Journal of Plastic, Reconstructive & Aesthetic Surgery (2019) 72, 1576–1606

JPRAS
An International Journal of Surgical Reconstruction
www.JPRASurg.com

Correspondence and Communications

Clinical outcomes of delayed targeted muscle reinnervation for neuroma pain reduction in longstanding amputees

Dear Sir,

Targeted Muscle Reinnervation (TMR) is a surgical technique which was first described more than fifteen years ago as a means of improving control of myoelectric prostheses in amputees. At present, there is growing evidence supporting its use in the treatment of peripheral nerve neuromas and phantom limb pain (PLP) in this population.[1-3] Symptomatic neuromas and PLP affect up to 80% and 85% of extremity amputations respectively, and have been shown to have a significant negative impact on prosthesis use, physical rehabilitation and quality of life.[4] A large number of non-surgical interventions have been developed to address these problems. However, none have been able to demonstrate consistent and durable symptom control of both neuroma and phantom limb pain (NPLP). The current gold standard treatment of intractable neuroma pain is traction neurectomy, which has been shown to have a 40% chance of recurrence at three years.[5] Evidence from a recent randomized clinical trial suggests that TMR has the potential to almost completely eradicate neuroma related pain and to reduce the frequency and severity of PLP.[1]

At present, little is known about the effectiveness of TMR in reducing NPLP in patients who have undergone their original amputation many years prior, with the current longest interval between amputation and TMR surgery being 29 years.[2] In order to expand on the current knowledge base, we describe our experience with eleven cases of longstanding amputations (>18 years) who underwent TMR surgery with the purpose of alleviating their NPLP (Table 1). The mean time from injury to TMR was 27 years (range 18 to 38 years). In ten cases, the operation was performed to manage severe NRP and in one case to reduce intractable PLP. One of the patients complaining of neuroma pain underwent a combined procedure with a free functioning ALT flap transfer to improve soft tissue coverage of the stump and provide additional targets for reinnervation. All cases suffering from NRP experienced either complete or partial relief from palpation-induced tenderness within three months of the procedure with a mean improvement of 5.55 in VAS. Incomplete neuroma pain resolution was noted in patients with unmasking of previously quiescent neuromas on clinical examination. All patients experienced a significant increase in PLP which took up to 6 months to resolve. The patient who underwent TMR surgery exclusively for PLP experienced worsening of his symptoms at 3 months post-operatively, but this fully subsided by the time of his next follow up at twelve months.

Our findings suggest that the beneficial effects of TMR surgery are unlikely to be affected by a delay in surgical intervention. Therefore, TMR surgery should be offered to all amputees with neuroma related pain and/or PLP, irrespective of when the original amputation was performed. Furthermore, we have observed that the regenerative potential of the transposed nerve stumps does not seem to decrease in these individuals – voluntary contractions of the reinnervated muscles was seen at three to six months post-operatively, just as in patients undergoing primary TMR for neuroma prevention soon after their amputation.

Table 1 Summary of cases of TMR with a greater than eighteen-year gap between the extremity amputation and the reinnervation surgery.

Patient	Age	Amputation Level	Nerve Transfers	Duration from injury to TMR (years)	Follow up (weeks)	Neuroma site	Pre-TMR neuroma pain	Post-TMR neuroma pain	Pre -TMR phantom limb pain	Post- TMR phantom limb pain
1	32	Left trans-tibial	1. Sensory branches of common peroneal nerve (x2) anastomosed to motor nerve to ALT flap. 2. Posterior tibial nerve anastomosed with motor nerve to medial head of gastrocnemius.	18	40	Sensory branches of common peroneal nerve	Yes	No	No	First six months post-op
2	59	Left trans-tibial	1. Common peroneal nerve anastomosed with motor nerve to lateral head of gastrocnemius. 2. Posterior tibial nerve anastomosed with motor nerve to soleus. 3. Cutaneous branch from posterior tibial nerve anastomosed with motor nerve to medial head of gastrocnemius.	19	12	1. Common peroneal nerve. 2. Posterior tibial nerve 3. Cutaneous branches coming off posterior tibial nerve	Yes	Yes, but due to unmasking of neuromas	Yes	Yes, but improved
3	54	Left trans-femoral	1.Peroneal component of sciatic nerve anastomosed with motor nerve to semi-membranosus. 2.Posterior tibial component anastomosed with motor nerve to biceps femoris.	24	21	1. Common peroneal nerve. 2. Posterior tibial nerve.	Yes	Yes, but due to unmasking of neuromas	Yes	Yes, but improved
4	54	Left trans-humeral	1. Median nerve anastomosed to lateral pectoral nerve (to pectoralis major muscle). 2. Motor branch to lateral head of triceps anastomosed with radial nerve.	20	208	1. Median nerve. 2. Radial nerve.	Yes	Yes, but due to unmasking of neuromas	Yes	Yes, but improved

(*continued on next page*)

Table 1 (*continued*)

Patient	Age	Amputation Level	Nerve Transfers	Duration from injury to TMR (years)	Follow up (weeks)	Neuroma site	Pre-TMR neuroma pain	Post-TMR neuroma pain	Pre -TMR phantom limb pain	Post- TMR phantom limb pain
5	42	Left trans-femoral	Muscular branches of biceps femoris and semitendinosus muscle anastomosed to sciatic nerve (x2)	23	79	Sciatic nerve	Yes	Yes, but due to unmasking of neuromas	Yes	Yes (no change)
6	46	Left trans-tibial	1. Sensory branch of peroneal nerve anastomosed with motor nerve to lateral head of gastrocnemius.	26	59	Sensory branch of common peroneal nerve	Yes	No	Yes	Yes (no change)
7	60	Left trans-tibial	1. Sensory branch of common peroneal nerve anastomosed to distal motor branch of peroneal nerve. 2. Sensory branch of posterior tibial nerve anastomosed with distal motor branch to lateral head of gastrocnemius.	27	43	1. Common peroneal nerve. 2. Posterior tibial nerve.	Yes	No	Yes	Yes, but improved
8	60	Right trans-humeral + Right trans-tibial	1. Median nerve anastomosed to clavicular head of pectoralis major 2. Ulnar n. anastomosed to minor motor branch of triceps 3. Posterior cord to part of triceps	32	6	1. Median nerve. 2. Radial nerve.	Yes	No	Yes	Yes, but improved

(*continued on next page*)

Table 1 (*continued*)

Patient	Age	Amputation Level	Nerve Transfers	Duration from injury to TMR (years)	Follow up (weeks)	Neuroma site	Pre-TMR neuroma pain	Post-TMR neuroma pain	Pre -TMR phantom limb pain	Post- TMR phantom limb pain
9	48	Left trans-tibial	1. Sensory branch of common peroneal nerve anastomosed to motor branch of peroneal nerve 2. Sensory (sural) branch of posterior tibial nerve anastomosed to motor nerve of FDL. 3. Sensory (main) component of posterior tibial to medial gastrocnemius motor nerve	34	6	1. Common peroneal nerve 2. Posterior tibial nerve.	Yes	Yes, but due to unmasking neuromas	Yes	Yes, but improved
10	56	Left transhumeral	1.Ulnar nerve anastomosed with motor nerves to pectoralis minor. 2. Median nerve anastomosed to motor nerves to pectoralis major.	38	105	N/A	No	No	Yes	First three months post-op
11	55	Left transfemoral	1. Nerve branches to biceps femoris and semimembranosus and semitendinosus anastomosed to the sciatic nerve (x2)	38	20	Sciatic Nerve	Yes	No	Yes	First three months post-op

Acknowledgments

None.

Funding

None declared

Conflict of interest

None declared.

Ethical approval

N/A.

Financial disclosure

All authors have nothing to disclose. No funding was received for this article.

Meetings

To date, this work has not been presented at any formal meeting or medical conference.

References

1. Dumanian GA, Potter BK, Mioton LM, Ko JH, Cheesborough JE, Souza JM, et al. Targeted muscle reinnervation treats neuroma and phantom pain in major limb amputees: a randomized clinical trial. *Ann Surg* 2018.
2. Ko JH, Kim PS, Smith DG. Targeted muscle reinnervation as a strategy for neuroma prevention. *Targeted muscle reinnervation: A neural interface for artificial limbs*. Taylor & Francis Group; 2014. Series in medical physics and biomedical engineering p. 45–66.
3. Valerio IL, Dumanian GA, Jordan SW, Mioton LM, Bowen JB, West JM, et al. Preemptive treatment of phantom and residual limb pain with targeted muscle reinnervation at the time of major limb amputation. *J Am College Surg* 2019;**228**(3):217–26.
4. Hsu E, Cohen SP. Postamputation pain: epidemiology, mechanisms, and treatment. *J Pain Res* 2013;**6**:121–36.
5. Pet MA, Ko JH, Friedly JL, Smith DG. Traction neurectomy for treatment of painful residual limb neuroma in lower extremity amputees. *J Orthop Trauma* 2015;**29**(9):e321–5.

Dominika A. Michno
Alexander C.S. Woollard
Norbert V. Kang
Department of Plastic Surgery, Royal Free Hospital, Pond Street, NW3 2QG, London, United Kingdom
E-mail address: dominika.michno@nhs.net (D.A. Michno)

https://doi.org/10.1016/j.bjps.2019.05.005

Catheter perineural analgesia after brachial plexus reconstructive surgery: Preliminary clinical experience in a reference center☆

Dear Sir,

Closed brachial plexus lesions (CBPL) are a common cause of trauma and disability in the young male adult.[1] Brachial plexus reconstruction (BPR) requires extensive surgical approaches, prolonged operative times and many patients present with postoperative pain (PP). Moderate to severe PP is a common complaint in patients who require ambulatory and non-ambulatory surgery, with a variable prevalence that oscillates between 30% and 86%.[2]

The use of locoregional analgesia has demonstrated adequate pain control in upper extremity procedures.[3,4] However, this technique has not been described in patients undergoing BPR. We performed a clinical prospective case series that included 14 adult patients with closed brachial plexus injuries who underwent BPR under general anaesthesia by one single surgeon (SGG) between March 2017 and April 2018 in a single reference centre in Medellin – Colombia.

BPR by supraclavicular incision was performed in all patients, with or without extension to the deltopectoral sulcus and medial arm depending on the surgical findings. A single tip perforated 18Fr catheter was placed under direct vision over the brachial plexus trunks before incision closure. A solution containing 150 mg of bupivacaine (0.5%) and 90 ml of normal saline was infused at a 5 mL/h rate. Acetaminophen (1000 mg PO q6h) and morphine (0.05 mg/kg IV if needed) were formulated for all patients in the postoperative period following the hospitalś institutional protocol.

Pain intensity scale (PIS) in a numeric scale from 0 (no pain) to 10 (worst pain ever) at 2, 12, 18, 24, 36 and 48 postoperative hours was evaluated in all patients for one of the investigators different from the surgeon. Numeric PIS scale can be considered one of the most widely known tools for evaluation of pain including PP and it also gives an idea of treatment efficacy.[5] In each evaluation, the patient assigned a value from 0 to 10, being 0 the absence of pain and 10 the worst imaginable pain (Figure 1). The investigator also evaluated clinical signs of local bupivacaine – related systemic toxicity, such as paresthesia, dizziness, diplopia, metallic taste, tinnitus, fasciculations, dysarthria and hypotension. Adverse effects such as nausea, emesis or pruritus were also evaluated. Catheter infection was diagnosed

☆ The paper has not been presented in any academic meeting.

Pain Scores Numeric Pain Scale

Patient	2 hours	12 hours	18 hours	24 hours	36 hours
1	6	4	1	1	0
2	1	2	1	1	0
3	1	1	1	0	0
4	2	1	0	0	0
5	1	1	0	0	0
6	2	1	0	0	0
7	3	2	0	0	0
8	1	0	0	0	0
9	0	0	0	0	0
10	0	0	0	0	0
11	4	0	0	0	0
12	2	0	0	0	0
13	1	6	2	0	0
14	1	5	0	0	0

Patients at 2, 12, 18, 24 and 36 hours represented in colorimetric scale. Red: most intense pain; Green. less intense pain.

Figure 1 Postoperative evolution of pain scale intensity in colorimetric scale according to postoperative elapsed time.

as the presence of erythema or pus in the insertion site at 48 h postoperative. All the variables were registered by the investigators in a digital form designed specifically for the study.

From the 14 patients, 13 (93%) were discharged at 36 h because of adequate control of PP. Only one patient required longer follow-up to treat a postoperative delirium, but his pain was also controlled. Of the total number of lesions, 93% were postganglionary. The mean time of brachial plexus evolution lesion was 8 months (SD $\pm$ 8.5 months). In all the included patients, Catheter perineural analgesia (CPA) infusion was withdrawn at 24 h postoperative because of pain scale scores of 1 or less. No systemic opioids were used, no signs of bupivacaine related toxicity and no catheter infections or accidental loss occurred.

We established the PIS scale at two hours value (mean) as a reference and we compared it against the mean values obtained at 12, 18, 24 and 36 h with the *T* test. Analysis was performed with R software version 3.4.3, and p values $<$ 0.05 were considered statistically significant

Figure 1 presents the results of postoperative evaluation of PIS in all patients at 2, 12, 18, 24 and 36 h represented in colorimetric scale, showing in red the most intense pain and in green the less intense pain

The difference between mean values at 2 and 12 h was not statistically significant. However, there was a statistically significant difference between 2 h and 18 and 24 h postoperative ($p < .001$) (Table 1).

CPA technique presented here, is a novel, safe and effective strategy for the management of postoperative pain after BPR surgery, minimizing length of hospital stay and systemic opioid requirements.

Table 1 Difference of mean values between PIS evaluations.

	Difference between mean values (p)[a]	CI 95%[b] IL[c] - SL[d]
2 vs. 12 h	0.143 (0.821)	−1.19 to 1.48
2 vs. 18 h	1.43 (0.008)	0.45-2.41
2 vs. 24 h	1.643 (0.001)	0.78-2.51

[a] *P* value: Difference of mean values α level 0,05.
[b] CI 95%: Confidence interval of 95%.
[c] IL: inferior limit.
[d] SL: Superior limit.

Funding

None.

Conflicts of interest

None declared.

Ethical approval

Not required.

References

1. Traumatic brachial plexus injury. *Green's operative hand surgery*. Green DP, Wolfe SW, editors. 6. ed. Philadelphia: Elsevier, Churchill Livingstone; 2011.

2. Acute Postoperative pain. *Anesthesia*. Miller RD, Eriksson LI, Fleisher LA, Wiener-Kronish JP, Young WL, editors. Elsevier Health Sciences; 2009.
3. Liu SS, Richman JM, Thirlby RC, Wu CL. Efficacy of continuous wound catheters delivering local anesthetic for postoperative analgesia: a quantitative and qualitative systematic review of randomized controlled trials. *J Am Coll Surg* Dec 2006;**203**(6):914–32.
4. Axelsson K, Nordenson U, Johanzon E, Rawal N, Ekbäck G, Lidegran G, et al. Patient-controlled regional analgesia (PCRA) with ropivacaine after arthroscopic subacromial decompression. *Acta Anaesthesiol Scand* 2003;**47**(8):993–1000.
5. Williamson A, Hoggart B. Pain: a review of three commonly used pain rating scales. *J Clin Nurs* 2005;**14**(7):798–804.

