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Review Article

Reverse Superficial Palmar branch of Radial artery pedicled flap for Palmar and Digital reconstruction: A systematic review of literature with a retrospective case review [☆]

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ABSTRACT

Background: Most studies on the superficial palmar branch of radial artery (SUPBRA) flap involve its use as a free flap with only few reports in literature regarding its use as a reverse pedicled flap. This systematic review presents a summary of the available literature on the indications, anatomy, technique, complications and outcomes of the reverse SUPBRA flap and also describes our experience.

Methods: A computer search was performed on the Embase, Medline and Pubmed databases for clinical studies describing the reverse SUPBRA flap in accordance with the standard principles for systematic review and Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines. A retrospective review of cases performed by the senior author was also conducted.

Results: Seven studies qualified for the review with 50 flaps in 50 patients meeting the inclusion criteria. The senior author has per-

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formed nine reverse SUPBRA flaps from 2006 to 2015. The flap was found to be most useful for defects of the thumb, index, palm and first webspace. Variations in vascular anatomy may necessitate a change of operative strategy. Venous congestion was common but transient in the majority. Complications were rare and included minor tip necrosis, scar contracture, donor site sensitivity and numbness, thumb adduction contracture and cold intolerance.

Conclusions: The reverse SUPBRA flap is a versatile flap for reconstructing defects of the thumb, index, palm and first webspace. It is quick to raise, has a low donor site morbidity and complication rate and achieves very reasonable functional and aesthetic outcomes.

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Introduction

Superficial palmar branch of radial artery (SUPBRA)–based flaps are a useful option for the reconstruction of volar defects of the digits and palm providing a ‘like for like’ reconstruction with glabrous skin. We and other authors have reported and presented its use as free and pedicled (antegrade and reverse) flaps^{1–4}. The pedicled reverse SUPBRA flap is a convenient option for the reconstruction of defects of the digits especially the thumb, index finger and palm and allows a faster raise than the free flap version. Other than a few case reports and series in the literature about its use, a comprehensive and systematic review on the flap characteristics, techniques, indications, contra-indications and outcomes has not been published. This study presents a systematic review of available literature on the clinical use of the reverse SUPBRA flap and describes our experience in its use.

Materials and Methods

A computer-based search was performed on EMBASE, MEDLINE and PUBMED databases in November 2020 using the search terms ‘((((((thenar OR palmar OR SUPBRA OR SUBBRA) AND reverse) AND Flap) NOT metacarpal) NOT interosseous) NOT homodigital).ti,ab,au’. The search strategy (Figure 1) was based on standard principles for systematic review and Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines⁵. No date limits were applied. Inclusion criteria included human studies, articles in English language or with English translation and reverse pedicle flaps based on the SUPBRA vessel axis. Exclusion criteria included nonclinical studies, free SUPBRA flaps, pedicled antegrade SUPBRA flaps and flaps not based on the SUPBRA axis. Two authors (AA and CL) independently scanned the titles and abstracts for relevance using the keywords stated above. A further full text review of the selected articles was performed using the exclusion criteria. Data collected included sample size, age, gender, risk factors, pathology, defect location, flap dimensions, donor-site management, pre-operative vessel identification technique, technical variations, contraindications, early and late complications, follow-up period, reported outcomes and sensory recovery. The data were summarised using descriptive statistics. A retrospective review of cases of the pedicled reverse SUPBRA flap performed by the senior author (FCI) was also performed and is presented.

Results

The database search yielded 113 results. After removing duplicates, the initial title and abstract review excluded 41 of the remaining 49 articles based on relevance to the topic leaving eight articles for full-text review. One further nonclinical study was excluded on the full text review, leaving seven

