CASE REPORT

Salmonella newport causing osteomyelitis in a patient with diabetesNatasha Weston,¹ Ed Moran²¹The Heart of England NHS Trust, Birmingham, UK²Department of Infectious Diseases and Tropical Medicine, Birmingham Heartlands Hospital, Heart of England NHS Hospital Trust, Birmingham, UK**Correspondence to**Dr Natasha Weston,
n.weston@nhs.net

Accepted 31 October 2015

SUMMARY

Salmonella is a foodborne pathogen that commonly causes intestinal symptoms. Bacteraemia and extraintestinal infections have been documented within the literature, and are more frequently associated with immunodeficiency and general debilitation. We discuss the case of a previously well 36-year-old man who presented with a septic knee and new-onset diabetes. Imaging confirmed osteomyelitis and a Brodie's abscess, with blood and tissue cultures revealing the isolate *Salmonella enterica newport*. He denied any previous gastrointestinal symptoms, recent travel, change in usual dietary habit or symptoms of diabetes. So far there have only been three reported cases of *S. newport* causing osteomyelitis. We discuss the incidence of *Salmonella* infections, including extraintestinal symptoms, its relation to immunodeficiency and the disease burden of *S. newport*.

BACKGROUND

Salmonellosis is one of the most common and widely distributed foodborne diseases, with significant morbidity, and is a notifiable disease. A small proportion of patients may experience bacteraemia and, of these, a minority will experience localised infections. As a result, the incidence of osteomyelitis varies, but has been reported to be <1% of total *Salmonella* cases. The incidence of septic arthritis is estimated to be even lower. Patients will present with pain and swelling of the joint, and as plain radiographs are of limited use, an element of clinical suspicion must be maintained to make the diagnosis. Blood cultures are positive in 71% of patients with *Salmonella* osteomyelitis, and are therefore useful in aiding the diagnosis.

Salmonella newport is well known to cause severe septicaemia and enterocolitis in animals, but is rarely transmitted to humans. If human infection does occur, typically it is a mild, localised disease.

CASE PRESENTATION

A 36-year-old man presented to accident and emergency with a 2-day history of left knee pain associated with fevers. The pain started when he had been using a cross trainer at the gym. The pain was more pronounced with movement, but present also at rest. He had no other associated symptoms. He was otherwise well and had no medical history. He did not take any regular medication. There was no history of recent travel or recent viral/gastrointestinal infections.

Physical examination revealed a fever of 38°C, his observations were otherwise within normal

parameters (heart rate 65 bpm, blood pressure 125/80 mm Hg, respiration rate 16 breaths/min, saturating 99% on air). Examination of his left knee revealed a swollen, red, hot, tender joint with an effusion. The remainder of the examination was unremarkable.

INVESTIGATIONS

The patient's blood tests showed: white cell count $17.93 \times 10^9/L$, neutrophils $15.21 \times 10^9/L$ and C reactive protein 264 mg/L. His platelet count, urea and electrolytes, and liver function tests, were normal. His capillary blood glucose was 18 mmol/L and serum ketones 3.1 mmol. Venous blood gas was normal and he was not acidotic. His glycated haemoglobin was 119 mmol/mol (13.1%).

X-ray of the knee (figure 1) revealed a marked joint effusion within the suprapatellar bursa. There was also a large well-defined area of lucency within the proximal tibia, the most proximal abutting the articular surface. No area of cortical destruction was identified. An MRI of this joint confirmed a Brodie's abscess with evidence of surrounding osteomyelitis (figures 2 and 3).

DIFFERENTIAL DIAGNOSIS

1. Septic arthritis with associated osteomyelitis.
2. Hyperglycaemia due to new-onset diabetes.

Figure 1 Left knee plain X-ray showing a Brodie's abscess.

CrossMark

To cite: Weston N, Moran E. *BMJ Case Rep* Published online: [please include Day Month Year] doi:10.1136/bcr-2015-212330

Figure 2 Left knee MRI T2-short τ inversion recoveries sequence imaging (transverse plane) showing a Brodie's abscess.

TREATMENT

Knee aspiration and blood cultures were taken. The patient was started on intravenous antibiotics. Flucloxacillin and benzylpenicillin were chosen in line with local protocol. He received intravenous fluids and short-acting subcutaneous insulin (NovoRapid) to treat his hyperglycaemia. He was booked for a knee arthroscopy washout and proximal tibia debridement.