Daniel Vélez
Diego Pizarro
Sebastián Gaviria
Sabrina Gallego
Plastic Surgery Department-School of Medicine, Universidad de Antioquia, Hospital Universitario de San Vicente Fundación, Calle 64 # 51 D 154 Bloque 8, Medellin, Colombia
E-mail address: daniel.velezr@udea.edu.co (D. Vélez)

https://doi.org/10.1016/j.bjps.2019.05.022

5,6 DICSA (dorsal inter-compartmental septal artery) or PIA(posterior interosseous artery) flap: Terminology is important

Dear Sir,

I apologise if the authors of "Techniques to enable identification and safe elevation of the posterior interosseous artery flap: Part2" [1] took umbrage at my letter. No objection to their technique was raised, indeed it is a technique I use myself ever since I was shown it by Gilbert and Masquelet in 1996 and is described in their book "An Atlas of flaps in Limb reconstruction (1995)".[2]

Nor did we state that "all other descriptions were incorrect", on the contrary the descriptions are perfect, it is the nomenclature that is incorrect, hence causing confusion.

As for submitting our own evidence for peer review, we were alas beaten to it by colleagues from Perth,[3] regardless we did not rely on our own evidence but the evidence of every anatomical textbook and article ever published that all place the posterior interosseous artery in the fourth extensor compartment.

The submitted figures perfectly highlight my point about the flap design being frequently mis-placed too radially if one uses the standard landmarks. Instead, the septum between ECU and EDM should be palpated to identify the axis of the flap, alternatively the mid-point between the olecranon and lateral epicondyle is preferred to the lateral epicondyle itself.

I have taught on numerous flap and anatomy courses and highlighted the problem with the nomenclature of the distally based "PIA" flap and how this misnomer may have led to inadvertent erroneous raising of a flap without blood supply. I have heard from many surgeons that this has indeed been the case and the flap replaced, or transposed and failed. I raise the issue not to offend the authors but to augment their quest for safer, easier, more successful flaps.

Conflict of interest

None.

Funding

None related to this topic.

References

1. Nikkah D, Pickford M. Techniques to enable identification and safe elevation of the posterior interosseous artery flap: Part2. *J Plast Recon Aesth Surg* 2019;**15**:4 2019 published online March 11.
2. Masquelet AC, Gilbert A. *An atlas of flaps in limb reconstruction*. London: Martin Dunitz; 1995.
3. Keogh A, Graham DJ, Tan B. Posterior interosseous artery pedicle flap: an anatomical study of the relationship between the posterior interosseous nerve and artery. *J Hand Surg* 2018;**43**(10):1050–3.

Henk Giele
Nuffield Department of Surgery, Plastic Reconstructive and Hand Surgery Department, Oxford University Hospitals, University of Oxford, Headley Way, Oxford OX3 9DU, UK
E-mail address: henk@what-about.me.uk (H. Giele)

https://doi.org/10.1016/j.bjps.2019.05.003

'WALANT carpal tunnel release: Technical considerations and pain outcomes'

Dear Sir,

Carpal tunnel release (CTR) was historically performed in the operating theatre under regional or even general anaesthetic. The majority are now completed with local anaesthetic (LA) as a day case procedure. Performing CTR as simply as possible (i.e., in an outpatient setting) streamlines provision in-line with a global need to better utilise healthcare resources to match demand. Tourniquet use for CTR facilitates dissection; however, not only is this uncomfortable, it requires an assistant and equipment not necessarily available in minor operation rooms. The concept of 'wide awake' surgery has been adopted variably in plastic surgery units, and proponents cite increased operative efficiency, higher turnover, and reduced patient discomfort.[1] Also known as *WALANT,* or Wide Awake Local Anaesthetic No Tourniquet,[2] we aimed to compare this technique to the 'standard' use of LA and tourniquet (LAT); in particular assessing patient discomfort, satisfaction and efficacy.

Patients who underwent CTR under either LAT, or WALANT were identified retrospectively from the electronic operation database. All had given informed consent prior to their operation and had completed contemporaneous paper questionnaires as part of the departmental audit process. Surgical technique was determined after consulting operation notes, and procedural pain was assessed using a validated Visual Analogue Scale (VAS) questionnaire. Patient satisfaction was established with direct questioning in a post-operative clinic review at 2 weeks.

The WALANT technique involved subcutaneous infiltration of 4.4 ml 2% lignocaine with 1:80,000 adrenaline; the operation was performed 15–20 min later (Figure 2). The 'standard' LAT technique employed plain 5 ml 1% Lignocaine and 5 ml 0.5% Levobupivicaine (injected in the same manner) with the addition of an upper arm tourniquet for the operative dissection. This was released after complete nerve exploration, prior to haemostasis and wound closure. All patients had the same sutures (5-0 Ethilon™), were given standard advice about hand exercises and dressings and were reviewed in outpatient clinic after 2 weeks.

Between April and August 2018 46 patients, with a mean age of 62, underwent CTR. 22 patients had WALANT, 24 had standard LA and tourniquet (LAT). Self-reported pain scores (VAS 0–10 point Likert scale; 10 being most painful) were mean 0.73 (WALANT) and 1.88 (LAT), respectively. The median of both groups was 0. With the exception of 1 outlier the WALANT cohort all reported $\leq$3 pain scores; whereas 5 LAT were recorded at $\geq$5. That this descriptive trend was not found to be significant (Mann–Whitney *U* test $p<0.05$) inferentially, is likely to represent a type 2 error, as extending to a $p \leq 0.08$ results in significance (Figure 1).

Reasons for discomfort in the WALANT group were deep nerve pain ($n=4$) and retractor discomfort ($n=1$). Patients in the other group noted deep nerve pain ($n=6$) and tourniquet pain ($n=5$). 93% of WALANT patients were extremely

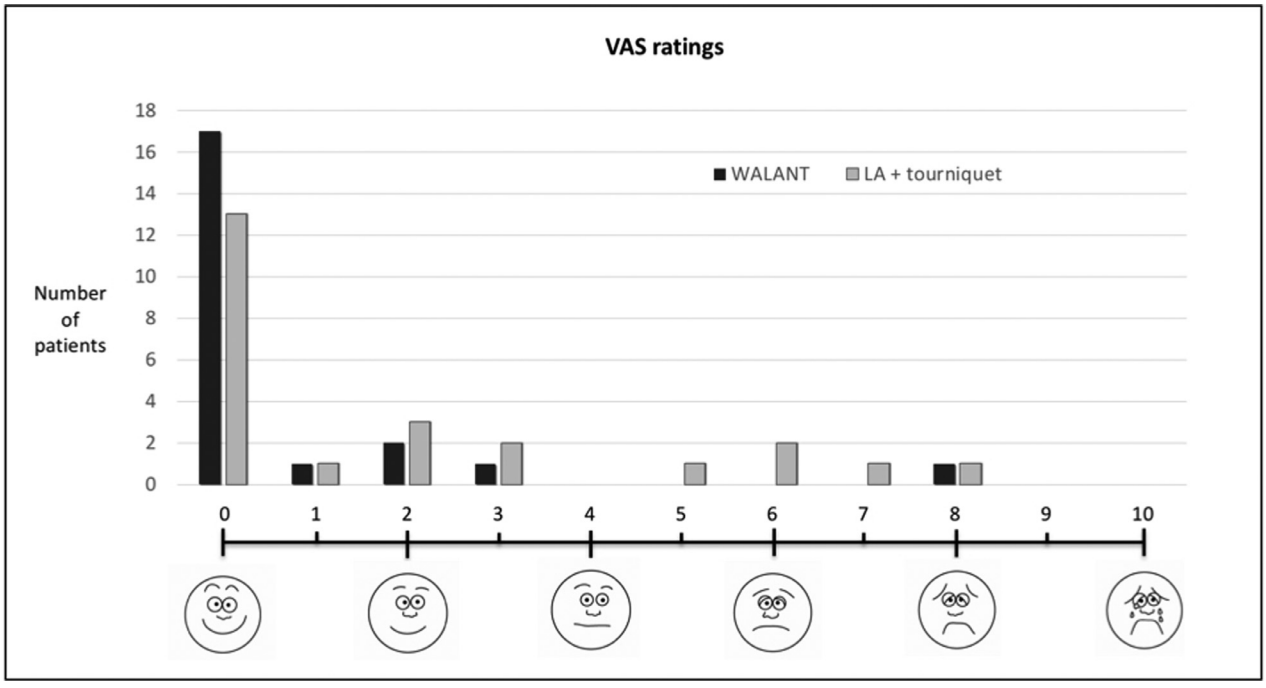

Figure 1 Bar chart demonstrating VAS scores in LAT and WALANT groups.

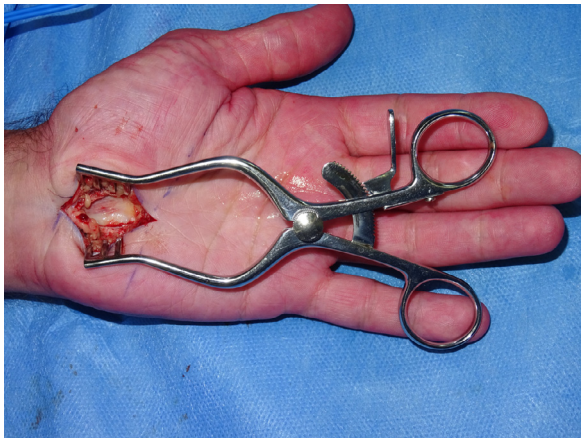

Figure 2 WALANT carpal tunnel release demonstrating bloodless field.

satisfied and all would recommend this technique. At 2 weeks all patients had symptomatic relief except one with documented cervical compression.

Our infiltration technique is different from Lalonde[2] who uses 10–20 ml and whilst this can aid haemostasis due to tumescence, we find it makes tissue planes more difficult to assess. Given that a notable source of discomfort was deep nerve pain in both groups, our small volume of subcutaneous LA may not be adequate; larger hands probably need a higher volume as well as infiltration deep to the forearm fascia. Furthermore, waiting 15–20 min may be adequate to achieve anaesthesia, but the vasoconstriction from adrenaline may not be maximal. The optimal time is at least 20 min and so to maintain the efficiency of an outpatient WALANT procedure.[2] ideally one patient would have LA then wait for surgery, whilst an already infiltrated patient is operated upon. Effective adrenaline vasoconstriction (as evidence by skin blanching) as well as blunt tipped retractors in the incision, can avert the need for diathermy haemostasis and shorten the operative duration. For those new to the technique, it is helpful to apply a tourniquet as backup, and we caution WALANT in recurrent cases where anatomy may be distorted and less visible with vascular scar tissue.

Recent studies have also found WALANT superior to LA and tourniquet with regards to pain. Gunasagaran et al. found a significant mean VAS difference (WALANT 2.33 versus LA/tourniquet 4.72), and Iqbal et al.[3] An RCT by Iqbal et al. corroborates this (mean VAS scores: WALANT 2.8, LA/tourniquet 4.6, $p = 0.003$).[4] Our VAS scores are favourably low in both groups, despite our small infiltration volumes. This may be due to our use of dental LA, which is more concentrated anaesthetic and adrenaline than that used by the other authors.[3,4]

In summary, we are reassured that both methods were acceptable in terms of pain, efficacy and satisfaction. This supports the literature that WALANT is at least as good as the standard LA/tourniquet method for most cases (caution recommended for revisions), and would transfer readily to an outpatient procedure room setting if this became a necessity.

Declaration of conflicting interests

The authors declare no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

Funding statement

The authors received no financial support for the research, authorship, and/or publication of this article.

References

1. Bismil MSK, Bismil QMK, Harding D, Harris P, Lamyman E, Sansby L. Transition to total one-stop wide-awake hand surgery service-audit: a retrospective review. *J R Soc Med Short Rep* 2012;**3**(23):1–9.
2. Lalonde D. *Wide awake hand surgery*. CRC Press; 2016.
3. Gunasagaran J, Sean ES, Shivdas S, Amir S, Ahmad TS. Perceived comfort during minor hand surgeries with wide awake local anaesthesia no tourniquet (WALANT) versus local anesthesia (LA)/tourniquet. *J Orthop Surg* 2017;**25**(3):1–4.
4. Iqbal HJ, Doorgakant A, Rehmatullah NNT, Ramavath AL, Pidikiti P, Lipscombe S. Pain and outcomes of carpal tunnel release under local anaesthetic with or without a tourniquet: a randomized controlled trial. *JHSE* 2018;**43**(8):808–12.

Dariush Nikkhah
Julia Ruston
Robert Pearl
James Blair
Queen Victoria Hospital, East Grinstead, West Sussex, UK
E-mail addresses: dariushnikkhah@hotmail.com, Nikkhahd@gmail.com (D. Nikkhah)

https://doi.org/10.1016/j.bjps.2019.05.014

Stump staining for clear visualization of lymphatic vessel's lumen

Dear Sir,

We read with great interest the article entitled "Lymphaticovenular anastomosis in the treatment of secondary lymphoedema of the legs after cancer treatment." by Phillips et al.[1] Their paper is of clinical significance in that they referred to the importance of supermicrosurgical lymphaticovenular anastomosis (LVA) to secondary lymphedema.[1] In LVA surgery, secure anastomosis of lymphatic vessel is a key to successful operation, but it is sometimes difficult especially when lymphatic vessel is sclerotic.[2] To address this challenge, we employ stump staining method for clear visualization of lymphatic vessel's lumen.

A lymphatic vessel and a recipient vein are dissected and prepared anastomosis as previously reported.[3-5] When a lymphatic vessel is sclerotic to a moderate extent, the lumen of the lymphatic vessel is difficult to identify under microscope visual inspection. Using a surgical marker or any other blue or green dye, dye is dropped on the stump of the lymphatic vessel to stain the vessel's wall. After this stump staining, the lumen can be easily identified (Figure 1). This technique helps us to visualize and trace vessel's wall clearly, allowing secure and easier supermicrosurgical anastomosis.

Although further studies are required to confirm the best way of lymphatic vessel's visualization, stump staining is considered to be useful for supermicrosurgical LVA and may overcome the technical difficulty. This method is a recommended for all beginner surpermicrosurgeons.

Conflicts of interest

None.

Disclaimers and disclosure

Preparation of the manuscript was supported, in part, by NCGM biobank fund (29-2004).

References

1. Phillips GSA, Gore S, Ramsden A, Furniss D. Lymphaticovenular anastomosis in the treatment of secondary lymphoedema of the legs after cancer treatment. *J Plast Reconstr Aesthet Surg* 2019. doi:10.1016/j.bjps.2019.03.013. [Epub ahead of print].
2. Yamamoto T, Yamamoto N, Yoshimatsu H, et al. Factors associated with lymphosclerosis: an analysis on 962 lymphatic vessels. *Plast Reconstr Surg* 2017;**140**(4):734–41.
3. Yamamoto T, Yamamoto N, Ishiura R. Indocyanine green lymphography for lymphedema screening following breast cancer treatment. *Plast Reconstr Surg* 2017;**139**(6) 1365e–1366e.
4. Yamamoto T, Narushima M, Yoshimatsu H, et al. Minimally invasive lymphatic supermicrosurgery (MILS): indocyanine green lymphography-guided simultaneous multisite lymphaticovenular anastomoses via millimeter skin incisions. *Ann Plast Surg* 2014;**72**:67–70.
5. Yamamoto T, Narushima M, Kikuchi K, et al. Lambda-shaped anastomosis with intravascular stenting method for safe and effective lymphaticovenular anastomosis. *Plast Reconstr Surg* 2011;**127**:1987–92.