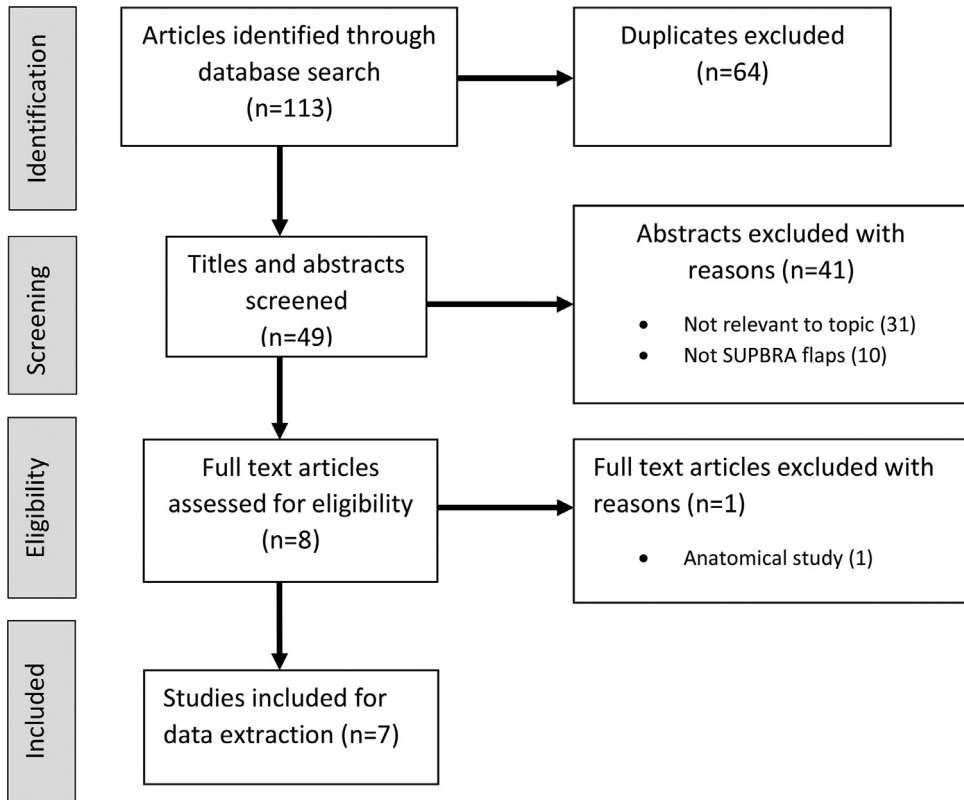


Figure 1. Flow chart depicting the search strategy for the inclusion of articles in the systematic review as per the PRISMA guidelines.

articles for final inclusion. The two independent reviewers agreed to the selected articles showing no bias in selection. All included studies were case reports or case series with Level 4 or 5 evidence on the Oxford level of evidence scale and were therefore prone to attrition, confounding, and selection biases inherent in these study designs. A summary of the findings from the systematic review is presented in [Table 1](#) and [Table 2](#).

The review identified 50 flaps in 50 patients from 1996 to 2019 involving 7 studies^{6,7,8,9,10,11,12}. Study samples ranged from 1 to 21 patients. The mean age was 32 years (range 8–76 years). Gender data were available only for 29 patients from six studies^{6,7,9,10,11,12} with seven females and 22 males. Data on risk factors and co-morbidities were available for 36 patients from three studies of which there were ten smokers and one diabetic^{8,9,11}. The aetiology of the defect was mentioned for 43 patients^{6,8,9,10,11} and included 13 traumatic wounds, five Dupuytren’s contracture releases, three burn contracture releases, two acute burns and one infective wound. In 21 cases from the series by Orbay et al⁸, the aetiology could be confidently identified only in two cases due to the mix of free and pedicled flaps in the series. The defect site could be identified in 31 patients^{6,7,9,10,11,12} and among these the most common location was the thumb (14), followed by the index (6), palm (5), middle finger (3), first webspace (2) and second webspace (1).

Data on flap dimensions were available from 6 studies^{6,7,8,9,10,11}. Flap width ranged from 15 to 35 mm and length from 22 to 100 mm in the different studies. The smallest flap was 15 × 20 mm and the largest 25 × 100 mm. The widest flap from the thenar area measured 35mm in width and required a local flap for the donor site closure⁷. In all other cases, the donor sites were 30 mm or less in width and were closed primarily. Zheng et al¹⁰ described pedicled reverse SUPBRA flaps raised

Table 1

Summary of data on patient and flap characteristics from the review.

