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Correspondence and Communications

Flap reconstruction after groin and medial thigh sarcoma resection reduces the risk of lower-extremity lymphedema

Dear Sir,

Extensive resection is an effective treatment for sarcomas in the groin and medial thigh region; however, various complications may develop postoperatively.[1,2] Infection, lymphorrhea, and lymphedema frequently develop in the groin/medial thigh because of the important lymphatic pathways from the lower extremities. Prolonged lymphorrhea and lymphatic cysts are causes of chronic lower-extremity lymphedema.[1] Symptoms become further exacerbated because of repeated cellulitis and movement limitations.

In the present study, we examined patients who did and did not receive flap reconstruction after extensive resection for sarcomas in the groin and medial thigh regions, and analyzed the usefulness of flap reconstruction, especially for preventing postoperative chronic lymphedema. In addition, we attempted to visually confirm the pattern of lymphatic fluid accumulation by using indocyanine green (ICG) lymphography.

From May 2010 to August 2017, extensive resection of soft tissue sarcoma of the groin or medial thigh region was performed in 40 patients at the National Cancer Center. The mean age of the patients was 56 years, and there were 21 men and 19 women. The mean follow-up period was 2 years and 7 months.

Fourty patients were divided into the two groups depending on the method of the wound closure; 25 patients underwent immediate flap reconstruction (the flap reconstruction group) and 15 underwent primary wound closure (the non-flap reconstruction group). Vascular reconstruction was performed in 7 patients (28.0%) in the flap reconstruction group and in 6 patients (40.0%) in the non-flap reconstruction group. No significant difference was observed between the groups ($p = 0.498$).

Concerning the types of flap used in the flap reconstruction group, a free flap was used in 7 patients and a pedicled flap in 18. The free flap used was an anterolateral thigh (ALT) flap in 4 patients, a latissimus dorsi musculocutaneous flap in 2, and a rectus abdominis musculocutaneous (RAMC) flap in 1. The pedicled flap used was specifically an ALT flap in 8 patients, a RAMC flap in 5, a deep inferior epigastric artery perforator flap in 3, a superficial femoral artery perforator flap in 2, and a medial circumflex femoral artery perforator flap in 1.

The medical records of the 40 patients were retrospectively analyzed. The rates of acute wound complication including acute edema, lymphorrhea, surgical site infection, and hematoma within 30 days postoperatively and chronic lymphedema were compared between the two groups. Statistical analysis of the variables was using the Ekuseru-Toukei software (Social Survey Research Information Co., Ltd., Tokyo, Japan). The variables were analyzed using Fisher's exact test and the student test.

Acute wound complications occurred in 8 patients (32.0%) in the flap reconstruction group and in 7 patients (46.7%) in the non-flap reconstruction group. No significant difference was observed between the groups ($p = 0.501$). In the flap reconstruction group, all flaps were engrafted.

Chronic lower-extremity lymphedema occurred in 4 patients (16.0%) in the flap reconstruction group and in 8 patients (53.3%) in the non-flap reconstruction group. Statistically significant difference was observed between the groups ($p = 0.029$) (Table 1).

It has been generally known that the flap reconstruction can reduce the postoperative complications. The present study showed the flap reconstruction can also improve and restore the function of remaining lymphatic pathways, which leads to a reduction of postoperative chronic lower extremity lymphedema. There are two possible reasons explaining such preventive effects of flap reconstruction:

1. Dead-space filling effect due to flap volume.
2. Formation of a new drainage route due to the spontaneous connection between the lymph duct of the flap and that of the wound stump.

Filling dead space with flap volume may reduce lymph fluid retention in the wound and diminish wound complications. Nirmal et al. reported that the use of the tensor fascial lata musculocutanous flap can reduce postoperative morbidity and decrease hospital stay following groin dissection.[3] The results of the present study also suggest that flap reconstruction may reduce the incidence of acute edema, lymphorrhea, infection, and hematoma. The flap coverage may also be useful for reducing the possibility of infection of the synthetic materials.

Concerning the mechanism by which lymphedema decreased in the flap reconstruction group, it is possible that the lymph duct in the flap and that in the wound stump may be connected by some mechanism, forming a new lymph drainage route.[4,5] We performed ICG lymphography in some cases and attempted to visualize the new lymphatic path-

Table 1 Comparison of postoperative complications between flap reconstruction and non-flap reconstruction groups.

	Flap reconstruction ($n=25$)	Non-flap reconstruction ($n=15$)	p value[a]
Acute wound complication	**8 (32.0%)**	**7 (46.7%)**	**0.501**
Acute edema	5 (20.0%)	5 (33.3%)	
Lymphorrhea	4 (16.0%)	6 (40.0%)	
Surgical site infection	2 (8.0%)	1 (6.6%)	
Hematoma	1 (4.0%)	2 (13.3%)	
chronic lymphedema	**4 (16.0%)**	**8 (53.3%)**	**0.029**

[a] Fisher's exact test.

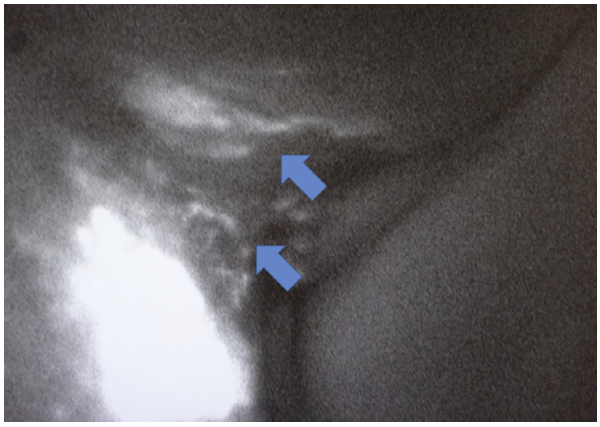

Figure 1 Formation of reticular collateral lymphatics (arrow) on indocyanine green lymphography.

ways. The preliminary results of the ICG lymphography suggested formation of reticular collateral lymphatics in the flap (Figure 1). In the lymphatic vessels from the lower extremities, a new connection appeared to have been formed between the lymph duct at the stump end and the flap, creating drainage routes passing through the flap. In conclusion, flap reconstruction after sarcoma resection in the groin and medial thigh region has the potential to prevent postoperative chronic lymphedema.

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Conflict of interest

None.

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Letter to the Editor: Sentinel lymph node biopsy in melanoma: Which hot nodes should be harvested and is blue dye really necessary?

Dear Sir,

The article by Ranson et al., "Sentinel lymph node biopsy in melanoma: Which hot nodes should be harvested and is blue dye really necessary?"[1] is generating much academic debate. The responses thus far seem to focus on advocating the continued use of blue dye due to the potential for higher false negative rates using radiocolloid tracer injection alone.

Whilst undoubtedly ensuring accuracy is important, Sentinel lymph node biopsy (SLNB) in melanoma is a prognostic tool, therefore we need to ensure the risk profile of blue dye use is acceptably low for our patients. Patent Blue dye is the commonest dye used in Europe for SLNB and other than the commonly associated side effects of skin tattooing, skin flushing and urine discolouration there are significant issues associated with hypersensitivity reactions. The estimated rate of anaphylaxis associated with Patent Blue dye injection varies between 0.15% to 1.1% in the literature.[2] In the 6th National Audit Project by the Royal College of Anaesthetists UK; the largest ever prospective study of anaphylaxis related to anaesthesia and surgery; Patent Blue dye injection was found to be the fourth commonest cause of perioperative anaphylaxis. Hypotension, laryngeal oedema, urticaria and cyanosis were the initial presenting features. In the study reactions to blue dye were described as "relatively common", "severe" and "requiring significant resuscitation". In contrast to most peri-operative anaphylaxis, there is sometimes a delay between the dye being injected and the onset of anaphylaxis.[2]

In the UK the largest number of SLNBs are carried out by Breast Cancer Surgeons. NICE guidelines from 2009 on "Early and locally advanced breast cancer: diagnosis and treatment" recommend performing SLNB using the dual-localisation technique with radioisotope and blue dye injection and there has been clear evidence in breast cancer that this technique carries the highest identification rates.[3] However; comparably high identification rates have also been demonstrated in the radioisotope-only technique in experienced hands.[4]

Recently many UK breast cancer centres have begun to question the use of blue dye injections and have opted to use radioisotope alone, adding blue dye injection selectively in patients with poor axillary radioactivity signal counts demonstrated immediately pre-operatively. Dual-localisation technique is always used in patients who have received neoadjuvant chemotherapy where the false negative rate of SLNB is proven to be higher than standard.

The fact remains that SLNB in breast cancer has a much greater role in prognostication and guiding adjuvant treatment in comparison to melanoma. So perhaps we should ask ourselves "if some colleagues in other specialities have rationed the use of blue dye injections in SLNB due to the risk profile to their patients why are we still putting our patients at risk with even less to gain at present in melanoma?".

Declarations

Conflict of Interest

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Letter to editor: Surgical-site infection following lymph node excision indicates susceptibility for lymphedema: A retrospective cohort study of malignant melanoma patients

Dear Sir,

We have read with great interest the article entitled "Surgical-site infection following lymph node excision indicates susceptibility for lymphedema: A retrospective cohort study of malignant melanoma patients" by Jorgensen et al.[1] Their work must be valued as the systematic review and analysis of risk factors for developing surgical-site infection and possibly lymphedema show that all factors must be taken into consideration trying to prevent and diagnose lymphedema in early stages.

The fact that complete lymph node dissection is performed even though the therapeutic value is still under discussion involves that even more attention must be paid to the associated morbidity. However, the Multicenter Selective Lymphadenectomy Trial II showed that, even though there is no survival benefit associated with an immediate complete lymph node dissection, this procedure is associated with prognosis and regional disease control. For these reasons been, surgeons must take into consideration when it is appropriate to perform a complete lymph node dissection, after positive sentinel lymph node biopsy,[2] in each district. In fact, the article underlines that risk factors for lymphedema, such as seroma and surgical-site infection occur more frequently following complete lymph node dissection when compared to sentinel node biopsy and that occur more often after inguinal dissection compared to axillary.[1]

Seroma and surgical-site infection have been investigated as risk factors for lymphedema, however the article suggested that surgical-site infection may mediate the onset of lymphedema, and that seroma, the most predominant and common postoperative complication in complete lymph node dissection, and the number of seroma aspirations increase the risk of surgical-site infection. The study showed that seroma is often followed by infection and that both variables lead to the effect through it.[1] In fact, seroma could be the origin of the lymphovascular leakage, and that could provide an entry for the infective process. The subsequent immunological response to the infection implies the release of bradykinin, that impairs the physiological lymphatic function.

