Complicated hand and wrist defects require durable and pliable tissues which are offered by flaps, instead of skin grafts. Various dorsoulnar flap options have been used in the regional flap armamentarium of the upper limb. Poor venous drainage may be a considerable handicap when moderate to large skin paddle dorsoulnar flaps are used. In the present case, we aimed to reduce the risk of necrosis by supercharging the dorsoulnar island flap. The current literature regarding dorsoulnar island flap has also been reviewed with focus on this flap. This technique has successfully been used for a complex wrist defect in a 48-year-old man. Postoperative follow up was one year. The flap survived completely with perfect hand function. We think this modification can prevent possible venous stress in the pedicled and free dorsoulnar flaps by obtaining extravenous drainage. The method is simple, does not need sophisticated microsurgical procedure and longer operative time.

Key words: Dorsoulnar, flap; forearm; hand; supercharge; wrist.

Soft-tissue repair of the complex hand defects exposing bone, tendons, nerves, and arteries is a challenge for reconstructive surgeons and often requires skin or fasciocutaneous flaps. Flaps have some superiorities over skin grafts such as opportunity for late reconstruction of underlying vital structures as well as immediate coverage, chance to provide sensate skin in specialized areas, and possibility to present a tissue which can grow normally without contraction. Adequate size, facility to close donor site, constant and long pedicle, pliability and thickness are the most considerable characteristics of an ideal flap in the hand.

However, regional flap options in hand are not many because of limited donor sites. Use of the dorsoulnar skin territory for the reconstruction of dorsal and palmar defects of the hand as an island flap based on the dorsal branches of the ulnar artery and nerve has been previously reported.[1,2] Although it has some recognized advantages, we encountered vascular problems particularly related to venous outflow, as a drawback of this flap, when we used moderate to large skin paddle dorsoulnar flaps. In the present case, we aimed to reduce the risk of necrosis by supercharging the dorsoulnar island flap. The current literature regarding dorsoulnar island flap has also been reviewed with focus on this flap.

Case report

A 48-year-old man sustained a complex volar wrist defect exposing all flexor tendons and median nerve,
caused by a traffic accident. After serial debride-
ments, dorsoulnar flap was planned to cover the
resultant defect (Fig. 1a).

Under pneumatic tourniquet control and axillary
block anesthesia, an island fasciocutaneous flap 8x4
cm in dimensions at dorsoulnar site of the forearm
was raised through the deep forearm fascia. The
antebrachial vein and a cutaneous medial forearm
nerve were also found, dissected approximately upto
5 cm and included in the flap (Fig. 1b). The flap’s
pedicle was placed just dorsal to the flexor carpi
ulnaris tendon, ascending end-branch of the dorsal
branch of ulnar artery and antebrachial vein were
identified and preserved. Dissection was continued
up to 2-3 cm proximal to the wrist crease (pivot
point) where the dorsal ulnar branch ramifies into
ascending and descending end-branches. Because
the flap was nourished by antegrade flow (ascending
branch), tourniquet was deflated and the flap was
observed for perfusion. Bleeding was also inspected
at the end of the antebrachial vein. The flap was then
transferred to the defect through a subcutaneous tun-
nel. No venous congestion was seen during either
harvest or inset. On the radial aspect of the wrist, a
cutaneous branch of the radial nerve and a branch of
the cephalic vein were identified and prepared for
microsurgical anastomoses. Then, an end-to-end
nerve coaptation and venous anastomosis were per-
formed under microscope (Fig. 1c). In order to pre-
vent vascular kinking, vessels should not be left too
long or in right angled orientation at the anasto-
moses site. The flap covered all the vital tissues
including flexor tendons and median nerve (Fig. 1d).
The donor site was covered with a split thickness
skin graft from the right thigh (Fig. 1e). Meticulous
hemostasis was achieved without the need for drain
placement.

The flap survived completely and no early com-
pllications such as infection, hematoma and necrosis
developed. Post operative follow up was one year. In
late postoperative course, function of wrist and all
the fingers is normal. Adaptation of the flap to the
defect site was perfect in terms of texture and color
harmony (Fig. 2). Flap sensation returned 4 months
following operation. Two point discrimination was
11 mm on the flap one year postoperatively.

Discussion

Coverage of the distal upper limb, which includes
forearm, wrist and hand, defects has remained a chal-
lenge for reconstructive surgeons. The wrist is a junc-
tional zone through which many vital structures of
the hand such as flexor tendons, radial, median and
ulnar nerves, and radial and ulnar arteries pass. This
area has also a considerable role in hand functions.
From this point, reconstruction of the complicated
wrist defects require durable and pliable tissues
which are offered by flaps, instead of skin grafts.

have successfully been utilized as popular distant
flaps in the literature. However, two-staged proce-
dure and long duration of immobilization are the
major handicaps of all distant pedicled flaps used in
the forearm and hand reconstruction. Although free
flaps are a good choice, their success rates decrease
when problems related to the recipient vessels
accompany the injury to the extremity. Local and
regional flaps, which have short operation and hos-
pitalization times, and no need for sophisticated
microsurgical procedures, are more advantageous
than the former options.