Satoshi Hosoya
Takumi Yamamoto
Department of Plastic and Reconstructive Surgery, National Center for Global Health and Medicine, 1-21-1 Toyama, Shinjuku-ku, Tokyo 162-8655, Japan
E-mail address: tyamamoto-tky@umin.ac.jp (T. Yamamoto)

https://doi.org/10.1016/j.bjps.2019.05.004

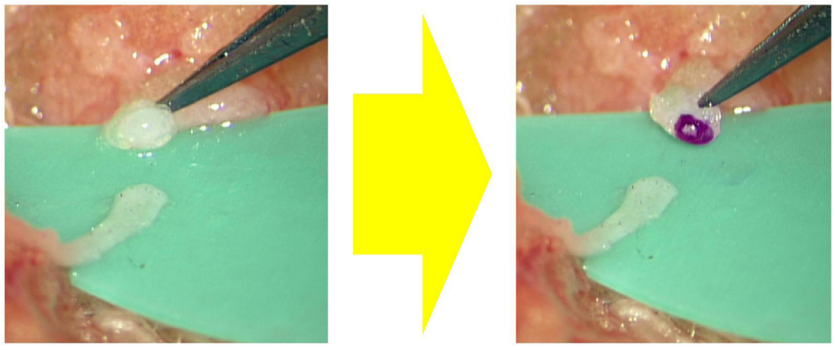

Figure 1 Stump staining method for clear visualization of lymphatic vessel's lumen; before (left) and after (right) stump staining.

Clinically significant incidental findings on computed tomographic angiography in patients evaluated for deep inferior epigastric free flap reconstructive breast surgery in South Wales

Dear Sir,

Abdominal computed tomography angiography (CTA) is commonly used pre-operatively to assess the vasculature in preparation for deep inferior epigastric (DIEP) free flap breast reconstruction. Pre-operative CTA has in multiple studies shown to confer benefits such as decreased operative time, reduced flap loss, increased surgeon confidence and decreased donor site morbidity.[1,2]

However, one side effect of this imaging investigation is the discovery of incidental findings which has been shown in previous studies to range between 13% and 75%.[3-5] Some of these findings are clinically significant and changes the surgical management plan.[3]

I order to add further input to the literature, we conducted a retrospective review at the Welsh Centre for Burns and Plastic Surgery, Morriston Hospital, Swansea of all the patients undergoing CTA as part of their preoperative planning for DIEP flap reconstructive breast surgery from January 2012 to June 2018. The patients were identified from the radiology departments 'CTA flap protocol' database and the preoperative scan reports were evaluated and findings were recorded. The CTAs for DIEP surgery are exclusively reported by two dedicated radiologist. The CTA protocol for DIEP perforator mapping extends from the diaphragm to the lesser trochanter of femur using 1 mm slices. Clinical letters and demographic patient information was accessed electronically and recorded.

Table 2 Further investigation following CTA ($n = 27$).

Imaging modality	Number of patients
USS	20
MRI	4
Bone scan	2
CT	1

A total of 229 patients, with a mean age of 49.4 years, underwent pre-operative CTA prior to their breast reconstruction surgery. Of the 229 patients, incidental findings were reported in 81 (35.4%) of patients and in 50 patients (21.8%) no further investigations were necessary as these findings were benign (Table 1). In 31 patients (13.5%) further imaging was required (Table 1) and majority of these underwent ultrasound investigations (Table 2). Particularly, eight patients (3.5%) had high suspicion of malignancy/metastases on their CTA report. Subsequently, only 3 (1.3%) of these were confirmed to be malignant lesions on further investigation. One other patient had a large incisional hernia detected on the CTA report which needed general surgery intervention and an alternative breast reconstruction option was performed. Furthermore, 6 patients (2.6%) had insufficient vessels for a DIEP breast reconstruction, some of these patients whom were planned for a bilateral procedure and therefore had other types of breast reconstruction. In total, 10 patients (4.4%) with either malignancy, insufficient vessels or other clinically significant findings on CTA had their surgical management plan altered as a result of the pre-operative imaging findings.

In our centre, we found that 81 patients (35.4%) had an incidental finding reported on their CTA investigation. This is in line with a previous study from Tong et al.[4] which quoted a rate of 36% of incidental findings in pre-operative CTAs. In an earlier study by See et al.[5] the incidental finding rate was found to be 13% and a recent study by Hughes et al.[3] found the rate of incidental findings to be as high as 75%. The discrepancy in incidence is partially explained by interobserver variability between reporting radiologists and their threshold for which incidental findings to report. More importantly, whereas the studies by Tong et al.[4] and See et al.[5] used a CTA protocol scanning from 4 cm above the um-

Table 1 CTA incidental findings ($n = 91$).

Abnormal finding*	Number of lesions requiring no further investigation ($n = 58$)	Number of lesions requiring further imaging ($n = 33$)
Liver lesions e.g. cyst, fatty infiltration	16	12
Gallstones	10	-
GI tract lesions e.g. diverticulae, herniae	8	1
Renal lesions e.g. calculi, cysts, horseshoe kidney	8	2
Bony lesions e.g. degenerative/sclerotic change	7	3
Pelvic lesions e.g. fibroids, ovarian cysts	6	13
Miscellaneous e.g. abnormal vessel atheroma	5	-
Spleen e.g. vascular anomalies, cysts	2	-
Lung lesion e.g. nodules	1	1
Lymph nodes	1	-
Soft tissue lesions	-	1

* Some patients had more than one incidental finding.

bilicus to the pubic symphysis and from the diaphragm to the femoral heads respectively, the CTA protocol by Hughes et al.[3] included an arterial phase CTA of thorax, abdomen and pelvis including pre- and post-intravenous contrast portal venous phase imaging of the liver.

In our patient cohort, 50 patients (21.8%) did not require any further investigations compared to 31 patients (13.5%) who did proceed to have further imaging. In 4 patients (1.8%) a new malignancy, metastatic disease or clinically significant incidental finding was detected and their DIEP breast reconstruction operations were cancelled. The surgical plan was also changed in another 6 patients (2.6%) who were deemed to have insufficient perforator vessels for DIEP reconstruction. In total, the surgical plan was changed in 4.4% of patients which is comparable to the study by Hughes et al.[3] which concluded a significant change in surgical management in 5.2% of patients. This is in contrast to both See et al.[5] and Tong et al.[4] who found that the surgical plan was changed in 0% and 1.4% of patients respectively.

The appropriate counselling of patients undergoing preoperative CTA is of outmost importance as incidental findings can lead to increased emotional stress from a patient perspective and an increased financial and administrative cost from a health board point of view.[5] This study which to our knowledge is the largest patient cohort to date investigating the incidence and consequences of pre-operative CTA for DIEP free flap surgery adds to the current literature regarding expected rates of incidental findings and the subset which are significant enough to change the management plan.

Acknowledgement

None to declare.

Conflict of interest statement

The author(s) declare(s) that there is no conflict of interest.

Funding

None to declare.

References

1. Ghattaura A, Henton J, Jallali N, et al. One hundred cases of abdominal-based free flaps in breast reconstruction. The impact of preoperative computed tomographic angiography. *J Plast Reconstr Aesthet Surg*. 2010;**63**(10):1597–601.
2. Teunis T, Heerma van Voss M, Kon M, van Maurik J. CT-angiography prior to DIEP flap breast reconstruction. A systematic review and meta-analysis. *Microsurgery* 2013;**33**:496–502.
3. Hughes J, Smith J, Jones L, Wilson S. Incidental findings in CT angiograms for free DIEP flap breast reconstruction–Do they change our management? *Eur J Surg Oncol EJSO* 2016;**42**(1):59–63.
4. Tong WMY, Dixon R, Ekis H, Halvorson EG. The impact of preoperative CT angiography on breast reconstruction with abdominal perforator flaps. *Ann Plast Surg* 2012;**68**(5):525–30.
5. See MS, Pacifico MD, Harley OJ, Francis I, Smith RW, Jones ME. Incidence of 'Incidentalomas' in over 100 consecutive CT angiograms for preoperative DIEP flap planning. *J Plast Reconstr Aesthet Surg* 2010;**63**(1):106–10.

Martin Van
Muhammad Umair Javed
Leong Hiew
Welsh Centre for Burns and Plastic Surgery, Morriston Hospital, Heol Maes Eglwys, Swansea, West Glamorgan, United Kingdom
E-mail address: martin.van@uhb.nhs.uk (M. Van)

https://doi.org/10.1016/j.bjps.2019.05.009

Anatomic location of sensory nerves to the superior and inferior gluteal artery perforators flap: Novel option for sensate autologous tissue reconstruction

Dear Sir,

While the concept of providing sensate reconstruction is not a novel concept in breast reconstruction, the majority of studies have focused on abdominally-based donor sites. However, not all patients are candidates for abdominally-based autologous breast reconstruction. A study from our group reviewed all options for sensate autologous breast reconstruction that have been previously described [1]. For numerous options, the location of sensory nerves within the context of flap dissection had yet to be elucidated. Our group has previously published cadaveric studies demonstrating the location of the sensory nerves supplying the medial and lateral thigh flaps [2,3]. The goal of this study was to determine the location of sensory nerves to the superior and inferior gluteal artery perforator (SGAP and IGAP) flaps.

Five bilateral cadaveric dissections were conducted to locate sensory branches to the SGAP and IGAP for a total of 20 flaps. Measurements were made for the entry of the nerve to the flap from the ipsilateral trochanter and posterior superior iliac spine (PSIS).

At least one sensory nerve was located in all 20 flaps. For the SGAP, each cadaver had two to four large caliber sensory nerves supplying each flap traveling with a perforator. The sensory nerve was on average 5.9 cm (SD 2.8 cm, range 1–11.5 cm) from the PSIS horizontally, 4.6 cm (SD 1.8 cm, range 1–7.5 cm) from the PSIS vertically, 11.2 cm (SD 2.8 cm, range 7–16 cm) from the trochanter horizontally and 3.1 cm (SD 3.0 cm, range 0–10 cm) from the trochanter vertically. For the ten flaps dissected, one had four sensory nerves, four had three sensory nerves and five had two sensory nerves identified (Figure 1).

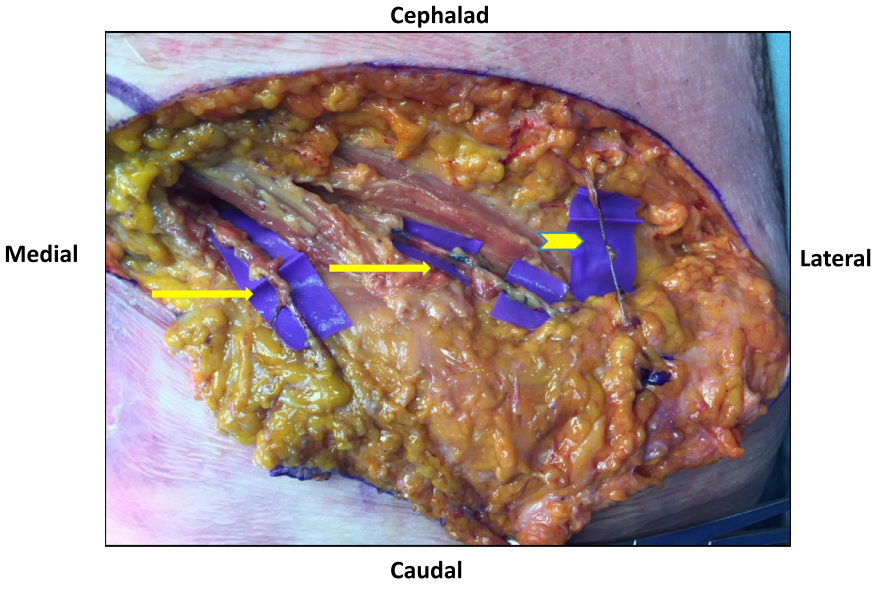

Figure 1 Perforator to SGAP flap with accompanying sensory nerve. Arrows indicates nerves traveling with perforators. Arrowhead indicates small sensory nerve entering flap from cephalad direction.

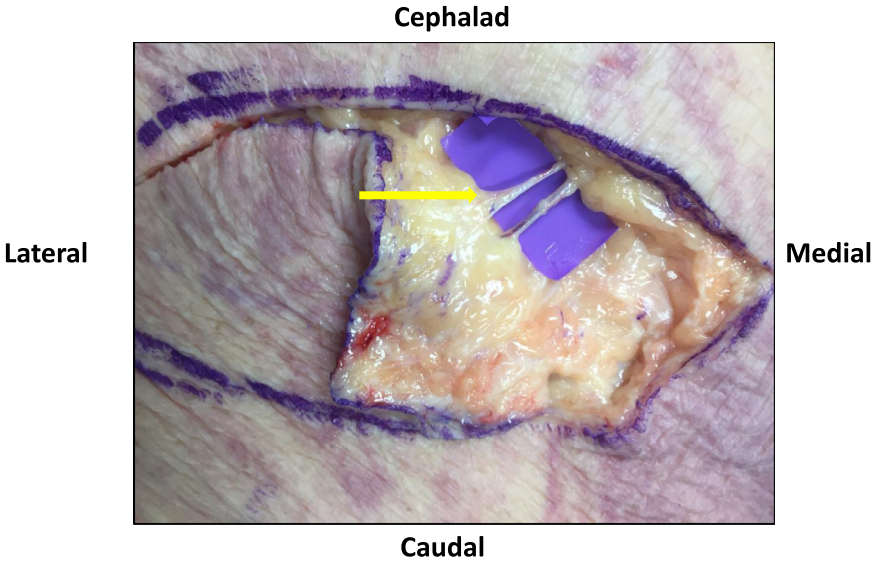

Figure 2 Perforator to IGAP flap with accompanying sensory nerve. Arrows indicates nerves traveling with perforators.

For the IGAP, each flap had one or two large caliber sensory nerves supplying each flap and traveling with a perforator. The sensory nerve was on average 5.5 cm (SD 2.3 cm, range 1–10 cm) from the PSIS horizontally, 12.2 cm (SD 1.4 cm, range 9.5–15 cm) from the PSIS vertically, 11.3 cm (SD 2.8 cm, range 6.5–16 cm) from the trochanter horizontally and 4.9 cm (SD 1.6 cm, range 2–8.5 cm) from the trochanter vertically (Figure 2).