The antibiotic prophylaxis to prevent surgical site infections in plastic surgery and its pros and cons have been investigated. In our experience we usually carry out intraoperative prophylaxis, using broad-spectrum antibiotics, the antibiotic therapy in then continued for seven-ten days. As for the drains, like the authors, we do not remove them until less than 50 ml serous fluid per day is drained. In case of seroma, we try to avoid, if possible, to evacuate it, in order to reduce the chances of contamination of fluid caused by the skin puncture: in case the drained fluid appears cloudy, a specimen for culture and sensitivity for antibiotics is sent.

Considering these factors, future studies should investigate the best options to avoid and treat surgical-site infections, in order to reduce the risk for lymphedema.

This study focuses on axillary and inguinal complete lymph node dissection and limbs lymphedema, highlighting that the risk of lymphedema is significantly higher after groin complete lymph node dissection.[1] We think that research should also focus on risks for patient affected by head and neck melanoma that more often undergo cervical lymphadenectomy. In fact, after decades of debate about the validity of sentinel lymph node biopsy for head and neck melanoma, this technique has been accredited and often shows positivity so that the patient must undergo to complete lymph node dissection of the locoregional lymph nodes.[2] Of course, this implies a higher risk of lymphedema of the head and neck.

The study, conducted on a population affected by melanoma, eliminates variables as other risk factors for lymphedema, such as radiation and chemotherapy that are used in other cancer populations and we agree with the authors that more studies on patients affected by malignant melanoma are needed to investigate the pathophysiology of lymphedema.

Considering that intentional sun exposure and sunbed are associated with an increased risk for melanoma[3] and that these factors are very common in western countries, we can estimate the dimension of the melanoma population, that makes it the ideal population of study. The melanoma population is also unique because of the many risk factors and positive prognostic risk factors involved in the pathophysiology of the disease.[3] For these reasons we should further investigate for confounding factors in this population.

Especially if we consider that there are very few therapeutic options and that some are still experimental, greater attention must be paid in order to prevent and treat lymphedema in early stages. For this reason, innovative surgical approaches are needed, such as multiple lymphatic-venous anastomoses (PMA) performed during lymphadenectomy, to prevent lymphedema, and lymph node flap transfer to treat chronic lymphedema.[4,5]

Conflict of interest, funding and ethical approval

All authors hereby declare not to have any potential conflict of interests and not to have received funding for this work. No ethical approval was needed.

Each author participated sufficiently in the work to take public responsibility for the content and agree to its publication.

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A comparison of patient reported outcome measures in patients who received both DIEP flap and PAP flap breast reconstructions☆

Dear Sir,

Breast reconstruction should be routinely offered to patients undergoing mastectomy surgery for breast cancer.[1] Post-operative recovery-time, the patient's occupation, hobbies and lifestyle must be considered when determining the most appropriate reconstruction technique for individual patients. Generally, patients prefer autologous breast reconstruction over implant-based methods for cosmetic and psychological reasons.[2] The Deep Inferior Epigastric Perforator (DIEP) flap is considered the gold-standard technique in free-flap autologous breast reconstruction however the Profunda Artery Perforator (PAP) flap is increasing in popularity amongst selected patients. We report a unique opportunity to compare patient-reported outcome measures (PROMs) from selected patients who have undergone both DIEP and PAP flap breast reconstructions on separate occasions.

Between 2007 and 2017 at the Department of Plastic and Reconstructive Surgery in the Norfolk and Norwich University Hospital, 872 patients underwent free autologous breast reconstruction. From a prospectively generated database we identified four patients who had underwent breast reconstructions using both DIEP flap and PAP flap methods.

All four women completed a post-operative Breast-Q questionnaire[3] at 12-months following each reconstruction. For PAP flap reconstructions, the questions of Sections 7 and 8 of the standard post-operative Breast-Q (physical well-being and satisfaction with abdomen) were replaced by unique questions to evaluate the physical well-being and satisfaction of the thigh.[4] An NRS scale from 0 to 20 assessed pain two-weeks post-operatively. Three-months after each procedure, patients detailed the recovery time (weeks) required to return to their normal daily activities equivalent to life before surgery.

All patients were treated for primary breast cancer with mastectomy followed by DIEP flap reconstruction initially. Following a variable length of time (mean 2.5 years, range 0–5 years), they suffered a contralateral breast cancer which was treated with mastectomy and reconstructed using PAP flaps (Figures 1-4). One patient underwent a contralateral breast reconstruction with implant first but, due to grade IV capsular contracture, required implant removal and a subsequent single PAP flap breast reconstruction (Figure 3). The other three patients underwent unilat-

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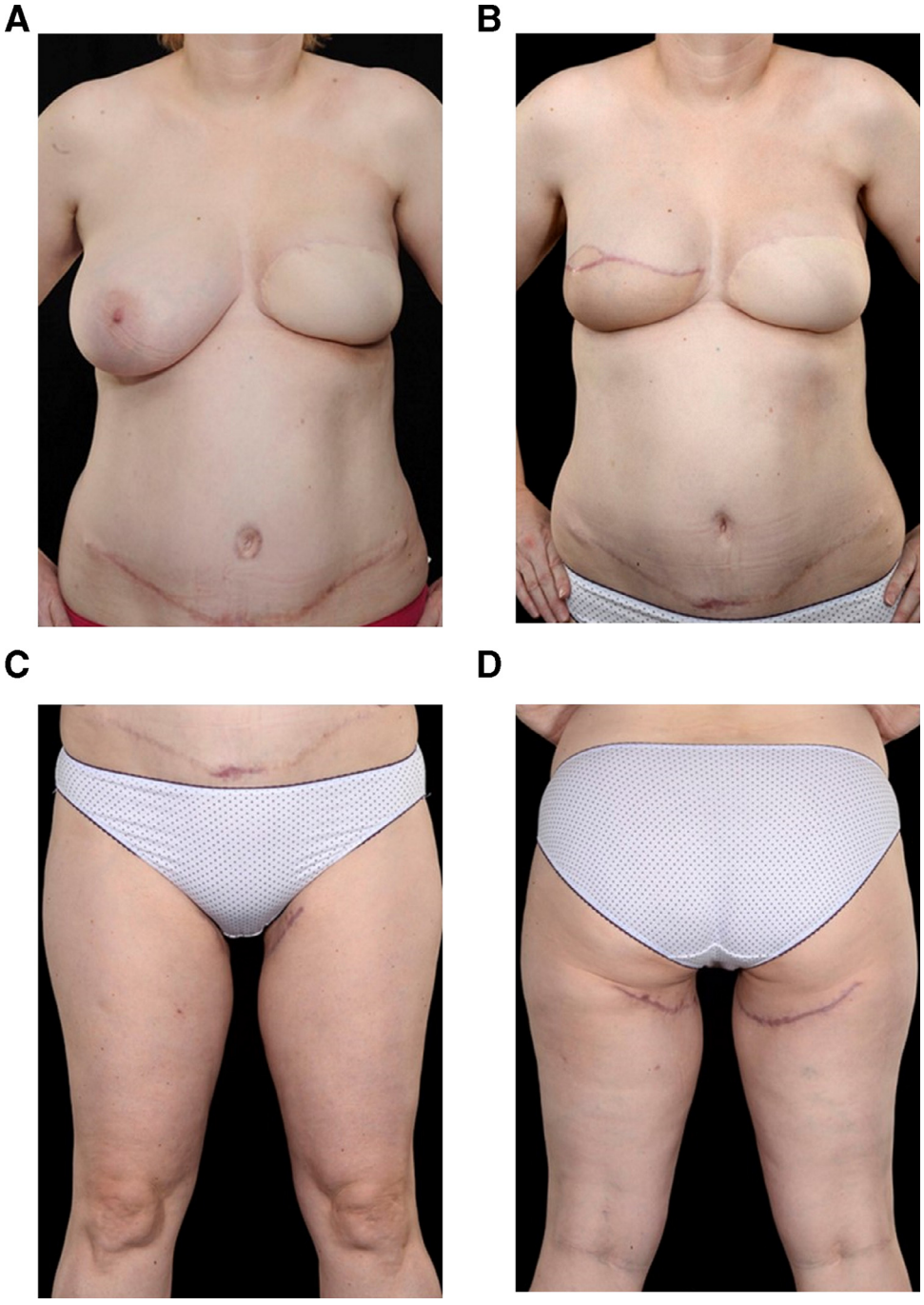

Figure 1 Image of delayed DIEP breast reconstruction (left breast) and delayed bilateral PAP flap reconstruction (right breast). A) Delayed DIEP flap breast reconstruction of left breast, showing breast mound and donor-site scar (lower abdomen) B) Delayed bilateral PAP flap breast reconstruction of right breast. C) Anterior view of lower abdomen and thighs showing DIEP flap donor-site scar (lower abdomen) and PAP flap donor-site scars (inner thigh). D) Posterior view showing left and right PAP flap donor-site scars.

