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Correspondence and Communications

The scratch collapse test: A QUADAS-2 assessment of a systematic review[¶]

Dear Sir,

We read this excellent review with great interest.[1] I have been fascinated ever since hearing Susan Mackinnon's great narrative on all things nerve related when lecturing in the UK, including her reliance on this phenomenon. Persuading her to show me how to perform the scratch collapse test (SCT), I have since applied it on all my patients with compressive neuropathies of upper and lower limbs: TOS, carpal/cubital/radial tunnel syndrome, tarsal tunnel, sciatic and peroneal nerve compressions – even piriformis syndrome, tumours and other nerve pathologies both pre and post operatively. Unfortunately, I have not once had a positive response. Admittedly, I have not repeated the test several times until a positive response was obtained – reported as necessary in some papers. The only affirmative outcome I witnessed was when my colleague confirmed my own recurrent carpal tunnel syndrome!

Unlike the Tinel test or Phalen's sign, the SCT is wholly subjective; the strength of scratch plus the rate and degree of force exerted against external rotation can be wilfully or subconsciously varied according to diagnostic belief. While, if the Tinel test or Phalen sign is properly performed, part of the response is evoked unsolicited from the patient. My impression of the SCT is similar to that of NICE guidance on the utility of kinesiology testing for allergies: whereby one elicits muscle weakness when the patient holds the suspected allergen.[2]

However, this should be scientific and so to science.

This systematic review scrutinises the studies performed regarding the diagnostic accuracy of the SCT for compressive neuropathies however; neither this analysis nor the papers on which it relies actually defines the SCT's role. Is it an add-on? Diagnostic? Localising? Perhaps a replacement test? A diagnostic accuracy study describes the behaviour of a test under particular circumstances. The eligibility criteria and description of the participants is crucial, as the test is only valid under similar circumstances. Sensitivities, specificities, NPV, PPV are compared but these statistics depend on the populations studied, the reference tests used, and the specific function of the test. These varied such that easy comparison and specific conclusions are difficult. The review shows that the test promotors report ($n = 3$) sensitivity and specificity of 0.64–0.77 and 0.99 compared to others who report ($n = 3$) 0.24–0.32 and 0.6–0.75, respectively: a statistically significant difference. Similar distinctions between promoters and others are seen with accuracy 0.82–0.93 compared to 0.31–0.41. They claim this is due to the learning curve and difficulty performing the test, however it could in fact be due to bias or the population studied.

In the promoters' reports the sample was one of convenience rather than a consecutive or random sample of clinic attendees. In all studies the participants are not a representative sample of the targeted population thus jeopardising the generalisability of the study results. The different methods of identifying eligible patients affects the spectrum and prevalence in the study population, influencing the estimates of diagnostic accuracy. The range and frequency of alternative conditions in patients without the target condition was not studied.

Exact execution of the SCT must be described to be reproducible: How hard and where to scratch or push? Push suddenly or progressively? Duration? How many repeats if initially negative? What period before repeating? How much collapse is positive? Prior information is given to participants?

Neurophysiology was used as the reference standard, however in some reports it was purely clinical. There was limited comparison with post-operative change and poor comparison with operative results and outcomes.

QUADAS-2, a quality assessment tool for systematic reviews of diagnostic accuracy studies,[3] was utilised by us to assess the papers identified. Though the review did not explicitly follow the tool, the authors covered fundamental aspects well, confirming the five papers authored by the test promoters have high rates of selection, confirmation and spectrum bias. Three of the remaining five papers had lower risk of confirmation bias, while one had high risk of confirmation bias against the utility of the test.

The review concludes that the SCT is able to localise both exact and multiple levels of compression, yet there was no correlation with reference tests, operative findings or outcomes.

The review relied heavily on the half of the papers with numerical results, claiming these met the majority

[¶] This letter has not been presented at any meeting, wholly or in part.

Table 1 Studies identified and assessed according to the STARD guidelines' thirty item scoring system.

Title	Author	Journal	Publication date	Score (good score = 30/30)
The accuracy of the scratch collapse test performed by blinded examiners on patients with suspected carpal tunnel syndrome assessed by electrodiagnostic studies	Simon J, Lutsky K, Maltenfort M, Beredjiklian PK.	J Hand Surg	2017	17
Diagnosis of carpal tunnel syndrome: interobserver reliability of the blinded scratch-collapse test	Blok RD, Becker SJ, Ring DC.	J Hand Microsurg	2014	18
Evaluation of the scratch collapse test for the diagnosis of carpal tunnel syndrome	Makanji HS, Becker SJ, Mudgal CS, Jupiter JB, Ring D.	J Hand Surg Eur	2014	20
Evaluation of the scratch collapse test in peroneal nerve compression	Gillenwater J, Cheng J, Mackinnon SE	Plastic Reconstr Surg	2011	20
Scratch collapse test for evaluation of carpal and cubital tunnel syndrome	Cheng CJ, Mackinnon-Patterson B, Beck JL, Mackinnon SE	J Hand Surg	2008	16

of the criteria required by STARD (Standards for Reporting of Diagnostic Accuracy Studies).[4] We assessed these studies using the STARD guidelines (applying the thirty items to be checked and scoring accordingly) and found them lacking. As a result, the estimates of sensitivity and specificity of the reported test can be flawed (Table 1).

Funding

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Conflicts of interest

None declared.

Ethical approval

Not required.

References

1. Čebron U, Curtin C. The scratch collapse test: a systematic review. *J Plast Reconstr Aesthetic Surg* 2018;**71**(12):1693–703 Available from:. doi:10.1016/j.bjps.2018.09.003.
2. NICE Food allergy in children and young people key to terms. *NICE Clin Guid* 2011;**116**(February).
3. Whiting R, Westwood M, Deeks R, et al. QUADAS-2: a revised tool for the quality assessment of diagnostic accuracy studies. *Ann Intern Med* 2011;**155**(4):529–36.
4. Bossuyt PM, Reitsma JB, Bruns DE, Gatsonis CA, Glasziou PP, Irwig L, et al. STARD 2015: an updated list of essential items for reporting diagnostic accuracy studies. *Clin Chem* 2015;**61**(12):1446–52 Available from:. doi:10.1136/bmj.h5527 .

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Additional advancement after elevation of a neurovascular advancement flap with interposition of an artificial nerve conduit

Dear Sir,

A neurovascular advancement flap is a useful procedure for fingertip reconstruction, but there is a limit to the advancement distance.[1] Among these flaps, an oblique triangular flap, which is based on a unilateral neurovascular bundle, can be transferred a distance of approximately 15 mm.[2] However, the acceptable distance differs in specific cases; sometimes there is a shorter possible advancement distance mainly due to limited lengthening of the digital nerve. To resolve this problem, we suggest