Reference	Sample Size	Age (years)	Gender	Comorbidity/ risk factors	Aetiology of defect	Defect location	Flap size (Width x Length) mm	Donor site closure	Vessel Identification and marking	Distal communicating vessel	Additional procedures	Contra-indications
Omokawa et al ⁵ 1996	1	47	M	No data	Trauma (1)	Thumb (1)	30 × 50	No data	HHA Doppler to trace artery	SPA	Iliac bone graft, nerve coaptation	No data
Omokawa et al ⁷ 2002	6	48 (29-63)	1F, 5M	No data	No data	Thumb (6)	22.5 × 35.8 (20 × 30 to 35 × 50)	Primary 5, local flap 1	HHA Doppler to trace artery	SPA (2), Thumb RDA or UDA (4)	3 nerve coaptations of (PCB)	No data
Orbay et al ⁸ 2009	21	45 (8-76)	No data	Smoker (9)	Dupuytren's (1), Burn contracture (1). Unclear in rest due to mix of free and pedicled flaps	1st web (1), Palm (1). Not enough data in rest.	15 × 22 to 25 × 100	Primary	Intersection of Kaplan line and radial border of 2nd webspace. Also, HHA Doppler used.	SPA Perforator in 2nd web, CDA of 2nd web. (Reverse flap based on FC communications between proximal and distal SPBRA perforators)		No data
Seyhan ⁹ 2009	7	44.7 (8-66)	4F,3M	Heavy smoker (1)	Trauma (1), Burn contracture (2), Dupuytren's (4)	1st web (1), Palm (4), Index (2)	22 × 50 (15 × 30 to 25 × 60)	Primary	Intersection of thenar and proximal palmar creases. Also HHA Doppler used.	Perforator in first web (keystone area). Included part of SPBRA vessel in 2 cases, perforators from distal SUPBRA in 5 cases.	CTR in all Dupuytren's.	Elderly heavy smokers
Zheng et al ¹⁰ 2015	6	31.8 (16-53)	1F, 5M	No data	Trauma (6)	Thumb (6)	15 × 35 to 30 × 70 (Wrist crease flap)	Primary	Merging point of thenar crease and central palmar crease. HHA Doppler not used but mentioned as useful.	SPA, Index palmar digital arteries, Thumb digital arteries. (Operation abandoned in 7 th case in series due to variable course of SUPBRA)	Anastomosis of SUPBRA to distal severed digital arteries. PCB and SRN to digital nerves.	No data
Tapan et al ¹¹ 2018	8	46.5 (26-67)	1F, 7M	Diabetic (1)	Trauma (5), Burn (2), Abscess (1)	Index (4), Middle (3), 2nd Web (1)	21.875(20-25) x 40.625(30-50)	Primary	Intersection of Kaplan line and radial border of 2nd webspace. HHA Doppler not used routinely.	SPA 4, RDA to IF 2, CDA to 2nd web 2	None	Prior vascular injury or scarring in the territory of perforators. ? Prior CTR scar
Sierakowski et al ¹² 2019	1	26	1M	No data	No data	Thumb (1)	No data	Primary	No mention. No data on HHA doppler use.	Branching of SUPBRA into thumb UDA and Index RDA	Supercharging vein, Artery to vein anastomosis, nerve coaptation	No data

Abbreviations: HHA Doppler: Hand-held acoustic Doppler, SPA: Superficial Palmar Arch, PCB: Palmar cutaneous branch of Median nerve, SRN: Superficial radial nerve branch, UDA: Ulnar digital artery, RDA: Radial digital artery, CTR: Carpal tunnel release.

Table 2

Summary of complications, follow-up and outcomes of the pedicled reverse SUPBRA flap from the review.

Reference	Sample Size	Immediate Complications	Late complications	Follow-up (months)	Outcome	Sensory recovery (2PD)
Omokawa et al ⁶ 1996	1	None	None	10	No data	8mm
Omokawa et al ⁷ 2002	6	Distal necrosis (1) - healed spontaneously	None	61	Acceptable cosmetic result of donor site	6,4,6mm in innervated flaps.
Orbay et al ⁸ 2009	21	Distal necrosis (1) in 76M, Dupuytrens, healed spontaneously.	None	24	Excellent cosmetic and functional	6mm for 1 case
Seyhan T ⁹ 2009	7	Distal necrosis (1) in a 70-year old.	None	12.6 (3-24)	Excellent cosmetic and functional outcome	No data
Zhenget al ¹⁰ 2015	6	Abandoned operation (7 th case in series) due to variable course of SUPBRA.	Donor site numbness (1)	16.5 (12- 26)	Good 5, Fair 1 (MHQ)	No data
Tapan et al ¹¹ 2018	8	None	Thumb adduction contracture (1) in diabetic.	16 (9-31)	Good aesthetic result for donor and recipient.	No data
Sierakowski et al ¹² 2019	1	None	None	No data	No data	No data

Abbreviations: 2PD: Two-point discrimination, MHQ: Michigan Hand Questionnaire.

from the wrist crease ranging in size from 15 × 35 to 30 × 70 mm with primary closure of all donor sites.

All studies mentioned details of the distal vascular anatomy and preoperative vessel identification method. Most authors described the use and benefit of preoperative hand-held Doppler to trace or locate the SUPBRA vessel^{6,7,8,9,10}. Some studies described additional procedures performed for making the flap sensate, for intra-operatively identified anatomic variations or as adjunctive procedures^{6,7,9,10,12}. Majority of the articles contained information on early and late complications.

There were three cases of distal flap necrosis (6%) all of which healed without further surgery^{7,8,9}. Late complications included one thumb adduction contracture (2%) in a diabetic¹¹ and one case of donor site numbness (2%) in a wrist crease flap¹⁰.

Follow-up data were available from all except one study¹². The average post-operative follow-up ranged from 10 to 61 months.

