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Case Report

Escherichia coli – Marauding masquerading microbe Amy Lee B.Med^{a,*}, Patrick Coleman M.B., M.R.C.P.I., F.R.A.C.P.^b^a Orthopaedic Registrar, Manly Hospital, NSW, Australia^b VMO Physician Specialist in Nephrology & Hypertension, Manly Hospital, NSW, Australia

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ABSTRACT

Background: *Escherichia coli* is a rare cause of monoarticular septic arthritis, but is an even rarer cause of polyarticular septic arthritis.

Case description: We report an unusual case of polyarticular septic arthritis with an atypical presentation caused by *E. coli*, the source of which was a left pyelonephritis. Our patient developed *E. coli* sepsis resulting in polyarticular septic arthritis (PASA) in the absence of typical risk factors except for pre-existing osteoarthritis. The joints involved were the hip, ankle, sternoclavicular and L5/S1 joints. Of interest, ankle pain was not reported or evident until correlated with nuclear medicine scans. Furthermore, sternoclavicular joint involvement presented as left shoulder pain, resulting in an initial misdiagnosis of left shoulder septic arthritis. The patient was treated with surgical washout and antibiotic therapy. He was subsequently discharged from rehabilitation having returned to his baseline level of mobility. Future consideration will be given to total hip arthroplasty.

Literature review: There are no reported cases of *E. coli* PASA involving more than three joints in the absence of any recognized risk factors for septic arthritis.

Purpose and clinical relevance: Asymptomatic involvement of joints can occur in polyarticular septic arthritis and should be considered in all cases of monoarticular septic arthritis (MASA). We believe that clinical suspicion is the key to early and comprehensive diagnosis of polyarticular septic arthritis particularly when presenting in an atypical fashion with an atypical pathogen. Strong consideration should be given to performing nuclear imaging in cases of monoarticular septic arthritis where polyarticular involvement cannot be definitively ruled out.

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1. Introduction

Escherichia coli is a rare cause of monoarticular septic arthritis, with most presentations caused by *Staphylococcus aureus*. In polyarticular septic arthritis, *E. coli* is an even rarer cause with poor prognosis, especially in the elderly where diagnosis and treatment is often delayed due to pre-morbid medical conditions and the nature of the presentation.

We identified two hundred and thirteen reported cases of PASA, of which twenty-five were from the same center aggregated over a thirteen year period.¹ Fifty of these cases were caused by gram-negative bacilli however in only five of these was *E. coli* isolated.^{2,3,8} Recognized risk factors for septic arthritis were identified in all five cases and all cases involved three or less joints. Blood cultures were not always positive, and surgical intervention was not always

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Fig. 1 – A whole body bone scan of the patient highlighting increased activity and uptake at the neck, left sternoclavicular joint, shoulders, lumbar spine, hips and ankles.

undertaken. The majority of presentations were diagnosed on the clinical purulent appearance of a joint aspirate. This is the first case of *E. coli* sepsis resulting in PASA involving more than three joints to be reported. It is remarkable due to the absence of any recognized risk factors for septic arthritis. Also, the joints involved (hip, ankle, sternoclavicular joint, L5/S1 joint) are not commonly implicated. Of interest, ankle pain was not reported or evident until correlated with nuclear medicine scans. Furthermore,

sternoclavicular joint involvement presented as left shoulder pain, resulting in an initial misdiagnosis of left shoulder septic arthritis.

Nuclear medicine scans are crucial in the diagnosis of foci of infections in these instances. Our case demonstrates that clinical suspicion, confirmed with nuclear imaging, is critical to early diagnosis and successful treatment of atypical presentations of PASA to minimize the potential associated morbidity and mortality.

Fig. 2 – A fusion CT-Gallium whole body scan of the patient showing increased areas of gallium uptake at the a) neck, b) left sternoclavicular joint, c) left hip, d) first sacral vertebral body, e) fifth lumbar vertebral body and e) left kidney.

2. Case report

A 75-year-old man with a history of severe bilateral arthritis of the hips, knees, ankles and lower back, self-referred to the Emergency Department because of increasing pain in his left hip and left shoulder that impeded his mobility. He reported a 72 h history of non-specific malaise, anorexia and diarrhea, which he attributed to a restaurant meal three days prior. He had suffered no trauma or falls to account for his pain. He reported self-limiting intermittent dysuria 2–3 weeks preceding his presentation. No other significant recent or past clinical history was elicited. His regular medications consisted of fish oil, glucosamine and acetaminophen as required. Premorbidly, the patient lived alone and, though he mobilized with two walking sticks, he was fully functionally independent and drove his car daily.

Physical examination revealed a confused man with a flushed facies. His pulse, blood pressure, respiratory rate and temperature were 107 beats per minute, 107/57 mmHg, 20 respirations per minute and 39.2 °C respectively. He had decreased range of movement in both hips but his left hip was clinically irritable. The remainder of the examination was unremarkable. X-rays of the pelvis and hips showed severe bilateral osteoarthritis with no evidence of joint effusion. Initial blood work revealed a C-reactive protein of 300 mg/L; a white cell count of $15.2 \times 10^9/L$; a platelet count of $79 \times 10^9/L$; and a serum creatinine of 135 $\mu\text{mol/L}$. Parenteral gentamicin and piperacillin/tazobactam were administered after a mid-stream urine (MSU) and blood for culture were obtained.

