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The Qatari Flap for Fingertip Reconstruction: Versatility, Reliability, Clinical Applications, and Review of Literature

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Background: Fingertip injuries are common; when the bone is exposed, it requires more than skin to cover the defect. After the introduction of the concept of perforator flaps, trials have been made to reconstruct finger defects with perforator flaps. Here, we describe a series of fingertip injuries that were treated with reverse flow island finger perforator flap.

Methods: We had 36 patients from January 2019 to June 2021, most of them male workers. We reported on the sizes of the defects and donor sites, the need to cover the pedicle with a skin graft, and complications. Patients were followed up for a period of 6 months, and the detailed elevation technique was mentioned.

Results: Thirty-four flaps survived completely. In 50% of the cases, patients had congestion and epidermolysis with preserved underlying flap, which had normal healing course. Two patients with diabetes had infections; one of them had 40% necrosis of the flap, and one additional case had superficial eschar with preserved underlying flap tissues.

Conclusions: Fingertip reconstruction rather than bone shortening is preferred to maintain the finger length. Multiple choices were suggested, but this flap had the disadvantage of limited coverage. After introducing the concept of perforator flaps into finger reconstruction, still more choices were added. The retrograde island digital artery perforator flap is a reliable choice, which is done in one stage and does not require loss of the digital artery. (*Plast Reconstr Surg Glob Open* 2023; 11:e5128; doi: [10.1097/GOX.00000000000005128](https://doi.org/10.1097/GOX.00000000000005128); Published online 21 July 2023.)

INTRODUCTION

Fingertip injuries are common among manual workers. Most surgeons would prefer to treat those by secondary intention in cases of minimal or no bone exposure. The use of local flaps is suggested when the distal phalanx is prominently exposed. Classic choices are V-Y advancement, unilateral or bilateral advancement flaps, and island digital artery flap.¹⁻⁶

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After the introduction of perforator flaps, Koshima et al applied the concept to reconstruct fingertip defects, which helped cover wider areas and preserved the digital artery.⁷ Since then, significant progress has been made in reconstruction of finger defects with the help of digital artery perforator mapping, which was reported in multiple studies.⁸

Digital artery perforators were used as island, local, and propeller flaps; innervated and adipose only flaps were also described.⁸⁻¹⁰ Here, we report a series of cases in which we performed an island reverse-flow dorsal digital artery perforator flap as a reliable, constant, and versatile option for reconstruction after fingertip injuries.

METHODS

This is a series of 36 patients who underwent reconstruction of their fingertip injuries using retrograde island

Disclosure statements are at the end of this article, following the correspondence information.

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digital artery perforator flap (the Qatari flap). They were treated between January 2019 and June 2021.

We reported the age, sex, comorbidities, smoking status, size of defect, size of donor, smoking status, complications including infection (total or partial loss of the flap), and the need to use a graft to close over the pedicle or the donor. (See table, Supplemental Digital Content 1, which displays patient demographics and flap course. <http://links.lww.com/PRSGO/C667>.)

We followed up all our patients for a period of 6 months. All patients were operated on by the same surgeon using the same technique. The first dressing was changed on the following day, and patients were discharged on the second postoperative day.

The first clinic visit was at 2 weeks for removal of stitches, then weekly until full healing, then at 3 and 6 months postoperative to assess for protective sensation, range of motion, and the scar. Protective sensation was tested using pinprick for pain and a cold metallic object for temperature. The scar was assessed subjectively by two plastic surgeons, not including the performer, and was rated as either acceptable or unacceptable. The patients were followed up by our occupational therapists as a standard of care for hand trauma cases.

SURGICAL TECHNIQUE

The procedure is carried out under regional anesthesia with the use of a tourniquet. The perforator is located using an 8-mHz Doppler pen. It is found consistently at the dorsal aspect of the digit, 2–3 mm proximal to the distal interphalangeal (DIP) joint on either side of the finger. The side is chosen depending on the site of the defect, and then the flap is designed slightly bigger than the defect (Figs. 1 and 2).

