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Review Article

A systematic review and meta-analysis of soft tissue reconstruction following debridement of tibial osteomyelitis: Comparing muscle and fasciocutaneous flaps

Nadia Taha[a,*], Ibrahim Natalwala[a], Shafiq Rahman[b], Gavin Barlow[c,d], Cher Bing Chuo[b]

[a] Department of Plastic Surgery, Leeds Teaching Hospitals, Leeds, UK
[b] Department of Plastic Surgery, Hull University Teaching Hospitals, Hull, UK
[c] Hull York Medical School, University of York, York, England
[d] Department of Infection, Hull University Teaching Hospitals, Hull, UK

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ABSTRACT

Introduction: Tibial osteomyelitis is a serious condition, often resulting from trauma or orthopedic surgery, frequently requiring soft tissue reconstruction after debridement. This systemic review and meta-analysis compared outcomes of muscle versus fasciocutaneous flap reconstruction following debridement of tibial osteomyelitis.

Methods: Following PRISMA guidelines, MEDLINE, EMBASE, PubMed Central, and Cochrane Central Register of Controlled Trials (CENTRAL) databases were searched. Prospective or retrospective comparative studies evaluating muscle and fasciocutaneous flap reconstruction following tibial osteomyelitis debridement were included. Non-comparative studies with only one flap type were excluded to reduce bias. Primary outcomes included osteomyelitis recurrence and flap failure; secondary outcomes assessed amputation rates and patient satisfaction.

Results: Six studies encompassing 207 patients (219 flaps) were included. The meta-analysis showed a trend towards lower osteomyelitis recurrence rate in the fasciocutaneous flaps, although

* Corresponding author.
E-mail address: Nadia.taha@nhs.net (N. Taha).

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this was not statistically significant in one scenario (odds ratio [OR] 3.35, 95 % CI 1.14–9.90 and OR 2.69 95 % CI 0.93–7.74). Significant flap loss rates were comparable, with no statistically significant difference (OR 1.68 95 % CI 0.45–6.25 and OR 1.12 95 % CI 0.30–4.23). Amputation rates were similar between flap types (OR 3.06 95 % CI 0.46–20.38). One study reported higher satisfaction with fasciocutaneous flaps regarding appearance ($p = 0.048$).

Conclusion: Both flap types effectively support reconstruction in tibial osteomyelitis, providing well-vascularized tissue to help reduce recurrence. Our study focused on the tibia, a bone particularly vulnerable to trauma and devascularization, and identified that muscle and fasciocutaneous flap coverage provided similar clinical outcomes.

Introduction

Tibial osteomyelitis can be a disastrous sequela of trauma or orthopedic surgery,[1] due to disease recalcitrance and an increased risk of amputation.[2] The tibia's subcutaneous antero-medial border makes it vulnerable to injury, and relatively few extra-osseous diaphyseal vessels may impair bony union.[3] Inappropriate fracture management may result in deep infection.[4,5] Osteomyelitis rates in open tibial fractures are reported as 0–2 % for Gustilo Anderson Grade I, 2–7 % for Grade II, 7 % for Grade IIIa, 10–50 % in Grade IIIb, and 25–50 % in Grade IIIc with significant amputation risk.[6] Chronic osteomyelitis defined as infection lasting months or years,[7] affects 5–50 % of open fractures, <1 % of fixed closed fractures, and 5 % of hematogenous infections.[8]

Essential management principles include infection eradication or suppression until fracture union, vascularized soft tissue reconstruction for skin defects, prevention of recurrence, and restoration of function.[9,10] Muscle flaps have been the workhorse in tibial reconstruction following debridement due to their capacity to fill dead space, increase vascularity, promote bone healing through osteogenic cellular and trophic factors, and to eliminate bacteria.[11–15] Recently, with heightened interest in perforator flaps, fasciocutaneous flaps are being increasingly used for both open fracture and osteomyelitis, with outcomes comparable to muscle flaps.[16] They provide thin, pliable coverage, superior aesthetic outcomes and ease for later flap re-elevation if secondary procedures are anticipated.[9,16,17]

Although numerous case series report success with both flap types, no randomized controlled trials have compared their effectiveness in tibial osteomyelitis specifically.[9,17–24] This study is a systematic review and meta-analysis comparing the outcomes of muscle and fasciocutaneous flaps in tibial osteomyelitis reconstruction.

Methods

The study followed the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) Statement and was published to the international prospective register of systematic reviews (PROSPERO) database (CRD42021249199).[25] There were no conflicts of interest, no funding and no ethical concerns raised.