In light of ongoing left hip pain, worsening left shoulder pain and persistent fevers, the patient was brought to the operating room one day after admission. An arthroscopic washout of the patient's left shoulder was performed. Minimal fluid was aspirated, with a negative Gram stain and no organisms grown. Open washout of the left hip revealed turbid low viscosity fluid from which *E. coli* was

cultured. This was sensitive to ampicillin, amoxicillin/clavulanic acid, gentamicin and ceftriaxone. The MSU subsequently grew *E. coli* with identical antibiotic sensitivities.

A CT scan of abdomen and sequential bone-gallium scan (Figs. 1 and 2) were performed. The patient was treated with parenteral piperacillin/tazobactam for 12 days followed by parenteral ceftriaxone for 22 days and subsequently, oral amoxicillin/clavulanic acid for six weeks. He was discharged home on day 47 of his admission, having spent 27 days on the rehabilitation ward. Orthopaedic follow-up for consideration of total hip arthroplasty was arranged.

3. Discussion

Septic arthritis, whether MASA or PASA, is an uncommon condition with potentially devastating sequelae. *S. aureus* is by far the most common organism implicated in cases of non-gonococcal septic arthritis.^{1,9} Though *E. coli* septic arthritis is rare, it is the most common organism isolated in cases of Gram-negative septic arthritis. There is little published literature clarifying whether this relates to MASA, PASA or combined incidences.⁴ Extra-intestinal sites of *E. coli* sepsis are varied but tend to cause more serious disease, even in non-compromised or non-immunosuppressed patients.³ As one would expect, the presence of diabetes, leukemia, cirrhosis, cancer, intravenous substance abuse, renal disease or immunosuppression increases the risk of septic arthritis.⁹ Aside from premorbid medical conditions such as degenerative joint disease, rheumatoid arthritis and corticosteroid therapy, age greater than 60 years and recent bacteremia are additional risk factors for developing septic arthritis. Poor prognostic signs include positive blood cultures and symptoms lasting more than twenty days.⁴ Of interest, and for reasons, which are poorly understood, the sternoclavicular joint appears to be peculiarly susceptible to Gram-negative anaerobic bacilli.¹⁰

Table 1 – Characteristics of PASA by decade of publication.

Characteristic	Before 1960	1961–1970	1971–1980	1981–1990	1991 – Present
Number	20	42	58	64	33
Age	47.9	58.6	53.9	50.5	60.6
Number of joints involved	4.25	3.33	3.02	3.97	3.81
Organism					
<i>S. aureus</i>	14	20	21	14	20
<i>E. coli</i>					5
Other gram negative bacilli	2	8	19	21	1
Others	1	8	14	27	4
Underlying disease					
Rheumatoid arthritis	14	21	27	18	13
Diabetes mellitus	0	5	5	7	2
Steroid therapy	4	13	17	14	14
Systemic lupus erythematosus	0	2	6	8	1
Surgical intervention	8/20	16/35	23/17	27/51	15/26
Imaging used		10 documented up to 1976			7
Positive blood cultures	9/14	19/27	28/36	43/52	19/26
Fatal cases	7/20	14/42	15/54	18/63	8/29

MASA has a particularly poor prognosis in the elderly due to pre-existing co-morbidities, delayed presentations and decreased natural immunity.¹ PASA has a poor prognosis regardless of age due to increased bacterial load and the fact it is usually associated with multiple co-morbidities. This accounts for a death rate of approximately 30%.^{1,2} PASA is an uncommon entity, with only a few single-digit case series in the published literature. The exception is the series of 25 cases reported by Dubost et al accrued over a 12-year period.¹ The average age at presentation was 62 years and the mean number of affected joints was four. In PASA, the most commonly affected joints in order of incidence were the knees, elbows, and shoulders whereas MASA usually affected the knees, hips and shoulders. PASA commonly presents with concurrent rheumatic disease, usually rheumatoid arthritis. This combination carries a significantly higher mortality rate in the context of typically chronic advanced joint destruction coupled with corticosteroid therapy.¹ Dubost outlined an increasing incidence of PASA by decade since before 1960, a decreasing trend of *S. aureus* as the causative organism, an association with pre-existing rheumatoid arthritis and a steady increase in cases caused by Gram-negative bacilli observed over the past fifty years.¹ In the past two decades, there have been four reported cases of *E. coli* PASA but, unlike our patient, all four cases had positive risk factors for septic arthritis.^{2,3,8} Despite these trends over time (Table 1), cases requiring surgical treatment and mortality rates have remained constant.¹

Early diagnosis remains paramount in achieving optimal outcomes for presentations of PASA, especially in the elderly. In many instances, blood cultures and even joint aspirate cultures remain negative despite clinical evidence of septic arthritis. In all cases, antibiotic therapy was commenced, regardless of whether a causative organism was found.^{1–10} The timing and decision to surgically intervene appears variable^{1–10} with no adherence to any clearly defined guidelines. Although clinical appearance of joint fluid appears to be the most widely accepted standard for diagnosis of septic arthritis,^{1–10} attempting this is difficult in PASA with multiple joints involved that may not be painful. Nuclear medicine scans are crucial in the diagnosis of foci of infections in these instances. Our case demonstrates that clinical suspicion, confirmed with nuclear imaging, is critical to early diagnosis and successful treatment of atypical presentations of PASA to minimize the potential associated morbidity and mortality.

Conflicts of interest

No benefits in any form have been received or will be received from a commercial party related directly or indirectly to the subject of this article.

Ethical approval

Each author certifies that his institution approved the reporting of this case and that all investigations were conducted in conformity with ethical principles of research.

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