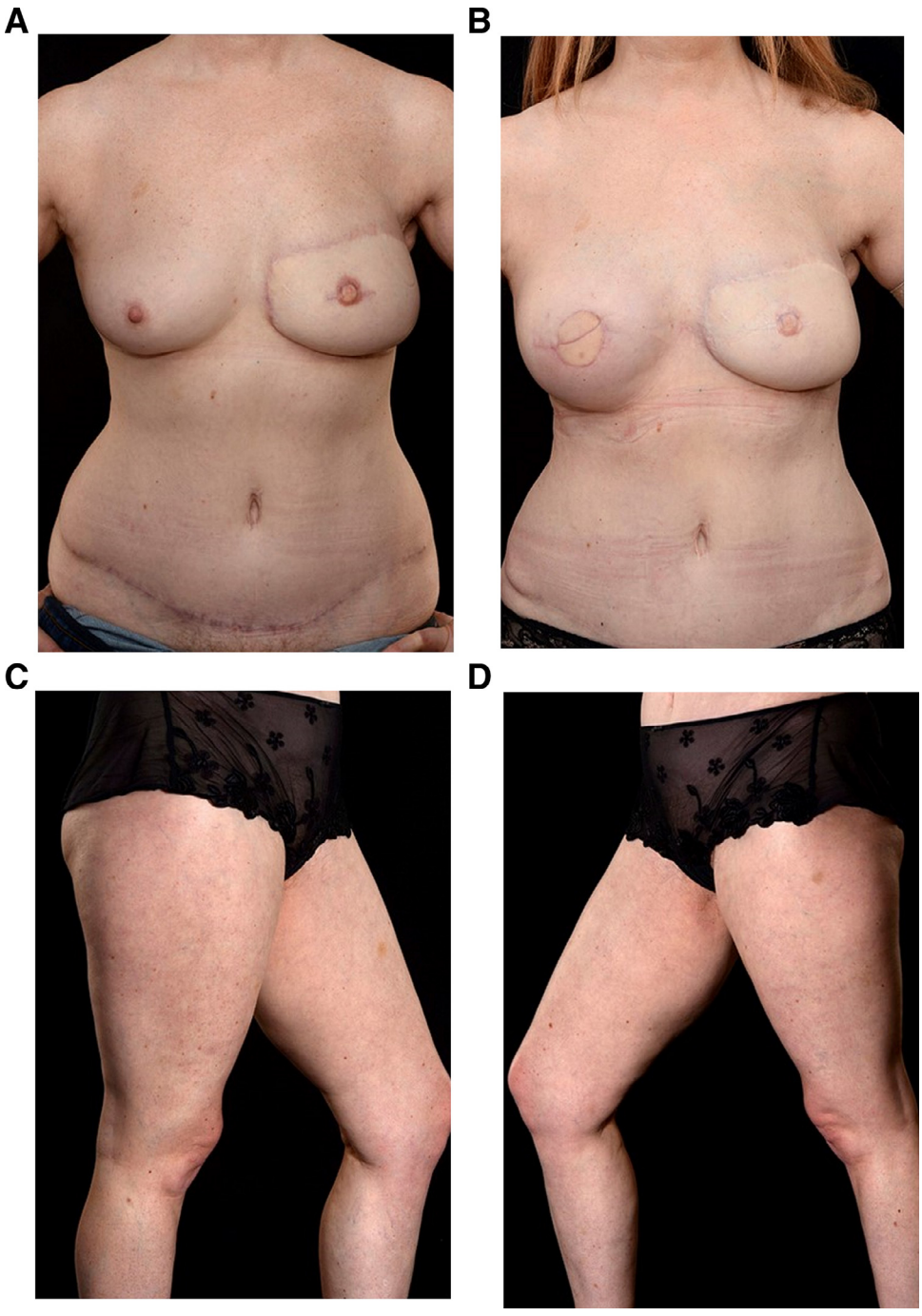

Figure 2 Images of delayed DIEP breast reconstruction (left breast) and delayed bilateral PAP flap breast reconstruction (right breast) A) Delayed DIEP breast reconstruction (left breast) showing donor-site scar (lower abdomen). B) Immediate bilateral PAP flap breast reconstruction (right breast) C) Right lateral view of the thighs following PAP flap breast reconstruction demonstrating well concealed left PAP flap donor-site scars D) Left lateral view of thighs following PAP flap breast reconstruction demonstrating well concealed right PAP flap donor-site scar.

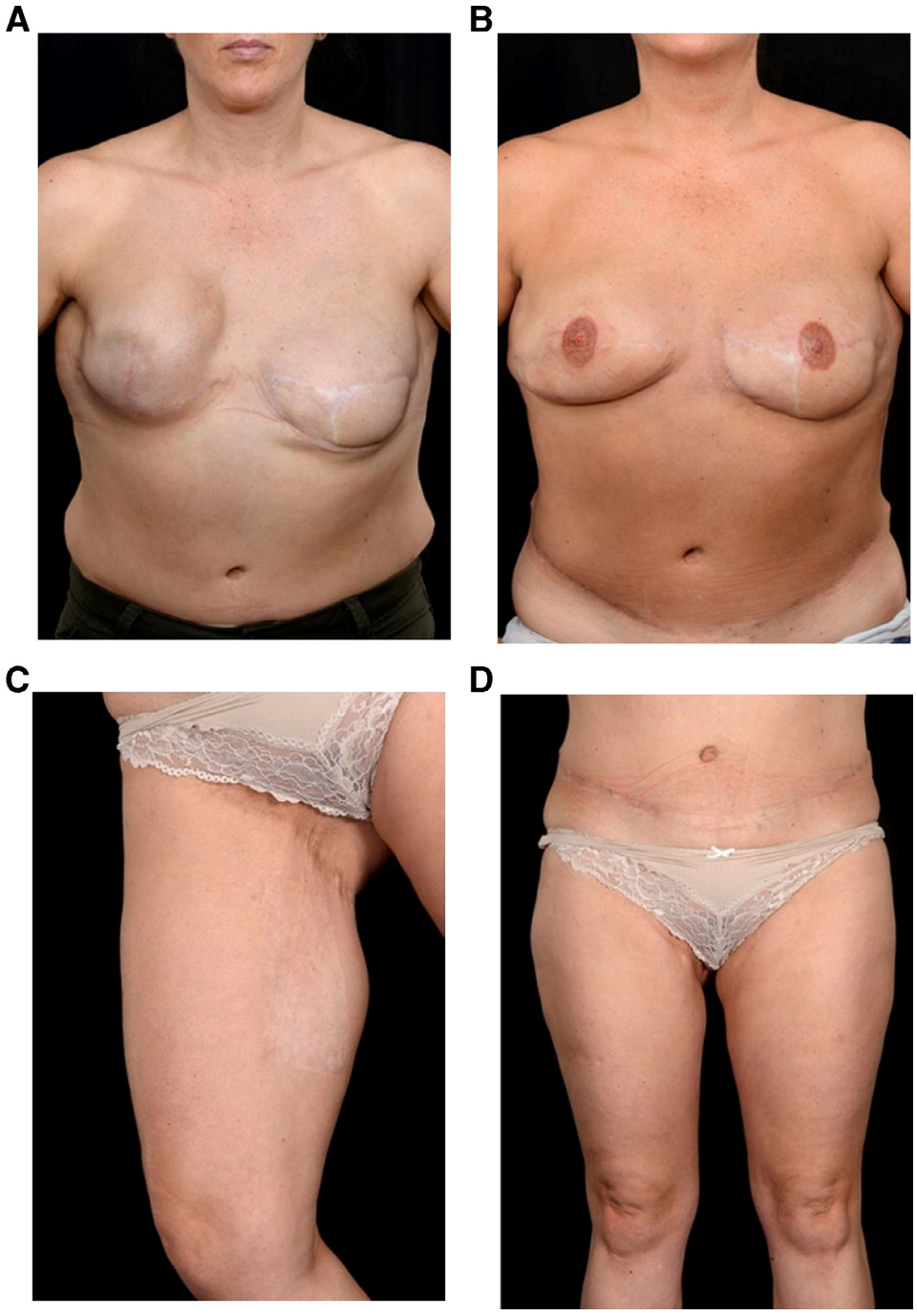

Figure 3 Images of delayed DIEP breast reconstruction (left breast) and PAP flap breast reconstruction (right breast). A) Breast reconstruction using bipedicled DIEP flap (left breast) and immediate breast reconstruction with expander and implant sequence (right breast) that following surgery caused a grade IV capsular contracture which was painful. B) Unilateral right PAP flap for breast reconstruction (right breast) following implant removal and capsulectomy. C) Image of PAP flap donor-site (inner thigh) 17-months follow-up after unilateral PAP flap breast reconstruction. D) Image of DIEP flap donor-site (lower abdomen): 36-months after unipedicled DIEP flap breast reconstruction.

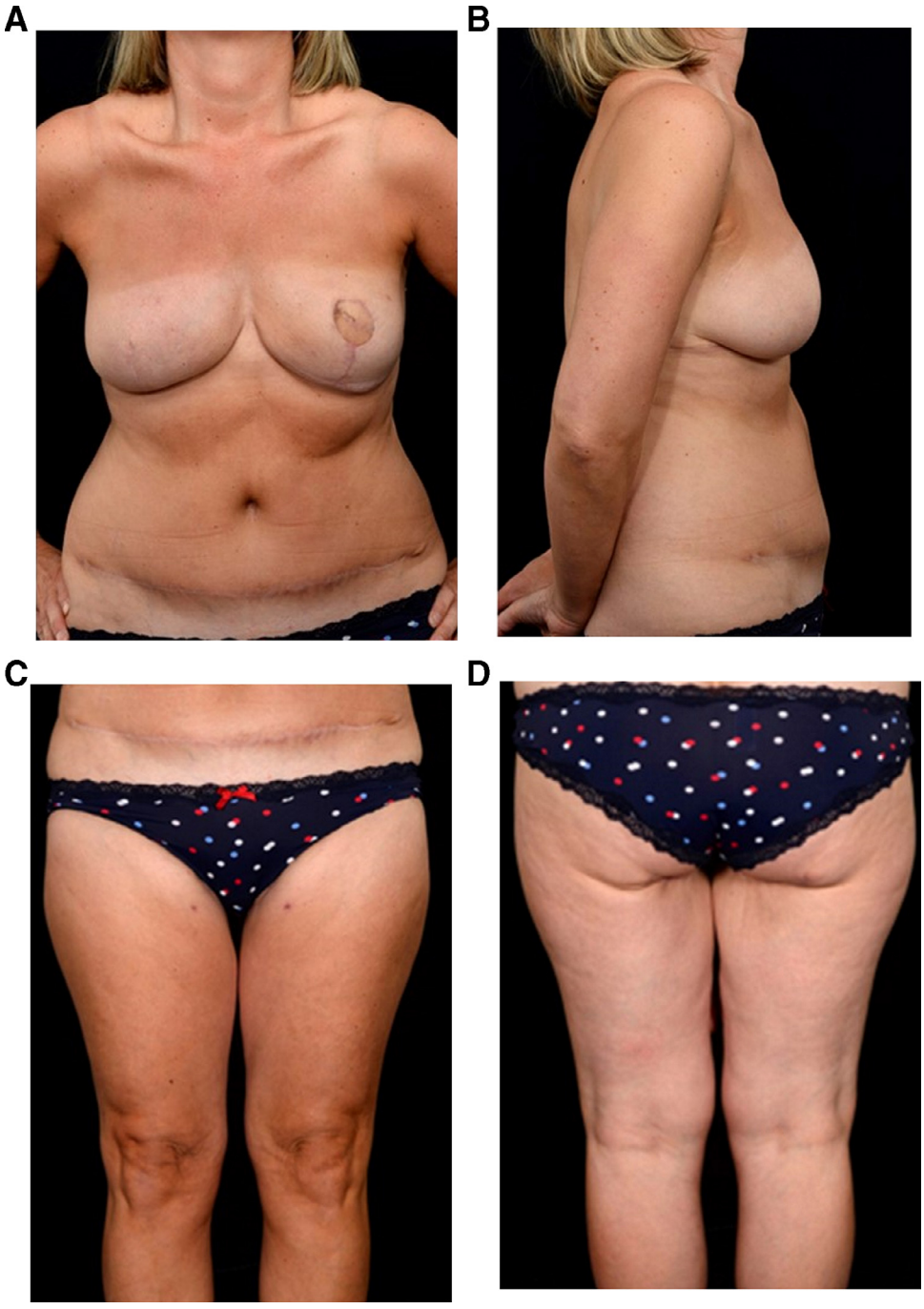

Figure 4 Image of reconstructed breasts 25-months following immediate unipedicled DIEP flap reconstruction (right breast) and 12-months following immediate bilateral PAP flap breast reconstruction (left breast). A) Anterior view of breast reconstructions B) Lateral view of DIEP flap breast reconstruction (right breast) C) Anterior view showing DIEP flap donor-site scar (lower abdomen) D) Posterior view of the buttocks demonstrating the PAP flap donor-site scars (inner thigh) are well-hidden within the gluteal creases.