Study types

Included studies were prospective randomized controlled trials (RCTs), non-RCTs, prospective and retrospective comparative cohort studies, and case series. Excluded were non-comparative studies

with one flap type, animal studies, reviews, case reports, letters, anatomical studies, and non-English publications. There was no minimum number of patients or length of patient follow up required.

Population

Patients of all ages with tibial osteomyelitis undergoing debridement and flap reconstruction (with or without fixation) were included, regardless of other demographics, co-morbidities, disease parameters including the Cierny-Mader classification of tibial osteomyelitis,[26] or if acute or chronic. Etiopathogenesis included post-traumatic, post-osteosynthesis, and hematogenous osteomyelitis. Studies involving osteomyelitis following joint arthroplasty were excluded. If tibial osteomyelitis was analyzed as a subgroup, including multiple long bones, authors were contacted and studies were excluded if relevant data couldn't be obtained.

Intervention

Debridement of the infected tibia and soft tissue flap reconstruction could be performed either as a single stage or multi-stage procedure. There was no restriction on the type of debridement, ranging from pin site over-drilling, to saucerization or segmental excision for more advanced disease. Any type of fixation with flap reconstruction was permitted for post debridement instability. Dead space management included antibiotic impregnated alloplastic materials, non-vascularized bone graft, and vascularized bone. Patients could also have simultaneous or subsequent bone transport for bone lengthening to manage segmental tibial defects.

Comparison

Following tibial debridement (with or without bone fixation), patients underwent reconstruction either with a muscle or fasciocutaneous flap, making two comparator groups for meta-analysis. Muscle flaps included musculocutaneous flaps (e.g. antero-lateral thigh flap with segment of vastus lateralis). Flaps could be local, pedicled, or free. Studies where chimeric flaps with vascularized bone and skin were used in a single stage were excluded.

Outcomes

All included studies had to report primary outcomes: recurrence of osteomyelitis and significant flap loss. Significant flap loss was defined as complete flap loss or the need for a subsequent flap due to near total loss of the primary flap. Secondary outcomes included amputation and patient reported outcome measures (PROM) to assess satisfaction with soft tissue reconstruction.

Search strategy

We searched MEDLINE and EMBASE (provided by Ovid), PubMed Central, and the Cochrane Central Register of Controlled Trials (CENTRAL). The search was last performed on May 6, 2025 and included articles from database inception to the search date. Forward and backward citation identified relevant papers from the included studies.

The search strategy used the key terms "osteomyelitis", "osteitis", "musculocutaneous", "muscle", "myocutaneous", "fasciocutaneous", and "flap". A further text term "bone infection" was also used. Full details of the search strategy are provided in Appendix A.

Study selection

Two review authors (IN and NT) conducted the search strategy using Covidence© systematic review software (Veritas Health Innovation, Melbourne, Australia, 2024). Duplicates were automatically removed. Relevant titles and abstracts were screened for eligibility as per the predefined criteria. Full texts were independently reviewed by two clinicians and disagreements resolved through discussion

with senior authors (CBC and GB). Author names, study location, intervention detail, participant numbers, date and duration of each study were checked for duplicates. Where there was uncertainty, senior authors were contacted. A study attrition chart was constructed to show the search outcomes and final study selection.

Quality control

The Cochrane Collaboration's tool from the Cochrane Handbook for Systematic Reviews of Interventions (version 5.1.0 March 2011) was used to evaluate the risk of bias in randomized controlled trials included in the meta-analysis.[27] The Newcastle-Ottawa Quality Assessment Scale (NOS) assessed non-randomized study quality focusing on selection, comparability and outcome assessment.[28] Studies could score up to nine stars with seven or above indicating high quality, 4–6 moderate quality, and three or under low quality methodology.[28]

Data extraction

Data were extracted independently by authors IN, NT, and SR and recorded in a Microsoft Excel© (Redmond, USA) spreadsheet. Study characteristics, demographics, co-morbidities, Cierny-Mader classification, previous injury and surgery prior to the onset of osteomyelitis, antibiotic regimens, type of debridement performed, management of dead space, type of flap reconstruction, primary outcomes, and secondary outcomes were collected. When additional data or clarification was required, authors were contacted by email where this was available.

Statistical analysis

Review Manager® version 5.4.1 (The Cochrane Collaboration, 2021) was used for statistical analyzes. Odds ratios with 95 % confidence intervals (CI) were calculated for dichotomous outcomes. Overall treatment effect was calculated from a weighted average of individual summary statistics. Heterogeneity was assessed using the Cochran Q test and I^2 statistic: $I^2 > 50$ % indicated significant heterogeneity. A fixed effects model and the Mantel-Haenszel method was used. Primary outcomes were presented as forest plots. Secondary outcomes not reported homogenously were analyzed and reportedly qualitatively.