A 2017 New York Times article, "After Mastectomies, an Unexpected Blow: Numb New Breasts," made the idea of hypoesthesia after mastectomy mainstreams. As the concept of providing sensate reconstruction continues to gain traction both in academia and in the lay media, surgeons must be aware of alterative options for patients who are not candidates for abdominally-based breast reconstruction. While a study reported on the sensation of commonly used options for autologous breast reconstruction, the anatomical distributions for the sensory nerves in the context of flap dissections has yet to be described [4]. Our group previously published on the location of the sensory nerves to the lateral and medial thigh flaps. In this paper, we present the anatomical location of the sensory nerves to the SGAP and IGAP flaps. While sensate SGAP reconstruction has been reported [5], the sensory nerves selected for these flaps were the "nervi clunium superiroes," branches. These nerves were described as coming off the dorsal branches of the

lumber segmental nerves and entering the flap from the cephalic direction. These authors cited that often multiple branches were present and they selected one with a "substantial diameter that crossed the incision line." While we routinely identified sensory nerves entering the SGAP from the cephalic direction, they were too small for coaptation without tracing back to a larger primary nerve which would require increased dissection outside of the primary dissection field. However, we were able to consistently locate sensory nerves with adequate calibers in predictable locations for both the SGAP and IGAP. While the distance from anatomical landmarks and number of sensory nerves identified per flap varied, the sensory nerves routinely traveled with the major perforator to the flap. Knowledge of the anatomic locations and relationships should allow for easier, more consistent identification and preservation of these nerves in sensate reconstruction.

This is the first study to report on the consistent location of a sensory nerve to the SGAP and IGAP flaps. We hope this report will expand the armamentarium of available flaps for sensate autologous reconstruction.

Conflict of interest

The authors have no disclosures.

Funding

None.

References

1. Gatherwright J, Knackstedt R, Djohan R. Anatomic targets for breast reconstruction neurotization: past results and future possibilities. *Ann Plast Surg* 2019;**82**(2):207–12.
2. Knackstedt R, Djohan R, Gatherwright J. Anatomic location of a sensory nerve to the lateral thigh flap: a novel option for sensate autologous tissue reconstruction. *J Plast Reconstr Aesthet Surg* 2019;**72**(3):513–27.
3. Gatherwright J, Knackstedt R, Kurlander D, Djohan R, et al. Anatomic location of a sensory nerve to the transverse upper gracilis (TUG) flap: a novel option for sensate autologous tissue reconstruction. *J Plast Reconstr Aesthet Surg* 2019;**72**(1):137–71.
4. Cornelissen AJM, Beugels J, Lataster A, Heuts EM, Rozen SM, Spiegel AJ, et al. Comparing the sensation of common donor site regions for autologous breast reconstruction to that of a healthy breast. *J Plast Reconstr Aesthet Surg* 2018;**71**(3):327–35.
5. Blondeel PN. The sensate free superior gluteal artery perforator (S-GAP) flap: a valuable alternative in autologous breast reconstruction. *Br J Plast Surg* 1999;**52**(3):185–93.

Rebecca Knackstedt
Department of Plastic Surgery, Cleveland Clinic, 2049 E. 100th Street, Cleveland, OH, 44195, USA

James Gatherwright
Division of Plastic Surgery, MetroHealth, Cleveland, OH, USA

Richard Drake
Cleveland Clinic Lerner College of Medicine, Cleveland, OH, USA

Risal Djohan
Department of Plastic Surgery, Cleveland Clinic, 2049 E. 100th Street, Cleveland, OH, 44195, USA

Correspondence to: Risal Djohan, Department of Plastic Surgery, Cleveland Clinic, Cleveland Clinic, 2049 E. 100th Street, Cleveland, OH 44195.
E-mail address: djohanr@ccf.org (R. Djohan)

https://doi.org/10.1016/j.bjps.2019.05.020

Capsule biopsy of acellular dermal matrix (ADM) to predict future capsular contracture in two-stage prosthetic breast reconstruction

Dear Sir,

Introduction

Capsular contracture is a common reason for implant removal in implant-based breast surgery. Acellular dermal matrix (ADM) is often placed along the inferolateral border of the pectoralis major muscle in order to prevent capsular contracture.[1] Leukotriene inhibitors, including Montelukast (Singulair) and Zafirlukast (Accolate), were recently introduced in research studies as medical agents to prevent capsular contracture. Systemic action of these medical agents, however, can bring unignorable side effects and cause additional economic burden.[2] Thus, it is not reasonable to prescribe these medical agents to every patient undergoing breast implant surgery.

To make the prevention approaches more effective, patient risk classification should be conducted. By categorizing patients from low to high risk of capsular contracture, high risk patients can be provided with more focused and intensive medical prevention. Risk factors for capsular contracture have been extensively studied, but more precise and quantitative tools to predict impending capsular contracture are still needed. We designed a prospective clinical trial to evaluate the prognostic role of ADM capsule to predict impending capsular contracture in two-stage prosthetic breast reconstruction.

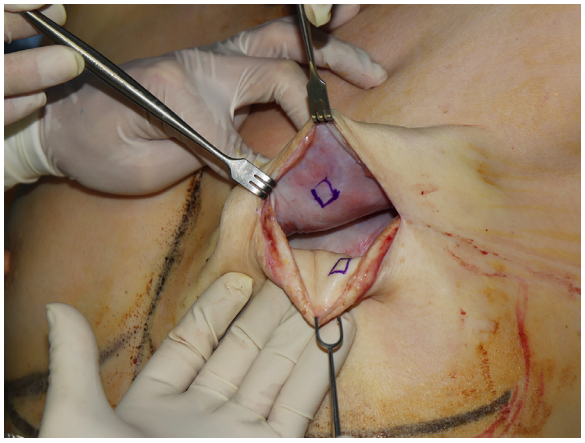

Figure 1 Capsule biopsy sites are demonstrated by gentian violet ink - one specimen from the capsule lining under the acellular dermal matrix (lower pole of breast) and another specimen from the capsule lining the subpectoral region (upper pole of breast). (For interpretation of the references to color in this figure legend, the reader is referred to the web version of this article.)

Method

Ten consecutive breast cancer patients undergoing acellular dermal matrix (ADM)-based expander-implant breast reconstruction were enrolled from November 2013 to October 2015. At the first stage, patients underwent total mastectomy and immediate breast tissue expander insertion with placement of acellular dermal matrix (ADM) (CGCryoDerm, CGBio, Republic of Korea). Biopsy specimens were obtained during expander-implant exchange at the second stage. The capsule biopsy technique is demonstrated as Figure 1. A study specimen was obtained from the capsule layer beneath the ADM (lower breast pole), while a control specimen was obtained from the capsule layer beneath the pectoralis major muscle (upper breast pole). Each capsule was meticulously biopsied as a 5×5 mm square-shaped full-thickness specimen using a No. 15 blade. All biopsy specimens were immediately fixed to 10% neutral buffered formalin and sent to the Pathology Department. A single experienced pathologist performed masked semiquantitative histopathologic scoring for capsule fibrosis and inflammation. This semiquantitative scoring was adopted from the previous study written by Basu et al.[3] With a minimum of 0 and a maximum of 18 points, a higher total histopathologic score indicated more severe cellular fibrosis and capsule inflammation. On the sixth postoperative visit, capsular contracture was clinically assessed by a single experienced plastic surgeon and Baker's grade was recorded. The plastic surgeon and pathologist were mutually blinded to the patient outcomes when reporting their examination results. This study was approved by the Institutional Review Board (IRB) of Samsung Medical Center and ClinicalTrials.gov registration number NCT03744273.

Using SPSS Statistics 24 (IBM, Chicago, IL, USA), the Spearman correlation test was performed to evaluate the correlation between total histopathologic score and postoperative 6-month Baker's grade. Values of $p < 0.05$ were considered statistically significant.

Table 1 Spearman correlation between capsule biopsy histopathologic score of and postoperative 6-month Baker's grade.

	Postoperative 6-month Baker's grade
Acellular dermal matrix (ADM) capsule	$r = 0.882^{*}$, $p = 0.009$
Subpectoral capsule (internal control)	$r = -0.685$, $p = 0.165$

r = Spearman correlation coefficient.
* Correlation is significant at $p < 0.05$.

Results

Mean patient age was 45.1 years (range 35-55) with a mean body mass index of 21.81 kg/m^2 (range 19.43-26.14). Three patients were excluded from the statistical analysis due to follow-up loss. Four out of seven patients developed Baker's grade 2 capsular contracture at the 6-month postoperative follow-up. No Baker's grade 3 or 4 patients were reported in this follow-up period.

The sum of the six histopathologic categories was 7.9 ± 3.4 versus 11.4 ± 3.4 for the ADM and subpectoral capsule, respectively (mean $\pm$ SD). The total ADM capsule histopathologic score showed a strong positive correlation with postoperative 6-month Baker's grade ($p = 0.009$). However, the subpectoral capsule was not statistically significant ($p = 0.165$). (Table 1).

Discussion

In this study, a strong positive correlation was observed between the ADM capsule total histopathologic score and postoperative 6-month Baker's grade. This suggests that patients with a higher ADM capsule score had a higher risk of capsular contracture in their first postoperative year. This finding could be supported by biofilm theory, which is currently the most convincing mechanism for capsular contracture.

Though multifactorial, biofilm is known as one of the critical causes of capsular contracture. Biofilm bacteria have an infection continuum that develops from the subclinical phase to the overt clinical phase of infection. During the subclinical phase, patients rarely experience symptoms or signs of capsular contracture because the biofilm bacteria remain down-regulated until they fully maturate into the clinical phase.[4,5] While some of our patients had relatively high cellular scores for the ADM capsule, none of them were showing clinical manifestations of capsular contracture at the time of the capsule biopsy. In other words, those patients with subclinical capsular contracture at the time of the capsule biopsy eventually showed overt clinical capsular contracture after six months of capsule biopsy. From this point of view, simultaneous capsule biopsy during the expander-implant exchange could help to detect the subclinical phase of capsular contracture before patients suffer from clinical capsular contracture.

Acknowledgments

Not applicable.

Financial disclosure statement

The named authors have nothing to disclose. No funding was received for this article.

References

1. Basu CB, Jeffers L. The role of acellular dermal matrices in capsular contracture: a review of the evidence. *Plast Reconstr Surg* 2012;**130**:118s–124s.
2. Gryskiewicz JM. Investigation of accolate and singulair for treatment of capsular contracture yields safety concerns. *Aesthet Surg J* 2003;**23**:98–101.
3. Basu CB, Leong M, Hicks MJ. Acellular cadaveric dermis decreases the inflammatory response in capsule formation in reconstructive breast surgery. *Plast Reconstr Surg* 2010;**126**:1842–7.
4. Rieger UM, Mesina J, Kalbermatten DF, et al. Bacterial biofilms and capsular contracture in patients with breast implants. *Br J Surg* 2013;**100**:768–74.
5. Tamboto H, Vickery K, Deva AK. Subclinical (biofilm) infection causes capsular contracture in a porcine model following augmentation mammaplasty. *Plast Reconstr Surg* 2010;**126**:835–42.

Ara Kim, Jae Hoon Jung
Department of Plastic Surgery, Samsung Medical Center, Sungkyunkwan University School of Medicine, Seoul, Republic of Korea

Yoon-La Choi
Department of Pathology and Translational Genomics, Samsung Medical Center, Sungkyunkwan University School of Medicine, Seoul, Republic of Korea

Jai-Kyong Pyon
Department of Plastic Surgery, Samsung Medical Center, Sungkyunkwan University School of Medicine, Seoul, Republic of Korea
E-mail address: pspriest.pyon@samsung.com (J.-K. Pyon)

https://doi.org/10.1016/j.bjps.2019.05.021

Sentinel lymph node biopsy in malignant melanoma; the East Midlands experience

Dear Sir,

Sentinel lymph node biopsy (SLNB), which identifies the first lymph node draining the skin, has been an integral part of staging and prognosticating malignant melanoma patients for the past 15 years. In the UK, it is indicated for patients with stage IB-IIC melanoma with a Breslow thickness of >1 mm, as per NICE guidance[1]. However, there remains significant heterogeneity in the offering and uptake of SLNB within the UK and international community. Anecdotally, we have noted differences in whether centres within our region will offer SLNB to patients with pT1b and/or pT4a/b tumours, as well as significant differences in the procedure uptake rates depending on which centre conveys the information.

With the recent evidence of improved melanoma free survival (MFS) following adjuvant therapy for patients with a positive SLNB, and the recent Melanoma Focus guidelines, it would be logical to expect that the number of patients choosing SLNB will increase, and the number of centres widening their criteria for offering the procedure would also increase[2]. We therefore felt, as a referral centre for SLNB, that it was important to establish the uptake rates amongst patients in our region and the reasons for declining or not offering SLNB, so we could identify the potential scale of increase that might follow. This would be critical in preparing the service for an increased workload, as it will impact on staffing, theatre capacity, histopathology services and nuclear medicine in particular.

We prospectively audited the application of the NICE and Melanoma Focus SLNB guidelines during a 3-month period in 2018 (prior to NICE approval of adjuvant therapy) within the East Midlands, to identify the number of patients with malignant melanoma potentially eligible for SLNB and the subsequent uptake rate of the procedure. We also recorded the reasons against undergoing SLNB. Data collection was facilitated by a pre-designed proforma and involvement of the skin cancer clinical nurse specialist (CNS) at the respective local or specialist skin cancer multidisciplinary team (i.e. LSMDT and SSMDT).

82 patients from 7 centres in the East Midlands region were identified as having malignant melanoma ≥0.8 mm Breslow depth. Of these patients, only 38% ($n = 31$) subsequently underwent SLNB. 13% ($n = 11$) of patients were excluded by the referring centre for having melanoma with a Breslow thickness outside that recommended by NICE (≤1 mm), or >4 mm with a further 5% ($n = 4$) of patients excluded on the basis of age and co-morbidities. Of potentially greater significance, 29% ($n = 24$) of eligible patients declined to undergo SLNB after consultation with either the operating surgeon or CNS. The uptake of SLNB varied significantly between centres, ranging from 9% to 73%.

Our data confirms our suspicion that there remains significant heterogeneity in the criteria used to determine eligibility of SLNB in our region and wide variation in uptake rates based on patient choice. Recent Phase III trials have identified an improved relapse-free survival with adjuvant targeted therapy and immunotherapy in certain patients with a positive SLNB and the use of Nivolumab, Pembrolizumab, and combination Dabrafenib and Trametinib, have all been approved by NICE for selected Stage III patients[2]. Given that these patients are, *a priori*, diagnosed by sentinel lymph node biopsy, it seems likely that this will result in a shift of patient and public opinion towards taking up SLNB, and result in an increased workload for SLNB centres. Equally, this survival benefit makes *not* offering SLNB to patients with a thick melanoma less acceptable, as it will potentially deny them early access to treatment for metastatic disease.

In our audit, almost 30% of patients regionally declined to undergo SLNB on the basis of patient choice and a further 13% were excluded due to having a Breslow depth outside the 1–4 mm range. As guidelines are updated to reflect the new evidence on adjuvant treatment, this group may all be offered SLNB and are more likely to take it up. This creates a potentially significant increase in workload for the receiving units who are carrying out SLNB. The heterogeneity between referral criteria from MDTs in the same geographical area also raises questions from patients who might live on the boundaries of different areas.

In our region, we are meeting to unify our SLNB criteria based on the latest evidence and guidelines, in an attempt to reduce this variation. In our centre, we are also investigating how we can cope with the additional workload, and discussing this with commissioners and NHSE. We discovered large variation in practise, and a significant number of patients not taking up SLNB as a prognostic procedure, who may feel differently about SLNB in the adjuvant therapy era. We would therefore strongly advise other SLNB centres to audit their regional numbers to help them understand the potential increase in workload they may experience.

Acknowledgments

None.

Conflict of interest

None.

Funding

None.