Microbiology confirmed a Gram-negative rod, which was later revealed to be a non-typhoid *Salmonella* spp (*S. newport*). This bacteria grew from blood cultures, pus, knee aspirate and tibia tissue samples. His antibiotics were rationalised to intravenous amoxicillin 2 g once the species and its sensitivities were identified.

He returned to theatre 48 h later for a knee washout as there was still discharge from the wound. Despite this, he continued to have evidence of severe infection, requiring a third operation 6 days later for another proximal tibia debridement. During admission, he also developed diabetic ketoacidosis (DKA) due to

late administration of insulin on the ward. He therefore required treatment via the DKA protocol.

He was discharged home to continue a total of 8 weeks intravenous antibiotics and to complete a further 3-month oral course. He received education about his diabetes and how to use insulin. He was advised not to weight-bear on his left knee for 6 weeks.

OUTCOME AND FOLLOW-UP

The patient made good improvement and tolerated the antibiotics well. His insulin was slowly weaned and he was reviewed by the endocrinology team for management of his diabetes.

DISCUSSION

Salmonellosis is one of the most common and widely distributed foodborne diseases, with tens of millions of human cases worldwide per year, and an estimated 39 000–303, 000 deaths worldwide per year.^{1 2}

Salmonella is a Gram-negative, rod-shaped, non-spore forming anaerobic bacteria.³ There are two species of *Salmonella*: *Salmonella enterica*, which contains six subspecies, and *S. bongori*.³ The enterica subspecies can further be categorised into over 2500 serotypes (serovars).³ The most common *Salmonella* spp isolated in the UK are: *S. enteritidis*, *S. typhimurium* and the typhoidal *Salmonella* spp (of which *S. typhi* and *S. paratyphi* account for just 2–5% of annual isolates; table 1).

Non-typhoidal *Salmonella* sp can be acquired from multiple animal reservoirs, and transmission is usually via consumption of undercooked meat, eggs or vegetables contaminated by animal waste.^{1 3} Onset of symptoms occur 6–72 h after infection and typically last 2–7 days.¹ Most often, patients experience symptoms of gastroenteritis and fever. Eight per cent of patients may experience bacteraemia and, of these, 5–10% will experience localised infections.³ Extraintestinal manifestations include infection of the central nervous system, pulmonary, musculoskeletal, urinary and reproductive systems.⁴

Patients who are immunodeficient have a higher risk of bacteraemia and subsequent localised infections.³

Figure 3 Left knee MRI T2-short τ inversion recoveries sequence imaging (sagittal plane) showing a Brodie's abscess.

Table 1

<i>Salmonella</i> by serotype					
Year	<i>S. enteritidis</i>	<i>S. typhimurium</i>	Typhoidal <i>Salmonella</i> spp	Other serotypes	Total <i>Salmonella</i> spp
2000	8616	2688	331	3798	15 435
2001	10 913	2129	433	3688	17 163
2002	9962	1945	309	3277	15 493
2003	10 095	2087	409	3273	15 864
2004	8990	1450	443	3763	14 648
2005	7046	1643	472	3714	12 875
2006	7319	1511	546	4022	13 398
2007	6467	1530	525	4107	12 629
2008	4361	1923	581	4038	10 903
2009	3978	1920	481	3577	9956
2010	2444	1959	569	4161	9133
2011	2582	2150	571	3824	9127
2012	2169	1902	430	3854	8355

Public Health England. Research and analysis: *Salmonella* by serotype 2000–2010. Published December 2010. <https://www.gov.uk/government/publications/salmonella-by-serotype> (accessed 6 June 2015).

Haemoglobinopathies such as sickle cell disease, malignancy, HIV, the use of immunosuppressants, interleukin deficiencies and diabetes, have all been associated with increased incidence and severity of *Salmonella* infections.^{5–7} Of particular note for this case, 28% of patients with focal *Salmonella* infections have concurrent diabetes.⁵

The incidence of osteomyelitis as a result of *Salmonella* varies, but has been reported to be <1% of total *Salmonella* cases.^{5 8 9} The incidence of septic arthritis is estimated to be even lower, at <0.1–0.2%.^{7 8} The most commonly responsible species are: *S. enteritidis*, *S. typhimurium* and *S. typhi*.^{5 7} Patients will present with pain and swelling of the joint, and as plain radiographs are of limited use, an element of clinical suspicion must be maintained to make the diagnosis. Blood cultures have been shown to be positive in 71% of patients with *Salmonella* osteomyelitis,⁵ and are therefore useful in aiding the diagnosis.

