A survey of orthopaedic surgical management of pressure-ulcer related pelvic osteomyelitis

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BRIEF REPORT

A survey of orthopaedic surgical management of pressure-ulcer related pelvic osteomyelitis

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Pressure-ulcer related pelvic osteomyelitis is managed with little high-quality evidence. We undertook an international survey of orthopaedic surgical management, covering diagnostic parameters, multi-disciplinary input, and surgical approaches (indications, timing, wound closure, and adjunctive therapies). This identified areas of consensus and disagreement, representing a starting point for future discussion and research.

Key words: pressure ulcer; decubitus ulcer; pelvic osteomyelitis; sacral osteomyelitis

INTRODUCTION

Pressure-ulcer related pelvic osteomyelitis (POM) is a challenging condition associated with high morbidity and mortality[1,2]. Management often involves prolonged and complicated antimicrobial therapy[1,2]. Surgical management is difficult due to anatomic constraints of the pelvis, associated

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patient co-morbidities, and the risk of recurrence[1,2]. It remains a relatively under-researched condition. Wong and colleagues systematically reviewed available data from observational studies and reported several important observations[3]: (1) t neither exposed bone nor MRI findings are synonymous with histologically-confirmed osteomyelitis and (2) antimicrobial therapy may not be beneficial if surgical wound closure will not be attempted[3]. Kaka and colleagues surveyed 558 Infectious Disease (ID) physicians in North America, identifying heterogenous approaches to diagnosis and medical management of POM[4]. Around 10% of respondents identified the role, timing and type of surgery as key knowledge gaps[4]. Recognising that surgical management is a challenging and uncertain area, and the frequent interface between Orthopaedic surgeons and infection specialists in such cases, we undertook a survey of orthopaedic surgical management of this disease to complement the work by Kaka and colleagues[4]. Our findings were presented in part at The European Bone and Joint Infection Society (EBJIS) Meeting, Graz, Austria, 8–10 September 2022[5].

METHODS

An 18-question multiple-choice questionnaire was designed initially by three of the authors (CDR, JT, and RS). Through iterative feedback from remaining authors, the final version was agreed. POM was defined as "a clinical/radiological diagnosis of osteomyelitis involving the ischium, sacrum, coccyx, pubic ramus or proximal femur underlying and considered to be related to a pressure (decubitus) ulcer". Likert-type scale responses were used for questions with graded responses (*e.g.* never/fewer than half of patients/around half of patients/more than half of patients/every patient). On 23rd February 2021, the online survey (Google Forms, Alphabet, Mountain View, CA) was sent to members of the Musculoskeletal Infection Society (MSIS), the European Bone and Joint Infection Society (EBJIS), and the European Society of Clinical Microbiology and Infectious Diseases (ESCMID) Study Group for Implant-Associated Infections (ESGIAI). No incentive for participation was provided. Two follow-up electronic reminders were sent at two-week intervals. The survey closed on 13th July 2021. Statistical analyses were performed using GraphPad Prism v9.5.0 (GraphPad Software, San Diego, CA).

RESULTS

In total, 41 Orthopaedic surgeons completed the questionnaire (**Table 1**). Respondents were mostly from Europe (n=18) and the U.S.A. (n=10). Most (29/41) had between 5 and 24 years of experience in practice. The number of patients with POM treated in the last year varied from none to ≥10 . Most respondents worked in tertiary or academic hospitals.

Concerning diagnosis, a high priority was attached to bone sample microbiologic and histologic findings (**Figure 1A**). A very low priority was attached to culture-positive superficial swabs ($p<0.0001$ compared to culture-positive bone biopsy). Palpable bone was also considered a high

priority for diagnosis, but more so in the absence of periosteal covering (p=0.006 compared to palpable bone with periosteal covering present).

Receipt of multi-disciplinary input was high overall (**Figure 1B**), especially from plastic surgery during the index procedure (n=31; more than half of cases or always) and tissue viability nursing/wound care (n=29; more than half of cases or always). Input from Occupational Therapy was lower (n=26; in half of cases or less).