Takeaways

Question: Is using this flap reliable?

Findings: The flap is reliable and has the freedom to cover any fingertip defect.

Meaning: The described flap is reliable to reconstruct fingertip defects with exposed bone to avoid shortening.

Because of the consistency of the perforator, we gave up the use of Doppler in our last cases. The flap is marked slightly bigger than the defect at the level of the metacarpophalangeal (MCP) joint or just distal to it.

Using a blade 15, mid-axial incision was made to connect the designed flap with the defect. The incision was made just deep to the dermis, and the surrounding skin was undermined in a subdermal plane to preserve the pedicle of the flap, which was then marked with a width of 3–5 mm to ensure inclusion of the blood vessel (Fig. 1). The flap and its pedicle were elevated at a supra paratenon plane to a point just proximal to the aimed perforator. (See Video 1 [online], which demonstrates in detail the elevation and inset of the Qatari flap.)

After completion of the dissection, the tourniquet was released to inspect the perfusion of the flap, which, in some cases, needed roughly 3–5 minutes of waiting to observe the bleeding points; this might be attributed to a spastic reaction of such a small vessel after the release of tourniquet. The flap was then transferred to the defect, and the skin was closed primarily in a tension-free fashion using 5-0 Ethilon interrupted stitches; however, in some cases, we needed to use a graft to cover over the pedicle or the donor area.

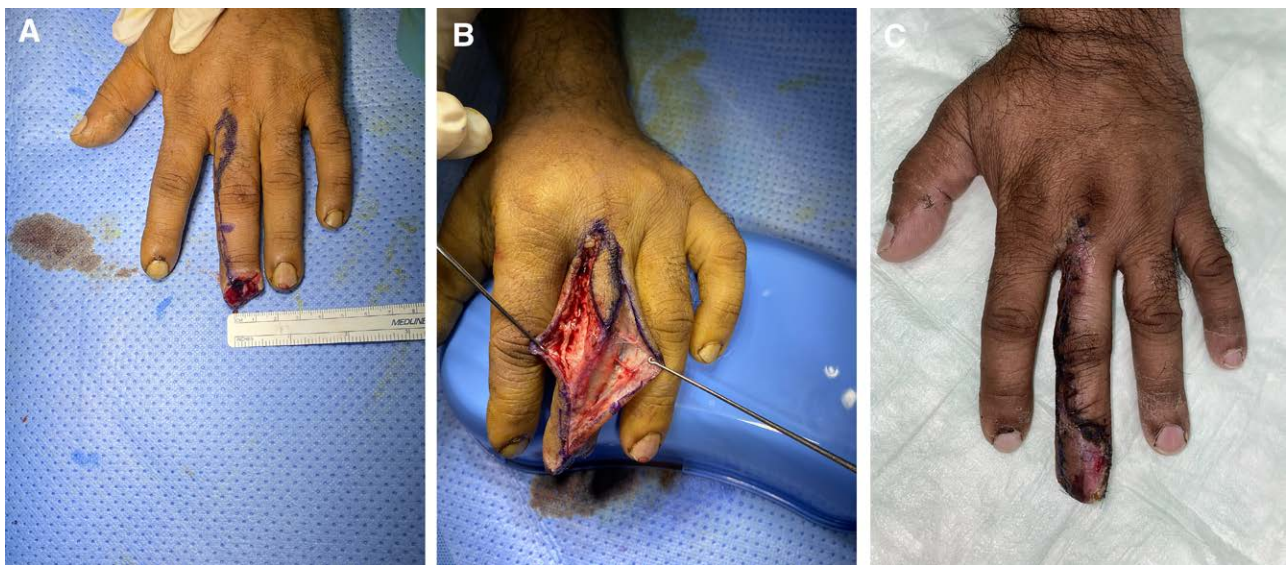


Fig. 1. Intra- and postoperative demonstration of the Qatari flap. A, Preoperative photograph showing the defect and marking of the flap. B, Intraoperative photograph showing flap dissection. C, Three weeks postoperative showing full healing of the flap.

