniques including venography.

## CONCLUSION

This superficial vein of the radial vessel is an important communication between the definitive superficial cephalic vein and the deep venous system of the radial aspect of the forearm. This study result can be used while harvesting and planning flaps in this part of the body. Furthermore, in future, further studies should be explored to prove the existence of such vessels along the ulnar territory also. Whether they have a role in thermoregulation<sup>[14]</sup> and in the survivability of venous flaps<sup>[15]</sup> are further topics of research. The vein if found in majority of the population, a pre-operative workup to demonstrate the vein can be done before a single venous anastomosis is contemplated. Hence, the vein

can become important criteria for microsurgions and reconstructive surgeons while planning these flaps.

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## Conflicts of interest

There are no conflicts of interest.

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