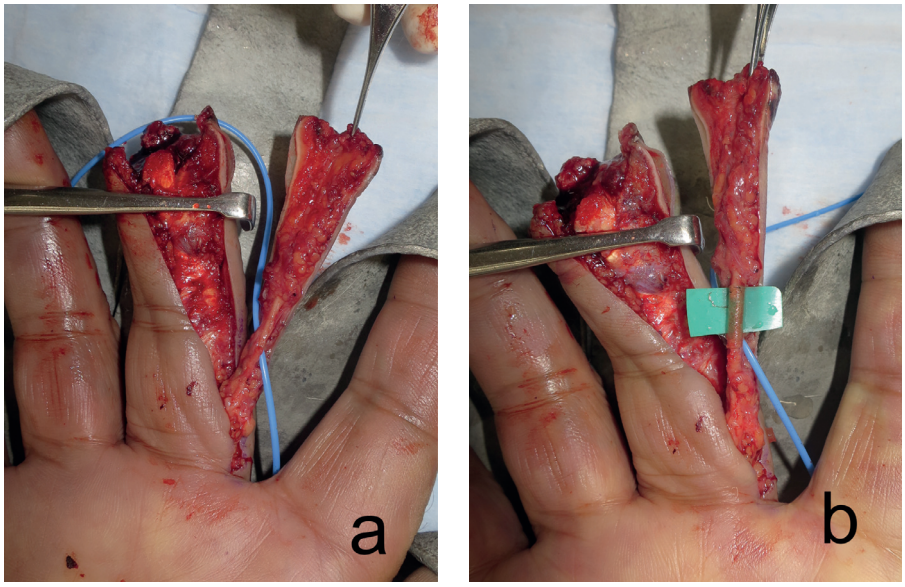

Figure 1 (a) After elevation of the oblique triangular neurovascular advancement flap, but it cannot reach the fingertip. (b) An interposed artificial nerve conduit extends the flap advancement distance.

artificial nerve conduit interposition in the pedicle of the neurovascular bundle of the advancement flap.

A 81-year-old man suffered an amputation injury of his right middle finger. Fortunately, nail matrix was preserved, and he hoped to undergo surgical intervention with a VY advancement flap to maintain the length of his finger. In the operation, an oblique triangular neurovascular advancement flap was elevated from the radial side above the sheath of the flexor tendon after debridement. The neurovascular pedicle of this flap was dissected to the base of the finger, but the acceptable advancement distance was only 8 mm (Figure 1(a)), which was shorter than that expected preoperatively. Mobility of the digital nerve was poor, and further lengthening was not possible. Thus, an all collagen nerve conduit (Renerve®, Nipro Corporation, Osaka, Japan) was interposed in the pedicle of this island flap following a cut of the digital nerve. Interposition of a 10 mm artificial nerve allowed a flap distance of 14 mm (Figure 1(b)). Flap circulation and appearance were reliable after flap inset, and the patient's postoperative course was uneventful. At 11 month after surgery, static two-point discrimination of this flap was recovered to 8 mm, and there was no fingertip paresthesia and cold intolerance.

A neurovascular advancement flap is a simple procedure for fingertip reconstruction, but unfortunately, flap distance is sometimes shorter than expected. While the digital artery is soft and flexible, the digital nerve is hard and inflexible, which sometimes prevents flap advancement. If the flap is transferred to the fingertip region in an aggressive manner, postoperative fingertip paresthesia or joint contracture might develop.[2] This procedure requires digital nerve cutting, but postoperative sensory recovery is good, because sensory recovery after bridging of the digital nerve gap with an artificial nerve conduit is acceptable for daily use,[3,4] and rewarding sensory recovery could be achieved after fingertip flap coverage by the re-innervation around the flap.[2]

The problem of this procedure is postoperative flap congestion. It is considered that the venous plexus around the epineurium of digital nerve is one of the important drainage routes in neurovascular advancement flap. Thus, there is concern about increasing the risk of flap congestion in this procedure. To prevent flap congestion, we believe that two surgical tips are important. First, in flap elevation, fat tissue around the flap pedicle, which comprise the venous drainage,[1] should be preserved as much as possible. Second, digital nerve lengthening should be performed in the pedicle region where the surrounding soft tissue is abundant.

This is a simple and reliable method to extend the flap advancement distance after VY advancement flap elevation, which could be applied for all types of neurovascular advancement flaps.

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Conflict of interests

None declared.

Funding statement

No benefit in any form has been or will be received related directly or indirectly to the subject of this article.

References

1. Varitimidis SE, Dailiana ZH, Zibis AH, Hantes M, Bargiotas K, Malizos KN. Restoration of function and sensitivity utilizing a ho-

modigital neurovascular island flap after amputation injuries of the fingertip. *J Hand Surg Br* 2005;**30**(4):338–42.
2. Usami S, Kawahara S, Yamaguchi T, Hirase Y. Homodigital artery flap reconstruction for fingertip amputation: a comparative study of the oblique triangular neurovascular advancement flap and the reverse digital artery island flap. *J Hand Surg Eur* 2015;**40**(3):291–7.
3. Meek MF, Coert JH. Recovery of two-point discrimination function after digital nerve repair in the hand using resorbable FDA- and CE-approved nerve conduits. *J Plast Reconstr Aesthet Surg* 2013;**66**(10):1307–15.
4. Haug A, Bartels A, Kotas J, Kunesch E. Sensory recovery 1 year after bridging digital nerve defects with collagen tubes. *J Hand Surg Am* 2013;**38**(1):90–7.

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The sooner the better? Patients' satisfaction following ortho-plastic treatment of lower limb open fractures within and after one week from injury

Dear Sir,

Lower limb open fractures (LLOF) treatment still represents a major challenge. The timing for flap reconstruction remains controversial, especially the ideal timing for wound coverage, despite being considered essential for limb salvage.[1]

In this retrospective study, we reviewed our experience with microsurgical reconstruction of LLOF, comparing two timings of definitive wound coverage by free flaps. We conducted a single-centre retrospective study at the Department of Plastic and Reconstructive Surgery of Cattinara University Hospital in Trieste (Italy). From January 2008 to May 2017 all patients with LLOF requiring the ortho-plastic approach (fracture fixation by orthopedic surgeons and free flap closure of soft tissue defects by plastic surgeons) were included.

In all patients the radical debridement and bone fixation were performed within 24 h from trauma. Two groups of patients were then identified based on time to free-flap reconstruction after injury: the acute (group 1, within seven days from injury) and the subacute group (group 2, beyond seven days). All patients not qualifying for major surgery one week after trauma entered in group 2. The data were stratified into these two groups and the following outcomes were compared: free-flap survival, overall complication rate, number of secondary procedures until the end result, time to bony union and the time until full-weight bearing. In addition, one year after flap surgery, all patients were given the Lower Extremity Functional Scale (LEFS) and the 36-Item Short Form Survey (SF-36) for evaluation of the post-trauma/post-surgery results.

We reviewed 25 patients, 12 were classified as group 1 (flap coverage within 7 days from injury) and 13 as group 2 (beyond 7 days after injury, mean 24 days – range 8–64 days). The mean follow up was 3 years (range 12 months – 4 years).

The overall free flap success rate was 100% in both groups. No significant statistical difference was recorded regarding reoperation, overall surgical complications, infection rate, need for secondary procedures, time to full weight bearing and bone union (Table 1).

At one-year post-operative follow-up visit, all patients were given the Lower Extremity Functional Scale (LEFS) and the SF-36 forms for evaluation. A statistically significant difference between the two groups was found: group 1 LEFS= 56.0 [46.75–67.75], group 2 LEFS= 74.5 [66.25–80.00], ($p = 0.02$ Mann Whitney's test). The results of the SF-36 showed that patients were more satisfied with their functional results in Group 2 score= 0.98 vs. group 1 score=0.70 ($p = 0.007$) and that the physical limitations were more frequently present in group 1 (score=0.63) vs. group 2 (score=1.00) ($p = 0.01$) (Table 2).