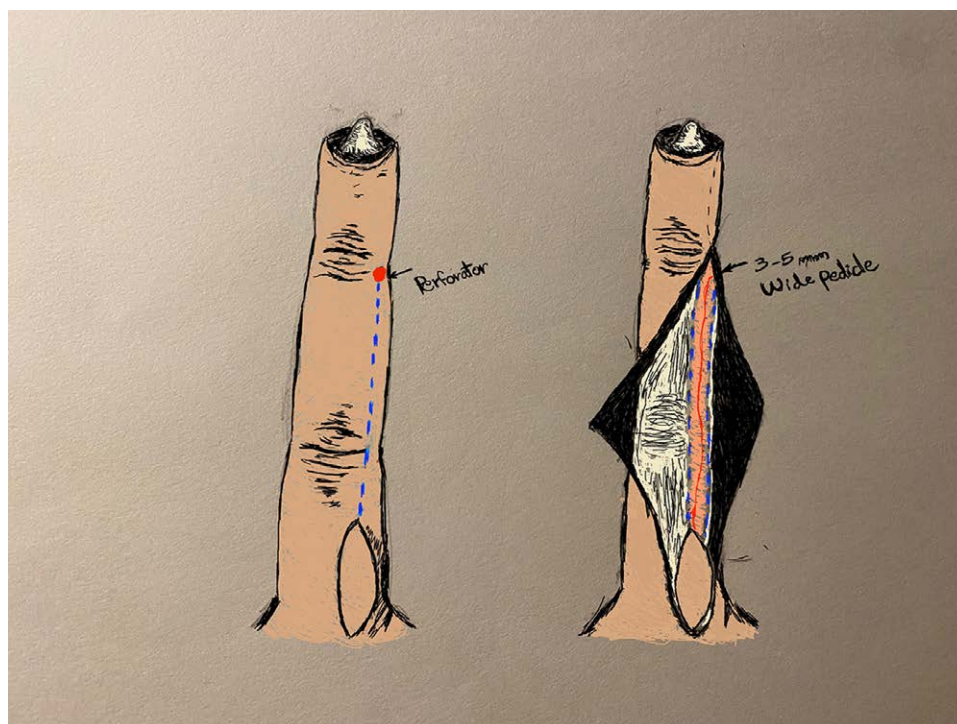


Fig. 2. Diagram illustrating the designed flap.

RESULTS

Our patients were 91% men, with a mean age of 37.8. Most of them were laborers, 22% were patients with diabetes, and 30% were smokers. The cause of the injury was machinery in all of the cases except three, in which the cause was infection. Mean defect size was 1.9 cm in length and 1.3 cm in width with exposed distal phalanx. Our mean operative time was 45 minutes.

Thirty-four flaps survived completely; however, in around 50% of cases, we experienced flap congestion and peeling of the epidermis with preserved dermis and adipose tissues (Fig. 3). The healing process was smooth,

with complete healing of the flap. In one case, we lost 40% from the distal part of the flap. The patient in that case was diabetic and had the initial injury caused by infection. In another case, superficial eschar developed in the flap, which was debrided in the clinic and left to heal by secondary intention.

We had infection in two diabetic patients, managed properly with antibiotic and wound care. A skin graft was used in three cases to cover the donor area, and in four cases, to cover over the pedicle of the flap.