Table 1 Pre-operative, surgical and post-operative variables comparing DIEP flap and PAP flap breast reconstructions.

	Pre-operative variables										
	Age in years (mean; range)	BMI in kg/m^2 (mean; range)	Cup size at time of reconstruction					Breast histopathology		Oncological treatment	
			A	*B*	*C*	*D*	*E*	*Invasive carcinoma*	*Ductal carcinoma in situ*	*NCT*	*CT*	*RT*
DIEP flap	46.5; 41.0–50.0	24.1; 18.8–27.8	0	1	1	1	1	3	1	1	2	2
PAP flap	48.5; 41.0–53.0	26.08; 24.0–27.8	1	2	1	0	0	1	3	2	1	2

Surgical variables

	Breast reconstruction timing		**Breast reconstruction**		**Mean operative time in hours (mean; range)**	**Flap weight in grams (mean; range)**	**Flap ischaemia time in mins (mean; range)**	**Perioperative medical or surgical complications**
	Immediate	*Delayed*	*Unipedicle (DIEP) or Unilateral (PAP)*	*Bipedicle (DIEP) or Bilateral to one side (PAP)*				
DIEP flap	1	3	1	3	6.09; 5.00–7.10	529.5; 481.0–718.0	39.5;25.0–53.0	0
PAP flap	2	2	1	3	7.23; 6.17–8.05	299.0; 257.0–357.0	31.9; 22.0–40.0	0

Post-operative variables

	Post-operative complications requiring a return to theatre	**Revision surgery to reconstructed breast**	**Revision surgery to donor site**	**Length of post-operative hospital stay (days)**	**NRS pain scale (2 weeks post-op)**	**Time for return to normal activities (weeks)**
		Liposuction or lipofilling				
DIEP flap	0	2	0	6; 5–7	3.2	5.4
PAP flap	0	2	1 (Bilateral PAP to one-side)	5; 4–6	2.4	4.6

DIEP: Deep Inferior Epigastric Perforator; PAP: Profunda Artery Perforator; BMI: Body mass index; NCT: Neoadjuvant chemotherapy CT: Chemotherapy; RT: Radiotherapy; NRS: Numerical rating scale.

Table 2 Comparing post-operative Breast-Q scores for DIEP flap and PAP flap.

		Mean score: DIEP flap	Mean score: PAP flap
HR-QOL Domains	1. Psycho social well-being	4.7	4.5
	2. Sexual-well being	3.0	3.3
	3. Physical well-being		
	a) Chest	1.4	1.5
	b) Donor site	2.5	1.7
Patient Satisfaction Domains	1. Satisfaction with breast	3.8	3.8
	2. Satisfaction with nipples	4 (1 of 4)	4 (1 of 4)
	3. Satisfaction with abdomen/thighs	3.1	3.8
	4. Satisfaction with outcome (aesthetic)	2.8	2.9
	5. Satisfaction with care		
	a) The information	3.8	4.0
	b) The surgeons	3.9	4.0
	c) The medical staff	3.8	4.0
	d) The office staff	4.0	4.0

Scores comparing DIEP flap and PAP flap patient-reported health-related quality of life domains. DIEP: Deep Inferior Epigastric Perforator; PAP: Profunda Artery Perforator; HR-QOL: Health-related quality of life.

eral DIEP flap breast reconstruction and then a contralateral breast reconstruction with a bilateral PAP flap.

The mean patient age during the first and second reconstruction was 46.5 years (range: 41–50 years) and 48.5 years (range: 41–53 years) respectively. Mean body mass index was 25.1 kg/m^2. No intra-operative or post-operative complications occurred. Mean flap weight was 529.5 g and 199 g for DIEP and PAP flaps respectively (Table 1).

Both post-operative Breast-Q questionnaires (DIEP and PAP flap) demonstrated high patient-reported satisfaction (Table 2). However, donor-site pain two-weeks post-surgery was greater following DIEP flap reconstruction (NRS scale: 3.2 for DIEPs and 2.4 for PAPs).

In Section 7 of the Breast Q patients reported less discomfort and impairment after PAP flap breast reconstruction (mean: DIEP: 2.5; PAP: 1.7). Comparing Section 8 Breast Q results, the donor-site demonstrated superior satisfaction after PAP flap reconstruction (DIEP: 3.1; PAP:3.8) (Table 2).

The Incidence of bilateral breast cancer has risen, and reconstructing bilateral breasts at different times poses reconstructive challenges. Although the DIEP flap is considered the gold-standard method, alternative donor-sites may be considered when the abdomen is unavailable or has been used previously. Based on patients' characteristics, the PAP flap can be a reliable second-choice.

Our findings suggest that both DIEP and PAP flaps are valuable breast reconstruction methods. When comparing donor-sites, patients reported the PAP flap's donor-site as more acceptable, particularly concerning the scar, which is well-hidden within the inguinal and gluteal creases. Post-operative pain was more bearable two-weeks after PAP flap reconstructions. Overall, recovery following PAP flap reconstructions seems less intensive and faster than DIEP reconstructions. We feel this comparison is reliable as each patient underwent the same extent of surgery in the abdomen and thighs (single pedicle DIEP flap and unilateral PAP flap or bipedicled DIEP flap and bilateral PAP flaps).

The main limitation hindering the use of the PAP flap is the smaller tissue volume that it provides and hence is usually indicted for slim patients with small-to-moderate-sized breasts. However, stacked PAP flaps can reconstruct a single breast and overcome this limitation[5] whilst providing similar satisfaction for the reconstructed breast shape compared with DIEP flap reconstructions (Table 1).

The four participants, except for the interval of time between reconstructions, were virtually free of biases. Hence, they were ideal subjects to describe the pros and cons of each procedure.

Our results suggest that post-operative recovery following PAP flap reconstruction was lighter than after DIEP flap, with a speedier return to daily life activities, less pain and a more satisfying donor-site scar, whilst offering equivalent satisfaction with the reconstructed breast. These observations enable professionals to improve autologous breast reconstruction methods from a patient's perspective, counsel them better and guide management decisions. When considering autologous breast reconstruction DIEP flap or PAP flap can be considered comparable options in selected patients.

Financial disclosures

No authors have any financial disclosures to make.

Ethical statement

This article abides by the Declaration of Helsinki. Informed consent from all participants was obtained prior to the study's onset.

Author contributions

DCM: Review of literature, writing and editing of the article, figure and table development, data collection and statistical analysis.
AF: Operated on patients, writing of the article, editing, final review of the article.

CS: Collected data, writing and editing of the manuscript.
SR: Operated on patients, original idea of the study, writing and editing of the article, review of literature.

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Preconditioning and postoperative hyperbaric oxygen therapy to reduce skin flap erosion after osmidrosis surgery

Dear Sir,

Osmidrosis surgery is still recognized as one of the best ways to treat body odor,[1] especially the liposuction assisted curettage due to the relatively small incision that does not leave any scars, which, nevertheless, may still cause many complications. One of the most common complications is the erosion of the skin flap, where the necrosis of the flap incision edge is about 4%.[2] Therefore, physicians who perform such surgeries often observe varying degrees of manifestations, some of which are relatively common superficial erosions (Figure 1) and some of which are proportionately deep erosions. Superficial erosions may disappear within a few days to a few weeks and heal completely whereas deep erosion, a kind of skin necrosis, is more likely to occur at the site of the incision. This necrosis easily leads to the appearance of scar tissue. Cutaneous microcirculation exists in the skin flap,[3] which is organized as two horizontal plexuses. One is distributed 1–1.5 mm below the skin surface and the other is distributed between the dermal-subcutaneous junction. Microcirculation refers to the blood circulation in the microvessels between the arterioles and the venules, where the blood and tissue cells exchange substances. The basic function of the microcirculation is to realize the material substitution and transport of oxygen, nutrients and metabolites to the cells various tissues. However, in the process of rotating knife scraping, the continuous friction in the skin flap easily damages the microcirculation, which

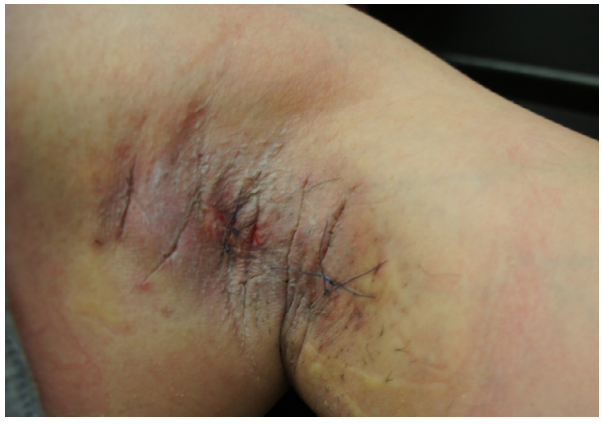

Figure 1 Relatively common superficial erosions are noted after 7 days of osmidrosis by liposuction assisted curettage.

is especially prone to occur in the pursuit of the complete clearance of the apocrine gland and, thus, leading to the serious damage of the skin flap. The pursuit for better clearance and the well preservation of the microcirculation of the skin flap often put clinicians in a dilemma. To improve this situation, our study aimed to achieve the best of both worlds; that is, to reduce the possibility of erosion or necrosis. Excessive friction or poor healing of the flap can also lead to pigmentation, thus affecting the appearance of the skin in the future. We performed hyperbaric oxygen treatment on 2 Fitzpatrick-skin-type-3 patients in Taiwan before and after osmidrosis surgery. There is a one-person MEDICONET Hyperbaric Oxygen Chamber (O_2One H810/H750) in Taiwan which, under the laws and regulations of Taiwan, does not require hyperbaric oxygen specialists. The three patients received hyperbaric oxygen treatment at 1.5 ATA dosages for 45 minutes before the operation, three days post operation following the yarn removal, and five days post operation following the quilting suture removal, respectively. It was later discovered that the recovery of the flaps treated with hyperbaric oxygen was healthier than the earlier observed patients who underwent general surgery with a recovery time of about one week earlier (Figure 2). It is, therefore, believed that the administration of hyperbaric oxygen treatment before surgery has a considerable effect in the improvement of the relative hypoxia of the skin flap during the surgery. This clinical phenomenon is consistent with the findings of many animal experiments mentioned in the literature. It is speculated that HBO preconditioning effectively slows the ischemic reperfusion injury, which is mainly through the regulating factors of apoptosis, the apoptosis signal-regulating kinase 1 and c-Jun N-terminal kinase.[4] Despite the small number of subjects in our case, we want to share our observation on the improved healing of the flaps through hyperbaric oxygen treatment. Furthermore, we speculate that it might be helpful in the reduction of the proportion of post-inflammatory hyperpigmentation in the future. We came to this opinion because the inflammation in the previous process is shortened and the healing is rapid, thus pigmentation is reduced. However, these require greater and larger studies to explore the extent of influence of hyperbaric oxygen treatment on skin flap osmidrosis surgery.