To date, the ideal timing for free-flap coverage of LLOF has been continuously debated; it is well established that complex wounds, like LLOF, should be closed as soon as possible, before entering in the subacute phase of healing.[2] The advantages of early reconstruction are related to the concept of early wound debridement and coverage aimed at decreasing the rate of bacterial colonisation and infection.[3] However, modern evolutions in wound management with negative pressure wound therapy (NPWT) have revised the concept of urgency in treatment of LLOF.[4]

When analysing our data, no statistically significant difference was present comparing the two groups regarding flap survival, overall complication rate, need for secondary procedures, bone union, time to full weight bearing and flap dimensions.

The analysis of responses to LEFS and SF-36 questionnaires showed a statistically significant better overall self-perception, less limitation during everyday life, less fatigue and pain, a better overall perception of general health and social life in group 2 patients. These results might be due to a better consciousness related to a larger time interval in which the patients had the chance to fully understand the complexity of their clinical conditions, a proper period of time to assimilate and understand the informed consent form and the complexity of the clinical condition. The surgeon too, can choose the best type of reconstruction only after taking into consideration the patient's work, habits, hobbies and expectations. The selection of the best reconstructive procedure for the patient should be tailored to the patient's wishes and expectations.

The limits of the present study are a small cohort of patients and the retrospective and single centre nature of the study. Further studies are needed to investigate the results

Table 1 Surgical details.

	Group 1	Group 2	*P* value
Gustilo-Anderson (*n*, %)			
IIIB	10 (83%)	8 (75%)	
IIIC	2 (17%)	2 (15%)	
Bone fixation (*n*, %)			
External	2 (17%)	2 (15%)	
Internal			
Plates and screws	5 (42%)	4 (31%)	
IM.+ plates, screws	1 (8%)	0	
Combined	4 (33%)	7 (54%)	
Mean defect dimension - cm^2	187	135	
(mean, range)	20-600	32-450	
Flap dimension cm^2	181	113	
(mean - range)	(24-600)	(24-300)	
Flap (*n*, %)			
ALT	5	9	
Gracilis	0	1	
Scapular	0	1	
Radial Forearm	2	0	
LD	3	0	
Ulnar	1	1	
Fibula	1	0	
mSAP	0	1	
Complication	5(41,7%)	2(15,4%)	0.20 Fisher test
Vascular complication (n, %)			
Arterial	0	0	
Venous	4	0	
Hematoma	1	0	
Deep infection/osteomyelitis (n, %)	0	0	
Superficial infection	0	1	
Cutaneous ulcer	0	1	
Bone union			
Bone union within 4 months	12(100%)	12(92,4%)	
Delayed	0	1(7,6%)	
Time to full weight bearing			0.39
$<$ 4 months	7(58,3%)	6(46,1%)	Chi squared
$\geq$ 4 months	5(41,7%)	7(53,9%)	test
Secondary procedures (*n*, %)	3(25%)	3(23%)	0.9 Fisher test
Total flap loss (*n*, %)	0	0	

Table 2 LEFS and SF-36 questionnaires results.

	Group 1	Group 2	*p* (Mann Withney's test)
LEFS score	56.0 [46.75-67.75]	74.5 [66.25-80.00]	$p = 0.02$
SF-36			
Functional result	0.70 [0.51-0.91]	0.98 [0.85-1]	$p = 0.007$
Role limitation due to physical health	0.63 [0.06-0.75]	1.00 [0.50-1.00]	$p = 0.01$
Energy fatigue	0.70 [0.55-0.75]	0.88 [0.76-0.95]	$p = 0.05$
Pain	0.78 [0.68-0.78]	0.90 [0.90-0.98]	$p = 0.01$
General health	0.63 [0.51- 0.75]	0.98 [0.90-1.00]	$p = 0.03$

of this study in a larger series of patients, possibly in a prospective manner.

Considering our results, we suggest a clear classification of early wound closure defined as every wound coverage performed within seven days from injury, when the wound is in its acute healing phase.

Our study proves that patients treated according to the BAPRAS/BOA guidelines for ortho-plastic surgery[5] but definitively covered later than seven days after trauma, could expect the same outcomes of treatment but fewer complications and finally remain more satisfied. The clue to our outcomes is an adequate single time debridement

avoiding additional "second look" procedures resulting in no deep infections.

Conflict of interest

No conflicts of interest to declare, no found received.

References

1. Arnež ZM, Papa G, Ramella V, Novati FC, Ahcan U, Stocco C. Limb and flap salvage in gustilo IIIC injuries treated by vascular repair and emergency free flap transfer. *J Reconstr Microsurg* 2017;**33**(Suppl 01):S03–7.
2. Karanas YL, Nigriny J, Chang J. The timing of microsurgical reconstruction in lower extremity trauma. *Microsurgery* 2008;**28**:632–4.
3. Godina M. Early microsurgical reconstruction of complex trauma of the extremities. *Plast Reconstr Surg* 1986;**78**(3):285–92.
4. Cherubino M, Valdatta L, Tos P, et al. Role of negative pressure therapy as damage control in soft tissue reconstruction for open tibial fractures. *J Reconstr Microsurg* 2017;**33**(S 01):S08–13.
5. Standards for the Management of Open Fractures of the Lower Limb. *British Association of Plastic, Reconstructive and Aesthetic Surgeons*; 2009.

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Microsurgery and limb salvage in patients with severe atherosclerotic disease

Dear Sir,

Introduction

Atherosclerotic disease presents a challenge to reconstructive surgeons particularly with limb salvage in the lower extremity. Atherosclerosis, a systemic disease, leaves patients with a tendency towards non-laminar, turbulent flow and thrombosis. The local effects of a diseased vessel containing atherosclerotic plaque means the vessels are thick with a narrowed lumen making the microsurgical anastomosis technically challenging. In patients with healthy non-diseased vessels, a leak immediately following an anastomosis is often repaired with an interrupted “salvage” suture. Atherosclerotic vessels are often very hard and inflexible. They can be difficult to penetrate with the microsurgical needle in an attempt address small anastomotic site leaks. An attempt at a salvage suture in the presence of severe atherosclerosis can lead to further compromise and may even necessitate a complete revision of the anastomosis. The senior surgeon advocates wrapping the anastomosis in a single layer of Absorbable, Oxidised Cellulose Gauze Hemostat (Gelita® Medical) to minimise handling of the anastomosis and to control minor bleeding.