References

1. NICE. (2015). *Melanoma: assessment and management*. [online] Available at: https://www.nice.org.uk/guidance/ng14/resources/melanoma-assessment-and-management-pdf-1837271430853 [Accessed 5 February 2019].
2. Melanoma Focus. *The current role of sentinel lymph node biopsy in the management of Cutaneous Melanoma – a UK consensus statement*, Cambridge, UK: Melanoma Focus; 2018. [online] Available at: https://melanomafocus.com/wp-content/uploads/2019/01/SNB-Consensus-Final-1.pdf. [Accessed 5 Feb. 2019].

Irfan Jumabhoy
Department of Burns, Plastics and Reconstructive Surgery, Nottingham City Hospital, Nottingham University Hospitals NHS Trust

Michelle Collins, Jonathan Pollock
Department of Plastic Surgery, Nottingham City Hospital, Nottingham, UK
E-mail address: irfan.jumabhoy@nhs.net (I. Jumabhoy)

https://doi.org/10.1016/j.bjps.2019.05.025

Suture material utilised influences suture extrusion rate in otoplasty: A non-randomised retrospective single-centre study

Dear Sir,

Introduction

The Mustardé and Furnas techniques use suture to modify cartilage layout. We used a combined Mustardé–Furnas (MF) technique.[1]

Throughout the history of otoplasty, a wide range of suture materials have been used, including collagen (catgut), polyester (Mersilene®), polyglecaprone (Monocryl®), Prolene®, polyglactin (Vicryl®), Ethilon®, polydioxanone (PDS®), Goretex®.[2]

The aim of this study is to compare the extrusion rate of difference suture materials used in otoplasty.

Material and methods

Retrospective descriptive and observational study from 1996 to 2016 of patients.

Each procedure was conducted by the same team of senior surgeons, though in some cases FGP was the first surgeon and in others ARJ was the first surgeon.

The inclusion criteria for the study were minor ear deformity, age >6 years old, MF technique, and prolene®, ethilon® or goretex® suture use. Severe deformities were excluded

We performed a resection of the posterior conchal skin. A deep mastoid pocket was created and the conchal cup accommodated there. Economic resection of the concha was performed if the concha was at least twice as big as pocket. The posterior cartilage was spared for better modelling. Three Mustardé sutures were used to recreate the antihelix and two conchal-mastoid sutures were used.

Prolene® (W8015T), ethilon® (W1612T), and goretex® (3200) suture was used to fold the anti-helical cartilage and reduce the concha-mastoid distance. The skin was closed with Vicryl® suture.

Patients aged under 14 years were operated under general anesthesia. The other patients were operated under local/regional anesthesia. All the patients were discharged four hours later.

All patients signed the informed consent prior to enrolment in the study. All parents provided consent for legal minors. The study was approved by our hospital ethics committee (JV, Ph.D. M.D.).

A post-operative follow-up period was conducted, with visits at one week, two weeks, one month, three months, six months and one year. All patients wore protective bandage around their ears during the first week postoperative. All patients were evaluated for 12 months post-procedure for the presence or absence of extrusion.

Table 1 Extrusion.

	No. patients	No. ears	No. extrusions	Extrusion rate
Prolene®	15	30	5	16.66%
Ethilon®	81	163	30	18.4%
Goretex®	76	150	5	3.33%
Total	**172**	**343**	**40**	

Table 2 Results.

	Result		*p*
	Failure	Success	
Prolene®	5 (16.7%)	25 (83.3%)	0.013
Goretex®	5 (3.3%)	145 (96.7%)	
Ethilon®	30 (18.4%)	133 (81.6%)	<0.001
Goretex®	5 (3.3%)	145 (96.7%)	
Prolene®	5 (16.7%)	25 (83.3%)	0.99
Ethilon®	30 (18.4%)	133 (81.6%)	

For statistical analysis we used the IBM© Statistical Package for the Social Sciences (SPSS)© version 24 for OS X©. Proportions were compared using Fisher's exact test.

Results

343 otoplasty procedures were performed using the MF technique. 172 patients underwent surgery; 153 bilateral ears and 19 unilateral. Out of the 172 patients 9 underwent bilateral, revision surgery. Of these 9, 4 were due to early extrusion and 5 were due to recurrent cartilage protrusion. Two patients had bilateral keloid scarring 6 months after surgery, requiring 3 infiltrations with intralesional triamcinolone; both cases resolved within 45 days.

The sample was divided into three groups, one group sutured with Prolene® (30 ears), a second group sutured using Ethilon® (163 ears) and a third group sutured with Goretex® (150 ears).

In the first group, all 15 patients underwent bilateral otoplasty, in the second, 72 patients underwent bilateral surgery and 9 unilateral; in the third group, 66 patients were operated bilaterally and 10 unilaterally.

40 patients with presence of extrusions were reported in the 12-month follow-up period (12%). In the first group (Prolene®), there were 5 patients were reported with extrusions (17%); in the second group (Ethilon®), there were 30 (18%) and in the third group (Goretex®), there were 5 (3%).

Table 1 lists the groups and their respective extrusion rates. Table 2 shows surgery outcomes by material used, in terms of "successful" or "unsuccessful".

Comparing the proportion using Fisher's exact test, we see a statistically significant difference between Goretex® and Prolene® ($p = 0.013$) and between Goretex® and Ethilon® ($p < 0.001$). However, there is no difference between Prolene® and Ethilon®.

Discussion

The suture extrusion rate varies between 0% and 22%. The lowest extrusion percentages are described when the suture used is 4-0 PDS® (0%) and 4-0 Mersilene® (0%), while the highest percentage is noted when Ethilon® suture is used.[3,4]

Initially, we used 4-0 Prolene® and 4-0 Goretex® sutures in MF otoplasty procedures. After reviewing the literature,[4] which demonstrated a lower extrusion rate with Ethilon® (2%), we switched to a 4-0 Ethilon®.

As the extrusion rate was higher than expected, we switched once more from Ethilon® to 4-0 Goretex®. We currently use Goretex® suture.

Our results show a lower extrusion rate for Goretex. We found statistically significant differences between Goretex® and Prolene® and between Goretex® and Ethilon®. To date we have observed no skin granuloma when Vicryl® suture is used.[5]

At the 6-month follow-up visits, we cut and extracted extruded sutures from patients complaining of discomfort. We observed that their discomfort resolved by the 12-month appointment, with no evidence of deformity recurrence.

We believe that cutting the end of the suture close to the knot results in a lower percentage of extrusion.[1]

Conclusion

According to our study, Goretex® produces a statistically significant lower suture extrusion rate compared to Prolene® and Ethilon®.

Conflict of interest

None.

Funding

The authors have no financial disclosures.

References

1. Songu M. Combined Mustardé and Furnas type otoplasty: the experience of 85 patients. *J Med Updates* 2013;**3**(3):129-34.
2. Maslauskas K, Astrauskas T, Viksraitis S, Samsanavidius D. Comparison of otoplasty outcomes using different types of suture materials. *Int Surg* 2010;**95**(1):88-93.
3. Speranzini M. How to avoid postauricular suture extrusion. *Otoplasty Plast Reconstr Surg* 2011;**128**(4):64.
4. Limandjaja GC, Breugem CC, Molen M, Kon M. Complications of otoplasty: a literature review. *J Plast Reconstr Aesthet Surg* 2009;**62**(1):19-27.
5. Rigg BM. Suture materials in otoplasty. *Plast Reconstr Surg* 1979;**63**(3):409-10.

Alberto Raposo*
Hospital Universitario Los Arcos del Mar Menor (HULAMM), Torre Octavio Street, San Javier 30739, Murcia, Spain
Research Group of Head and Neck at Catholic University San Antonio, United States

Juan Calero
Research Group of Head and Neck at Catholic University San Antonio, United States
Murcia, Spain

Alberto Guilllén
Hospital Universitario Santa Lucia, Cartagena, Murcia, Spain

Ana Giribet
HULAMM, Torre Octavio Street, San Javier, Spain

Andrés Barrios
Head of Otorhinolaryngology Department, HULAMM, San Javier, Spain

Francisco García-Purriños
Research Group of Head and Neck at Catholic University San Antonio, United States
Head of Otorhinolaryngology Department, HULAMM, San Javier, Spain

*Corresponding author at: Alberto Raposo, Hospital Universitario Los Arcos del Mar Menor (HULAMM), Torre Octavio Street, San Javier 30739, Murcia, Spain.
E-mail addresses: albertoraposojimenez@gmail.com, albertoraposo@hotmail.com (A. Raposo)

https://doi.org/10.1016/j.bjps.2019.05.028

Training and mentorship in plastic surgery

Dear Sir,

Many surgeons ask what is most important in training a Plastic and Reconstructive surgeon. Some argue that hours are key; however it is questionable if large volume alone is the answer to achieve great training. A trainee who is guided by mentors can upskill much faster than those who experience immense hours. Trainees with mentors do better; they have less burnout and attrition from their training scheme.[1-3] Over the years I have noted important qualities in the character of the best surgical mentors; which I believe are tenets to becoming a great surgeon.[4]

Emotional quotient (EQ)

The importance of EQ was recently touched upon by Tim Lane in a Royal College of Surgeons editorial.[5] Emotional quotient or intelligence is the ability of a surgeon to recognise their own emotions and those of others and use this information to guide their thinking and behaviour. I have seen master surgeons vanish into anonymity based on their poor EQ, their inability to work with theatre staff or remain collegiate with other specialities. We are the surgeon's surgeon for many specialities and if this is not embraced the surgeon can become isolated. We have all heard that the surgeon who is *Available*, *Affable* and *Approachable* is the best role model for a Plastic Surgeon.

The teacher

The consultant that gives opportunities to his trainees is the one who will always be admired. The greatest mentors I have had have always given me the chance to do a case knowing that if I fail they can bail me out. I think this quality takes a special person to let go and *Train*. Transference of technical skills with constructive feedback is essential in a great trainer.

I encourage the reader to try training their registrar how to raise a flap that they do often; it is much harder to train someone through the steps than doing it yourself. A comparison would be trying to fly a plane without being in the cock-pit with the pilot, and giving instructions that have to be very accurate. Many surgeons are not able to do this; it is a true art taking someone through a case that you know you can do much better.

The evolving surgeon

The mentor who enjoys learning from his fellows and registrars and adapting his practice over time will always be successful. It was Harold Kleinert who famously said that he wanted his fellows to be better than him. The evolving surgeon will stimulate mentees, to set high goals, to go above and beyond and do better than their mentors.[3] Great units in surgery survive in this manner.

When I was a junior surgeon a consultant told me there are three types of consultant; the surgeon who becomes a consultant, makes a few mistakes and continues to regress and eventually has a very small practice taking on nothing that is outside their comfort zone, the second is the surgeon who does certain operations and continues to do the exact operations for 30 years of practice. Finally the best surgeons are those that change their practice and evolve over the course of their career.

The innovator

The surgeon who drives innovation and taking on the difficult cases that others avoid. When a department encourages a fear of failure, every aspect of the department is pushed back. Trainees become more tentative and do not take on more complex cases, they do not question whether cases can be done a different way. This leads to a loss I believe in imagination which is key in reconstructive plastic surgery. When an organisation becomes a conveyor belt and only one reconstructive method is used one can argue that the culture in that department has become stagnant. The best surgical mentors I have had never blamed others or their trainees for their failures. They were open to their failures, presented their failures to large audiences and were proud to say why it went wrong and offer an alternative solution.

The evidence-based surgeon

An Evidence-based approach and reflection in their practice through clinical expertise is a key quality in a great mentor. Those that question the routine procedures we do day to day and get involved in research to streamline patient care are the surgeons to follow. Using reliable evidence and clinical expertise which comes through experience is very useful as a specialist plastic surgeon. Furthermore reflecting on ones results and how they compare to other research groups is another important quality. At the same time being a surgeon who is willing to collaborate with other units and specialities through research.

Many surgeons may have only one or two of these qualities but if shared and followed by a training surgeon this can have a lasting and positive impact on their career.

Conflicts of interest

None declared.

References

1. Rohrich RJ. Mentors in medicine. *Plast Reconstr Surg* 2003 15;**112**(4):1087–8.
2. Ramanadham SR, Rohrich RJ. Mentorship: a pathway to succeed in plastic surgery. *Plast Reconstr Surg* 2019;**143**(1):353–5.
3. Franzblau LE, Kotsis SV, Chung KC. Mentorship: concepts and application to plastic surgery training programs. *Plast Reconstr Surg* 2013;**131**(5) 837e–843e.
4. Jupiter J. The making of a great surgeon. *Tech Hand Up Extrem Surg* 2014;**18**(2):61.
5. Lane T. Emotional Intelligence. *Ann Royal Coll Surg* 2019;**101**:1.

Dariush Nikkhah
Jeremy Rawlins
Royal Perth Hospital, Wellington St, Western Australia, Australia
E-mail address: dariushnikkhah@hotmail.com (D. Nikkhah)

https://doi.org/10.1016/j.bjps.2019.05.008

A simple, inexpensive and non-microscope based model for microsurgical training

Dear Sir,

Microsurgery is a fine motor dependent practice with a steep competency learning curve. Repetition is vital to skill acquisition and retention, and to clinical success.[1] Pressures on time in training and efficiency during operating have driven advances in simulation training.[2] There is evidence to show that technical skills acquired on simulation low fidelity models correlate strongly with improved performance on human cadaver models and that self-directed practice leads to improved technical performance. In recognition of this, many Plastic Surgery units in the UK have microsurgical skill areas equipped with microscopes for their trainees. Rat models are usually only utilised on dedicated microsurgical skills training courses, however chicken femoral arteries dissected from chicken thighs are an easily accessible non-live option and the vessels compare closely to human vessels.[3] Cheapest of all though, are synthetic vessel constructs made from silicone or polyvinyl alcohol gelatin tubes.[4] Vessels of differing sizes and thickness can be made to complement the level of skill and competency. We present a non-microscope based model for microsurgical training that can accommodate any vessel construct. It is cheap to assemble and can either complement the departmental microsurgery suite or used at home for personal training.

A 2.5× magnification lens (e.g. Velleman VTMG2) with an incorporated stand is used for magnification and vessel platform and can be purchased for less than £10 from amazon.co.uk. It is of reasonable quality and although a 2.5× magnification is lower than the 10× magnification achievable using an operating microscope, it is sufficient to gain confidence with anastomotic technique while preserving stereoscopic visualisation which is not possible on iPad and tablet models.[5] A desk lamp can be used to provide illumination but we suggest an LED desk lamp is a better alternative as it can more precisely direct the beam onto the workbench and can also be powered by a USB battery pack for portable operation. Microsurgical instruments such as Nyes curved micro-scissors (£6), a curved ophthalmic Castroveijo needle holder (£13) and Jewellers Watchmakers forceps (£6) can be purchased on Ebay. Alternatively, a complete 12 cm titanium instrument set can be purchased from aliexpress.com for £37. Training sutures 8-0 or 9-0 can also be purchased from aliexpress.com (search for "microsurgery nylon suture") for around £0.90 each or acquired from hospital theatres when expired. Vessels can be made using liquid latex, purchased from art stores and typically costing around £12 for a 1 kg bottle (tiranti.co.uk). We use this to manufacture hundreds of vessels. The technique recommended to construct the tubes uses a wire of known thickness such as a k-wire or a weaving needle. We advise preparing the wire first with petroleum jelly, then talc powder to permit easy removal of the tube onto sets. The wire is submerged in the liquid latex and allowed to air dry for a few hours. Two crocodile clips (Ebay) can be super-glued together using a paperclip to make an Acland clamp. This model can be used anywhere (Figure 1) and is great for end-to-end or end to side anastomoses with or without a size mismatch (Figure 2).