Most studies described good to excellent aesthetic and functional outcomes^{6,8,9} but did not specifically mention how this was assessed. Zheng et al¹⁰ used the Michigan Hand Questionnaire and reported five good and one fair outcomes among their six patients. Objective assessment of sensory recovery of the flaps was available from three studies^{6,7,8}.

Our experience

From 2006 to 2015, we have performed nine reverse SUPBRA flap reconstructions in nine patients. All procedures were performed by the senior author under brachial block or general anaesthetic with an arm tourniquet. Preoperative examination of the donor site and hand-held Doppler were employed routinely for marking the vessel axis as described previously^{3,4}. The flaps were raised from the thenar area and parallel to the thenar crease including the marked SUPBRA vessel. Flap elevation began proximally with ligation of the SUPBRA just distal to the wrist crease. The flap once elevated was supplied by reverse flow from the distal communications with the superficial palmar arch (SPA) or anastomoses

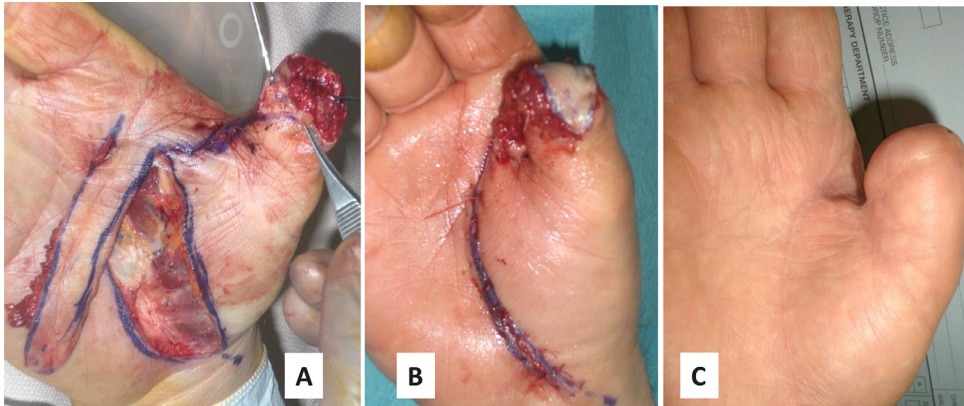


Figure 2. Pre-operative and post-operative photographs of thumb reconstruction with a reverse SUPBRA flap. (A) Thumb amputation defect and an elevated reverse SUPBRA flap. (B) Flap inset into thumb defect with donor site closed. (C) Healed flap and donor site with well-concealed donor scar.

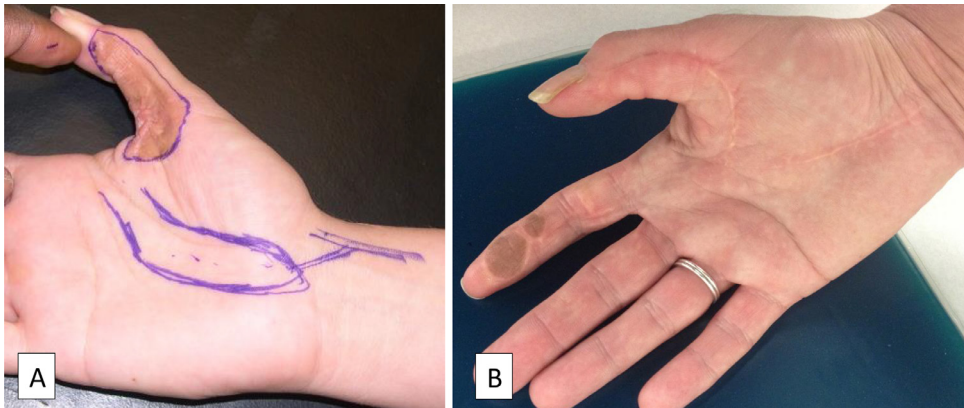


Figure 3. Pre-operative and post-operative photographs of resurfacing a pigmented thumb skin graft with a reverse SUPBRA flap. (A) Pigmented skin graft over volar aspect of the thumb from previous burn reconstruction. (B) Post-operative photo showing the healed flap with good colour and texture match and good functional outcome.

/ perforators in the first webpace. The flaps were rotated on these vessels at the base to reach the defect. All donor sites were closed primarily (Figure 2, Figure 3).