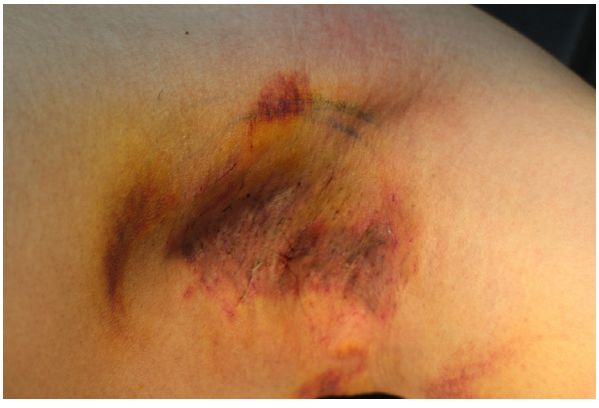

Figure 2 Flap condition on day 7 seemed recovering better after hyperbaric oxygen therapy on before, 3 days and 5 days after surgery.

Funding

None.

Conflicts of interest

None declared.

Ethical approval

Not required.

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RE: Not a plastic surgeon's best friend: Dog bites an increasing burden on UK plastic surgery services

Dear Sir,

We read with interest the article by O. Cameron et al.[1]

In their article, the authors outline the growing burden of the problem particularly the increasing number of patients, approximately 7000 per year, afflicted with dog bites requiring hospital admission in England.[1] However, we feel this would represent an underestimate of the true number of dog bites requiring medical attention across the country

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with many patients managing their bite wounds at home or by our primary healthcare colleagues. Further, coding errors which may not differentiate between cat or dog bites and poor documentation of these injuries undermines the true nature of the problem.

As stated in the recent article by O. Cameron et al, awareness of the laws pertaining to the Dangerous Dogs Act 1991 is required to protect our patients. Legislative changes in 2014 (Anti-Social Behaviour, Crime and Policing Act) meant the bill was amended so that the law extends to include all private property meaning dog owners can be prosecuted if their dog attacks a person in their home or garden.[2] There is an exemption from prosecution should said dog injure a trespasser in their own home. This distinction reflects the increased likelihood of a trespasser entering a dwelling uninvited with a malign intent. Postal workers, nurses, utility workers and other occupations requiring home visits or access to private property will be protected. Whilst this is not a legal journal, knowledge of the law is required to promote and encourage safeguarding of victims.

Despite this improvement in the law we as plastic surgeons also have a moral duty to prevent dog bites from occurring, especially since most of these admissions require plastic surgery input. By collating data in a registry, we can disseminate it and work with key stakeholders such as veterinarians, police officers and social services to educate dog owners and target repeat offenders. The latter is highlighted by a recent survey which found the majority of respondents (51%) had been bitten on more than one occasion.[3] A registry may also act as a reinforcement for pet owners to take more responsibility of their pets and prompt a more responsible ownership of dogs.

We believe a national collaboration between specialties is needed to manage the burden of dog bites. At LTH NHS Trust our close working multidisciplinary team has led to a dog bite register. So far, this register has enabled us to assess the most common breed of dogs attributed to a dog bite, situations in which dog bites occur, the nature and severity of bites and the management and outcome of patients reviewed within the region.

We are exploring new preventative measures such as educating dog owners about the law and training methods so that a dog can respond to basic commands. Previous studies confirm that owners and children can also benefit from educational sessions that instil a more precautionary behaviour around dogs that may reduce the incidence of attacks.[4] However, we acknowledge not all attacks are preventable as often the reason why victims are bitten are multifaceted and complex. Hence public health initiatives should also focus on what to do in the event of a dog bite, much like first aid care for a burn. This may help reduce the estimated £9.5 million per year cost in treating this growing problem.[5]

Conflicts of Interest and funding

None

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What is optimal wound management to prevent infection in non-hand mammalian bite Injuries? A systematic review

Dear Sir,

Mammalian bites account for 1% of all Emergency Department (ED) visits in the United Kingdom, with infection rates varying from 2% to 20%.[1,2] Mammalian bites on the hand, where tendons and joints are more superficial, are more prone to infection and should be considered separately.

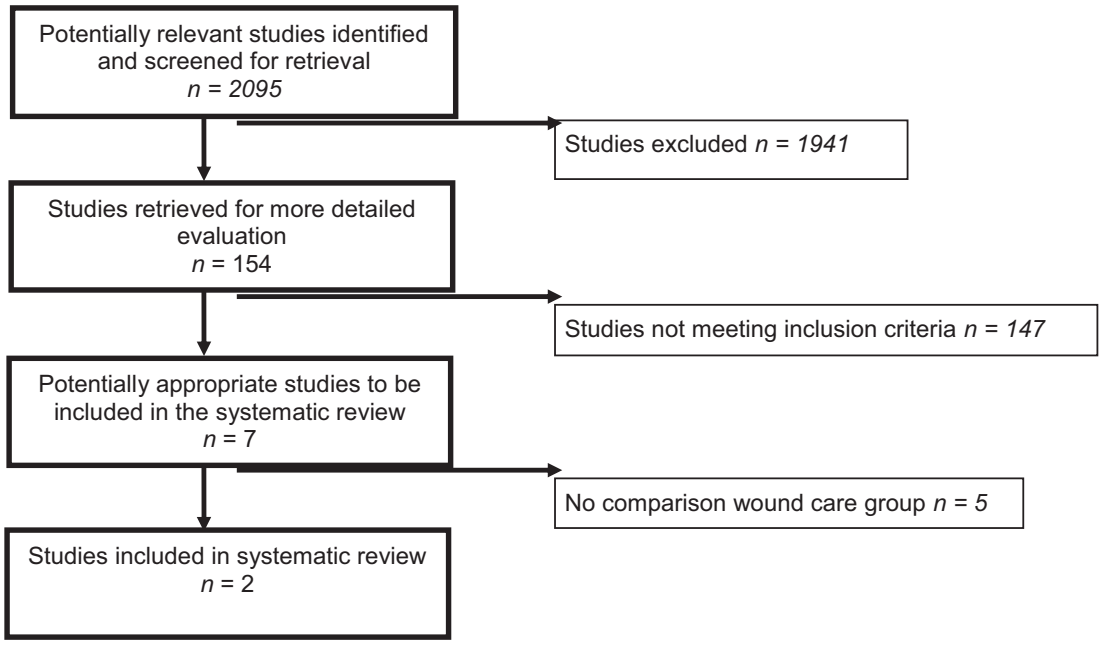

Figure 1 PRISMA flow diagram demonstrating the search strategy for the review.

There is no consensus on how to prevent infection in mammalian bite wounds.[3] Primary closure of the bite wound has received considerable attention and was initially argued to increase infection rates,[1] although others suggest rates are reduced.[4] Management of the initial wound is likely to be a significant factor. Prophylactic antibiotics have limited benefit, and wound management is variable and may comprise: (1) wound cleansing or (2) irrigation, with or without debridement.[3] Some authors advocate early surgical inpatient treatment to prevent infection,[5] while others perform irrigation with or without debridement in the ED.[6]

The aim of this systematic review is to determine optimal wound management to reduce the risk of infection in non-hand, mammalian bite wounds.

Methods

Three authors (JAD, AK and RJC) independently carried out a systematic literature review of all studies in Ovid MEDLINE, Ovid EMBASE and the Cochrane Central Register of Controlled trials. Both 'free-text term' and 'MeSH term' searches were performed using the search terms (Boolean operators italicised): [mammal* *OR* dog* *OR* fight* *OR* human* *OR* cat* *OR* animal*] *AND* [bit*] *AND* [wound*], restricted to English language.

All papers reporting wound management for mammalian bites and infection rates were included. Papers reporting on penetration of internal viscera, eyes, and hand and wrist bites were excluded, as were those with no comparison group, as studies are disparate in terms of animal bite, location, time to presentation and wound care, preventing comparison. Papers outlining method of closure with no reference to wound management were also discarded.

The search was last undertaken in November 2018. The study selection process was performed in accordance with the PRISMA statement (Figure 1). 2095 studies were identified, with 154 retrieved for detailed review. 147 did not meet inclusion criteria and five were excluded. Two papers were included in the review. The primary outcome measure was incidence of infection.

Results

Two studies were included and both were case series (Table 1).[6,7] The first included 106 patients all treated in ED, managed by one or more of the following; irrigation, debridement and antibiotics. Twelve percent of irrigated wounds developed infection, compared to 69% without irrigation. Debridement was performed in 14 cases but not performed in 46, and infection rates were 7% and 17%, respectively.

The second study included 704 cases. A total of 159 wounds contaminated with dirt, blood or devitalised tissue were scrubbed first with a povidone-iodine sponge, and four became infected (2.5%), compared to 606 wounds not scrubbed prior to irrigation, with 12 becoming infected (2.0%). Thirteen patients had devitalised tissue which was excised, with 13% developing infection, compared to 742 who were not debrided, and 1.8% developing infection.

Both studies were observational in design and were therefore at high risk of bias through methodological limitations, according to comprehensive risk of bias assessment with the Cochrane Risk of Bias Tool.[8]

Discussion

Mammalian bite wounds carry significant costs to health services, estimated to be US$160 million per year in the United States.[9] In spite of their huge burden, best treatment to

Table 1 Overview of included studies.