The steep learning curve in acquiring microsurgical competency and the time constraints in clinical practice makes it vital that trainees undertake more simulation training. It represents a safe, controlled environment and effective adjunct to clinical practice where skills can be optimised. Limitations on aiding microsurgical decision making on the operating table can at least be minimised through proficiency in the skill.

Low fidelity training models have been shown to attribute similar skill acquisition to microscope based simulation models. Our proposed model is similar to that used by Malik et al., but is easily obtainable, affordable and trans-

Figure 1 The microsurgical model.

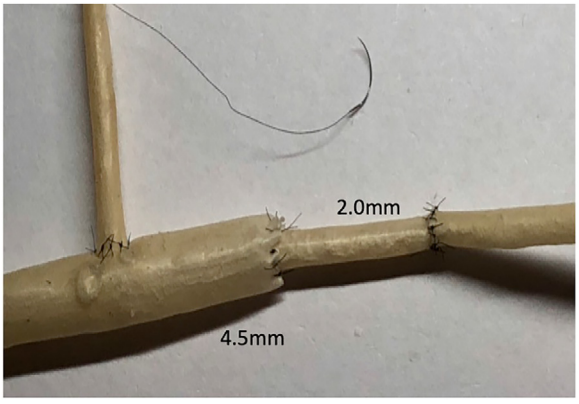

Figure 2 Latex tube constructs of different sizes; end to end and end to side anastomoses.

portable. Latex vessels of variable compliance, depending on the number of latex layers, can be made to create vessels of similar compliance and elasticity to in vivo which make for good transference of skills in practice. Individuals with an allergy to latex could utilise a silicone alternative for a tube construct.

In conclusion, this is an inexpensive non-microscope based model for microsurgical training, easily purchased from online sources and a valuable resource for teaching and practicing microsurgery.

Conflicts of interest

We declare we have no conflicts of interest, financial, consultative, institutional or otherwise.

References

1. Grober ED, Hamstra SJP, Wanzel KR, Reznick RK, Matsumoto ED, Sidhu RS, Jarvi KA. The educational impact of bench model fidelity on the acquisition of technical skill: the use of clinically relevant outcome measures. *Ann Surg* 2004;**240**:374–81.
2. Skipworth RJE, Terrace JD, Fulton LA, Anderson DN. Basic surgical training in the era of the European working time directive: what are the problems and solutions? *Scott Med J* 2008;**53**:18–21.
3. Masud D, Haram N, Moustaki M, Chow W, Saour S, Mohanna PN. Microsurgery simulation training system and set up: an essential system to complement every training programme. *J Plast Reconstruct Aesthet Surg* 2017;**70**:893–900.
4. Atlan M, Lellouch AG, Legagneux J, Chaouat M, Masquelet AC, Letourneur D. A new synthetic model for microvascular anastomosis training? A randomized comparative study between silicone and polyvinyl alcohol gelatin tubes. *J Surg Educ* 2018;**75**:182–7.
5. Malik MM, Hachach-Haram N, Tahir M, Al-Musabi M, Masud D, Mohanna PN. Acquisition of basic microsurgery skills using home-based simulation training; randomised control study. *J Plast Reconstruct Aesthet Surg* 2017;**70**:478–86.

Terry-Ann Curran
Department of Plastic and Reconstructive Surgery, Salisbury District Hospital, United Kingdom

Susannah Eves
Department of Plastic and Reconstructive Surgery, Southmead Hospital, Bristol, United Kingdom

Georgina J Williams
Department of Plastic and Reconstructive Surgery, Charing Cross Hospital, London, United Kingdom

Luigi Troisi, Marios Nicolaou*
Department of Plastic and Reconstructive Surgery, Salisbury District Hospital, United Kingdom

*Corresponding author.
E-mail address: drmarios@gmail.com (M. Nicolaou)

https://doi.org/10.1016/j.bjps.2019.05.010

Borescope: A frugal tool for capturing cleft palatal surgeries

Dear Sir,

Video documentation of cleft surgeries is an integral aspect of cleft services for monitoring, auditing, reviewing, self-assessment, analyze surgical outcome and most important for learning and teaching.

Presently numerous educational resources are available, but high-quality video footage, from a surgeon's perspective, can be useful to impart detailed information of various surgical techniques which are difficult to convey. More so for corrective cleft surgeries as the visual field for the primary surgeon is narrow and deep which also requires direct illumination and thereby resulting in even more restricted visualization field for an observer.

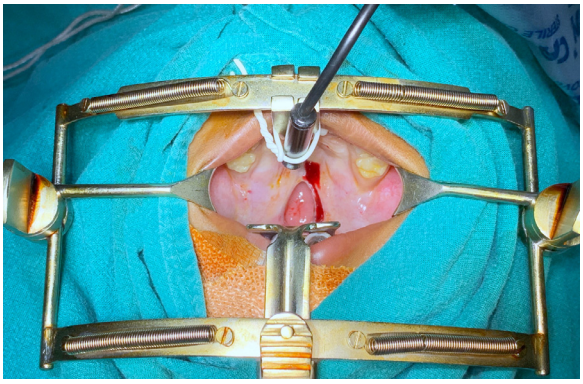

Figure 1 Borescope secured to the Dingman mouth gag with sterile tie wires.

Traditionally intraoperative surgical videos were recorded by professional videographer using extensive and expensive armamentarium which inflates the cost significantly.[1] To overcome these hurdles various techniques have been implemented to record surgeries such as an endoscope held by an assistant or secured onto a mouth gag/mayo stand.[2-4] A camera mounted onto the headlight have also been used previously, each having its own limitations.[5]

An ideal method for visualization and capturing the operative field should be versatile enough to provide an adequate projected view of the surgical field simultaneously should not disrupt the natural flow of the procedure.

Keeping this in mind, we present a frugal tool to capture high-quality photo/video for cleft palate surgeries using a borescope (Price approximately 20 USD). We used a standard quality borescope with following specifications, camera diameter – 5.5 mm with 6 adjustable LED white light, having a 66-degree view angle along with a 1.5-m waterproof cable bearing a USB Micro B output. The borescope is sterilized via gas sterilization using ethylene oxide (EtO). Once the patient is scrubbed, painted, draped with the Dingman mouth gag in situ, the borescope is placed over the incisal guidance onto the Dingman. It is then attached to a smartphone via USB Micro B to visualize the field. Once the camera position is confirmed by the operator it is then secured to the Dingman mouth gag with sterile tie wires (Figure 1). The cable is enclosed in a sterile camera sleeve, up to the smartphone. Thus, as we can see the entire assembly remains sterile and if any manipulation required it can be done easily. Once everything is checked the recording is initiated directly onto the smartphone hence visualizing and recording concomitantly (Figure 2). Pictures can be taken simultaneously as well. The video can be relayed remotely as well via WIFI through the smartphone hence multiple views can observe.

Therefore, as we can see using a borescope for capturing cleft palate surgeries poses numerous benefits. A borescope is readily available, affordable, portable and easy to use. This serves as a major boon, as in developing countries such as ours, high-end technologies are not readily available and if available it is associated with high cost. It can be easily sterilized via EtO, the video is directly recorded on to the smartphone which can be transferred onto a hard drive or cloud storage thus eliminating the need of another expensive armamentarium. The borescope comes with a USB Micro B to USB converter; therefore, the scope can be directly attached to a personal computer as well. Due to its sleek profile, it does not hinder the surgical field. As it is secured to the mouth gag it provides distortion-free images as compared to head mounted or hand-held devices.

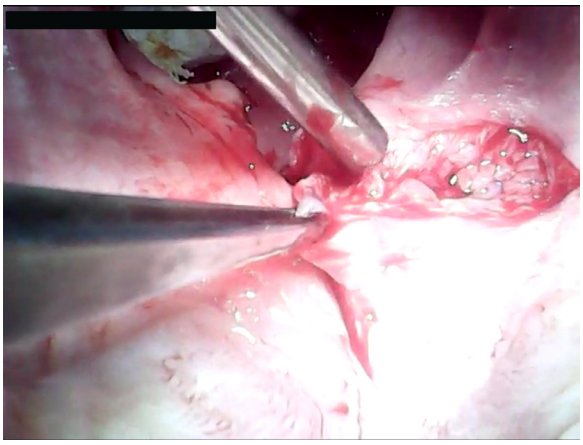

Figure 2 Intraoperative image captured using a borescope.

The borescope secured to the Dingman mouth gag is a simple, frugal, easily reproducible method for capturing and visualizing the operative field for multiple observe and will definitively aid in teaching and assessment of cleft palate surgeries.

Financial disclosure

No funds/sponsorship was obtained from any external source to procure the borescope that has been used in this paper. The borescope and smart phone was the authors' personal properties.

Conflict of interest

The authors have no conflict of interest to report.

Acknowledgment

None.

References

1. Hespin A, Matthews J. New workflows for clinical video recordings in cleft care. *J Vis Commun Med* 2017;**40**(4):142–8.
2. Raurell, Southern SJ, Fenton OM. Perioperative use of the endoscope in cleft palate surgery: a preliminary report. *Ann Plast Surg* 2000;**45**:677–8.
3. Valente DS, Giglio A, Barcellos C, Borile G, Chem R. Endoscopically assisted, intraorally approached palatoplasty. *Plast Reconstr Surg* 2005;**116**:1820–1.
4. Demoss P, Murage KP, Tholpady S, Friel M, Havlik RJ, Flores RL. Low-cost, high-definition video documentation of corrective cleft surgeries using a fixed laparo-scope. *J Plast Reconstr Aesthet Surg* 2014;**67**:e58–9.

5. Kanani M, Kocyildirim E, Cohen G, Bentham K, Elliott MJ. Method and value of digital recording of operations for congenital heart disease. *Ann Thorac Surg* 2004;**78**:2146–9 (discussion 2149).

Suraj Arjun Ahuja
Department of Oral & Maxillofacial Surgery, MGM Dental College & Hospital, Junction of NH4 and Sion-Panvel Expressway, Sector 1, Kamothe, Navi Mumbai, Maharashtra 410209, India

Gaurav Deshpande
Department of Oral & Maxillofacial Surgery, MGM Dental College & Hospital, Junction of NH4 and Sion-Panvel Expressway, Sector 1, Kamothe, Navi Mumbai, Maharashtra 410209, India

Abhishek Dutta
Department of Oral & Maxillofacial Surgery, MGM Dental College & Hospital, Junction of NH4 and Sion-Panvel Expressway, Sector 1, Kamothe, Navi Mumbai, Maharashtra 410209, India

Srivalli Natarajan, Usha Asnani
Department of Oral & Maxillofacial Surgery, MGM Dental College & Hospital, Junction of NH4 and Sion-Panvel Expressway, Sector 1, Kamothe, Navi Mumbai, Maharashtra 410209, India

Imran Khalid
Department of Oral & Maxillofacial Surgery, College Of Dentistry King Khalid University, Guraiger, Abha 62529, Saudi Arabia
E-mail address: drahujasuraj@gmail.com (S.A. Ahuja)

https://doi.org/10.1016/j.bjps.2019.05.019

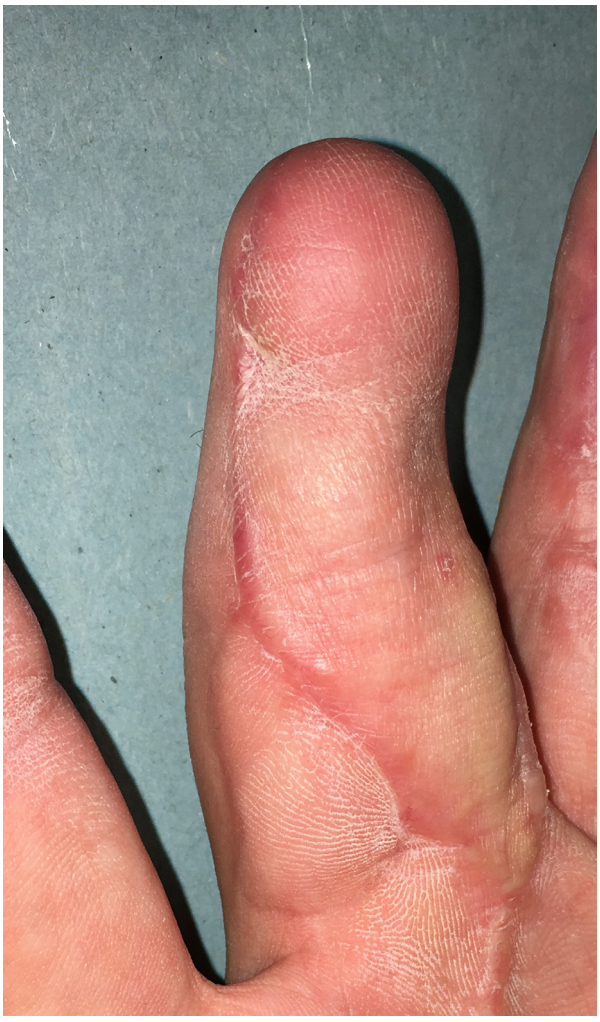

Figure 1 Free toe pulp flap reconstruction of ring finger with anastomoses to digital artery and dorsal vein.

Re "Free medialis pedis venous flap transfer for reconstruction of volar finger defects: Clinical application and esthetic evaluation"

Dear Sir,

Kawakatsu[1] reports using venous flow-through flaps from the medial plantar region to cover palmar soft tissue finger defects. We complement him on the impressive results and the technical skill demonstrated.

We are writing to advocate that readers also consider using free toe-pulp flaps for palmar/leading edge and distal fingertip tissue loss (Figure 1). These areas in particular are best served by reconstructions that are both sensate and durable.

Toe pulp provides suitably padded glabrous skin that is more durable and has a better grip than a venous flow through flaps. A digital nerve can be harvested with a free toe pulp flap and anastomosed to the severed distal end of a digital nerve, enabling restoration of sensation with good results.[2] Our experience shows that the fingerprint of a free toe pulp can be used for identification purposes with modern electronic accessories. Insensate fingertips are prone to re-injury and tend to be excluded by the patient[3]. The author's proposed locations of donor sites may be more prone to rubbing on shoes, whilst up to 2cm wide toe pulp flap donor sites from the lateral side of the great toe can be directly closed.

We acknowledge that a venous flow through flap may be quicker and easier to raise, but if anastomosed to the digital vessels, then the pedicle of a free toe pulp does not need to be long, and flap harvest need not be onerous. The venous flow through flap requires a high level of microsurgical skill, with three anastomoses needed, and this

might add to the overall duration of the procedure in comparison to the two anastomoses required for a free toe flap, as well as an additional potential site of failure. As the author states, the viability of conventional free flaps is higher than that of venous free flaps, which are notoriously unreliable[1,4].

Conflict of interest

No conflict of interest.

Funding

No funding.