Results

A total of 2354 articles were identified from the literature search. Twenty-four full papers were reviewed of which 18 were excluded; see Figure 1 for details. Six studies were included in this meta-analysis; all studies were retrospective cohort studies.[2,29–33]

Study characteristics

Table 1 amalgamates the baseline characteristics of the studies.[2,29–33] A total of 207 patients from six eligible studies were included, with a pooled mean age of 37 years (Standard Deviation [STD] 4). One patient in the study by Tsai et al. was excluded due to having a single stage free fibula with skin paddle reconstruction; this was possible as there was no osteomyelitis recurrence or flap loss.[31] In total, 219 flaps were performed: 127 muscle (58 %) (MS) and 92 fasciocutaneous (42 %) (FC). Of these, 178 were free flaps (84 %) with 104 (58 %) muscle (F-MS) and 74 (42 %) fasciocutaneous (F-FC). The latissimus dorsi was most common in the F-MS group, used in 68 (54 %) procedures, while the lateral arm and scapular flaps were the most common in the F-FC group, used in 20 (23 %) procedures.

The duration of osteomyelitis varied across the studies; 4 weeks,[29,32,33] 6 weeks,[2] and 3 months.[30] Tsai et al. did not report duration.[31] Most cases were post-traumatic[2,29–31,33] with few exceptions including one valgus osteotomy[30] and two pathological fractures.[29] Cierny-Mader classification was reported in two studies,[30,33] with 89 % of 94 classified as Type III or Type IV disease.

Table 1
Summary of demographic characteristics, number and types of flaps, duration of osteomyelitis, duration of antibiotic treatment, etiology and follow up time of the included studies and outcomes analyzed.

Study	Study design	Number of patients included	Age range (mean)	Gender (M:F)	Number of flaps and flap type		Duration of osteomyelitis (mean)	Duration of antibiotics	Etiology	Mean follow up time
					Musculocutaneous	Fasciocutaneous				
Buono et al.[30]	Retrospective case series	24	16–75 (41)	18:6	13 latissimus dorsi One serratus anterior	One anterolateral thigh Four lateral arm Five thoracodorsal artery perforator One radial forearm	3 months to 22 years (7.5 years)	12 weeks	Post-traumatic Post valgus osteotomy surgery	2.5 years
Campbell et al.[2]	Retrospective case series	12	19–63 (39)	9:3	Two latissimus dorsi One rectus abdominis One gracilis Four gastrocnemius	One anterolateral thigh Four local	NR	2–27 months	Post-traumatic	4.2 years
Heppert et al.[32]	Retrospective case series	50	MC: 12–58 (36) FC: 13–58 (37)	NR	30 lattissimus dorsi Two lattissimus dorsi and serratus anterior	15 radial forearm Four parascapular two lateral arm	(32.5 months)	10 days	Post-traumatic	NR
Khater et al.[29]	Retrospective case series	28	15–55 (29)	27:3	Seven gastrocnemius local Nine soleus local One free gracilis free	Seven posterior tibial artery perforator One peroneal artery perforator Three free anterolateral thigh	NR	NR	Post-traumatic Pathological	12 months
Tsai et al.[31]	Retrospective case series	23	NR	NR	16 muscular anterolateral thigh Three medial gastrocnemius	Four anterolateral thigh	NR	NR	Post-traumatic	27 months
Zumiotti et al.[33]	Retrospective case series	70	7–71 (33)	61:9	28 latissimus dorsi Nine serratus anterior	20 scapular 14 lateral arm	4 weeks to 30 years (13.9 months)	6 weeks	Post-traumatic	46 months

NR, not recorded.