Author	Country	Design	Mammal bite	Patients	Intervention	Comparison	Primary outcome
Callaham[7]	USA	Retrospective series	Dog	106	Irrigated with >150 ml normal saline through 19 G needle ($n=44$)	Not irrigated ($n=1$)	13.6% of irrigated wounds infected compared to 0% not irrigated
					Debrided by excision of devitalised tissue ($n=14$)	Not debrided ($n=46$)	7.1% of debrided became infected vs 17% not debrided *P* value
Dire et al.[6]	USA	Prospective series	Dog	704	Providone-iodine-impregnated sponge to scrub prior to irrigation ($n=159$)	No scrub prior to irrigation ($n=606$)	4 (2.5%) with scrubbing developed infection vs 12 (2.0%) who were not scrubbed ($P=0.76$)
					Excision devitalised tissue ($n=23$ wounds)	No excision ($n=742$ wounds)	13.0% with excision devitalised tissue developed infection vs 1.8% who did not ($P=0.01$)

prevent development of infection remains unknown following this systematic review. The two studies conflicted in terms of outcome for debridement, and had individual suggestions for optimal management, with irrigation proposed to reduce infection.

The two series in this review are limited by their observational design to account for confounding factors. Callaham's study was a retrospective review, and may be prone to recall bias. It is not possible to ascertain what constituted debridement, and hence there may be significant heterogeneity in the intervention patients received.

Admission rates for patients presenting with mammalian bites ranges from 5% to 51%,[10] and factors associated with admission include underlying structural injury on clinical assessment, large or multiple wounds, and bites where children require general anaesthesia. It is currently unclear whether all other wounds could be managed in ED.

Wounds considered to be higher risk for infection include those presenting more than 24 hours after a bite causing puncture wounds, having almost double the infection rate compared to bites causing lacerations. This may be due to a crush, which can devitalise tissues and harbour infection.[10] The higher infection rate may be due to difficulty irrigating the wound or debriding deep, devitalised tissue. Whether these wounds can be managed under local anaesthesia in ED is unclear, because of non-standardised treatment between centres.

Mammalian bite injuries are a common problem without clear evidence to define best practice. Further evidence is required which should have a significant clinical, organisational and financial impact.

Conflicts of interest

None

Funding

None

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A simple code for efficient indicative number recording with e-logbook

Dear Sir,

Over 31,000 surgeons use the Pan-Surgical electronic logbook (www.elogbook.org) to record their operative exposure. It is endorsed by the surgical colleges as well as the associations of the surgical specialities. Accurate coding of operations on the e-logbook is important to correctly demonstrate meeting the required indicative numbers. Failure to do so can delay completion of training. Indicative numbers may appear artificially low if the consolidation algorithm required by the certifying body does not capture certain procedures that can be coded by two or more different options.

Although e-logbook was a welcome addition to surgical training many years ago, its interface and functionality has not changed for many years. Tasks such as adding complications or editing multiple procedures are extremely time consuming. Multiple edits may be required if, for example, procedures have been miscoded or wrongly imported from the ISCP logbook.

Despite multiple attempts over several years the senior author has been unable to engage with the e-logbook help desk for implementation of improvements or for allowing third party development.

A workout for facilitating the process of multiple procedures editing or adding complications is suggested.

Technique

The technique suggested uses a freeware browser extension and essentially allows the user to edit procedures by opening a new window without resetting the master list of operations with each edit. See Figure 1. The author and multiple other trainees have saved several hours by using this technique. As a disclaimer and although highly unlikely, the authors wave any responsibility for any data loss that may result by the use of the outlined technique.

Instruction

This enhancement works with Google Chrome, Microsoft Edge, Safari, Opera Next, and Firefox browsers. The instructions below are for the Chrome browser:

1. Open chrome and navigate to the following page to install the tampermonkey extension: https://tampermonkey.net/.
2. Click on the appropriate button on this page to install the tampermonkey extension to chrome.
3. Once installed you will see the tampermonkey icon on the toolbar.
4. Click on this icon and select the add new script option.
5. Copy and paste the following code in the text field overwriting any other code displayed:

```
// ==UserScript==
// @name          Open E-logbook.org and edit previous procedures in a new tab
// @namespace     http://5b4wn.com/
// @version       0.2
// @description   Lets you edit a previous operation in a new page
// @author        Marios Nicolaou
// @match         https://client.elogbook.org/main/default.aspx?S=1&CMD=BROWSE&T=1
// @grant         Free to use
// ==/UserScript==
(function() {
  'use strict';
var els = document.getElementsByTagName("form");
for(var i = 0, l = els.length; i < l; i++) {
  var el = els[i];
  el.target="_blank";
}
})();
```

6. Click the Save button (Disk icon).

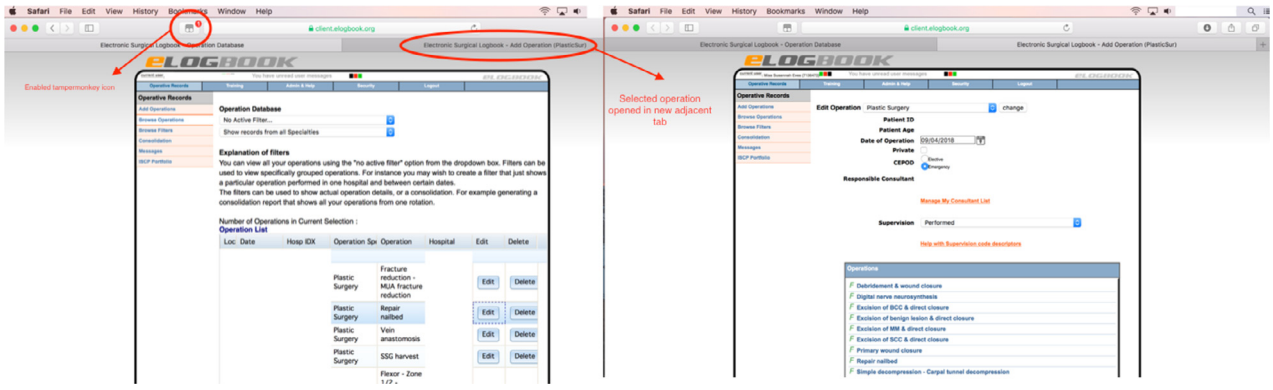

Figure 1 Tamper Monkey Icon activation.

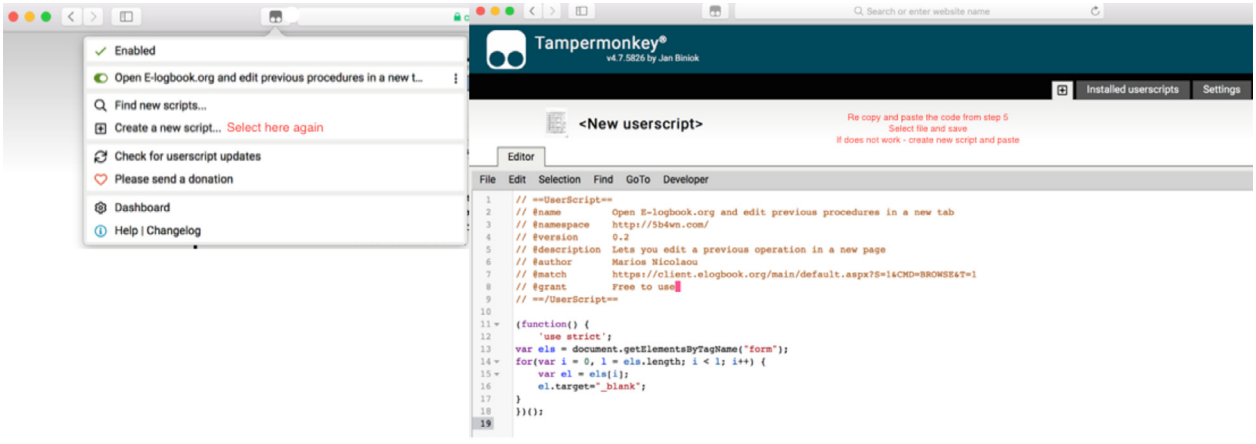

Figure.2 Process to re-enter script if utilising and icon does not appear active.

7. To edit multiple procedures using this script, log in to elogbook, and select the “Browse operations option”. Click on the tampermonkey icon in the toolbar and ensure that this script is enabled.

The icon now has a small red square with the number 1 printed in the middle to show that the script is active.

If this is not the case ensure that the URL in your browser is the same as the following line in the script:

// @match https://client.elogbook.org/main/default.aspx?S=1&CMD=BROWSE&T=1.

To correct this, click on tampermonkey icon and select “create a new script”. Then copy and paste the code from step 5 again. See Figure 2.

Result

If all appears to be correct, when the user presses the Edit button next to an operation, a new tab opens up in the browser that allows the procedure to be edited. Once the user finishes editing, the tab can be closed and the user can continue to the next operation without the software automatically rewinding back to the beginning of the logbook after the completion of each edit.

We would recommend for complete browser safety, the script should be disabled after completing the systematic editing, by clicking on the relevant tampermonkey icon.

Conclusion

It is hoped that sharing this simple to apply computer code will help trainees to more efficiently utilise the e-logbook recording system to ensure accurate reflection of indicative procedural numbers.

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Intranodal lymphangiography with indocyanine green: Application in lymph node transfer and beyond

Dear Sir,

Diagnostic imaging of truncal lymphatics is a diverse field with several modalities available. The growing popularity of vascularized lymph node transfer (VLNT) for the treatment of lymphedema has brought the topic into focus of plastic reconstructive surgeons worldwide. During this procedure, it is physiologically advantageous to perform lymph node efferent lymphatico-lymphatic anastomosis (ELLA) by including efferent lymphatic vessels in the flap while avoiding excess soft tissue[1]. However, in practice it is difficult to identify these vessels.

We used the indocyanine green (ICG) with the PDE system (Hamamatsu Photonics, Hamamatsu, Japan) to visualize the LN efferent lymphatic vessels by intranodal ICG lymphangiography (IIL). Firstly, the lymph nodes were identified intraoperatively by palpation, then directly punctured, and injected with ICG using a 30-gauge needle. The flow of ICG from the LN was then followed using the PDE system allowing us to identify the efferent lymphatic vessels with ease for inclusion in the flap and subsequent ELLA (Figure 1).