When identifying patients likely to benefit from surgical intervention being undertaken (**Figure 1C**), source control for sepsis (most influential parameter in 24/41), followed by abscess/collection, and then wound closure had the greatest influence. Concerning the timing of surgery when it was determined surgical intervention was to be undertaken (**Figure 1D**), most respondents favoured operating after control of acute infection and after physiological or psychological optimisation. There was variation in what was considered the minimum extent of surgical debridement. Most respondents considered this to be marginal bone debridement (dissection to bleeding bone; 28/41). However, similar numbers considered the significantly different options of soft tissue debridement (6/41) and wide local bone debridement (clearance of >5mm beyond extent of infection; 5/41) to be the minimum. One respondent answered with intra-lesional bone debridement. Urinary and faecal diversion procedures and implanted antimicrobials were used infrequently (**Figure 1E**). The most favoured wound closure technique was local or regional primary tissue transfer, rather than free flaps, but substantial variability in responses was present (**Figure 1F**).

Regarding decision-making about duration of antimicrobial therapy (**Figure 1G**), there was agreement that recurrent osteomyelitis was an indication for a longer antimicrobial course. However, there was no clear agreement on the appropriate duration if soft tissue coverage could not be achieved after debridement, or if no debridement was planned (with almost equal numbers favouring “longer” and “shorter” durations). Infection specialist input was received by 34/41 respondents in all cases, 2/41 in more than half, 3/41 in less than half, and 1/41 never. The majority of respondents received this input as a bedside consultation, and this modality was preferred compared to telephone advice (p=0.02; **Figure 1H**).

Respondents had variable experience of treating POM in the preceding year so we stratified responses based on this (**Supplementary Figure 1**) and compared responses specifically between those who had vs. had not treated patients with POM in the preceding year (Supplementary Table 1). Respondents with more experience attached less priority to MRI findings and local findings of soft tissue infection and more to palpable bone lacking periosteal covering. Such respondents were also less likely to favour surgical intervention as early as possible (instead favouring intervention after antimicrobials, optimisation and control of acute infection). Compared to respondents who had treated no patients in the preceding year (n=8), respondents who had treated patients in the last year (n=32) favoured primary wound closure with local/regional tissue transfer (19/32 vs. 1/8 responded there was a role for the technique more than half of cases or always, p=0.04).

DISCUSSION

Several consistent opinions amongst surveyed orthopaedic surgeons were identified. Preferred diagnostic approaches are bone sample microbiological and histological findings, and palpation of bone lacking a periosteal covering. Multi-disciplinary team input is frequently utilised, especially Plastic Surgery and Tissue Viability/Wound Care nurse specialists, and the benefits of this approach have been previously reported[6,7]. Source control of sepsis, drainage of abscess/collection, and obtaining wound closure are the most influential indications for surgery. Advantages of wound closure include meeting the patient's objective and to prevent recurrent infections or malignant change[2,8]. Timing of surgery was preferred following control of acute infection and physiological or psychological optimisation. Bedside input from an infection specialist was considered desirable and usually received.

Regarding diagnosis, in comparison with the recent survey of ID physicians[4], we found a similarly low priority was attached to culture-positive superficial wound swabs and high priority was attached to bone sample culture and histopathology results. Recently, a systematic review has found that a positive culture result from a bone sample is sensitive for diagnosis of POM when compared to histopathology (76-100% sensitivity), but lacks specificity (8-67%), possibly reflecting contamination during sampling[9], which is a concern with radiologically-guided sampling. It is particularly difficult to obtain uncontaminated bone samples in pelvic osteomyelitis with large open ulcers. ID physicians considered palpable bone at the ulcer base or positive probe to bone test to be strongly indicative whereas surgeons attached greater priority to palpable bone specifically lacking periosteal covering. There was disagreement on the utility of MRI. Although ranked as the 1st test to choose by 24% of ID physicians, in our survey MRI findings received a median score of 4 (interquartile range 3-5, on a scale of 1 [lowest priority] to 7 [highest]). MRI is known to have poor specificity (22%) for identifying histologically-confirmed pelvic osteomyelitis due to the confounding effect of bone remodelling[10].