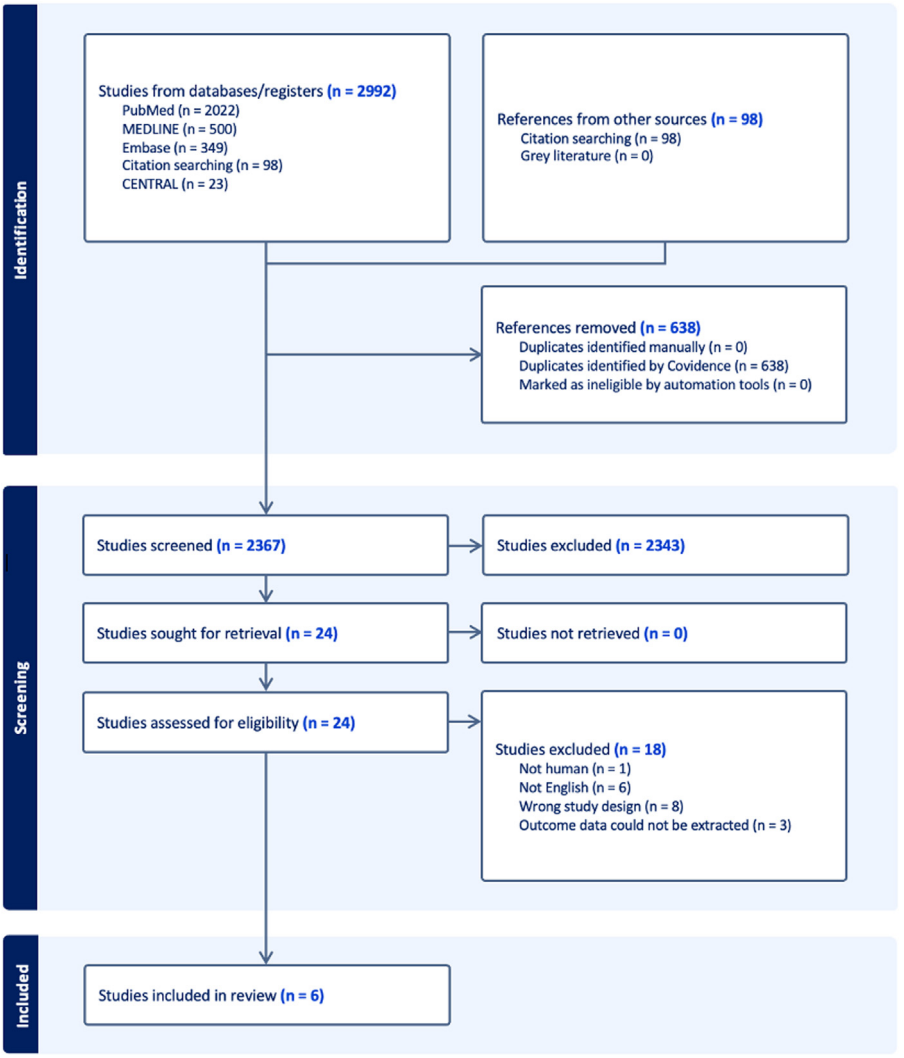

Figure 1. PRISMA study flow diagram.[25]

Most studies administered post-operative antibiotics[2,29,30,32,33] with duration ranging from 10 days[32] to 12.8 months[2] and a pooled mean of 8.4 weeks (STD 1.4 weeks). Both Campbell et al.[2] and Zumiotti et al.[33] reported culture sensitivities, with *Staphylococcus aureus*, gram-negative rods, and polymicrobial infections being the most common.

Heppert et al. used a single stage approach for debridement and reconstruction,[32] whereas others opted for multi-stage procedures. Flap selection criteria varied; Zumiotti et al. used muscle flaps for osseous defects, cavities, or wounds over 6 cm[33]; Buono et al. selected flaps based on defect size, arteriographic results, and patient preference[30]; Tsai et al. used muscle flaps for defects with dead space.[31] Three studies did not specify selection criteria.

Dead space management varied across studies. Autologous avascular and vascularized bone grafts were commonly used.[2,30,32,33] The protocol described by Zumiotti et al. is specific and included iliac crest bone graft for defects under 8 cm, bone transport for 8–15 cm, and contra-lateral free fibula for

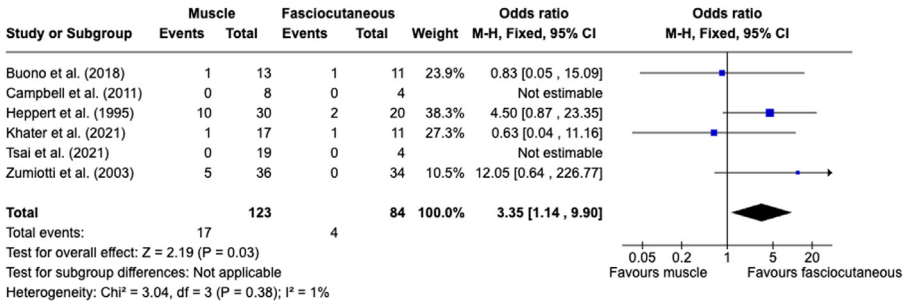

Figure 2. Forest plot of osteomyelitis recurrence following debridement of tibial osteomyelitis and either muscle or fasciocutaneous flap reconstruction for Scenario A.