References

1. Kawakatsu M. Free medialis pedis venous flap transfer for reconstruction of volar finger defects: Clinical application and esthetic evaluation. *J Plast Reconstr Aesthet Surg* 2019;**72**(3):459-66 Epub 2018 Dec 13. doi:10.1016/j.bjps.2018.12.003.
2. Balan JR. Free toe pulp flap for finger pulp and volar defect reconstruction. *Indian J Plast Surg* 2014;**49**(2):178-84 May-Aug. doi:10.4103/0970-0358.191319.
3. Callahan AD. Sensibility assessment: prerequisites and techniques for nerve lesions in continuity and nerve lacerations. In: Hunter JM, Mackin EJ, Callahan AD, editors. *Rehabilitation of the hand: surgery and therapy*. 4th ed Philadelphia: USA: Mosby; 2003. Cited in Sarkar S, Eapen C, Adhikari P. Sensory changes in the upper limb in type 2 diabetic patients - a case control study. J Clin Diagn Res, 2011; 5(1):96-100 p. 129-50.
4. Goldschlager R, et al. The nomenclature of venous flow-through flaps: updated classification and review of the literature. *Microsurgery* 2012;**32**(6):497-501 Epub 2012 Mar 21. doi:10.1002/micr.21965.

Anže Škrlec
James Henney
James Henderson
Department of Plastic and Reconstructive Surgery, Southmead Hospital, Southmead Road, BS10 5NB Bristol, United Kingdom
E-mail address: anze.skrlec@nbt.nhs.uk (A. Škrlec)

https://doi.org/10.1016/j.bjps.2019.04.018

Reply: Comment on 'Free medialis pedis venous flap transfer for reconstruction of volar finger defects: Clinical application and esthetic evaluation'

Dear Sir,

I appreciate the comments of Škrlec and colleagues regarding my recently published article.[1] I agree that it is useful to reconstruct volar finger defects with a free toe pulp flap, which is equal to a free hemi-pulp flap elevated from the great toe, especially in patients with finger pulp defects. However, the reason I agree is not because the free toe-pulp flap can obtain superior sensation and durability, but is because it is easier to cosmetically reconstruct the shape of the finger pulp with an excellent texture and color match.

It is important for the reconstructed finger to have adequate sensory recovery and durability if the patient's usual work requires frequent use of it after injury. Free toe pulp flap transfer may provide effective finger function without short-term donor site complications. However, skin ulcers, etc. may occur to the toe over the long term due to sacrifice of the artery and nerve, even if the donor site can be closed directly. Thus, some patients do not want free toe pulp flap transfer for reconstruction of a partial volar finger defect, depending on differences of culture, occupation, age, and gender.

The properties of finger skin are similar to those of skin near the medial plantar region, while toe skin is durable but thicker. Therefore, a free medial plantar flap, free medialis pedis flap, medial plantar venous flap, or my recently reported flap have all been employed to reconstruct defects of the finger pulp and shaft. I think it is better to choose a venous flap that is associated with less damage to the donor site if the flap viability rate and histological findings are similar to those of conventional free flaps, especially when the flap is relatively small. In addition, use of a free medial plantar venous flap for reconstruction of volar finger defects without harvesting the medial plantar subcutaneous nerve has achieved good postoperative sensory recovery.[2]

Despite non-physiological circulation, venous flaps continue to be used for reconstruction of soft tissue defects because they are easy to elevate, and even a venous flap with

a long pedicle can be elevated quickly because it is based on a vein rather than sacrificing an artery. I tend to disagree that my method of using an arterialized flow-through flap with the venous anastomosis as the outflow requires a higher level of microsurgical skill compared with that required for a free toe pulp flap with a short pedicle. However, this opinion may be based on clinical experience with replantation of amputated digits at the distal phalanx level in children as well as adults. In addition, the overall duration of the surgical procedure is not important if the venous flap with three anastomoses achieves high viability and a normal appearance like a conventional free flap with an extra venous anastomosis to avoid congestion.

Based on various characteristics of patients, plastic and reconstructive surgeons should choose a method of reconstruction that not only achieves better long-term functional and aesthetic outcomes at the recipient site, but also results in fewer damages and complications at the donor site over the long term. Although this is often difficult, I hope that my article on the clinical and aesthetic outcomes of free medialis pedis venous flaps for reconstruction of volar finger defects provides some useful points for making a decision.

Funding

None.

Conflicts of interest

None declared.

References

1. Kawakatsu M. Free medialis pedis venous flap transfer for reconstruction of volar finger defects: clinical application and esthetic evaluation. *J Plast Reconstr Aesthet Surg* 2019;**72**(3):459–66.
2. Yokoyama T, Hosaka Y, Kusano T, Morita M, Takagi S. Finger palmar surface reconstruction using medial plantar venous flap: possibility of sensory restoration without neurorrhaphy. *Ann Plat Surg* 2006;**57**(5):552–6.

Motohisa Kawakatsu
Department of Plastic and Reconstructive Surgery, Sumiya Orthopaedic Hospital, 337, Yoshida, Wakayama-shi, Wakayama 640-8343, Japan
E-mail address: kawakatsu@sumiya.or.jp (M. Kawakatsu)

https://doi.org/10.1016/j.bjps.2019.05.006

Letter to the Editor: The use of indocyanine green angiography in postmastectomy reconstruction: Do outcomes improve over time?

Dear Sir,

We read with interest the article by Diep and colleagues on the learning curve for the use of indocyanine green angiography (ICGA) in post mastectomy breast reconstruction to improve outcomes.[1] This is an important finding on the surgeons' experience required for effective use of the ICGA technique. As stated, clinical judgement remains the current standard at the time of tissue expander placement. However, it is a subjective assessment and varies between surgeons worldwide, partly due to differences in surgeons' personal experience and surgical training.

ICGA is a recently available fluorescence imaging technique that has been shown to aid intra-operative surgical decision making on the assessment of flap perfusion to reduce intra- and post-operative complications.[2] However, ICGA is an invasive technique that requires injection dye (with multiple contraindications) and a transit time of about 90 s prior to tissue perfusion imaging. It is a non-continuous technique that has a delay of 10–15 min for re-imaging (ICG plasma half-life is 3–4 min). ICGA has a high cost: $76,700–$250,000 for equipment; and $105–$275 for ICG per case for dye. The total cost of use for the SPY Elite system (Stryker, Kalamazoo, Mich.) may be as high as $650 per case.[3] Alternative, lower cost ICGA devices are available[3] but the issues of safety, ease of use and subjective image assessments remain. All these factors limit the wider uptake of the ICGA technique.

At Exeter, UK, we recently demonstrated the feasibility of using Laser Speckle Imaging (LSI), a light scattering technique for assessing flap perfusion, to aid intra-operative surgical decisions during immediate or delayed breast reconstruction following mastectomy.[4] In this observational, single institution study, we illustrated the potential clinical usefulness of LSI by comparing perfusion in the 4 zones of abdominal flaps, and illustrated further with a case showing very low perfusion in part of a mastectomy native breast skin envelope that subsequently required debridement.

Our findings are supported by a recent observational intra-operative LSI study, which found highly significant differences in the overall perfusion of flaps that developed serious post-operative complications compared with un-

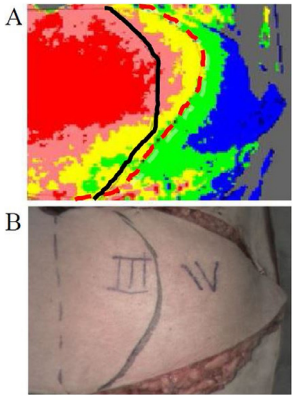

Figure 1 Figure 1(A) and photo image Figure 1(B).

eventful flaps.[5] They also showed potential use of perfusion pulsatility to indicate venous obstruction, highlighting another potential advantage of continuous, real-time LSI imaging.

Implementation of LSI intra-operatively for assessments of flap perfusion could share similar issues as the ICGA regarding a learning curve. However, one significant advantage of LSI is that output is calibrated against a diffusion standard so that LSI tissue blood flow levels are colour-coded (Figure 1(A)) in real-time rather than the relative levels of fluorescence intensity assessed subjectively with ICGA (objective images for ICGA are only available after off-line processing of ingress or egress curves). Further advantages of LSI are: it is a non-invasive (dye-free) and continuous technique; it causes minimal disruption and adds significantly less additional time (mere seconds) to the procedure compared with ICGA; it has a lower recurrent cost. LSI is therefore potentially a more implementable alternative to ICGA to provide objective and comparable intra-operative assessments of flap perfusion.

Use of the ICGA technique has, over many years, demonstrated the great advantage of knowing tissue blood flow during reconstructive surgery for avoiding post-operative complications. However, there are inherent limitations to the ICGA technique for this application. Further research, including direct comparison, is needed to establish whether the potential advantages of LSI tissue blood flow assessment can be realised and if its learning curve will be shorter.

Conflicts of interest

RG is employed by Moor Instruments Limited, the company responsible for the development of the LSI system used in the study by To et al.,[4] in Exeter, UK on which our Laser Speckle Imaging experience is based.

Funding source

The original study performed by the authors in Exeter,[4] UK was funded by the Technology Strategy Board (now called Innovate UK), who was not involved in the study design; the collection, analysis and interpretation of data, writing of the manuscript and the decision to submit the manuscript for publication. No funding has been received for the preparation of this letter.

References

1. Diep GK, Marmor S, Kizy S, et al. The use of indocyanine green angiography in postmastectomy reconstruction: do outcomes improve over time. *J Plast Reconstr Aesthet Surg* 2019;**72**(4):548–54.
2. Komorowska-Timek E, Gurtner GC. Intraoperative perfusion mapping with laser-assisted indocyanine green imaging can predict and prevent complications in immediate breast reconstruction. *Plast Reconstr Surg* 2010;**125**(4):1065–73.
3. Griffiths M, Chae MP, Rozen WM. Indocyanine green-based fluorescent angiography in breast reconstruction. *Gland Surg* 2016;**5**(2):133–49.
4. To C, Rees-Lee JE, Gush RJ, et al. Intraoperative tissue perfusion measurement by laser speckle imaging: a potential aid for reducing postoperative complications in free flap breast reconstruction. *Plast Reconstr Surg* 2019;**143**(2) 287e–292e.
5. Rauh A, Henn D, Nagel SS, Bigdeli AK, Kneser U, Hirche C. Continuous video-rate laser speckle imaging for intra- and postoperative cutaneous perfusion imaging of free flaps. *J Reconstr Microsurg* 2019 (EFirst).

Cynthia To
Diabetes and Vascular Medicine Research Centre, NIHR Exeter Clinical Research Facility, University of Exeter Medical School, Exeter EX2 5AX, UK

Jacqueline E. Rees-Lee
Breast Care Unit, Torbay and South Devon NHS Foundation Trust, Torbay Hospital, Lowes Bridge, Torquay TQ2 7AA, UK

Rodney J. Gush
Moor Instruments, Millwey, Axminster, Devon EX13 5HU, UK

Nicholas H. Cawrse
Department of Plastic Surgery, Royal Devon and Exeter NHS Foundation Trust, Barrack Road, Exeter EX2 5DW, UK

Angela C. Shore
Diabetes and Vascular Medicine Research Centre, NIHR Exeter Clinical Research Facility, University of Exeter Medical School, Exeter EX2 5AX, UK

Andrew D.H. Wilson
Department of Plastic Surgery, Royal Devon and Exeter NHS Foundation Trust, Barrack Road, Exeter EX2 5DW, UK
E-mail address: s.t.c.to@exeter.ac.uk (C. To)

https://doi.org/10.1016/j.bjps.2019.05.007

Re: A large-volume academic center retrospective audit of the temporal evolution of immediate breast reconstruction protocols and the effect on breast prosthetic infection

Dear Sir,

We read with interest the paper by Manahan et al. regarding the role of Acellular Dermal Matrix (ADM) in Breast Reconstruction.[1] They provide a retrospective single institution study of 328 women in three arms to assess the outcomes associated with ADM, and with a specialised anti-infection protocol. They reported a breast complication rate of 23%, with 14% attributable to infection. Interestingly the anti-infection protocol did not significantly reduce infection rates.

The authors were able to detail risk factors for infection, including the presence of ADM, large mastectomy volume, increased initial fill volume, seroma and mastectomy flap necrosis. It is unclear how this was determined as the latter two complications are listed separately from infection in Table 2, although the later discussion described overlap between these complications. Furthermore the infection outcome was not clearly defined leading to the potential of incorrect diagnosis.[2]

Unfortunately, they do not describe the rate of implant loss, arguably the most important complication when assessing reconstructive outcome. Infection alone encompasses a broad range of complications, including periprosthetic infection, superficial cellulitis and non-infective postoperative inflammation.[2] This results in a wide range of treatments, from oral antibiotics to explantation with resulting reconstructive failure. While all complications should be reported, implant loss carries significant psychological morbidity and high financial cost, especially where patients pursue tertiary reconstruction with autologous tissue.[3]

Infection rates following immediate implant-based reconstruction are high. A large prospective study in the UK demonstrated a 25% implant infection rate, with 8.9% lost at three months.[4] The Michigan Breast reconstruction outcome study demonstrated a two-year implant infection rate of 35%, with a lower loss rate of 3.8% when including immediate and delayed reconstruction.[5] Meta-analyses have shown an increased risk of infection and implant loss with concomitant use of an ADM.[6] Our own research shows that patients who suffer implant loss have similar patient-reported outcome measures to those who undergo mastectomy only.[7] Furthermore, they often also suffer additional symptoms such as pain, scar tethering and poor wound healing related to repeated operations attempting to salvage the implant prior to failure.[8]

We welcome the publication of this institution's outcomes, and commend the authors for their discussion of this important topic. However we urge that any paper discussing the outcomes of implant-based reconstruction publish their implant loss rate. This information is vital for any informed decision making regarding options for immediate reconstruction, particularly where risk factors for implant loss are present.

Ethical approval

Not required.

Funding

None.

Conflicts of interest

None declared.

References

1. Manahan MA, McNichols CH, Bello RJ, et al. A large-volume academic center retrospective audit of the temporal evolution of immediate breast reconstruction protocols and the effect on breast prosthetic infection. *J Plast Reconstr Aesthet Surg* 2019;**72**(2):225–31.
2. Franchelli S, Pesce M, Baldelli I, Marchese A, Santi P, De Maria A. Analysis of clinical management of infected breast implants and of factors associated to successful breast pocket salvage in infections occurring after breast reconstruction. *Int J Infect Dis* 2018;**71**:67–72.
3. Holmes WJM, Quinn M, Emam AT, Ali SR, Prousskaia E, Wilson SM. Salvage of the failed implant-based breast reconstruction using the deep inferior epigastric perforator flap: a single centre experience with tertiary breast reconstruction. *J Plast Reconstr Aesthet Surg* 2019.
4. Potter S, Conroy EJ, Cutress RI, et al. Short-term safety outcomes of mastectomy and immediate implant-based breast reconstruction with and without mesh (iBRA): a multicentre, prospective cohort study. *Lancet Oncol* 2019;**20**(2):254–66.
5. Alderman AK, Wilkins EG, Kim HM, Lowery JC. Complications in postmastectomy breast reconstruction: two-year results of the Michigan breast reconstruction outcome study. *Plast Reconstr Surg* 2002;**109**(7):2265–74.
6. Smith JM, Broyles JM, Guo Y, Tuffaha SH, Mathes D, Sacks JM. Human acellular dermis increases surgical site infection and overall complication profile when compared with submuscular breast reconstruction: an updated meta-analysis incorporating new products. *J Plast Reconstr Aesthet Surg* 2018;**71**(11):1547–56.
7. Ali SR, Holmes WJM, Quinn M, Emam AT, Prousskaia E, Wilson SM. Tertiary breast reconstruction for salvage of the failed implant-based reconstruction using the deep inferior epigastric perforator flap. *J Reconstr Microsurg* 2019.
8. Coriddi M, Shenaq D, Kenworthy E, et al. Autologous breast reconstruction after failed implant-based reconstruction: evaluation of surgical and patient-reported outcomes and quality of life. *Plast Reconstr Surg* 2019;**143**(2):373–9.