Multiple questions arose from the responses regarding management strategies. Occupational Therapy and Dietetic colleagues may be under-utilised in the multi-disciplinary approach to management. Adjunctive surgical therapies are used infrequently but could be beneficial in selected cases. This may be because of concerns that temporary faecal diversion may be difficult to reverse and patients may find it difficult to regain bowel control. However, it may be useful in patients with faecal incontinence. Although local/regional soft tissue transfer was the preferred method of wound closure there was a wide range of responses which differed by experience of the respondent.

Data support a shorter post-operative antimicrobial course (5-7 days) if flap coverage has been achieved and indicate no benefit from antimicrobial treatment if coverage is not to be attempted[3,11]. However, there was substantial heterogeneity regarding the impact of surgical intervention on antimicrobial duration in our survey (Figure 1G). In the survey of ID physicians by Kaka and colleagues[4], duration of antimicrobial therapy was stratified by extent of debridement (full vs. no

(or partial) debridement) but wound closure was not specified. Responses to this question indicated some ID physicians recommend a longer antimicrobial course if no/partial debridement is undertaken compared to full debridement, contrary to data indicating lack of benefit in this scenario[3]. Combined with our survey findings this indicates an opportunity to improve stewardship practices exists when debridement and wound closure are not to be undertaken. Orthopaedic surgeons are likely to follow guidance from infection specialists regarding duration so it is noteworthy that in another area of orthopaedic infection (fracture-related infection) antimicrobial regimes have been reported to follow published guidelines in only 25% of cases in one series[12].

A significant limitation of this work is the number of respondents. Although this likely reflects the limited interest in this condition from a surgical perspective, it also indicates a risk of selection bias. This is a complex disease and a pragmatic survey cannot capture the multitude of factors that will influence decision making about surgical management. We did not stratify by cause of pressure ulceration *(e.g.* spinal cord injury or multiple sclerosis), nor extent of sensory loss. Future work could be to seek the opinions of other surgical specialties that manage this condition, such as Plastic surgery.

In summary, this international survey of Orthopaedic surgical management of POM has identified areas of consensus and disagreement, both within orthopaedic respondents and when compared to a recent survey of ID physicians. This represents a starting point for future discussion about management approaches, and for formulating clinical trial questions to ultimately inform guidelines for management.