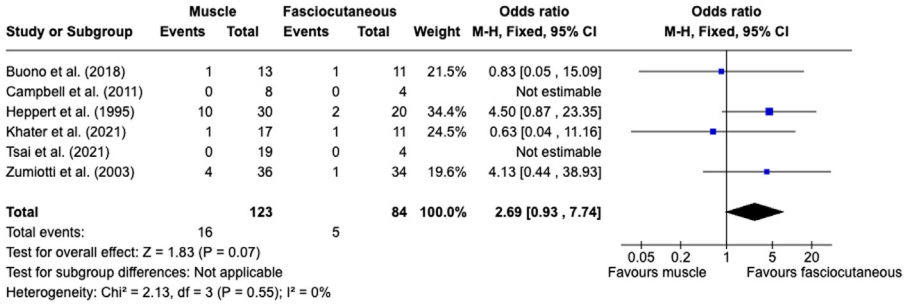

Figure 3. Forest plot of osteomyelitis recurrence following debridement of tibial osteomyelitis and either muscle or fasciocutaneous flap reconstruction for Scenario B.

defects >15 cm.[33] Buono et al. used local gentamicin polymethylmethacrylate (PMMA) beads, followed by bone grafting at the second stage.[30] Tsai et al. addressed dead space with myocutaneous flaps for soft tissue defects.[31]

Four studies reported follow up duration, the pooled mean was 39.9 months.[2,30,31,33] Heppert et al. described long term follow up but no mean was reported for the duration of months.[32] Khater et al. did not describe follow up duration.[29]

Primary outcome measures

Osteomyelitis recurrence

All studies reported osteomyelitis recurrence. Zumiotti et al. classified outcomes as "Good" or "Poor", with seven "Poor" outcomes, including five osteomyelitis recurrences, and two flap losses. Six had MS flaps and one FC flap but recurrence in which flap type was unclear.[33] Two scenarios were analyzed: all five recurrences in MS (Scenario A), or four in MS group and one in FC (Scenario B). Therefore, two forest plots were generated to account for both scenarios. Two studies reported no recurrences.[2,31] Khater et al. described sinus formation for one patient in each group.[29] Recurrence was higher in the muscle group (17 versus 4), and only statistically significant in Scenario A (odds ratio 3.35 95 % CI 1.14–9.90, $p = 0.03$) (Figure 2) not Scenario B (2.69 95 % CI 0.93–7.74, $p = 0.07$) (Figure 3).

Significant flap loss

Tsai et al. reported no flap losses[31] while Khater et al. described one partial MS flap loss managed conservatively.[29] Campbell et al. reported one flap failure but did not specify the flap type and therefore it was excluded from this analysis.[2] In Zumiotti et al., due to the way outcomes were classified, there were either two flap losses in the MS group and none in the FC group (Scenario A) or one flap

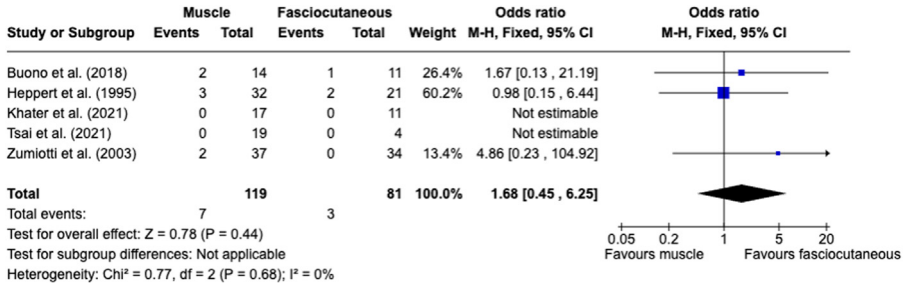

Figure 4. Forest plot of significant flap loss following debridement of tibial osteomyelitis and either muscle or fasciocutaneous flap reconstruction for Scenario A.