Methods

In the context of high energy lower limb trauma and salvage surgery we present a series of five patients all of whom had evidence of severe atherosclerotic disease with narrowing of the intima, plaque and calcification. Rather than attempt a salvage stitch, the anastomosis was carefully but deliberately wrapped in a single sheet of hemostat to control bleeding (see Figures 1 and 2). The hemostat is made of 100% biodegradable organic oxidised cellulose extracted from natural alpha grade cotton. The advantage of this is the hemostat can be left in place. This ensures patient comfort and reduces the risk of encapsulation. The hemostat causes haemostasis by providing a strong matrix for platelet adhesion and aggregation as well as acceleration of a platelet plug. The low pH is thought to exhibit

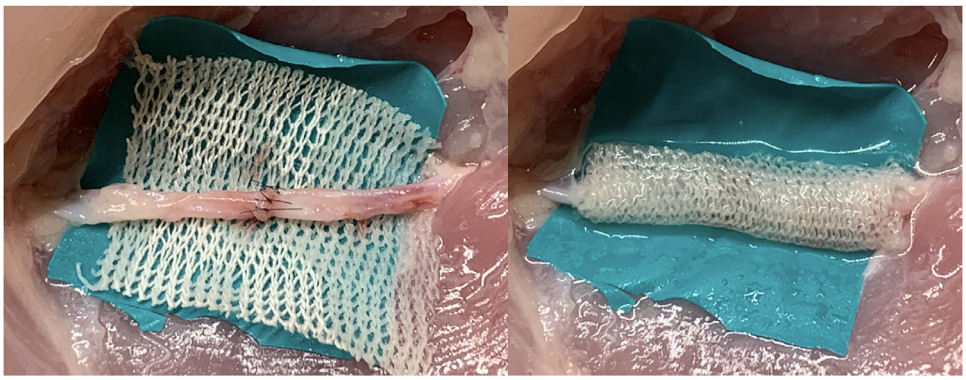

Figure 1 The photographs above show a magnified simulation of a vessel with an arterial anastomosis. The hemostat is wrapped around the anastomosis in a single layer.

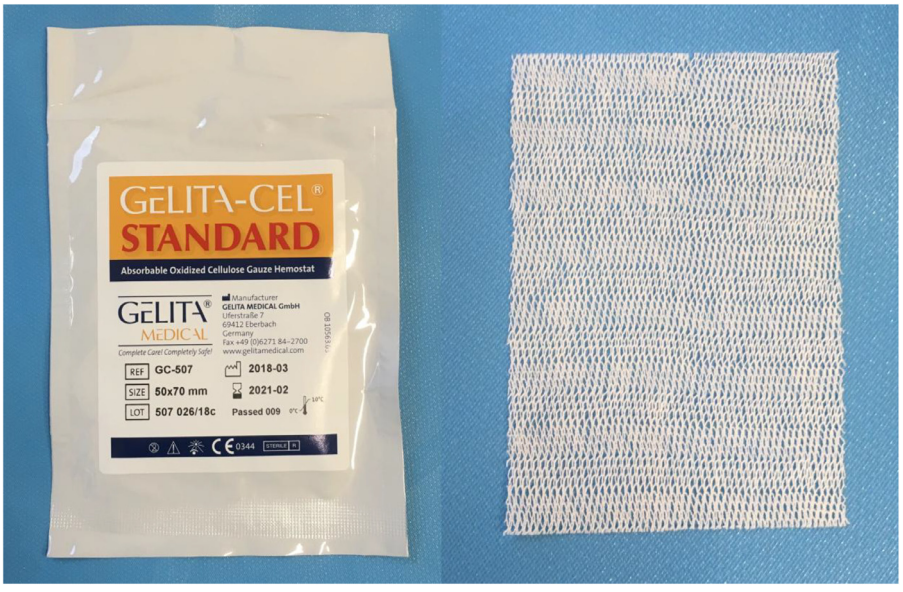

Figure 2 The photographs above show the Absorbable, Oxidised Cellulose Gauze Hemostat (Gelita® Medical). Less hemostat is used for an anastomosis in a clinical setting. The hemostat can be wrapped around the vessel and does not need to be removed.

antibacterial properties. The manufactures claim the product, depending on the operation site and method of use, is completely biodegraded in less than four weeks.

Results

In the immediate post-operative period there were no requirements for revision anastomosis, return to theatre, haematomas or flap losses. All patients made a good recovery in a timely manor.

Conclusion

For patients with severe atherosclerosis the senior surgeon advocates wrapping the anastomosis in hemostat to minimise handling of the anastomosis and to control minor bleeding rather than placing an additional stitch. This simple technique is worth considering in high risk patients with severe atherosclerotic disease and those for which microvascular anastomosis has already been a challenge.

Conflict of interest

There are no conflicts of interest or financial disclosures in relation to the product described.

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Intra-pedicular injection of indocyanine green in flap surgery: A preliminary report

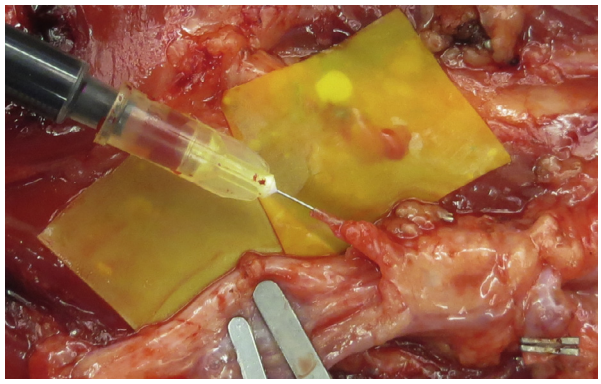

Figure 1 An arterial branch of the perforator is isolated and cannulated. The blood flow in the pedicle is temporarily interrupted by microvascular clamps.

Dear Sir,

"How long it can be?" is a question that continues to nag many, if not all, reconstructive surgeons performing flaps surgery. Taylor,[1] Saint-Cyr[2] and Rozen[3] among others, gave an invaluable contribution in understanding the anatomical and the clinical territories of individual cutaneous perforating arteries. The purpose of their researches was more or less the same, i.e., to provide the foundations to a method to guide surgeons in designing safe flaps. Unfortunately, even though they developed some important "rules of the thumb" that should be kept in mind when planning perforator flap reconstructions, a key factor escapes, by definition, such rules: the inter-individual anatomical variability of the skin perforator sizes and locations and the vascular branching system between the different skin perforators (choke and true anastomoses). This variability could be one of the reasons why in some patients we are able to rise extremely wide flaps based on a single perforator, while in others the same design on a similar perforator location would invariably lead to flap necrosis.

Even though perforator course and its subcutaneous branches can be investigated successfully preoperatively by means of CT angiography in some thick flaps, e.g., Diep flap,[3] in which the abundant adipose tissue provides an excellent contrast and vessel visualisation, in thinner flaps, such as those in the leg, there is currently no reliable method to confidently trace the subcutaneous course of the main perforator's branches.

Given this lack, we started to investigate the use of the intraoperative indocyanine green (ICG) angiography during flap harvest with an intra-pedicular injection of the dye, instead of the conventional intravenous route.

The main steps of the procedure are summarized as follow:

1. An exploratory incision is made on the side of the planned flap long enough to allow pedicle evaluation and dissection.
2. The perforator is then freed in a retrograde way.
3. During its dissection, the sizeable branches of the perforator are visualized and the most suitable one (based on calibre and favourable position) is set up for cannulation.
4. The perforator blood flow is temporarily interrupted by placing a microvascular clamp at its base and the selected arterial branch is prepared for 5–10 mm under loupe magnification (better under microscope magnification) and dilated enough to accommodate a blunt flexible 30 G (0,31 × 25 mm) microcannula.
5. The cannula mounted on a syringe containing indocyanine dye is then inserted into the branch and kept in sealed position by the surgeon's fingers or alternatively by 9–0 stitches (Figure 1).
6. While the surgeon is slowly injecting the ICG, the assistant or scrub nurse holds the handheld near-infrared camera perpendicular to the skin area under examination in order to visualize the aborisation pattern (Figure 2, left and Video 1).
7. The main perforator's branches can be marked accordingly on the skin surface (Figure 2, right).