The patient data from our series are presented in Table 3. The average age in our series was 55 years (range 21–84 years) with four female and five male patients. Comorbidities and risk factors included smoking (2), diabetes (1), atrial fibrillation with anticoagulant or antiplatelet medication use (2) and dementia (1). Indications for surgery included trauma (3), Dupuytren's contracture (2), resurfacing of previous skin graft (1), infective wound (1), pulp reconstruction after neurolysis (1) and skin cancer resection (1). The defect location was the thumb in four, palm in two, index finger in two and first webpace in one case. The average flap width was 21.7 mm (range 20–30 mm) and average length was 72.2 mm (range 50–100 mm). There were no flap failures. Transient venous congestion (which resolved spontaneously) was noted in two flaps. A minor tip necrosis occurred in a 55-year-old smoker but healed without any surgical intervention. Late complications included bulky flaps with scar contracture in 2 patients needing debulking and contracture release, donor site nerve pain in one patient which required prolonged desensitisation therapy but eventually settled and cold intolerance in one patient following a first webpace reconstruction. The average follow-up was 12.8 months (range 6–

Table 3

Summary of patient and flap data from our series.

Age (years)	Sex	Comorbidities	Cause of defect	Defect location	Flap size wxl (mm)	Donor site closure	Complications	Follow up (months)
34	F	Nil	Resurfacing old skin graft scar	Thumb	25 × 80	primary	Nil	8
47	M	Nil	Trauma	Palm	20 × 50	primary	Transient venous congestion, nerve pain at scar	24
44	M	Ekzema	Trauma	Thumb	20 × 70	primary	Bulky flap, thinning	12
82	F	Dementia, HT	Skin cancer	Thumb	20 × 60	primary	Nil	6
53	M	Smoker	Trauma	Thumb	20 × 70	primary	Minor tip necrosis, healed conservative.	14
72	F	T2DM, HT, OA, AF, Tr myelitis.	Pulp reconstruction after neurolysis	Index finger	20 × 100	primary	Transient venous congestion	8
84	F	Apixaban, Aspirin, AF, TIA, Aspirin, Statin	Dupuytren's	1st webspace	20 × 50	primary	Cold intolerance	11
21	M	Smoker	Infection	Index finger	20 × 60	primary	Bulky flap, contracture release	14
58	M	Nil	Dupuytren's	Palm	20 × 50	primary	Nil	18

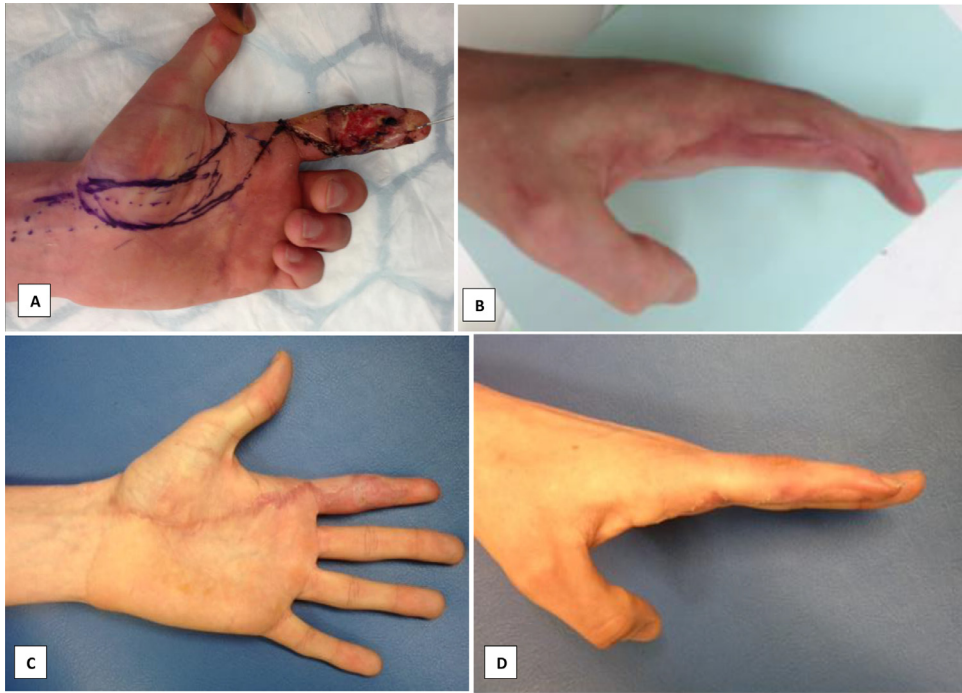


Figure 4. Reconstruction of post-infective wound of the index finger. (A) Flap markings for coverage of defects involving the volar and radial aspects of the index finger. (B) Healed flap at 6 months showing a bulky contracted flap causing flexion contracture of the finger. (C, D) Final result following flap thinning and contracture release showing excellent functional and aesthetic outcomes.

24 months). Patients had early hand therapy to prevent contractures and maintain joint mobility. All patients had good functional outcomes in relation to movement and use of the hand except the two patients with scar contractures who needed secondary surgery for flap thinning and contracture release with excellent final outcomes (Figure 4).