There have only been three case reports of *S. newport* causing osteomyelitis.^{5 9 10} In one of these case reports, the patient was also discovered to have a new diagnosis of diabetes.⁵ *S. newport* is well known to cause severe septicaemia in animals (cattle, turkeys, horses), but is rarely transmitted to humans.⁸ If human infection does occur, typically it is a mild, localised disease.^{6 8} The incidence of *S. newport* has been increasing, and there have also been reports of multiple drug-resistant cases in Canada.^{7 8}

Learning points

- ▶ High clinical suspicion is needed to diagnose septic arthritis.
- ▶ Blood and tissue cultures are paramount in isolating the organism and allowing targeted antibiotic therapy.
- ▶ Osteomyelitis is often a surgical disease requiring debridement; simple washout and antibiotics may not suffice.
- ▶ Immunodeficiency increases the risk of atypical infections.

We may, therefore, see more cases of *S. newport* causing systemic disease in the future.

In this case, the source of the organism was not identified, and the patient denied any recent gastrointestinal symptoms, travel or change in usual diet. With the exception of his apparently well-controlled diabetes, there was no other identifiable risk factor for invasive disease. Recovery of the organisms from blood cultures, knee aspirate and tissue samples enabled targeted antibiotic therapy.

Contributors NW was involved in identifying the case, performing the literature search and writing the case. EM reviewed the article, adding additional comments and specialist knowledge about the disease to improve the accuracy and content of the discussion.

Competing interests None declared.

Patient consent Obtained.

Provenance and peer review Not commissioned; externally peer reviewed.

REFERENCES

- 1 World Health Organisation. WHO: *Salmonella (non-typhoidal)* Fact sheet N139. <http://www.who.int/mediacentre/factsheets/fs139/en/> (cited 30 Jan 2015).
- 2 Majowicz SE, Musto J, Scallan E. The global burden of nontyphoidal salmonella gastroenteritis. *Clin Infect Dis* 2010;50:882–9.
- 3 Mandell GL, Bennett JE, Dolin R. *Principles and practice of infectious diseases*. 7th edn, Philadelphia: Elsevier publishing, 2010.
- 4 Ispahani P, Slack RC. Enteric fever and other extra intestinal salmonellosis in University Hospital, Nottingham, UK, between 1980 and 1997. *Eur J Clin Microbiol Infect Dis* 2000;19:679–87.
- 5 Gondusky JS, Gondusky CJ, Helmer SW. Salmonella osteomyelitis in new-onset diabetes mellitus. *Orthopedics* 2009;32:690–3.
- 6 Matheson N, Kingsley RA, Sturgess K, et al. Ten years experience of salmonella infections in Cambridge, UK. *J Infect* 2010;60:21–5.
- 7 Sy AM, Sandhu J, Lenox T. Salmonella enterica Serotype Choleraesuis Infection of the Knee and Femur in a Nonbacteremic Diabetic Patient. *Case Rep Infect Dis* 2013;2013:506157.
- 8 Poppe C, Martin K, Muckle A, et al. Characterization of antimicrobial resistance of Salmonella Newport isolated from animals, the environment, and animal food products in Canada. *Can J Vet Res* 2006;70:105–14.
- 9 Jackson DC. Salmonella osteomyelitis in infancy with a case due to Salmonella Newport infection. *Med J Aust* 1958;45:160–2.
- 10 Shimada T, Nishimura Y, Kimura G, et al. Vertebral osteomyelitis presenting with bilateral pleural effusions in a leprosy patient. *Diagn Microbiol Infect Dis* 1996;24:101–3.

Copyright 2015 BMJ Publishing Group. All rights reserved. For permission to reuse any of this content visit <http://group.bmj.com/group/rights-licensing/permissions>.
BMJ Case Report Fellows may re-use this article for personal use and teaching without any further permission.

Become a Fellow of BMJ Case Reports today and you can:

- ▶ Submit as many cases as you like
- ▶ Enjoy fast sympathetic peer review and rapid publication of accepted articles
- ▶ Access all the published articles
- ▶ Re-use any of the published material for personal use and teaching without further permission

For information on Institutional Fellowships contact consortiasales@bmjgroup.com

Visit casereports.bmj.com for more articles like this and to become a Fellow