Our attempts are guided by the hypothesis that the intra-pedicular injection of the ICG, compared to the commonly used intra-venous route, would allow the visualisation of the vascular network originating from one single cutaneous perforator (perforasome) avoiding the interference by all the surrounding vascularised tissues, thus permitting a better orientation and tailoring of the flap prior to its complete harvest. We are currently investigating different injection settings (such as different dye concentrations and injection methods) in search of the best way to visualise the arborisation pattern. Time-consuming vessel preparation, dye leakage out of the pedicle and field contamination with permanent staining are the main pitfalls that undermine the procedure.

By sharing our preliminary findings with the surgical community, we hope to speed up the determination of their physiological significance and clinical relevance in flap surgery.

This research conforms to the World Medical Association Declaration of Helsinki and was approved by the local Ethical Committee

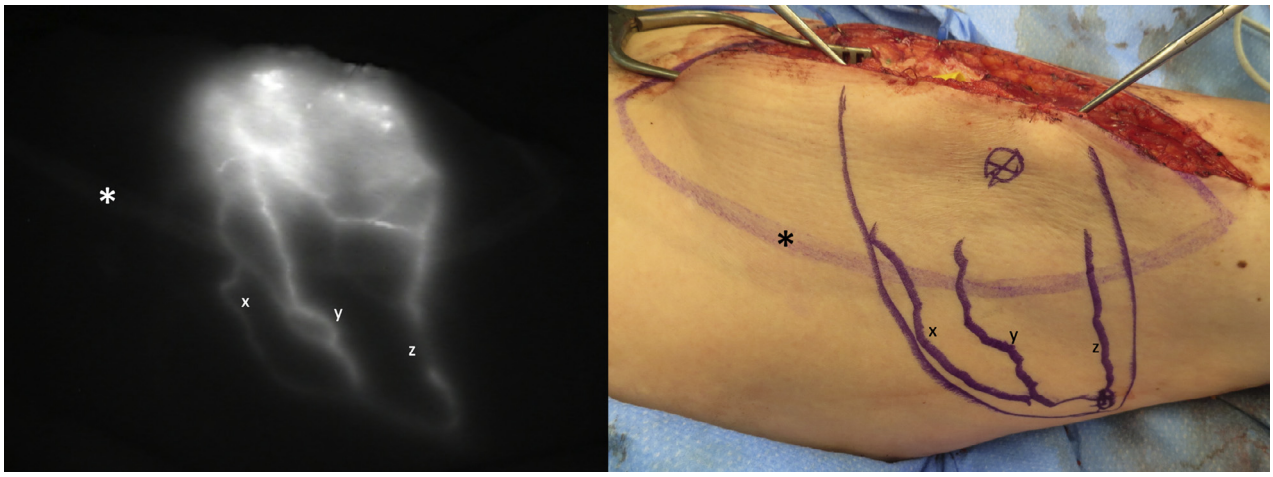

Figure 2 *Left* - ICG angiography image obtained by direct cannulation of the pedicle's artery seen in Figure 1. Note that three pathways (*x, y, z*) branch off from the main central bright spot and seems to join distally. *Right* - The three main branches are marked on the skin surface. On both the angiography image (left) and the photograph (right) the standard anterolateral thigh flap design is visible and marked with an asterisk *.

Disclosure

The authors have no financial conflicts or commercial associations to disclose.

Conflict of interest

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Supplementary material

Supplementary material associated with this article can be found, in the online version, at doi:10.1016/j.bjps.2019.03.027.

References

1. Taylor GI, Corlett RJ, Dhar SC, Ashton MW. The anatomical (angiosome) and clinical territories of cutaneous perforating arteries: development of the concept and designing safe flaps. *Plast Reconstr Surg* 2011;**127**(4):1447–59.
2. Saint-Cyr M, Wong C, Schaverien M, Mojallal A, Rohrich RJ. The perforasome theory: vascular anatomy and clinical implications. *Plast Reconstr Surg* 2009;**124**(5):1529–44.
3. Rozen WM, Ashton MW, Le Roux CM, Pan WR, Corlett RJ. The perforator angiosome: a new concept in the design of deep inferior epigastric artery perforator flaps for breast reconstruction. *Microsurgery* 2010;**30**(1):1–7.

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Flexor digitorum superficialis tenodesis for treatment of flexible swan neck deformity of fingers. Comparison between two surgical techniques to fix the tendon: A pilot study☆

Dear Sir,

The flexor digitorum superficialis tenodesis procedure, as described by Curtis,[1] to correct swan neck deformity (SND) of the finger, has been described differently regarding the

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Table 1 Pre and postoperative PIP extension joint ROM of the involved fingers and recurrence analysis.

Treatment group (bone anchor)						Control group (A2 pulley)					
PIP extension											
Patient no.	Finger no.	Pre op	Post op	Delta	Rec	Patient no.	Finger no.	Pre op	Post op	Delta	Rec
1	1	16	4	12	1	6	1	13	−18	31	0
2	2	12	0	12	0	7	2	17	6	11	1
3	3	21	18	3	1	8	3	15	16	−1	1
3	4	30	36	−6	1	9	4	11	1	10	1
4	5	8	2	6	1	9	5	15	−2	17	0
4	6	15	−6	21	0						
4	7	18	10	8	1						
5	8	12	−2	14	0						
Mean		16.5	7.75	8.75	0.63			14.20	0.60	13.60	0.6
Sd		6.761	13.625	8.084	0.23			2.280	12.442	11.696	0.24
Mean rec extension			14						7.66		
Difference between mean delta						−4.85					
Delta rec extension						6.33					

PIP: proximal interphalangeal; ROM: range of motion.
Rec = recurrence.
Mean rec extension is the mean of extension excluding the fingers without recurrence.
t-Test "Treatment group delta" vs. "Control group delta" $p = 0.392$.
Relative Risk of recurrence "treatment vs. control group" Fisher exact test $p = 1$.
t-Test "Treatment mean rec extension" vs. " Control mean rec extension" $p = 0.5$.

fixation of the proximal slip of flexor tendon. Littler[2] described the superficialis tenodesis (ST) through a tunnel in the bone. Milford[3] described the "sublimis tenodesis" technique, fixing the tendon to local soft tissues (A2 pulley). Other authors have suggested to attach the proximal slip of the tendon directly into the bone using an anchor.[4]

However, we did not find, in the literature case series, the treating of SND with bone anchor in ST. Apart from experts' opinions, no published report compared the ST technique with a bone anchor versus the ST technique with suturing directly to the A2 pulley.

In this short report we propose a pilot study of a two-arm, randomised controlled trial comparing ST with a bone anchor (treatment group) and ST with direct suture to the A2 pulley.

The primary outcome considered was to evaluate the recurrence rate of SND after surgery (relapse if post-operative PIP extension $> 0°$) and to compare the ability to correct the PIP extension deformity defined as the difference in degrees between pre- and post-operative PIP extension (delta). Functional evaluation was performed by means of Disability of Arm Shoulder and Hand (DASH) questionnaire.

The relative risk of SND recurrence of treatment versus control and a two-sample *t*-test analysis on the mean relapse and on the delta between pre- and post-operative extension were calculated.