Discussion

The reverse SUPBRA flap is a useful reconstructive option for volar defects of the radial digits, palm and first webspace. Various other authors have also reported on its use. The review identified variations in indications, anatomy, flap characteristics, surgical technique, additional procedures, and outcomes among the included studies and these are described along with our experience.

Age and co-morbidities do not seem to have limited the use of this flap. The review showed successful use of the flap in patients from 8 years to 76 years⁸ of age. In our series, the oldest patient was 84 years old. This speaks to the versatility and ruggedness of the flap. Some authors have used the flap in smokers^{8,9} and diabetics¹¹ with very satisfactory outcomes. However, Seyhan⁹ suggested caution in elderly and heavy smokers. Though the review identified distal flap necrosis in a 76-year-old⁸ and a 70-year-old⁹ patient, a causal link between age and the complication could not be established from the available data. We have used the flap in an 84-year-old female with atrial fibrillation on antiplatelet therapy and a 72-year-old diabetic female with atrial fibrillation on anticoagulants without any flap issues. A 53-year-old male smoker developed minor flap tip necrosis in our series which healed without further surgical intervention while there were no issues in the other 21-year-old male smoker.

From the review, the most common indication (defect) was traumatic tissue loss (54%), followed by Dupuytren's contracture release (21%), burn contracture release (12.5%), acute burns (8.3%) and infective wounds (4.2%). This is similar to our series with trauma being the most common indication (33.7%) followed by Dupuytren's surgery (22.2%). Other indications in our series included skin cancer (11.1%), secondary pulp reconstruction (11.1%), pulp infection (11.1%) and skin graft revision (11.1%).

From the review, the most common defect location (and reach) was the thumb (45%), followed by index (19.4%), palm (16.1%), middle finger (9.7%), first webspace (6.5%) and second webspace (3.2%). Omokawa et al initially concluded that the potential reach of the flap was limited to the pulp of the thumb and radial border of the index finger at the proximal phalanx level¹³. In a later cadaveric study, they added that the distal vascular connections enable a reach potentially to the tip of the index finger, first webspace and pulp of the thumb¹⁴. The maximum flap length in their clinical series was 50 mm^{6,7}. However, longer flaps have been used by multiple authors including the senior author. The longest flap described in the review was 100mm,⁸ which is similar to our series. Zheng et al¹⁰ described reverse SUPBRA flaps with the skin paddle transversely oriented at the wrist crease. This modification can greatly increase the reach of the flap but does not provide glabrous skin. However, we do not have experience with the use of this donor site.

In our experience, the flap can be used for defects of the thumb, index finger, middle finger and the first and second webspace. A diagrammatic illustration of the reach of the flap (Figure 5) clearly shows the best recipient sites. Although in practice, the reach of the flap may be increased by a few degrees of finger flexion at the metacarpophalangeal joint, one can see that the reach drops off rapidly toward the ulnar digits. Hence, we have preferentially used the flap for reconstruction of defects of the thumb, index, palm and first webspace which are all within easy reach of this flap. We prefer not to use it for the other digits as much of the flap length is lost in transport across the palm and it can only realistically reach the proximal parts of the fingers as shown by the arc of rotation (Figure 5).

The maximum width of the reverse SUPBRA flap from the review was 35mm and flaps 35mm or wider needed reconstruction with a local flap or skin graft⁷. From our experience, donor defects up to 25mm wide can be closed primarily with no difficulty and extending up to 30mm in the palms of ladies with supple skin. Another modification we have used is to reduce the skin paddle (by 5mm) and incorporate adipofascial extensions on either side to increase the flap size. This allows easy donor site closure and leaves small areas of vascularised adipofascial tissue covering the recipient site which re-epithelialize within a couple of weeks. In one of our cases for index finger pulp reconstruction, we used a modified skin paddle with a narrow bridge over the pedicle which reduced the donor skin defect, the proximal bulk of the transferred flap and the likelihood of pedicle compression / flap oedema (Figure 6).

The vascular territory and anastomoses of the SUPBRA have been described by various authors^{2,3,4,7,9}. Using cadaveric dye injection studies, Omokawa et al¹³ showed that the SUPBRA supplies an area of dimension 51 mm x 34 mm (length x width) over the proximal parts of the abductor pollicis brevis and opponens pollicis muscles and they surmised that the radial aspect of the thenar eminence is the donor site. In most reports, the skin paddle was elevated from the thenar area or just medial to it. This is different from our preferred donor site as demonstrated in our free version of the flap^{3,4} where the donor site is more ulnar than in other reports and skirts around the mid palmar crease. We have also modified the shape of the skin paddle to an 'oblong leaf' shape with the central rib along the thenar crease, which, in our experience, produces a more acceptable donor scar camouflaged in the crease³.