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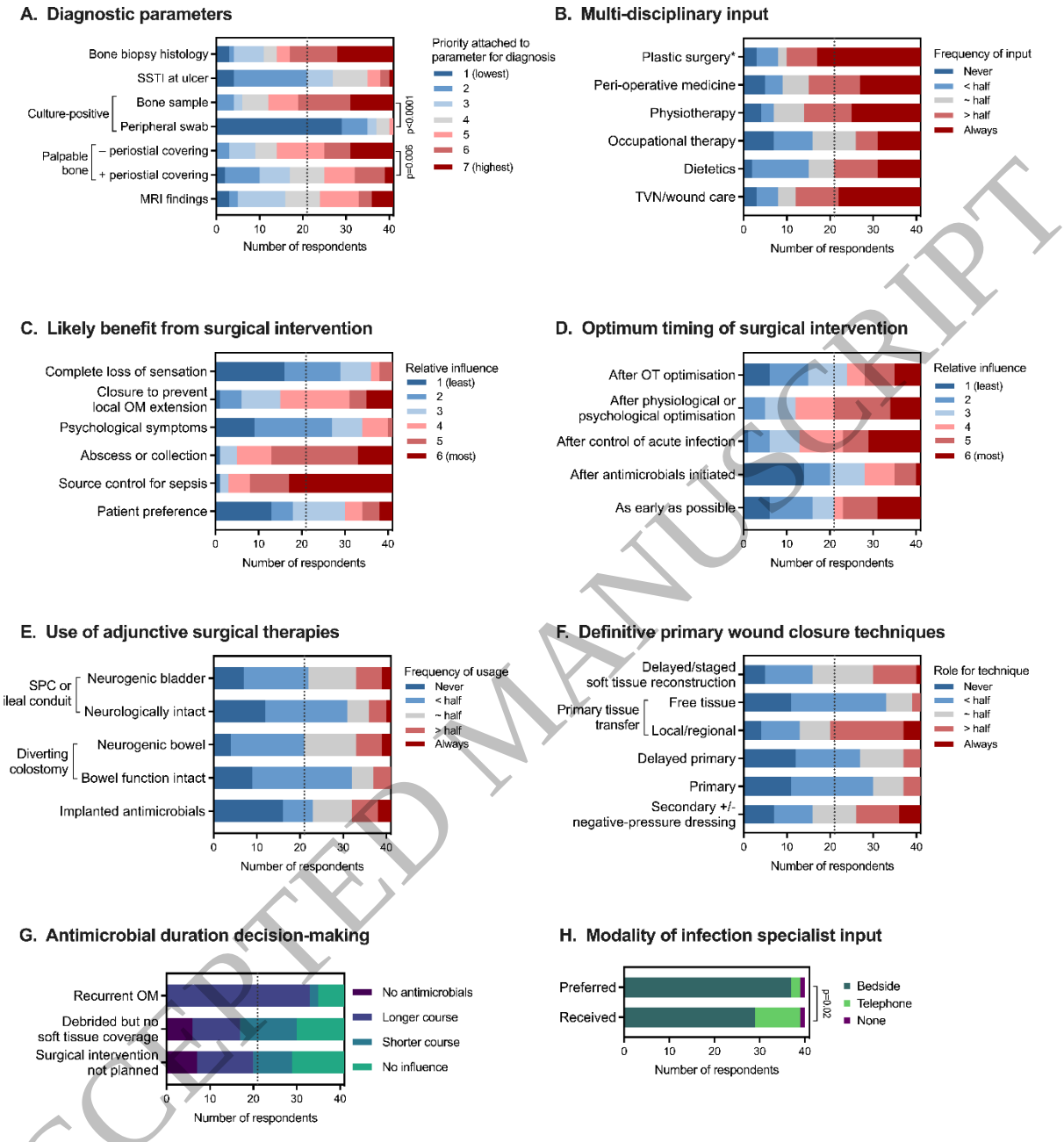
Table 1: Respondent characteristics

Characteristic	N
Years practicing Orthopaedic surgery	
<5	5
5–14	13
15–24	16
≥25	7
Number of patients with POM treated in last year	

None	8
1–5	13
6–10	8
≥10	11
Missing	1
Geographic location	
Europe (exc. UK)	18
USA	10
UK	4
Other	9
Type of hospital	
Outwith USA	
Tertiary	26
Secondary	2
Private	2
USA	
Academic	8
City/County	2

Figure 1: Questionnaire responses

(A) "What relative degree of priority do you attach to the following parameters when diagnosing pressure-ulcer related pelvic osteomyelitis?" Comparisons made by Mann-Whitney test. **(B)** "How often do you receive input from the following specialities in the management of patients with pressure-ulcer related pelvic osteomyelitis?" *"How often do you obtain surgical input from a Plastic Surgeon during the index procedure?" **(C)** "Rank the relative influence of each variable on identifying which patients are likely to benefit from surgical intervention" (respondents could assign the same rank to multiple variables). **(D)** "Rank the relative influence of each variable on the optimum timing of surgical intervention" (respondents could assign the same rank to multiple variables). **(E)** "How often do you use the following adjunctive surgical therapies?" **(F)** "Select whether there is a role for the following primary definitive surgical wound management techniques." **(G)** "What antimicrobial approach would you use in the following scenarios?" "Longer" is >2 weeks, "shorter" is 2 weeks or less. **(H)** "Which modality of infection specialist input do you most commonly receive?" "Which modality of infection specialist input would you prefer to receive?" Responses compared by Fisher's exact test (telephone vs. bedside).
Vertical dotted lines mark n=21 on the x-axis.
The denominator is n=41 responses for all panels apart from panel H where n=40.



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