Nine patients were enrolled in this study, for a total of 13 fingers. The mean follow-up time was 19 months for the treatment group and 18 months for the control group. Patients' SND were from different causes: chronic mallet finger, rheumatoid arthritis, post-traumatic chronic hyperextension of the PIP joint, spasticity.

In Table 1 PIP joint extension values are reported and data regarding recurrence are presented. The mean post-operative extension was 7.75° in the treatment group and 0.60° in the control group. The mean delta between pre- and post-operative extension was 8.75° in the treatment group, 13.60° in the control group. The SND recurrence rate was 62.5% (5/8) in the treatment group and 60% (3/5) in the control group.

The recurrence's relative risk between treatment vs. control group did not show any significant difference (Table 1). There was no significant difference in mean relapse between treatment and control groups neither when considering mean delta extension.

Pre-operative DASH score in the treatment and the control groups were, respectively, 33.31 and 14.53. Post-operative DASH score in the same groups were 38.5 and 22.5.

The non-superiority test was added to understand if a significant difference between groups could exist. With the significance at 0.05 the equivalence margin delta (the difference of mean post-operative PIPj extension between treatment and control group in relapse or between delta) was $\geq$6.37° in terms of relapse, $\geq$4.93° in terms of delta extension.

In this short report no differences between groups were identified, although a certain reduction in extension of PIPj was obtained.

It is mandatory to report that the small sample size is the major limitation of this work because it does not reach the adequate significance level. The heterogeneity of the population, as shown by pre-op DASH scores, make the groups not comparable.

Interventions on DIP joint were not reported here but will be considered in a more extensive paper.

The recurrence rate of hyperextension was extremely high, with no significant difference between groups. The definition of recurrence could be considered strict because even a single degree of hyperextension defines a recur-

rence. Reducing criteria (recurrence $\geq$ 5° of hyperextension), the recurrence rate was reduced at 40%. It could mean that in most cases a palmar check rein was created, losing over time its effectiveness, regardless of the method of fixation.

According to these observations, the key question may not be the method of fixation. The limit of the techniques is probably the softness itself of the connective tissue of the patients. Whether the tendon is fixed to the bone or to the pulley, if the collagen of the patients does not have a reliable structure (as in a hypothetic case of constitutional laxity) the procedure will fail, or it will have an important degree of relapsing.

In conclusion this pilot study performed a comparison between two different fixation techniques of flexor tendon's slip. A RCT in this field would be useful, but it is difficult to design because of the high heterogeneity of this pathology and the relative low frequency. The preliminary data cannot identify which procedure best prevents recurrence of SND, but both procedures show a high suspicion of failure due to constitutional hyperlaxity.

Funding

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Conflicts of interest

None declared.

Ethical approval

Not required.

References

1. Curtis RM. Treatment of injuries of proximal interphalangeal joints of fingers. *Curr Pract Orthop Surg* 1964;**23**:125–39.
2. Littler JW. The hand and wrist. In: Howorth MB, editor. *A Textbook of Orthopaedics*. Stamford, CT: Dorman; 1959. p. 284–5.
3. Milford L. Sublimis tenodesis technique by Curtis. In: Edmonson AS, Crenshaw AH, editors. *Campbell's Operative Orthopaedics*. 6th ed. St. Louis: Mosby; 1980. p. 319.
4. Feldon P, Terrono AL, Nalebuff EA, et al. Rheumatoid arthritis and other connective tissue disorders. In: Wolfe SW, editor. *Green's Operative Hand Surgery*. 6th ed. Oxford, UK: Elsevier Churchill Livingstone; 2011. p. 1993–2065.

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The Clavien-Dindo classification for post-discharge reconstructive surgery complications and comparison of caregiver registration

Dear Sir,

Objective

Post-discharge surgical complications are notoriously underreported[1] yet the incidence of complications is frequently used as a surrogate marker of quality in surgery. Analysis of complications has the potential to improve the quality of patient care and enables comparison and justification of additional costs. The Clavien-Dindo Classification of Surgical Complications (CDC) is a grading system that uses therapeutic consequence as basis to rank complications[2] (Table 1). It is not complex, easily recordable and if reproducible, could encourage shared decision-making, improve time management and quality of patient care. This study investigated interobserver reliability between qualified, registered wound-care nurses and board-certified reconstructive surgeons, with the aim of improving post-discharge surgical complication registration and grading.

Table 1 The Clavien-Dindo Classification (CDC) of surgical complications.[2]

Grades	Definition
Grade I	Any deviation from the normal postoperative course without the need for pharmacological treatment or surgical, endoscopic and radiological interventions Allowed therapeutic regimens are: drugs as antiemetics, antipyretics, analgesics, diuretics and electrolytes and physiotherapy. This grade also includes wound infections opened at the bedside.
Grade II	Requiring pharmacological treatment with drugs other than such allowed for grade I complications. Blood transfusions and total parenteral nutrition are also included.
Grade III	Requiring surgical, endoscopic or radiological intervention
- IIIa	Intervention not under general anesthesia
- IIIb	Intervention under general anesthesia
Grade IV	Life-threatening complication (including CNS complications)[a] requiring IC/ICU-management
- IVa	single organ dysfunction (including dialysis)
- IVb	Multiorgan dysfunction
Grade V	Death of a patient
Suffix "d"	If the patients suffers from a complication at the time of discharge, the suffix "d" (for 'disability') is added to the respective grade of complication. This label indicates the need for a follow-up to fully evaluate the complication.

[a] brain hemorrhage, ischemic stroke, subarrachnoidal bleeding, but excluding transient ischemic attacks (TIA);IC: Intermediate Care; ICU: Intensive Care Unit.

Methods

The first stage of the study consisted of translation of the written American English CDC into Dutch according to the internationally accepted rules of forward-backward translation.[3]

The second stage was content validation and reliability, both prospectively assessed by skilled registered wound-care nurses and plastic surgeons (one of each per patient) from a random sample obtained from early post-discharge patients in a reconstructive surgery outpatient department. This was followed by a chart review 6 months later with the aim of identifying discrepancies in severity grading between the nurse and the surgeon and/or whether a surgery-related complication had been missed or only became obvious or worse following the initial severity grading and recording. To determine statistically the extent to which the parties disagreed and the frequencies of agreement, a weighted kappa was calculated. The Gelre Institutional Review Board approved the study, and all patients provided informed consent.

Table 2 Comparison of CDC-grading by nurses and surgeons: *highlighted figures show cases with complete agreement*.

Grading	Nurses				
	0	I	II	III	Total
Surgeons 0	16			-	16
I	6	10	1	-	17
II		2	4	-	6
III	-	-	-	-	0
Total	22	12	5	0	

Legend to Table 2: Of the 39 patients entered, 16 [41%] cases were graded *by both* as 0 (no complication), 10 [25.6%] cases as Grade I and 4 [10.3%] were as Grade II. Complete agreement in grading was found in 30 [76.9%] of the 39 cases. Discrepancy was found in 9 [23.1%] of the 39 cases: 6 cases were scored as 0 (no complication) by the nurses and Grade I by the surgeons; 2 cases were graded as Grade I by the nurses and as Grade II by the surgeons; 1 case was graded as Grade I by the surgeon and as Grade II by the nurse.