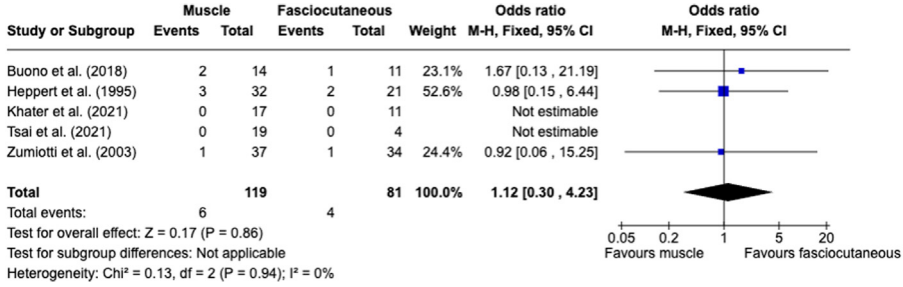

Figure 5. Forest plot of significant flap loss following debridement of tibial osteomyelitis and either muscle or fasciocutaneous flap reconstruction for Scenario B.

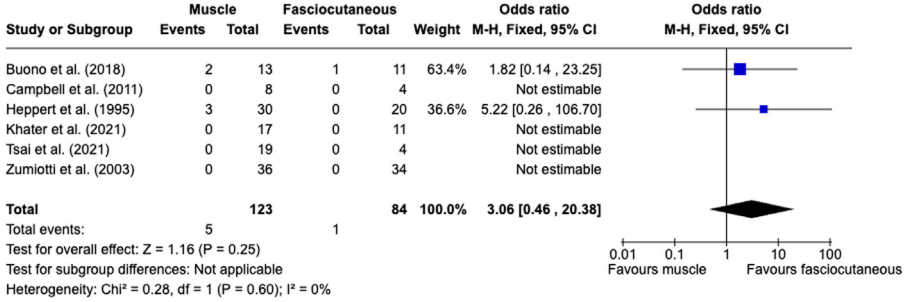

Figure 6. Forest plot of amputations following debridement of tibial osteomyelitis and either muscle or fasciocutaneous flap reconstruction.

loss in each group (Scenario B). As before, two forest plots were generated to account for both scenarios. Overall, there was no significant difference in flap losses between the MS and FC flap groups (odds ratio 1.68 95 % CI 0.45–6.25, $p = 0.44$ for Scenario A (Figure 4) and odds ratio 1.12 95 % CI 0.30–4.23, $p = 0.86$ for Scenario B (Figure 5)).

Secondary outcome measures

Amputations

There were five (5 %) amputations in the MS flap group and one (1 %) in the FC flap group and no amputations from either group in patients from four of the studies.[2,29,31,33] Overall, there was no significant difference in the rate of amputation between the two groups (odds ratio 3.06 95 % CI 0.46–20.38, $p = 0.25$), see Figure 6.

Table 2
Newcastle-Ottawa quality assessment of all included studies.

Study	Selection	Comparability	Outcome	Total
Buono et al.[30]	☆☆☆☆	☆	☆☆	7
Campbell et al.[2]	☆☆☆☆	☆	☆	6
Heppert et al.[32]	☆☆☆	☆	-	4
Khater et al.[29]	☆☆☆☆	☆	☆☆	7
Tsai et al.[31]	☆☆☆☆	-	☆☆	6
Zumiotti et al.[33]	☆☆☆☆	-	☆☆	6

The total score shown is out of a maximum of nine points.

Patient reported outcome measures (PROM)

Four studies reported PROMs. Buono et al. found all patients (four MS flaps, six FC flaps) were full weight-bearing without pain and returned to prior activity levels. Interestingly, no patients in the MS flap group rated the appearance of their reconstruction "aesthetically acceptable", whereas five out of the six patients in the FC flap group did (Fisher's Exact test, $p = 0.048$) and "fine sensitivity" was better.[30] Campbell et al. reported all patients could walk, however 25 % had not returned to prior activity; 20 % didn't return to work but all patients involved in sport prior to their injuries returned to playing. Seventeen percent required walking aids or reported mild pain on walking long distances. Lower Extremity Functional Scale (LEFS) was used to evaluate post-operative patient function as a percentage of maximal function; the patients achieved a mean of 64 % overall, and 67 % performed activities of daily living with "minimal to no difficulty". However, any difference in PROMs between the muscle and fasciocutaneous groups was not reported.[2] Tsai et al. reported post-debulking aesthetic satisfaction for all patients, but not before debulking or in patients who did not have their flap debulked. It was not possible to ascertain any differences between the muscle and fasciocutaneous groups. The authors also described a clinician reported aesthetic Likert score that showed an improvement in the appearance, contour, color, and texture of the flaps after debulking.[31] Khater et al. compared patient outcomes after 12 months post-operative follow-up. They collected individual scores for categories of flap thickness and texture match, and aesthetic satisfaction. The patients with FC flaps had a higher total score mean (9.50 ± 1.34) compared to the MS flaps (7.25 ± 1.29); however, these results were not significantly different, $p = 0.27$.[29]

Risk of bias

All included articles were assessed for risk of bias and the methodological quality with the NOS as shown in Table 2. The assessment has given a range of scores from 4 to 7 suggesting moderate to high quality methodology.