Full healing took 3 weeks on average, after which patients were able to go back to work, except for the cases

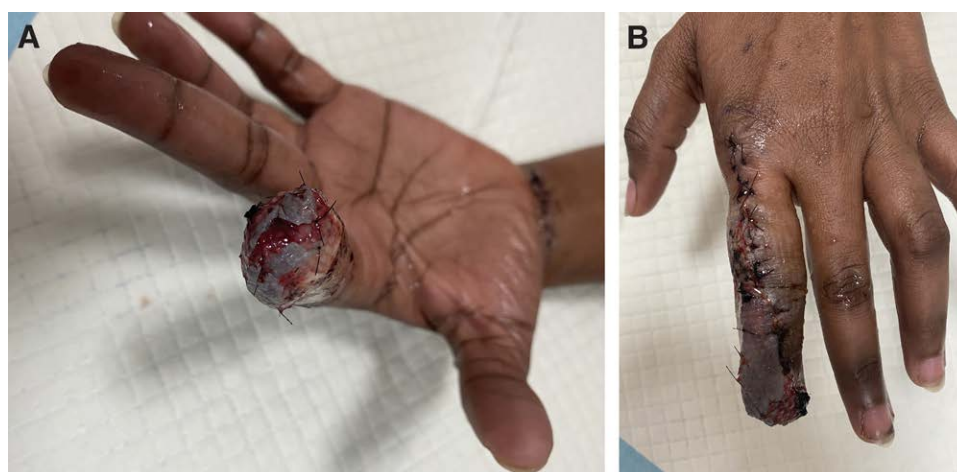


Fig. 3. These images show the period of congestion and epidermolysis. The patient had full healing of the flap in 4 weeks. A, Marking. B, flap pedicle demonstration.



Fig. 4. Intra- and postoperative demonstration of the Qatari flap. A, B, Preoperative photographs. C, D, 1-week postoperative photographs.

where we had necrosis or infection; an additional 2 weeks were added (Figs. 1 and 4). At 6 months, all patients had full range of motion with protective sensation at the site of the flap in terms of pain and temperature sensation. No painful scar, contractures, or keloids were detected; scars were aesthetically acceptable in all cases, but we did not use a scale for this purpose.

DISCUSSION

Fingertip injuries are common. Treatment of such defects to maintain the finger length and cover the bone

when exposed has gained more attention in recent years, especially after the advancements made in the field of micro and super microsurgery, although some surgeons still prefer to manage such defects by secondary intention healing, claiming simplicity, low cost, and reproducibility of the method. However, it has the disadvantages of hyperalgesia, shortening of the finger, and persistent phalanx exposure.¹¹

Reconstruction options suggested previously include local V-Y flaps; however, their coverage is limited to areas less than 1 cm. For bigger defects, cross finger and thenar flaps can be used, but these have the drawback of causing stiffness because of the positioning before separation.

The anterograde or reverse flow homo-digital artery island flaps are other options that involve loss of the digital artery. The main complications are prolonged surgery, flap loss, and contracture.^{12–14}

The description of perforator flaps by Koshima and Soeda in the late 1980s marked a new era for reconstructive surgery.¹⁵ A perforator flap refers to an area of skin that can be raised on a supplying vessel that often traverses connective tissue or muscles. These flaps are suitable for small- to moderate-sized defects and can be raised as pedicled or free flap.¹⁶

Digital artery perforator anatomy was described by Koshima in 2006 through his cadaver study, and he reported the use of them in five cases to cover fingertip defects after visual identification of the perforator under loupe magnification.⁷

At the same time, another digital artery perforator map was published by Kostopoulos et al. They used their map to design V-Y or propeller flaps to cover adjacent defects on the finger after tumor resection, and they reported no flap loss.^{17,18}

Since then, multiple case series were published testing the theory and displaying variations. The innervated digital artery perforator flap that depends on the end branch of the digital neurovascular bundle to provide sensate reconstruction of the finger pulp was reported by Ozcanli et al. They studied the flap outcomes in depth, and the size ranged between 1.6×0.7cm and 3.5×2cm. They reported no flap loss and reasonable sensation, with very few patients who developed hypersensitivity and cold intolerance, and they used a full-thickness skin graft to cover the donor in all cases.^{19,20}