Results

Of the1568 post-discharge patients, 41, seen within 14 days of discharge, were randomly chosen. Two had to be excluded because of poor data quality. Complete agreement in grading was found in 30 [76.9%] of 39 cases (Table 2). Discrepancy was found in 9 [23.1%] of cases. The discrepancies were more prevalent in the early phase of the study. All were due to a different interpretation of the therapeutic consequence. The calculated weighted kappa was 0,618 (confidence interval 0,38-0,86) indicating substantial agreement.

Discussion

Clavien et al. proposed three types of negative outcome following surgery: failure to cure, sequela and complication.[2] The first two are straightforward and easily recognizable. A "surgical complication" exists when a deviation from the ideal postoperative course is recognized and the first two have been excluded. The embarkation point of this study is this definition.

Coupling complication registration with a severity grading system, such as using the therapeutic consequence as the basis for ranking surgical complications, prevents

subjective interpretation and should prevent any tendency to downgrade a complication.

In this study, nurses were more inclined to grade a complication lower than the plastic surgeon, most likely due to a cognitive bias: our wound-care nurses are very experienced, which may have led to an initial self-confident response. This is exemplified by the fact that in most of the cases where a "no complication" had been recorded, it was actually a Grade I surgical complication, as was confirmed at the 6-month postoperative file review. Alternatively, as these discrepancies all occurred in the early phase of the study, it may have been part of a learning curve. Retrograde analysis showed a decline in discrepancies as the project advanced in time. We believe that this finding underscores the importance of regular feedback and discussion with all involved during the period of the study.

This study also confirmed the importance of a retrospective review. Underestimation has been described before, with a higher percentage,[4] and seemed to occur more frequently where a Grade 1 surgical complication had been recorded. In the current study it may have been a matter of timing (within 2 weeks following discharge after surgery), which then births the question as to when the most suitable timing for registration of a surgical complication should be, particularly in an outpatient setting.

Our study enjoys no synergy with previous studies. As far as we could ascertain, the CDC has not been validated in an outpatient setting before. Yet, the study has some limitations. The study cohort was intentionally homogeneous so that we could investigate the feasibility of introducing a surgical complication classification in an outpatient setting, with the initial severity grading being done by registered wound-care nurses. Furthermore, the numbers are limited, which is inherent in not only this, but in all pilot studies. The study revealed a predominance of complications of a lower grade (Grade III or lower), known to be more frequently underreported and those in which most discrepancies in the perception of severity have previously been found.[5]

None of these limitations should, however, distract from the central finding – that experienced, registered wound-care nurses can add value to grading and registering post-discharge complications using the CDC, but that continued monitoring and review are required.

Conflict of interest

None.

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References

1. Visser A, Ubbink DT, Gouma DJ, Goslings JC. Surgeons are overlooking post-discharge complications: a prospective cohort study. *World J Surg* 2014;**38**:1019–25.
2. Dindo D, Demartines N, Clavien PA. Classification of surgical complications: a new proposal with evaluation in a cohort of 6336 patients and results of a survey. *Ann Surg* 2004;**240**:205–13.
3. Beaton DE, Bombardier C, Guillemin F, Ferraz MB. Guidelines for the process of cross-cultural adaptation of self-report measures. *Spine* 2000;**25**:3186–91.
4. Mazeh H, Cohen O, Mizrahi I, et al. Prospective validation of a surgical complications grading system in a cohort of 2114 patients. *J Surg Res* 2014;**188**:30–6.
5. Slankamenac K, Graf R, Puhan MA, Clavien PA. Perception of surgical complications among patients, nurses and physicians: a prospective cross-sectional survey. *Patient Saf Surg* 2011;**5**:30.

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Aerosol-related thermal injuries: A simple approach to managing a frosty problem

Dear Sir,

We commend the recent efforts of Bednarz et al.[1] in their attempt to increase the awareness of initial first aid required to manage aerosol-related thermal injuries.

We do, however, wish to express the importance of addressing the psychological and mental health needs of patients presenting with aerosol-related thermal injuries. Twenty different patients have presented to our burn service within the last five years with such injuries. None of these patients sought any medical intervention within the first 24 h meaning that the window of initial first aid had been missed. Seventy percent of patients had used aerosols to perform deliberate injury prior to first contact with our service. Many patients having multiple burns of varying degree or repeated injury to the same area.

We advocate early referral to mental health services and psychology support. Psychological approaches to addressing self-harm are varied as the issue is complex, with no 'one size fits all' intervention. As such, evidence exists for the use of Cognitive behavioral therapy, Psychodynamic interpersonal therapy and Dialectical behavior therapy[2,3] in reducing rates of self-harm. Psychological assessment of deliberate self-harm should be focused on understanding the context and function behind patients' self-harm behavior, as well as the unintended consequences or secondary gains of receiving treatment.[4] We manage these patients with a multidisciplinary approach, as our experience has shown that early surgical intervention alone can perpetuate the cycle of deliberate self-harm, by unwittingly re-enacting unhealthy and traumatizing relationship patterns or by reinforcing patients' fears of complete healing.[5]

Conflict of interest

There are no conflicts of interest.

References

1. Bednarzl B, King CC, Dheansa BS. Aerosol-related thermal injuries: a simple approach to managing a frosty problem. *JPRAS* 2019;**72**(3):513–27.
2. Carroll R, Metcalfe C, Gunnell D. Hospital presenting self-harm and risk of fatal and non-fatal repetition: systematic review and meta-analysis. *PLOS One* 2014;**9**(2):e89944.
3. Hetrick S, Robinson J, Spittal M, Carter G. Effective psychological and psychosocial approaches to reduce repetition of self-harm: a systematic review, meta-analysis and meta-regression. *BMJ Open* 2016;**6**:e011024.
4. Barton CR, Dickson WA. Surgery by satellite: a new generation of self-harmers. *Br J Plast Surg* 2002;**55**:702–3.
5. Elmore J, Frank RE. Approach scar revisions after self-inflicted wounds with caution. *Plast Reconstr Surg* 2000;**105**:1240–1.

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Excision and direct closure of burns – A proposed wound follow-up protocol

Dear Sir,

Early tangential or fascial excision of burn wounds and skin grafting is accepted best practice in burns care, and was first described in Janzekovic's seminal paper in 1970[1]. Studies since then have demonstrated that early excision and skin grafting is associated with better outcomes than conservative wound care including reduced mortality and length of stay[2]. Another reconstructive strategy for smaller sized burns with sufficient laxity of surrounding tissue, is direct closure with a tension-free sutured repair. Attitudes towards excision and direct closure in acute burns surgery vary, and in 2014 a UK survey found that 53% of consultant burns surgeons would consider it as an operative strategy, and the remaining 47% would not[3]. The main concerns highlighted by survey respondents were with dehiscence and hypertrophic scarring. Although dehiscence is a complication which would not occur with skin grafting, hypertrophic grafts are a recognised complication in up to 67% of cases[4,5]. A previous prospective study has shown that excision and direct closure in acute burns surgery (in select cases) has acceptable complication rates and avoids donor site morbidity[3]. The rate of hypertrophic scarring and dehiscence were 11.6% and 12.3% respectively. There is a paucity of evidence in the literature for directly closing excised burns, despite this surgical approach being used at burns services in the UK.

