Staphylococcal pyomyositis in a temperate region: epidemiology and modern management

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ABSTRACT

Objectives: To describe all cases of staphylococcal pyomyositis in the Geelong region of Victoria over 110 months, to estimate the incidence of this disease, and to describe the clinical outcomes and identify any predisposing factors.

Design, participants and setting: A prospective case series identified by clinical features (local pain and fever) and magnetic resonance imaging (MRI) findings (hyperintense signal on T2-weighted scan), among patients presenting to Geelong Hospital, Victoria between 1 April 1998 and 1 June 2007.

Main outcome measures: Estimation of incidence, clinical course and identification of predisposing factors.

Results: We estimate an annual incidence of 0.5 cases per 100 000 person-years, and propose a recent history of vigorous exercise (six of 11 patients) and underlying skin condition (five of 11 patients) as possible predisposing factors. MRI showed eight patients had osteomyelitis and one had septic arthritis. All patients had bacteraemia and one had mitral valve endocarditis. The duration of intravenous antibiotic therapy varied between 4 and 12 weeks, and all patients were completely cured.

Conclusion: Pyomyositis should be considered in patients presenting with local pain, fever, muscle tenderness, and a recent history of vigorous exercise or underlying skin condition. MRI may guide non-surgical management.

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Pyomyositis is a primary acute bacterial infection of the large skeletal muscles, associated with abscess formation. Generally more common in tropical regions, pyomyositis also occurs in temperate regions, although its incidence there has not been determined. Mortality of up to 10% in temperate regions has been reported.[1] A review of 100 North American cases over 20 years indicated some of the epidemiological differences between temperate and tropical pyomyositis.[2] Predisposing conditions included: a recent history of trauma (in up to 63% of cases),[2] recent skin infection,[2] diabetes mellitus,[3] HIV infection,[4] injecting drug use[5] and other types of immunosuppression.[6] Bacteraemia has been reported in up to 31% of cases.[2] Importantly, magnetic resonance imaging (MRI) aids early diagnosis and enables identification of patients suitable for percutaneous drainage.[7-9]

With the increase in the number of strains of community-associated methicillin-resistant *Staphylococcus aureus* (MRSA) and in the number of Panton–Valentine leukocidin (PVL) secreting strains of methicillin-sensitive *S. aureus* (MSSA) in our community, early detection of and appropriate therapy for pyomyositis will be important. In temperate-climate disease, clinical features on presentation include pain, fever, limitation of movement of the affected area and associated leukocytosis. Management has comprised intravenous antibiotics with drainage of any abscess, either under radiological guidance or by open procedure. Outcomes in most large series of people with pyomyositis were complete cure, with minimal residual symptoms.[1]

In this study, we set out to identify the incidence and outcome of, and predisposing factors for, staphylococcal pyomyositis in a region of south-eastern Australia.

METHODS

The study was carried out in Geelong, a provincial centre in Victoria with a stable population of about 240 000, served by a 450-bed teaching hospital in a clearly defined region known as the Barwon Statistical Division. All infectious diseases referrals for the region were handled through the Department of Infectious Diseases based at Geelong Hospital. Ethical approval was not sought as this was part of a hospital-wide *S. aureus* bacteraemia audit.

Cases of pyomyositis were defined by a clinical presentation of localised pain, swelling, restriction of movement and fever of 38°C or higher, and a hyperintense signal on T2-weighted MRI. Blood culture results and other microbiological criteria were not used for the case definition.

We assessed cases of pyomyositis in patients presenting for admission between 1 April 1998 and 1 June 2007 (110 months) prospectively using an Epi Info database (version 501b; Centers for Disease Control, Atlanta, Ga, USA), established in 1994 and, later, an infectious diseases database in Microsoft Access (Microsoft Corporation, Redmond, Wash, USA), established in 2000. Additional clinical information was obtained through detailed retrospective chart review.

After discharge, all patients were assessed and followed up prospectively by the infectious diseases physicians for an average of 75 days.