In this respect, we believe the IIL technique may be useful in improving the VLNT procedure. Furthermore, a growing number of endoscopes used for laparoscopy and thoracoscopy currently use the PDE system. Therefore, IIL can be applied with endoscopy to visualize deep truncal lymphatics and to ascertain the existence of lymphatic leakage, and the presence or absence of lymphatic obstruction during lymph node dissection intraoperatively in place of lipoidal lymphangiography techniques. Conventional lipoidal lymphangiography is a technically demanding procedure involving cannulation of lymphatic vessels of the foot and has largely been superseded by intranodal lipiodol lymphography for diagnosis of chylorrhea.[2,3] ILL utilizes ICG in place of lipiodol for intranodal lymphography and has the advantage of using a hand-held PDE camera allowing for diagnostic flexibility that is essential during surgery.

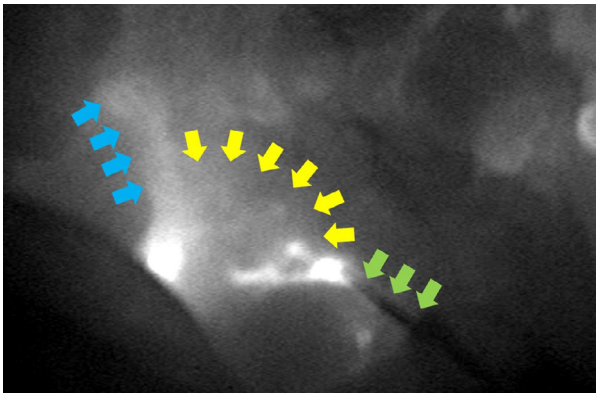

Figure 1 We directly punctured lymph nodes (yellow arrowhead) and injected ICG by the 30 G needle (green arrowhead). Efferent lymphatic vessel from lymph nodes are detected (blue arrowhead).

An important concern with the use of ILL for VLNT is the potential damage to the LN as a consequence of needle puncture affecting its function following transplant. Murine models have demonstrated increased necrosis following auto-transplant in severely traumatized fragmented LN, nevertheless, even after such extensive trauma most LN still showed resilience and regained the function.[4,5] Thus it is unlikely that the needle puncture during ILL would significantly affect the VLNT, however further evaluation of the invasiveness of the procedure may be required.

Conflict of interest

None.

Funding

None.

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Flexor tendon retrieval in zone 2 using the push-pull technique

Dear Sir,

Flexor zone 2 tendon injuries often present with tendon retraction into the palm. This is particularly the case when the injury occurs with the hand clenched over a sharp object such as a knife. To minimize tendon sheath and annular pulley injury, multiple techniques have been described for flexor tendon retrieval using dental wire,[1] paediatric feeding tubes[2,3] and skin hooks.

One can always try to make a window in the sheath proximally to retrieve the retracted proximal tendon. Tang and colleagues in their recent paper suggested that *'surgeons should make a separate incision in the palm to deliver the tendon end though preserving sheath and annular pulley'*[4] (Figure 1).

Figure 1 demonstrates such an approach; once the sheath is opened just proximal to the A1 pulley, both the FDS and FDP tendons are delineated. Tendon retrieval can then be performed by "walking" up the retracted FDP or FDS with two forceps into the centre of flexor zone 2 (Figure 2). This we find is a very effective, rapid technique, which is particularly useful in cases where multiple digits are involved. The senior author has performed this technique in over 62 zone 2 flexor repairs. Figure 2 demonstrates, how the technique was used to retrieve the middle and ring finger FDP, with preservation of all pulleys and only a small window made over the A3 pulley.

The technique does have drawbacks and occasionally does not work, particularly in the little finger where zone 2 is tight and our preference there is to use dental wire for retrieval. We recommend this technique as the first line choice before dental wire or a feeding tube is used. Its benefits are that it maintains the anatomical position of the divided tendon and minimizes injury to the vinculae and the distal end of the flexor tendon. Achieving delivery of the proximally retracted tendons without "unzipping" the finger and preserving the tendon sheath/pulley structures using such a technique fastens the intraoperative time and wound recovery time. Previously described tendon retrieval techniques all have their advantages and disadvantages and we suggest this "push-pull technique" as an addition to the armamentarium of a hand surgeon.

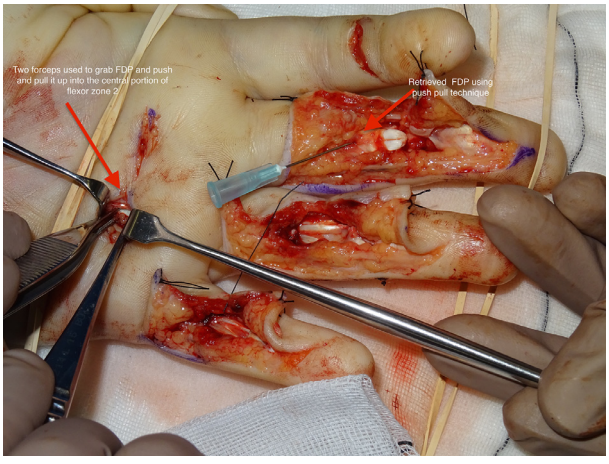

Figure 1 Push pull technique illustrated in palm. Two forceps are used to grab the FDP tendon and "walk" it up under the skin and for it to emerge distally in the wound.

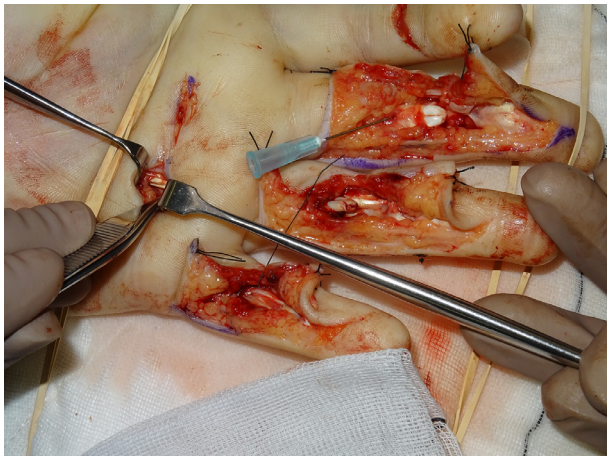

Figure 2 FDP retrieval in middle and ring fingers illustrated with this technique. Delineate FDP and FDS proximally in the palm.

Conflict of interest

None.

Funding

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Letter to the editor regarding: Selective non-operative management for penetrating extremity trauma: A paradigm shift in management☆

Dear Sir,

We read with great interest the recently published cohort study by Khajuria et al.[1] comparing penetrating extremity injury examination results to operative findings. The increasing rate of crime involving a knife or sharp object[2] is of concern to all trauma surgeons, and a great pressure to develop safe and effective clinical pathways for penetrating trauma. We agree with the authors that more pragmatic methods may be appropriate to treat these injuries, but question the author's assertion that their data has shown selective non-operative management to be a safe alternative to surgical exploration.

Firstly, the authors define a positive finding on surgical exploration as "any neurovascular or tendon injury". We feel strongly that muscle injury should have been included in this as a positive finding, and would be interested to know the author's rate of muscle bulk repair. At our unit, muscle is routinely repaired when injured, to ensure alignment of muscle fibres and to close dead space. This is rarely possible under local anaesthetic, and often necessitates operative management. Effective methods of muscle injury management are not well described, but studies that exist suggest that muscle repair is associated with better outcomes.[3,4]

Secondly, surgical exploration of a penetrating trauma is rarely solely diagnostic. Painless exploration in a clean environment is a basic part of wound management, allowing sufficient debridement and the creation of an acceptable scar.[5] In the paradigm of Selective Non-Operative Management (SNOM-PET) we are curious as to whether these steps are performed under local anaesthetic in the Emergency Department or simply deemed unnecessary. If the latter we note that neither study examining the clinical practice of SNOM-PET describes robust follow up of their patients which have not undergone surgical exploration. Instead they rely on self-reporting to a Level 1 Trauma Centre in Holland, and a District General Hospital in rural South Africa.

With these concerns, we cannot agree with the author's conclusion that their findings support the possible safety of SNOM-PET in the lower limb. Non-operative management is a pragmatic option for the vast number of penetrating traumas being seen across the country, but its introduction would benefit from good clinical evidence of safety.

☆ This work has not previously been presented at any meeting.

Conflict of interest

None.

Funding

None.

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Selective non-operative management for penetrating extremity trauma (SNOM-PET)

Dear Sir,

We appreciate the comments by Dickson and colleagues in their letter to the editor on our published article.[1] We agree with them that non-operative management is a

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pragmatic approach for penetrating trauma and our paper is the first documented attempt to apply this approach to a UK trauma population. It is inevitable and appropriate that conservative management of trauma is scrutinized as it is counter to most current plastic surgical doctrine, though conservative management of other types of trauma is commonplace. Managing trauma conservatively is a much harder decision to make than managing it operatively. Successful non-operative management requires more detailed assessment and more extensive experience than operative management. Our paper was attempting to define our centre's experience of trying to avoid operations that confer no clinical benefit but just add to the patient's morbidity.

We disagree that repairing muscle routinely in penetrating injuries is of benefit. These wounds are often small with a narrow tract that penetrates through numerous large muscles. The vast majority will heal without any functional deficit. Meaningful exploration would require extensive incisions and dissection that are likely to increase rather than decrease the morbidity from the injury. We determine evidence of the need to explore muscle stab wounds by clinical signs (the presence of significant pain on muscle tensing, swelling, bleeding, tenderness away from the wound site, loss of function) or on the suggestion of a significant injury on imaging (muscle disruption, large haematoma, extravasation).

We also disagree that routine surgical exploration of all penetrating trauma is a basic part of wound management. As we have already stated, routine exploration may not add any clinical benefit and may increase morbidity. Many of these wounds do not benefit from debridement and a simple washout and closure under local anaesthetic in the Emergency Department may be all that is required.[2] The challenge is separating those that will benefit from surgical exploration from those that will not.

We agree that following up the non-surgically managed cases would have helped confirm efficacy but this cohort of trauma patients are very non-compliant and so this was challenging. In future studies we are planning more formal follow up but suspect non-compliance will continue to be an issue.

The aim of our paper was to attempt to work out when surgical exploration is not required in the clinical care of penetrating extremity trauma. Our conclusions are that all upper limb injuries should be explored, as well as most lower limb injuries. However we believe that there is a carefully defined subgroup of lower limb penetrating injuries that receive no benefit from surgical exploration. We would welcome other colleagues' thoughts on this and suggestions on how we can continue to develop evidence-based trauma management.

Conflict of interest statement

None.

Funding

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Acknowledgments

None.