Discussion

Osteomyelitis typically causes inflammation, oedema and pus accumulation within the medullary cavity, raising intramedullary pressure and leading to blood flow stasis and thrombosis of feeding vessels. Bone devascularization with resultant destruction then leads to the formation of sequestra and cloacae, sometimes extending into adjacent joints causing septic arthritis and pain.[34] Above all, it requires adequate debridement to remove the existing infecting organisms and any necrotic nidus which may promote infection recrudescence, alongside appropriate antibiotic selection and administration.

Effective debridement often results in a soft tissue defect requiring reconstruction. Fasciocutaneous flaps are thin, pliable and offer good aesthetic outcomes and can be re-elevated if additional orthopedic procedures are required.[9,16,17,29] Muscle flaps are better suited for large dead spaces or contour deficits as they conform to the defect[14,21,31] and integrate well with debrided wounds,[35] with aesthetics improving over time. Both flap options must be considered during reconstruction following tibial osteomyelitis debridement.

Literature outcomes

A meta-analysis by Kovar et al. compared muscle flaps with fasciocutaneous flaps following debridement of lower extremity osteomyelitis. Although the fasciocutaneous group had a lower recurrence rate, this difference was not statistically significant ($p = 0.165$). There was a significant imbalance in the cohort size with 588 muscle flaps, and 163 fasciocutaneous flaps. Furthermore, many of the included studies reported outcomes for only one type of (preferred) flap, rather than comparing both within the same study and hence introducing a higher risk of patient selection bias and treatment heterogeneity.[36]

A meta-analysis of comparative studies of complications and outcomes for lower extremity free flaps performed for trauma and osteomyelitis was performed by Shimbo et al. They found no significant difference in the long-term outcomes of primary or recurrent osteomyelitis rates with 14.7 % in the muscle flap group versus 12.4 % in the fasciocutaneous flap group ($p = 0.69$). Their findings, however, suggested that fasciocutaneous flaps might be preferable to muscle flaps in minimizing partial flap necrosis and donor-site complications (7.4 % versus 12.0 %; $p = 0.007$ and 6.7 % versus 16.7 %; $p < 0.0001$ respectively).[37] In our study, we did identify a trend towards a lower incidence of osteomyelitis recurrence in the fasciocutaneous group, but this was only statistically significant in one scenario, and may have been attributable to flap selection bias as the more complex or severe cases may have received muscle flaps. We note that five of the six studies that we have included were excluded from the meta-analysis by Kovar et al.[36]

Paro et al. performed a retrospective review of the clinical outcomes between muscle and fasciocutaneous free flaps in the lower extremity following osteomyelitis or bony non-union, acute trauma and tumor resection. Subgroup analysis was not provided but overall, they noted higher complication rates in smokers ($p < 0.03$) and found that fasciocutaneous flaps allowed for earlier weight-bearing ($p < 0.03$), which supports increased postoperative mobility. However, there was a significantly higher rate of aesthetic revision surgery of 29 % in fasciocutaneous flaps compared to 8.1 % in the muscle group ($p < 0.01$).[38] In a retrospective cohort study of free tissue transfer by Huffman et al., there was no significant differences in osteomyelitis recurrence, partial flap necrosis, limb salvage or ambulatory status over a median 14.6-months follow-up in 48 patients undergoing reconstruction following staged debridement of lower limb osteomyelitis.[39] Garcia del Pozo et al. similarly reported no significant difference in the relapse rate between the two flap types in 61 patients with long bone osteomyelitis who received flap surgery.[40]

Management of tibial osteomyelitis

The management of tibial osteomyelitis has historically involved a two-stage approach, with initial debridement followed by soft tissue reconstruction.[3,41] However, contemporary practice has started to shift toward single-stage procedures, supported by modern surgical techniques and dead space management using alloplastic antibiotic loaded calcium sulphate (CS), combination CS and hydroxyapatite (HA) materials, and bioactive glass.[41,42] Despite this, recent studies indicate that a staged treatment approach is still preferred in some centers.[29,39]