Blood cultures were incubated in a BACTEC 9120 series continuous monitoring blood culturing instrument (Becton-Dickinson Microbiology Systems, Sparks, Md, USA) and isolates were identified by the MicroScan WalkAway 96 system (Dade Behring Sacramento, Calif, USA). Antibiotic susceptibility testing was tested by MicroScan automated broth dilution or by the Calibrated Dichotomous Sensitivity (CDS) disc diffusion method.[10]

Incidence rates for pyomyositis were calculated within the Barwon Statistical Division and quoted per 100 000 person-years. Age and sex proportions were also standardised to the Australian population.[11]

RESULTS

We identified 11 cases of staphylococcal pyomyositis in our temperate region over the 110 months. We estimate an incidence in this region of 0.5 cases of pyomyositis per 100 000 person-years (this assumes that all cases were referred to the infectious diseases service of Geelong Hospital during the study period).

Patients of all ages were affected, and five of our 11 patients (45%) were aged 16 years or younger (range, 6–65 years). Eight of the 11 patients were male (the male-to-female ratio reported in the literature varies between 1:1.5 and 3:1).[12] Five patients had an underlying skin disease, and six had engaged in recent vigorous exercise. None of

1 Summary of clinical course and outcome of 11 patients with staphylococcal pyomyositis* in Geelong over 110 months

Patient	Imaging	Intervention	Duration of treatment	Antibiotic therapy	Complications†	Outcome	Follow-up period‡
1	CT, MRI	Ultrasound-guided percutaneous drainage	12 weeks IV 12 weeks oral	Flx/Cfz (IV), Diclox (oral)	Osteomyelitis: right sacroiliac joint	No clinical evidence of disease	102 days
2	MRI	None	6 weeks IV 12 weeks oral	Cfz (IV), Diclox (oral)	Osteomyelitis: pubic bones	No clinical evidence of disease	126 days
3	CT, MRI	CT-guided percutaneous drainage	16 days IV 2 weeks oral	Cfz (IV), Diclox (oral)	None	No clinical evidence of disease	48 days
4	MRI	None	4 weeks IV 12 weeks oral	Cfz (IV), Flx (oral)	None	No clinical evidence of disease	92 days
5	MRI	None	11 days IV 14 days oral	Cfz (IV), Flx (oral)	Osteomyelitis: left ischial tuberosity and acetabulum	No clinical evidence of disease	30 days
6	MR	None	6 weeks IV 2 weeks oral	Flx/Cfz (IV), Flx (oral)	Osteomyelitis: left sacroiliac joint	No clinical evidence of disease	40 days
7	MRI	None	6 weeks IV 12 weeks oral	Cfz (IV), Diclox (oral)	Osteomyelitis: femoral§	No clinical evidence of disease	91 days
8	MRI	None	4 weeks IV	Flx/Cfz	Osteomyelitis: right superior ramus of pubis	No clinical evidence of disease	50 days
9	MRI	None	6 weeks IV	Flx	Osteomyelitis: left T8 costotransverse joint	No clinical evidence of disease	76 days
10	MRI	None	5 weeks IV	Benzylpenicillin	Osteomyelitis: left ischial tuberosity	No clinical evidence of disease	100 days
11	MRI	None	6 weeks IV	Cfz	Septic arthritis: pubic symphysis	No clinical evidence of disease	68 days

CT = computed tomography. MRI = magnetic resonance imaging. IV = intravenous. Flx = flucloxacillin. Cfz = cephazolin. Diclox = dicloxacillin.
* All patients had bacteraemia and methicillin-sensitive *Staphylococcus aureus* was isolated in each case. † Based on magnetic resonance imaging findings.
‡ Defined as days from diagnosis. § Patient had coexistent mitral valve endocarditis. ◆

the 11 patients had a history of intravenous drug use, type 2 diabetes or recent trauma. Two patients required computed tomography-guided or ultrasound-guided aspiration of collections, and all patients were completely cured (Box 1).

DISCUSSION

The detailed pathogenesis of staphylococcal pyomyositis is not known. In 1904, it was shown that pyomyositis could only occur in *S. aureus*-inoculated animal muscles that had been initially traumatised by electric shock, pinching or ischaemia,[13] suggesting the role of initial trauma in the pathogenesis. Vigorous muscle activity, such as in competitive sport, also appears to have a role in pyomyositis,[14] and had been undertaken by six of the 11 patients in our series. It is postulated that initial muscle trauma followed by a breach in the skin or mucosa, leading to bacteraemia and ultimately infection of the traumatised muscle, is the pathogenesis.[13] Interestingly, none of the patients in our series had a history of trauma. Five patients had an underlying skin disease (three had active dermatitis, one had paronychia and one had eczema) providing a possible portal of entry for the organism. Tropical pyomyositis studies report coexisting pyoderma in 55%–72% of cases.[15]