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Digital model simulation technology for ear reconstruction of microtia with craniofacial asymmetry

Dear Sir,

Craniofacial asymmetry is often observed in microtia patients, due to the accompanied craniofacial microsomia deformity, such as mandibular dysplasia and/or depression of the mastoid region, which makes it difficult to obtain symmetrical results in ear reconstruction.[1] In the process of reconstruction, both ear location and framework fabrication are interfered by the asymmetry. Mandibular hypoplasia and the heterotopic residual ear cannot be regarded as an appropriate locating reference, which poses difficulties to the surgeon when determining the location for the reconstructed ear. Moreover, depression of the mastoid region hinders assessment of morphological parameters, especially the height of the framework of the reconstructed ear. To enhance the aesthetic and symmetric outcomes in patients with microtia and mild skull malformations, we developed a digital simulation technology to adjust the location and calculate the parameters of the framework in ear reconstruction surgery.

Here, we report and summarize the outcomes of 50 patients (36 males and 14 females; mean age, 8.28 years; age range, 5–20 years) with microtia and hemifacial microsomia (HFM) with a Pruzansky type I or IIa mandibular defor-

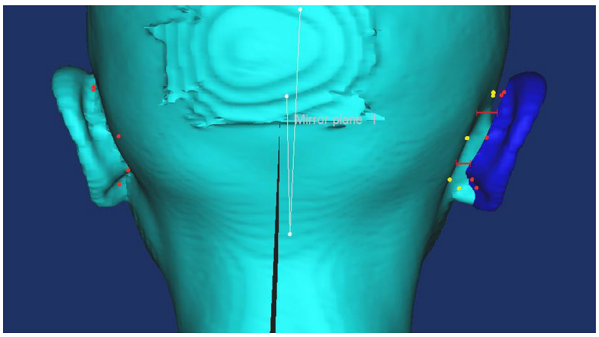

Figure 1 The simulated location of the reconstructed ear on a model of a patient with Pruzansky type IIa HFM.

mity who underwent surgery between September 2014 and February 2016.

Digital three-dimensional (3D) simulation models were created using preoperative computed tomography (CT) data and Mimics v.15.0 software (Materialise NV, Leuven, Belgium). The bilateral pinnal features and craniofacial asymmetry were clearly and accurately depicted on these 3D models.

The simulated models were used for pre-surgical planning for placement of the reconstructed ear, which was initiated by marking key points on the normal auricular side. A plane going through the pronasale and the midpoint of the inner canthus perpendicular to the Frankfurt horizontal plane was established as a reference plane. The auricular and key points on the normal side were mirrored to the deformed side to mark the location of the ear framework on the simulation model (Figure 1).

In order to gain a realistic reconstructed ear, the breadth, length, and height of the simulated normal ear were measured as references. In addition, the width of the gap between the skull and mirrored ear was measured as a corrective parameter for fabrication of the framework to compensate for the deficiency of height caused by depression of the mastoid region.

With the aid of the location information and parameters, all patients underwent ear reconstructive surgery using tissue expanders and autogenous costal cartilage.[2] Sterilizable 3D models were printed and used as templates during surgery. All patients completed a follow-up examination at 12 months. The symmetry and form of each reconstructed ear was independently rated by the surgeons and patients or their families.

The symmetry of the reconstructed ear to the normal ear was satisfactory for each patient (Figure 2). For those patients with microtia combined with mild craniofacial asymmetry, such as Pruzansky type I or IIa HFM, the digital method described here allows for objective positioning of the ear. In this study, simulated models were used to confirm the location of the reconstructed ear according to a mirror image of the normal ear. Each of the marked key points on the mirrored ear was projected to the affected side of the skull with this visual projection positioning method for appropriate placement of the reconstructed ear.

The proposed method provides accurate parameters for the design and fabrication of an individualized framework. In contrast with a previous clinical study,[3] the morphological and corrective parameters obtained from the simulated model provide a more visual and quantified means to guide the design and fabrication of the cartilage framework.

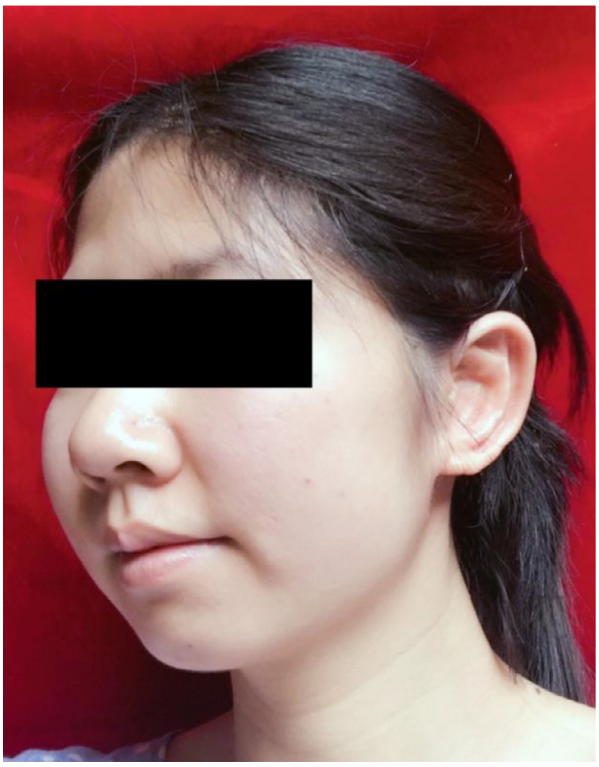

Figure 2 Appearance of the reconstructed ear in a typical case, 6 month postoperatively.

As one of limitations to this study, pre-surgical planning may not be effective for patients with severe craniofacial deformities. Moreover, a further follow-up focusing on the pinnal morphology is needed.

Conflicts of interest

None.

Ethical approval

The study conformed to the Declaration of Helsinki and was performed with local center ethical approval (number 2014-43).

Acknowledgment

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Live Surgery: An innovative plastic surgery teaching programme for medical students utilising real-time operating theatre audiovisual link-ups☆

Dear Sir,

For undergraduate students the operating theatre constitutes an important and unique educational experience. Despite this, traditional 'in theatre' surgical training is not without problems. The environment naturally limits the number of students who may safely or usefully attend at any one time. Furthermore, feedback suggests that many students find the surgical environment particularly intimidating and are reluctant to ask questions as a consequence.[1,2]

Live Surgery is a novel, modern approach of surgical education. Surgical procedures are recorded and broadcast real-time to a lecture theatre of undergraduate students and/or junior doctors. Pre-operative complementary lectures, which are case-focused and highlight specific anatomical and pathological considerations, help to orientate the learner through the experience. In addition, real-time interaction between learners and the operating surgeons is facilitated by direct audio link-ups and through the integration of live social media feeds, such as Twitter.

Through Live Surgery, we set out to improve general understanding and education of Plastic Surgery, whilst driving innovation to deliver novel ways to complement the current undergraduate curriculum. Ultimately, through this endeavour we sought to inspire the next generation of surgeons.

The immersive operative experience was recreated using high-definition handheld, floor-mounted rotating cameras and a ceiling mounted 360-degree camera (Figures 1, 2). This technology was set up in conjunction with the St. George's Advanced Patient Simulation and Skills (GAPS) team and with the Digital Services Department.

Cases were pre-selected to maximise training opportunities. Focused conventional lectures of up to one hour, describing the relevant anatomy, pathology, operative steps, and surgical risks, were delivered prior to the live-link with the surgical team. Intra-operatively, the surgical team guided observers through the operative steps, providing live commentary to the high-quality streamed images and responded to questions asked verbally or read from the live Twitter feed. Feedback was obtained using paper/electronic questionnaire. Numerical scores and free-text comments were collected.

A total of four Live Surgery events were held at St. George's University. Streamed operations included: abdominoplasty; nipple reconstruction; scar revision; carpal tunnel decompression; cheek reconstruction with fat grafting; and axillary lymph node clearance. A total of 75 students attended these events. Feedback was received from 53 participants, of whom the vast majority were fourth year medical students.

Mean score for interest was 87%, with educational relevance scoring 88%. Overall, 88% of attendees found that video streaming made asking questions of the surgeons an easier, less intimidating experience. Overall, the majority of free-text comments were in reference to the novelty of the idea, the level of interaction or the perceived educational benefit. No negative comments were submitted on the feedback forms.

A literature search demonstrates a small number of similar 'proof-of-concept' studies. As far back as 1998, Methany et al at Brown University School of Medicine utilised videoconferencing of surgical procedures to teach undergraduate students about pelvic anatomy.[3] Gul et al. performed a similar evaluation of 'in-theatre' videoconferencing versus conventional theatre teaching for a number of common general surgical procedures at St. Mary's Medical School, London.[4] Both studies indicated the students' preference for telemedicine-assisted surgical teaching, with high acceptance and satisfaction rates observed.

With Live Surgery, we aimed to build upon these experiences. We sought to complement our live events with focused conventional lectures; a strategy which was well received according to student feedback. We also wished to eliminate the "passive viewer" syndrome [3,4] by enabling direct interaction between student and operating surgeon.

☆This project was presented at the Association of Surgeons in Training (ASiT) National Conference in Edinburgh, April 2018.

Figure 1 Pre-operative filming, surgeon running through the outline of the Live Surgery session.

Figure 2 Multiple intra-operative views shown to the audience, including the 360-degree view of the operating theatre (bottom left). NB – Permission has been gained for use of the above images in a journal publication from all identifiable individuals.

We expanded on the direct audio link-up approach, by permitting questions to be posted via social media (in this instance, Twitter).

The practice of broadcasting live surgical procedures has been the subject of considerable debate.[5] Many highlight its value as an effective teaching tool, whilst others have raised concerns regarding the potential risks for patient safety and privacy. Some argue that because of the 'theatrics' of live recording, there is a risk that the surgeon may become distracted or be under heightened stress, especially when answering numerous, sometimes complicated, questions. Furthermore, filming may increase the length of the procedure, thereby increasing the risk of subsequent infection for the patient.

From our perspective, when implemented and executed correctly, Live Surgery represents a novel, interactive and innovative method of teaching, which ameliorates many of the issues encountered with traditional 'in-theatre' learning. Using high-definition imaging and commentary to complement a focused educational programme, Live Surgery at St George's enabled our undergraduate students to participate in an immersive surgical experience which, at time of writing, is not offered anywhere else in the country. Although this study constituted a relatively limited pilot involving only a small number of students, it no doubt demonstrates the great potential of this educational technique.

We are grateful to the staff and patients who permitted us to film their cases for student benefit. Particular recognition is given to Miss Joy Odili, Mr. Mark Soldin and Miss Lillian Cooper.

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