At our regional burns centre we perform excision and direct closure routinely in selected cases. We aimed to retrospectively review the wound complications associated with excision and direct closure in acute burns surgery centre over a one-year period. We also considered the implications for specialist burns dressing clinic follow-up and whether select cases could have postoperative follow-up in the community to reduce the burden on specialist burns dressing clinics and to better convenience patients.

Retrospective review of patients undergoing excision of burns and direct closure at a regional burns centre was undertaken over a one-year period (January-December 2017). Those who had part-grafting in addition to direct closure and those lost to follow-up were excluded. Patient demographics, burn morphology, operative data, and wound complications (including wound dehiscence and infection) were collected. Specialist burns dressing clinic follow-up data were also reviewed. Descriptive statistical analysis of the data was conducted.

A total of 50 patients underwent excision and direct closure for acute burns surgery over the study period. Intraoperatively all burns were excised with a narrow margin to healthy tissue. The majority of the burns were closed in layers with monocryl™ or vicryl™ in the deep-dermal layer and monocryl™, ethilon™, prolene™ or vicryl rapide™ at the epidermis. Two patients were excluded (lost to follow-up). 48 patients were included in the final analysis. The

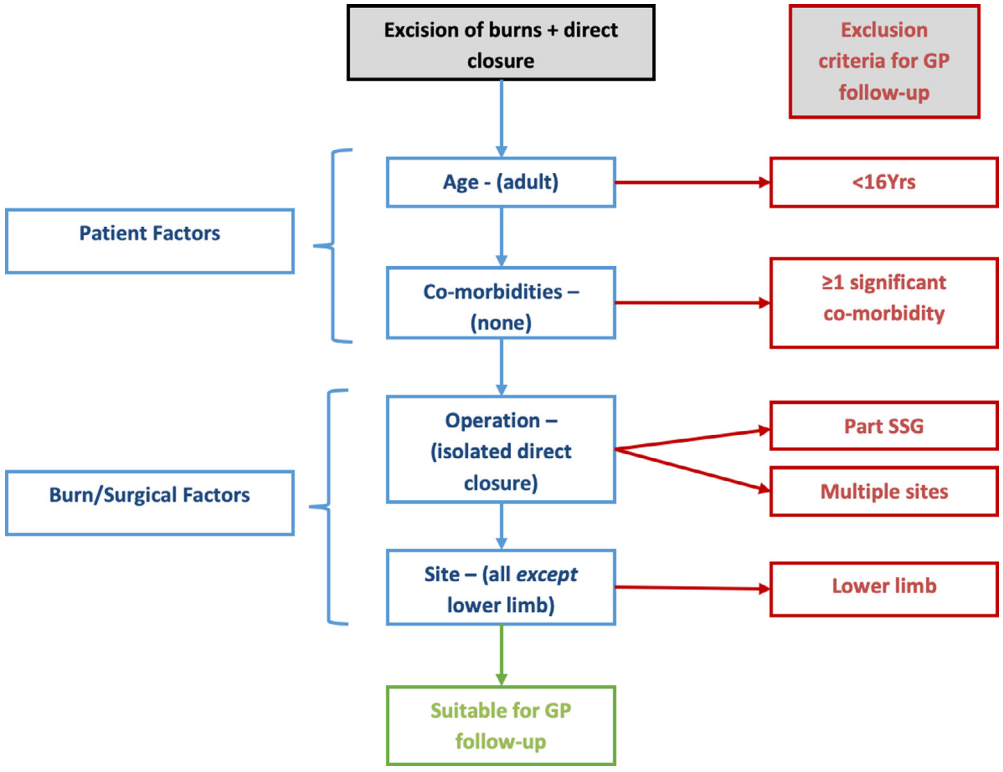

Figure 1 Algorithm for wound follow-up in patients undergoing excision and direct closure of burns.

median age was 41 (range: 9–97) and 58% did not have any pre-existing medical co-morbidities ($n = 28$). The most common type of burn sustained was contact ($n = 19$), scald ($n = 12$) and chemical ($n = 7$). All burns were either mixed depth, deep dermal or full-thickness. The mean number of days for the first wound check postoperatively at burns dressing clinic was 5 days (SD: 2.3). The mean total number of burns dressing clinic appointments was 2.7 (SD: 1.6). 75% ($n = 36$) did not sustain any postoperative wound complications. The rate of full dehiscence was 6% ($n = 3$). The overall rate of dehiscence (including minor dehiscence) was 21% ($n = 10$) and all were managed non-operatively. 50% ($n = 5$) of the patient's burns with full or partial dehiscence were on the lower limb. There were two cases of postoperative wound infection (4%) that required admission for intravenous antibiotics.

On a near weekly basis burns were excised and primarily closed at our unit over the course of a year. 75% of patients had no complications during their follow up at our specialist burns outpatient clinic. The data prompted the development of a proposed treatment algorithm for follow-up in the community in select cases (Figure 1) based on the following rationale. Primarily closed surgical wounds are routinely managed in the primary care setting at General Practice (GP) clinics by practice nurses. This would therefore be of particular benefit to those patients who live far away from their regional specialists burns centre or who struggle with transport. Once a burn is fully excised and primarily closed it resembles a simple wound with no specialist dressings required. As such we propose that patients without specific risk factors for wound complications, or other particular requirements, can be managed in the community. Paediatric dressing changes can be more complex and often require appropriate analgesia and therefore warrant specialist follow-up in the paediatric burns clinic. Those with co-morbidities, such as diabetes, have greater theoretical likelihood of wound healing issues and would benefit from review in the burns dressings clinic. Those undergoing part grafting or those who have multiple sites directly closed are too complex to be managed in the community. Additionally, greater proportional wound dehiscence rates on those undergoing excision and direct closure on the lower limb indicate that burns located at these anatomical sites are inappropriate for community follow up. If any patients followed up in the community developed minor dehiscence, the burns dressing clinic with subsequent specialist review would be indicated.

The majority of patients (75%) undergoing excision of burns and direct closure did not sustain any postoperative wound complications. We have developed a postoperative treatment algorithm to potentially manage select cases in the community. In this current climate of resource constraints and increasing demand, there is an impetus for developing strategies to improve efficiency. Hopefully, this will be of greater convenience to our patients and will have cost-saving implications for our burns service. Ongoing prospective audit will determine whether this can be safely implemented into clinical practice.

Acknowledgments

None.

Conflicts of Interest

None.

References

1. Janzekovic Z. A new concept in the early excision and immediate grafting of burns. *J Trauma* 1970;**10**:1103–8.
2. Ong YS, Samuel M, Song C. Meta-analysis of early excision of burns. *Burns: J Int Soc Burn Inj* 2006;**32**:145–50.
3. Bain CJ, Wang T, McArthur G, Williams G, Atkins J, Jones I. Safety and efficacy of excision and direct closure in acute burns surgery: outcome analysis in a prospective series of 100 patients and a survey of UK burns surgeons' attitudes. *Burns: J Int Soc Burn Inj* 2014;**40**:1635–41.
4. Bombaro KM, Engrav LH, Carrougher GJ, et al. What is the prevalence of hypertrophic scarring following burns? *Burns: J Int Soc Burn Inj* 2003;**29**:299–302.
5. McDonald WS, Deitch EA. Hypertrophic skin grafts in burned patients: a prospective analysis of variables. *J Trauma* 1987;**27**:147–50.

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