The senior author has previously summarised the vascular anatomy of the SUPBRA flap based on personal observations as well as that of other authors³ and has also reported his experience with the use of the free SUPBRA flap⁴ and the pedicled antegrade SUPBRA flap² for the reconstruction of defects of the digits and thumb. The SUPBRA vessel was noted to bifurcate into a superficial and a deep branch 2.5 cm from the scaphoid tubercle^{3,8}. The deep branch can be ligated as reported by Kamei et al¹⁵ for their free SUPBRA flaps or can be included and this has been found to allow longer flaps to be raised³. It has however been argued that the 'superficial branch' is actually a long perforator¹⁶.

As a reverse flow flap, the flap is nourished by anastomoses of the SUPBRA vessel with another distal vessel or vascular network distally. From their cadaveric injection studies, Omokawa et al¹³ re-

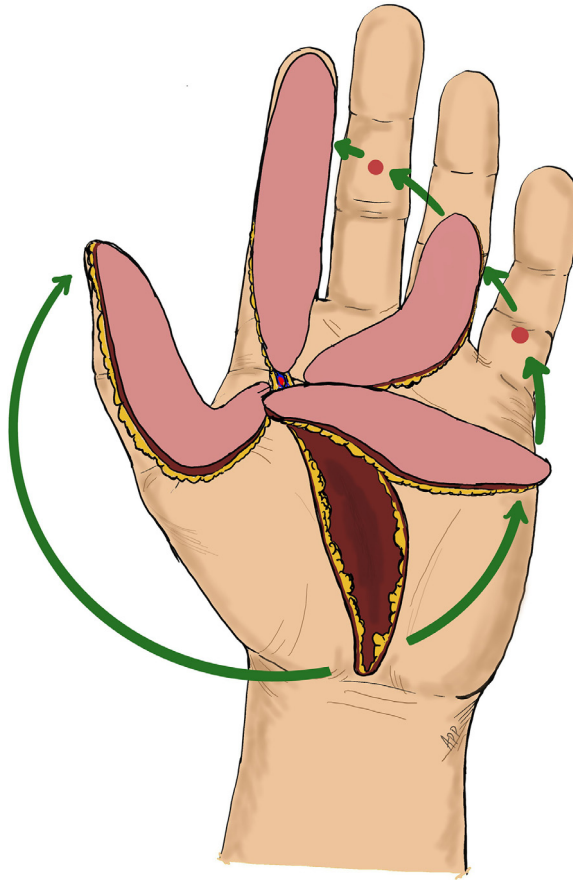


Figure 5. Diagrammatic representation of the arc of rotation and potential reach of the reverse SUPBRA flap. The flap is best suited for defects of the thumb, index and palm and flap reach rapidly reduces toward the ulnar digits with more of the flap lost in transport.

ported that the distal communication of the SUPBRA artery was with the SPA in 47%, an artery from the deep palmar arch in the first webpace in 20%, thumb radial digital artery (RDA) in 33% and the thumb ulnar digital artery (UDA) in 23%. In over 60% of cases it connected with an artery in the palm^{9,13}. Among the clinical cases in the review, the distal perfusion of the flap was via communications with the SPA, Common Digital Artery to second web, RDA to index finger and palmar digital arteries of the thumb^{7,8,10,11}. All cases in our series were based on anastomoses with the SPA or with the first webpace arteries and none were observed with the thumb digital arteries.

Kim and Hwang¹⁷ described flaps based on perforators from the terminal branch of the SPA, the RDA of the index finger or the princeps pollicis artery to resurface first webpace and proximal thumb defects. Though these flaps were supplied by anastomotic connections of different arteries including the SUPBRA, they were not based on the SUPBRA axis and were not reverse flaps. Hence, we did not include them in the review. They were advanced in a 'sliding' pattern. A reverse flow flap based on this design was suggested as a possibility, but no example was given. The pivot was located toward the base of the second metacarpal at the intersection of a longitudinal line along the radial border of the second metacarpal and a transverse line along the ulnar border of the thumb. In our series, the pivot was closer to the distal end of the mid-palmar crease at the head (instead of the base) of the second metacarpal.



Figure 6. Use of a modified skin paddle for the reconstruction of index finger pulp defect following neurolysis for painful pencil-tip deformity. (A) Flap markings shown and neurolysis being performed (B) Flap elevated and inset into pulp. Note the use of a narrow skin bridge over the pedicle.