All 11 patients in our study presented with severe local pain and restriction of movement, and a fever of 38°C or above, compared with another study reporting only 59% of patients with a temperature of over 38°C at presentation.[2]

All 11 patients had bacteraemia, with eight having osteomyelitis, one having septic arthritis and one having mitral valve endocarditis as complications. It is unclear whether the bacteraemia precedes or is a result of the pyomyositis. All patients recovered completely with no residual signs of disease, which we hypothesise may have been the result of early detection and institution of appropriate antibiotic therapy.

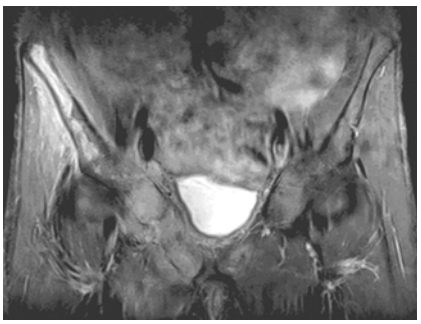
Duration of intravenous therapy varied between 11 days and 12 weeks. Six patients received cephazolin treatment initially while they were inpatients and subsequently through hospital-in-the-home services; one patient received flucloxacillin for inpatient treatment only; three patients received flucloxacillin initially as inpatients and then received cephazolin on discharge to hospital-in-the-home, and one patient received inpatient benzylpenicillin for a penicillin-susceptible strain of *S. aureus*.

We did not perform PVL testing, but this may become important with increasing rates of community-associated MRSA and PVL-positive MSSA being reported, and is a possible subject for further research.[16]

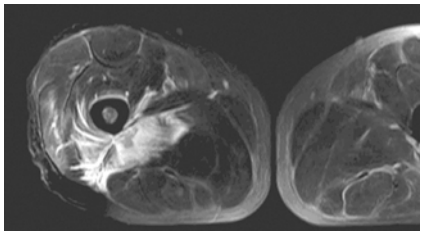
Diabetes mellitus is an important risk factor for the development of pyomyositis, with an increased rate of skin colonisation by *S. aureus* in patients with diabetes compared with control patients without diabetes.[17] None of the patients in our series had elevated fasting plasma glucose levels, which may have contributed to their favourable outcomes. None of our patients had any risk factors for HIV,[4] and therefore formal testing was not performed. Pyomyositis has also been associated with injecting drug use,[5] malignancy[2] and autoimmune disease[6], none of which were reported by patients in our series.

MRI helped in making the diagnosis and delineating the extent of the muscle involvement in all patients, as (see Box 2) the high signal intensity of the pathological process (prolonged T2) can be easily distinguished from the relatively low signal intensity of normal muscle (shortened T2). The superiority of MRI for differentiating pyomyositis from other pathological processes, outlining the extent of involvement and localising fluid collections, has been previously reported.[8]

2 Magnetic resonance imaging (MRI) scans showing pyomyositis



Coronal post-gadolinium enhanced T1-weighted MRI scan showing diffuse contrast enhancement of the musculature adjacent to the right iliac wing suggestive of pyomyositis, and enhancement of the iliac wing consistent with contiguous osteomyelitis.



Axial fat saturation T2-weighted MRI showing hyperintensity within the vastus medialis and the lateral portion of adductor magnus, consistent with pyomyositis. ◆

The ability of MRI to obtain multiplanar contiguous sections provides excellent anatomical detail of each muscle group and precisely locates the site of disease. MRI scans in 43 cases of pyomyositis found that hyperintense signals on T2-weighted images were detected in all patients.[18] A hyperintense rim on unenhanced T1-weighted images and peripheral enhancement after gadolinium injection was useful for identifying the number, size and location of soft tissue abscesses.[18]

With an estimated annual incidence in Australia of 0.5 cases per 100 000 person-years, we suggest that pyomyositis should be considered in any patient presenting with localised pain, fever and muscle tenderness. We found that the established predisposing factors, recent vigorous exercise or an underlying skin condition may assist in the diagnosis of pyomyositis, as may investigation by MRI. We also found that with early, appropriate antibiotic therapy, complete cure can be achieved.

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COMPETING INTERESTS

None identified.

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