Effective debridement and tailored antibiotics remain crucial for successful outcomes.[9,39] Langit et al. challenged the traditional approach of “wide tumor-like resection” for chronic osteomyelitis, which often resulted in structural instability and necessitated extensive bony reconstruction. Their study demonstrated that a multidisciplinary team (MDT) approach involving adequate debridement guided by appropriate radiological imaging, and targeted antibiotics, achieved similar outcomes to radical debridement, with 85 % resolution after the primary procedure and 90.7 % at the last follow-up (mean 29 months) in cases predominantly involving the tibia.[43]

The most commonly used F-MC and F-FC flaps in lower limb reconstruction are the latissimus dorsi flap (38.1 %) and the anterolateral thigh flap (ALT) flap (64.8 %).[44] In our analysis, the most frequently used F-MC and F-FC flaps were the latissimus dorsi (54 %), the lateral arm and scapular flaps (23 %). In the F-FC flap group, Zumiotti et al. only compared lateral arm and serratus anterior flaps which increases the weighting of this away from the ALT flap.[33] One potential reason may be that sometimes it is not possible to raise an ALT flap at the same time as the orthopedic procedure,

whereas the lateral arm free flap can be raised simultaneously. Scapular and parascapular flaps may have been used for large skin defects.

Animal studies

Animal models further support the efficacy of both muscle and fasciocutaneous flaps.

An early canine model showed that muscle flap coverage of a devascularized tibial segment was associated with significant increase in bone blood flow and osteotomy union compared with skin closure alone.[11] Musculocutaneous flaps were reported superior to random pattern and pedicled skin flaps in resisting necrosis and reducing bacterial load in the wound bed, associated with an early increase in flap blood flow.[13,35] Salgado et al. induced tibial osteomyelitis in 26 goats with *Staphylococcus aureus* and subsequently performed single stage debridement and reconstruction with either a muscle or pedicled fasciocutaneous flap, followed by 5 days of antibiotics. He found no significant difference in osteomyelitis recurrence rates ($p = 0.25$) at 1 year, suggesting that both well-vascularized muscle and fasciocutaneous flaps could be similarly effective options for tibial osteomyelitis wound coverage.[45]

Limitations

This systematic review and meta-analysis have highlighted some key findings; however, the results are constrained by inherent limitations due to the predominantly retrospective, observational, non-randomized nature of the included studies. Sample sizes across studies were relatively small, and significant heterogeneity existed between cohorts, with varying follow-up periods, antibiotic regimens, and debridement stages. Only three of the author groups have reported the Cierny-Mader grading, further reducing overall comparability. Ideally, prospective, high quality studies with more homogenous patient groups and better delineated treatment arms to mitigate bias are needed. This would certainly add to the current evidence base and determine whether fasciocutaneous flaps should be utilized more routinely for tibial osteomyelitis given their favorable aesthetic outcomes and amenability for re-exploration for secondary orthopedic procedures.

Conclusion

This focused study found that muscle and fasciocutaneous flaps offered comparable clinical outcomes following debridement and reconstruction of tibial osteomyelitis. The authors acknowledge that preoperative planning (including vascular imaging), adequate debridement and appropriate antibiotic use are key contributors to a good clinical outcome in conjunction with soft tissue reconstruction using a well vascularized flap. We advocate that flap choice should be informed by the characteristics of the defect, the need for flap-based dead space management, patient characteristics and preference. Future high quality trials are recommended to provide better evidence on the optimal flap choice in tibial osteomyelitis management.

Funding

None.

Ethical approval

Not required.

Declaration of competing interest

None declared.

Appendix A

The following search strings were used to search MEDLINE:
Osteomyelit* AND (Musculo* OR Muscle OR Myocutaneous OR Fasciocutaneous OR Flap) AND tibia
"Bone Infection" AND (Muscle OR Myocutaneous OR Fasciocutaneous OR Flap) AND tibia
Osteitis AND (Muscle OR Myocutaneous OR Fasciocutaneous OR Flap) AND tibia
Osteitis AND (Muscle OR Myocutaneous OR Fasciocutaneous) AND flap
The following search strings were used to search PubMed Central (PMC):
Osteomyelit* AND flap AND tibia
"Bone infection" AND flap AND tibia
Osteitis AND flap AND tibia
The following search string was used to search EMBASE:
Osteomyelitis AND (Musculocutaneous OR Muscle OR Myocutaneous OR Fasciocutaneous OR Flap) AND tibia {Including Related Terms}, filter language: English, filter article type: Article, filter relevance: four or more stars
NB: three stars or less were all irrelevant on scoping review
The following search string was used to search Cochrane Library: osteomyelit* flap osteitis flap "bone infection" flap

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