Orbay et al⁸ and Seyhan⁹ described a variant of the reverse SUPBRA flap in that some of their flaps did not need sacrifice of the SUPBRA vessel. In the series by Orbay et al⁸, the reverse flaps were perfused by fascio-cutaneous communications between proximal and distal SUPBRA perforators and the SUPBRA vessel was not raised in the flap. In the seven reverse flaps described by Seyhan⁹, two of the otherwise perforator style flaps included the distal part of the SUPBRA vessel to gain extra reach for index finger defects. The remaining five flaps were perfused purely by a distal SUPBRA perforator and again, the SUPBRA vessel was not included in the flap. For defects over the pulps of the index and thumb, we identified the ‘deep branch’ of the SUPBRA and followed it distally preserving all the perforators into the skin paddle up to the anastomosis with the SPA or the first webspace vascular network. We believe that this was necessary to raise longer flaps with greater reach without vascular compromise of the distal tip of the flap. We preserved as many proximal perforators as possible during the elevation to ensure good perfusion into this part of the flap which eventually becomes the distal flap. For other flaps that we raised for palm defects, we used the perforator or leash of anastomoses that arises at or close to the junction of the SUPBRA with the SPA and these are in a way very similar to cases by Seyhan⁹.

Dividing the SPA for greater reach is reported but we did not do this and preferred to inset the flap with a slight flexion of the metacarpophalangeal joint with splinting in this position afterwards. This position was corrected over two to three weeks under supervision of the hand therapist.

Anatomical variations of the SUPBRA vessel and its distal connections should be kept in mind during planning. These may necessitate a change in strategy¹² or abandonment of the procedure.¹⁰ A hand-held Doppler can be helpful to identify these connections and in cases where this is not conclusive, use of digital subtraction angiography or magnetic resonance angiography has been recommended⁷. In the report by Sierakowski et al¹², the flap required a ‘venous supercharging’ as the distal SUPBRA vessel had no accompanying venae comitantes. In our series, we did not come across any unexpected anatomical variations that required a change of operative plan.

Omokawa et al⁷ and Orbay et al⁸ have described coaptation of the palmar cutaneous branch (PCB) of the median nerve to the digital nerves with good sensory recovery. Zheng et al¹⁰ have also described the coaptation of the nerves when indicated in their reverse SUPBRA flaps from the wrist crease. However, there is evidence that these flaps can regain useful sensation by neurotisation even without nerve coaptation¹⁸ and we have noted this significant neurotisation previously in the free version of the flap⁴. In our series, we did not perform any nerve coaptation of the flaps and though not routinely measured, satisfactory recovery of at least protective sensation is anticipated. Moreover,

lack of sensation even when the flap is used for the pulp area of the thumb has not been a complaint in our patients.

Zheng et al¹⁰ described the anastomosis of the SUPBRA to the distal severed digital artery for revascularisation of ischaemic digits when indicated. This can potentially restore the circulation to the digit as well as provide vascularised soft tissue cover with a single flap.

From the reported literature and our series, the flap has good reliability and a low complication rate and is not associated with any major donor site morbidity. There were no major complications reported and most studies described good to excellent functional and aesthetic outcomes, though the assessment methods were unclear in many studies. Our series had no flap losses or major complications but as previously mentioned, there was one minor flap tip necrosis in a smoker, which healed without any surgical intervention and two bulky flaps with associated contracture which required flap thinning and contracture release with good to excellent functional results subsequently.

Seghan⁹ and Tapan et al¹¹ have described the contraindications to performing the reverse SUPBRA flap and these include in addition to elderly heavy smokers, prior vascular injury or scarring in the territory of the perforators. Previous carpal tunnel release scar encroaching this area may also be a contraindication¹¹.

Our study had several limitations which could potentially impact our results and conclusions. The available studies were case reports and small sample case series with many gaps in the data including sample sizes, age and gender distributions, risk factors, cause and location of the defect, flap dimensions, complications, follow-up protocols and outcomes. In most studies, the methods of assessing outcome measures were also not specified and hence the robustness could not be ascertained. Moreover, due to the varying terminology used for the vessel including 'SUPBRA, SPBRA and SUBRA' and for the flap including 'reverse glabrous palmar flap', 'reverse thenar area island flap', 'reverse mid palmar island flap', 'thenar pedicled flap', 'radial thenar flap' and 'reverse midpalmar flap', it is possible that the search criteria could have missed some articles.

Conclusions

The reverse SUPBRA pedicled flap is a versatile flap ideally suited for reconstruction of the thumb, index finger, first web and palm defects. The use of the flap is associated with a low complication rate and low donor site morbidity. The flaps have been found to regain useful sensation even in the absence of nerve coaptation. In appropriate cases, the flap can provide excellent reconstruction and achieve good functional and aesthetic outcomes.

Declaration of Competing Interest

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Ethical approval

N/a

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