John R. Kiely
Will J.M. Holmes
Plastic and Reconstructive Surgery Department, Pinderfields Hospital, Mid Yorkshire Hospitals NHS Trust, Wakefield, UK
E-mail address: johnkiely@nhs.net (J.R. Kiely)

https://doi.org/10.1016/j.bjps.2019.05.011

The history and heritage of the plastic surgery research council

Dear Sir,

Professional bodies contribute to the advancement of the medical field by hosting meetings to promote discussion and exchange of ideas. In the mid-twentieth century, there was a growing need among young researchers to establish an organization in the field of plastic surgery with a primary focus on research. Against this background, a meeting in San Diego in 1954 laid the foundation for the establishment of the Plastic Surgery Research Council (PSRC). On the invitation of Milt Edgerton, sixteen members attended the first PSRC meeting at Johns Hopkins in the fall of 1955.[1]t

The founders adopted the word 'council' to refer to the 'open gathering' of those concerned. They encouraged the presentation of ongoing research projects to obtain peer feedback. The logo of PSRC was chosen to be the drawing of Baronio's sheep.[1] Giuseppe Baronio was an Italian physician who conducted a series of successful skin autografts in 1804.[2] The survival of the graft marked an accomplishment which predated that in humans.[2] At the ninth meeting in Kansas City, 1964, Dr. Dick Stark's suggestion of Baronio's sheep was accepted as the official emblem. A rectangle with rounded borders with Baronio's sheep in the center was chosen to represent the PSRC. Although 'Founded at Johns Hopkins' was initially suggested to be part of this logo, this was not incorporated.[1]

Abstracts from the annual PSRC meetings have been published in *Plastic and Reconstructive Surgery* Journal supplement and more recently, in the supplement of *Plastic and Reconstructive Surgery Global Open*. Figure 1 shows the numbers of published abstracts over the last twelve years through this meeting.

Research and scientific advancements have made inroads into social media platforms over the last few years.[3-5] PSRC has a broad reach across three major social media platforms – Facebook, Twitter, and Instagram. From its inception in Facebook on September 26, 2016, PSRC has accrued 1169 followers. The Twitter and Instagram pages of PSRC (established in May 2017 and January 2018, respectively) have 471 and 834 followers, respectively. With regular posts on the latest research, upcoming meeting dates, and resident social events, these platforms provide students, residents and faculty surgeons with up-to-date information. Residency programs 'take-over' the Instagram page periodically to provide insight into their program and current research.

The number of PSRC members has grown over the last 64 years to reach a total of 654 members (124 senior members, 8 senior associates, 168 senior emeritus, 133 candidate members, 212 active members, 9 associate members). Only active members (who are under the age of 50) have voting privileges. This was proposed to provide an opportunity for budding researchers to be involved in organizational decisions.

From the organization which started with sixteen invited individuals convening at Baltimore in 1955, PSRC has grown and is holding its 64th annual meeting in Baltimore this

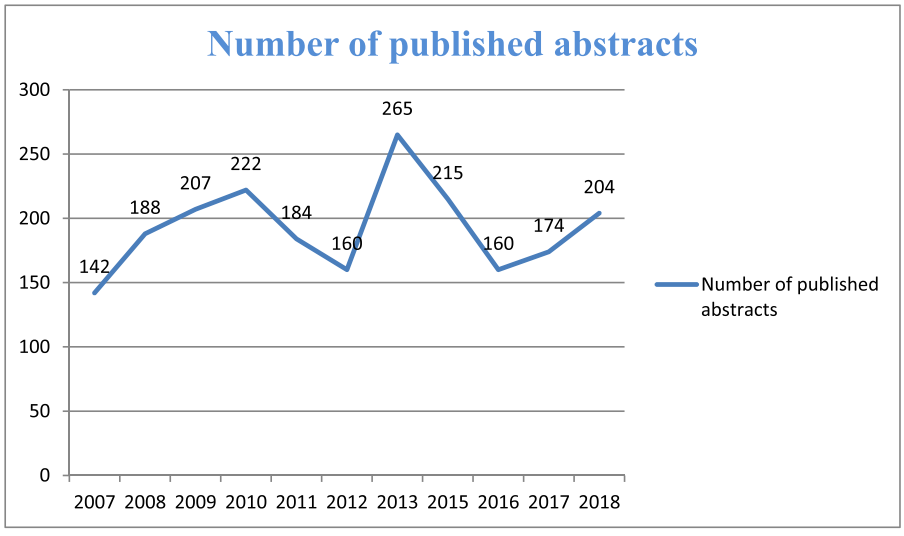

Figure 1 Number of published abstracts from PSRC meeting.

spring. It is an epitome of dedication to research, and its rich heritage deserves highest commendation.

Disclosure

None of the authors has a financial interest to declare in relation to the content of this communication.

References

1. Randall P. The plastic surgery research council. Thirty-five year history. 1990.
2. Baronio G. Degli innesti animali. Milano, Stamperia e Fonderia del Genio. 1804.
3. Chopan M, Sayadi L, Clark EM, Maguire K. Plastic surgery and social media: examining perceptions. *Plast Reconst Surg* 2019;**143**(4):1259-65.
4. Reusche R, Buchanan PJ, Kozlow JH, Vercler CJ. A systematic review of smartphone applications for plastic surgery providers: target audience, uses, and cost. *Ann Plast Surg* 2016;**77**(1):6-12.
5. Sorice SC, Li AY, Gilstrap J, Canales FL, Furnas HJ. Social media and the plastic surgery patient. *Plast Reconstr Surg* 2017;**140**(5):1047-56.

Malke Asaad
Division of Plastic and Reconstructive Surgery, Mayo Clinic, 200 First Street SW, Rochester, MN 55905, United States

Aashish Rajesh
Department of Surgery, Mayo Clinic, 200 First Street SW, Rochester, MN 55905, United States

Thanapoom Boonipat, Krishna Vyas
Division of Plastic and Reconstructive Surgery, Mayo Clinic, 200 First Street SW, Rochester, MN 55905, United States
E-mail address: asaad.malke@mayo.edu (M. Asaad)

https://doi.org/10.1016/j.bjps.2019.05.018

Re: The use of indocyanine green angiography in postmastectomy reconstruction: Do outcomes improve over time?

Dear Sir,

We read with interest the paper by Diep et al.[1] The authors provide a retrospective review of Indocyanine green angiography (ICGA) use in two-stage implant-based immediate reconstruction comparing short-term complication rate in 135 patients over three different time points stratified into three equally sized groups. ICGA was used to determine areas of perfusion less than 20% to undergo debridement, prior to placement of the expander. The authors demonstrate a reduction in the incidence of mild skin flap necrosis and cellulitis over the study period. They conclude that ICGA use in immediate implant reconstruction improved over time with lower rates of ischaemic complications, greater initial fill volume and shortened time to reconstruction completion. Ischaemic complications included cellulitis and/or mastectomy flap necrosis. However, we feel these conclusions are not entirely supported by the data and may be unduly influenced by their acknowledged conflicts of interest, and stated interest in Novadaq, the company that makes the ICGA scanner.

The authors found a significant decrease in ischaemic complications between the three groups ($p = 0.03$). However, subgroup analysis shows that the decrease in ischaemic complications was only seen in the rate of mild flap necrosis, which by their definition did not require intervention. The rate of moderate or severe flap necrosis requiring debridement was unchanged in the three groups. Although there appeared to be a trend towards a reduction in cellulitis, this did not reach statistical significance and may not be ischaemic in origin. Therefore whilst there was a statistically significant difference in rates of ischaemic complications, we do not feel this translates as a clinical significance.

In addition, they claim that the use of ICGA improved outcomes with respect to increased initial expander fill volumes. We would be grateful for information on how intra-operative fill volume was determined as the ICGA was only used prior to expander placement, and not when performed intra-operative filling. We would suggest that the increase in intra-operative fill volume seen between the three groups could be the result of groups one and two being underfilled due to surgeon preference.

Finally, they conclude that ICGA improved outcomes by enabling shorter wait time to definitive reconstruction. Their median initial expander fill volume only varied by approximately 150 ml for a 500 g breast (Group 1 0.46 ml/g vs. Group 3 0.76 ml/g), which does not appear sufficient to account for the 59-day reduction. In many departments, including our own, time to second-stage reconstruction is related more closely to patient logistics and surgeon preference, rather than expander fill. Without further information, their conclusion is difficult to justify.

We are disappointed that this paper does not include implant loss in their results, which we feel represents the most important complication in any implant-based reconstruction study. Although not reported here, implant loss is a frequent early complication in reconstructive breast surgery, seen in 8.7% of patients at 3-months.[2] When implant failure occurs, this is associated with substantial psychological and physical morbidity, as well as increased financial cost especially if further reconstructive surgery is pursed.[3]

Whilst we welcome this interesting paper looking at the role of ICGA in implant-based reconstruction, we feel that the study's conclusions are not fully justified, based on the methods stated and the outcomes reported. We would ask any publication assessing implant-based reconstruction complications to state the rate of implant loss, in the same way that publications of autologous reconstruction always

present their flap failure rate, as this equates to the most serious of adverse outcomes and of paramount importance when looking at modalities that may improve outcomes.

Funding

None.

Conflict of interest

None declared.

Ethical approval

Not required.

References

1. Diep GK, Marmor S, Kizy S, et al. The use of indocyanine green angiography in postmastectomy reconstruction: do outcomes improve over time? *J Plast Reconstr Aesthet Surg* 2019;**72**(4):548–54.
2. Potter S, Conroy EJ, Cutress RI, et al. Short-term safety outcomes of mastectomy and immediate implant-based breast reconstruction with and without mesh (iBRA): a multicentre, prospective cohort study. *Lancet Oncol* 2019;**20**(2):254–66.
3. Holmes WJM, Quinn M, Emam AT, Ali SR, Prousskaia E, Wilson SM. Salvage of the failed implant-based breast reconstruction using the deep inferior epigastric perforator flap: a single centre experience with tertiary breast reconstruction. *J Plast Reconstr Aesthet Surg* 2019.

John R. Kiely
Will J.M. Holmes
Plastic and Reconstructive Surgery Department, Pinderfields Hospital, Mid Yorkshire Hospitals NHS Trust, Wakefield, UK
E-mail addresses: John.kiely@midyorks.nhs.uk, johnkiely@nhs.net (J.R. Kiely)

https://doi.org/10.1016/j.bjps.2019.05.055

Letter of response re: The use of indocyanine green angiography in postmastectomy reconstruction: Do outcomes improve over time?

Dear Sir,

We appreciate the interest that Kiely et al. expressed in our recent article regarding the retrospective review of indocyanine green angiography (ICGA) use in two-stage implant-based immediate breast reconstruction, comparing short-term complication rates in 135 patients over three different time periods, stratified into three equally sized groups.[1] We found that the outcomes for mastectomy with immediate expander-based reconstruction improved with increasing case volume after implementation of ICGA.

We agree with Kiely et al. that our findings are observational and not causal. We found what appeared to be a trend towards a reduction in cellulitis, though this did not reach statistical significance. However, there was a statistically and clinically significant difference in rates of ischemic complications (combined flap necrosis and cellulitis). Furthermore, upon further review of our data, we found that the rate of expander loss was 6.7% (3 out of 45 patients) in Group 1, 4.4% (2 of 45) in Group 2, and 0% in Group 3. We should note, though, that the outcomes of the two patients with expander loss in Group 2 likely would not have been altered with ICGA. One patient lost the expander due to infection following a full thickness burn from a heating pad sustained more than 2 weeks after surgery, and the other required an expander exchange on postoperative day one due to expander deflation. The three patients in Group 1 who experienced expander loss did so due to expander infection. As Kiely et al. indicated, this would be a clinically relevant outcome measure. We agree that expander loss is associated with significant psychological, physical, and financial morbidity, and agree that any strategies that could potentially minimize this costly complication is clinically important. We regret to not have included this outcome measure in our original report and thank Kiely et al. for raising this important question.

Kiely et al. correctly noted that we found that the use of ICGA improved outcomes with respect to increased initial expander fill volumes over time. One of the two plastic surgeons performed ICGA during the study time period, did always repeat ICGA following expander filling to examine the flow pattern of the flaps after filling. He found this to be of major benefit to observe whether the flow pattern was changed after the devices were filled. This senior surgeon performed 53% of the study cases. The second plastic surgeon in this study, who performed the remainder of the study cases (47%), did not routinely repeat ICGA in this manner, and thus, this was not specifically detailed in the methods.

With regards to our finding of a shorter wait time to definitive reconstruction over time with use of ICGA, we agree that patient logistics and surgeon preference can play a role. However, in this group of patients from a single institution with plastic and oncologic surgeons that have similar practice patterns and preferences, it is unlikely for surgeon preference to change over the study time period. Because of the potential for patients to factor into the wait time, particularly due to cancer management reasons, we excluded patients who required adjuvant chemotherapy and/or radiation therapy (i.e. chemotherapy and/or radiation received after the index mastectomy) from this analysis.

Finally, NOVADAQ, the company that manufactures the ICGA fluorescence imaging system, did not review the results or the findings of the manuscript at any point prior to publication. We transparently reported that one of our authors acknowledged potential conflicts of interest as a consultant for NOVADAQ. However, the single author that

reported this stated conflict of interest reviewed the findings and manuscript, but was not directly involved in the conceptualization, methodology, or analysis of the data for our manuscript. Moreover, the purpose of this manuscript was not to promote the use of the ICGA imaging system, but to evaluate the outcomes of the implementation of new technology over time. Thus, the authors strongly disagree with Kiely et al. that the results of this study "may be unduly influenced by their acknowledged conflicts of interest."

Conflict of interest

Dr Cunningham is a consultant for Novadaq Corp and Mentor Corp. The remaining authors declare they have no conflicts of interest.

Reference

1. Diep GK, Marmor S, Kizy S, et al. The use of indocyanine green angiography in postmastectomy reconstruction: do outcomes improve over time? *J Plast Reconstr Aesthet Surg* 2019;**72**(4):548-54.

Gustave K. Diep
Schelomo Marmor
Scott Kizy
Jing Li Huang
Eric H. Jensen
Pamela Portschy
Bruce Cunningham
Umar Choudry
Todd M. Tuttle
Jane Yuet Ching Hui
Department of Surgery, University of Minnesota, 420 Delaware Street SE, Mayo Mail Code 195, Minneapolis, MN 55455, USA
E-mail address: jhui@umn.edu (J.Y.C. Hui)

https://doi.org/10.1016/j.bjps.2019.06.001