This flap was compared with the homo-digital reverse flow flap by Gulec et al, who found the former to have the advantage of digital artery preservation and shorter operating time. They described the incidence of transient congestion in a few flaps that resolved without any intervention.²¹

Li et al described the use of the same flap to cover the finger pulp in three cases, and reported 1.2×1.7cm flap size and good sensation in all flaps without any loss. They used skin grafts to cover the donor site in all cases.²²

Xianyu et al used innervated fasciocutaneous homodigital laterodorsal flap supplied by the dorsal branches of the digital artery in seven patients to cover finger pulp defects. The mean size of the flap was 1.8×1.5cm, with no flap loss but good sensation; the skin graft is used to close the donor site.²³

Haoliang et al reported the use of bigger sized propeller flaps in 10 cases to cover distal defects; their flap size was approximately 5×2cm. All flaps survived with two congestion cases and good final aesthetic and functional outcomes with minimal donor site morbidity.²⁴

Chen et al in their large series of 177 patients using different perforator flaps to cover defects on the middle and distal phalanx reported failure of 12 flaps and venous congestion in 18, with partial necrosis of 10%–20%, with no functional morbidities. All donor sites were covered with skin grafts, which showed signs of extensor tendon adhesions in 14 cases, which resolved with physical therapy only.²⁵

Sometime before this era, Bene et al and Pelissier et al described the use of the reversed dorsal digital island flap

to cover defects on the dorsal and dorsolateral aspects of the finger, which was based on communicating branches between the volar and dorsal arterial supply of the digit as per their description.^{26,27} Pelissier described in his work of 27 cases the use of different flaps depending on the site of the defect.^{26,27} On the contrary, we used one flap that has a specific blood supply detected by Doppler, which has the freedom to cover any moderate-size defect on the distal phalanx volar or dorsal aspect. In our series, we used a retrograde island digital artery perforator flap that was intended to cover fingertip defects.

Our main indication to use the Qatari flap was bone exposure, but another potential indication is a painful adherent fingertip scar after secondary intention healing, the scar can be excised, and the area can be covered with the described flap to provide padding over the bone.

We depend on one main perforator that is detected by hand-held Doppler, branching 2–3mm proximal to the DIP joint on either the ulnar or the radial side of the finger to cover defects of the distal phalanx. This perforator is constantly found at the same site; so in the last cases, we did not use the Doppler. We had no total flap loss, with protective sensation gained in the flap after a period of 6 months in all cases.

We had one case of 40% necrosis in a diabetic patient who presented with a finger abscess, and the course was complicated by tip infection, which was resolved with antibiotics.

Our flap has a stage of initial congestion and peeling of the epidermis, which happened in around 50% of the cases. This can be attributed to involving a retrograde vein in the pedicle, which drains blood to the flap, resulting in congestion, but our flap tolerated the congestion and survived without necrosis, just like the venous flow through flap.

This flap should be used cautiously in older patients with peripheral vascular diseases, patients with diabetes, and smokers, because it depends on a very small vessel, which might be compromised in such groups of patients. The usual course is not to use a skin graft; however, in some cases, we needed to use a graft either to cover the pedicle of the flap in case of tight closure or to cover the donor site.

The Qatari flap is reliable because the perforator is consistent and can be detected by Doppler. The flap is versatile because of the relatively long pedicle (around 2.5cm), which gives freedom of mobility to transfer the flap to any defect in the distal phalanx, and can cover up to 2.5×1.5cm defects. We aimed to introduce our approach to manage fingertip defects using the described technique.

The limitation of the study is its descriptive nature, with the lack of control group or comparison with other suggested treatment options. We recommend testing this method using superior study designs to compare its outcomes with methods that have been used in the literature.

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DISCLOSURE

The authors have no financial interests to declare in relation to the content of this article.

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