The reverse posterior interosseous flap has com-
monly been used in coverage of palmar and dorsal
hand defects in adults[5] and even in children,[6] As in
our case, however, flap perfusion may be disturbed
in volar defects of the wrist itself, because anasto-
moses obtaining reverse-flow between the anterior
and posterior interosseous arteries are likely to be
injured from trauma. Moreover, this flap can not
reach to the distal surface of the hand such as the fin-
gers. In this region, reverse phalangeal flaps[7] are
fairly popular and the choice of treatment. The dis-
tally based radial forearm flap[8] has been the main
flap used in palm reconstruction, but sacrifice of the
radial artery and major donor site scar has dimin-
ished its popularity. In our wrist defect, we did not prefer
this flap because of the above reasons as well as a
high risk of necrosis. The same handicaps were valid
for the reverse ulnar artery forearm flap[9] using the
main ulnar artery, despite the fact that free version of
this flap has reliably been harvested for head and
neck reconstruction.[10]

The ulnar flap proximally based on the dorsal
branch of the ulnar artery has been first reported by
Becker and Gilbert in 1988. Because of its short pedicle; this flap was only indicated in reconstruction of the anterior aspect of the wrist. In an attempt to lengthen the pedicle, Bertelli and Pagliei then described the reverse flow neurocutaneous dorsal ulnar flap based on the anastomoses of the dorsal branch of the ulnar artery with the dorsal intermetacarpal arteries and with the digital arteries in their anatomical and clinical studies. In 1999, Karacalar and Özcan suggested a similar flap, which was called distally pedicled dorsoulnar forearm flap, supplied by the dorsal carpal arch in order to reach more distant defects of the hand. Choupina and co-workers introduced an osteofasciocuta-
neous form of the first described flap as a new option for composite hand defects. Lastly, the free dorsoul-
nar flap was applied to severely injured digits and postburn contractures of the fingers by Inada et al.\[14\] and Ülkür and colleagues,\[15\] respectively.

In the present case, we outlined the flap more proximally than that of Bertelli and Pagliei,\[11\] which was similar to that of Karacalar and Özan,\[12\] on the dorsoulnar aspect of the distal forearm. By this way, the ulnar aspect of the wrist was preserved and donor site closure was more readily achieved, resulting in a concealed donor scar. However, on the contrary to the distally pedicled dorsoulnar forearm flap described by Bertelli and Pagliei,\[11\] and Karacalar and Özan,\[12\] we preferred a proximally (antegrade) pedicled flap based on the dorsal branch of the ulnar artery, because flap’s pedicle was enough to reach to the defect located in the wrist.

We obtained sensation to the flap by including the medial forearm cutaneous nerve rather than the dorsal branch of the ulnar nerve as previously described.\[11\] This presents supplement advantages which include not to destroy the arterial pedicle associated with the nerve, facility of coaptation by harvesting the nerve segment in desired length, and to leave less numbness at the donor site.

However, in addition to some disadvantages of the dorsoulnar island flap which involve transferring hair-bearing and darker skin to the volar site, and limited arc of rotation, its’ nourishment problems should also be taken into consideration. Although high survival rates for the dorsoulnar flap have been reported in clinical series, capacities of arterial and venous nourishment of this flap have not been clearly mentioned. Antonopoulos et al.\[16\] encountered superficial necroses resulting from poor venous drainage in two of six cases where larger flaps were harvested. They suggested some modifications such as inclusion of superficial veins in the pedicle or anastomosis of these veins to the dorsal venous arch in such cases. Karacalar and Özan,\[12\] and Ülkür et al.\[17\] reported partial flap necroses in one out of two and eight cases, respectively. We also experienced some venous congestions and distal loses in our previous dorsoulnar flaps. Perhaps, wider patient series and more anatomical studies can clarify this issue.

In our case, we thought that complicated volar wrist defect located close to the flap’s pedicle would have disturbed perfusion, especially venous circulation, of the flap. Thus, in order to enhance venous flow, we supercharged the dorsoulnar flap by anastomosing its main vein, the antebrachial vein, to a branch of the cephalic vein.

“Supercharging” means vascular augmentation of the flap by anastomosing an unrelated distant vascular source to the flap, while “turbocharging” involves anastomosing a vascular source already present within the flap’s pedicle to the flap. Supercharge obtains extra drainage of superficial venous system of the forearm to the flap, in addition

Fig. 2. Postoperative outcome. (a) Anterior view. Good adaptation of the flap to the wrist is noted with an acceptable scar. (b) Lateral view shows full flexions of the fingers. The flap seems fairly thin and does not require any debulking procedure. [Color figure can be viewed in the online issue, which is available at www.aott.org.tr]
to that of accompanied veins to the artery in the pedicle. Supercharging is a precaution to avoid venous congestion in risky patients as in our case. Thus, this procedure should be applied initially without waiting for congestion in such cases. We think that this method can prevent possible venous stress in the pedicled dorsoulnar flap. Furthermore, supercharging can also be used in the free dorsoulnar flap for the same purpose. In our previous study,[18] we obtained successful results by applying the same modification to the sural flap in lower extremity reconstruction.

Finally, we believe that by means of this surgical maneuver, perfusion problems may be decreased and the dorsoulnar flap may become much more popular in distal upper limb restorations. We suggest supercharging in suitable cases since it is simple, does not need sophisticated microsurgical procedure and longer operative time.

Conflicts of Interest: No conflicts declared.

References