



# **Early Infection of Bilateral Total Knee Arthroplasty with *Salmonella typhi*: Case Report and Review of Literature**

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## **Authors' contributions**

*This work was carried out in collaboration among all authors. Authors AR and A. Anand designed the study, performed the statistical analysis, wrote the protocol and wrote the first draft of the manuscript.*

*Authors MVS, VM, SP and A. Amin managed the analyses of the study. Authors A. Anand and A. Amin managed the literature searches. All authors read and approved the final manuscript.*

## **Article Information**

DOI: 10.9734/JAMMR/2019/v29i430084

### Editor(s):

(1) Dr. Panagiotis Korovessis, Department of Orthopaedic, Chief Orthopaedic Surgeon, General Hospital "Agios Andreas" Patras, Greece.

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(3) Ali Al Kaissi, Pediatric Orthopaedics-Speising Orthopaedic Hospital, Austria.

Complete Peer review History: <http://www.sdiarticle3.com/review-history/48043>

**Case Report**

**Received 11 January 2019**

**Accepted 23 March 2019**

**Published 03 April 2019**

## **ABSTRACT**

*Acute Salmonella typhi* prosthetic joint infection (PJI) is a rare event. In Endemic areas one needs to be cautious if the patient is immunocompromised. We report a case of bilateral simultaneous PJI of the knee in a 60-year-old lady who was not immunocompromised. The patient presented on Post op Day 5 with Fever and local signs suggestive of infection. As this was an Early PJI she was successfully treated with Debridement, Poly exchange and Intravenous and oral antibiotics for 6 weeks. This case highlights the fact that in patients living in these areas and in seasons where incidence of enteric fever is high, patients should be screened preoperatively for Salmonella infection by history and stool cultures. To our knowledge this is the first case report of Early Bilateral Simultaneous infection with *Salmonella typhi*.

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**Keywords:** Debridement; immunocompromised; *Salmonella typhi*; prosthetic joint infection.

## 1. INTRODUCTION

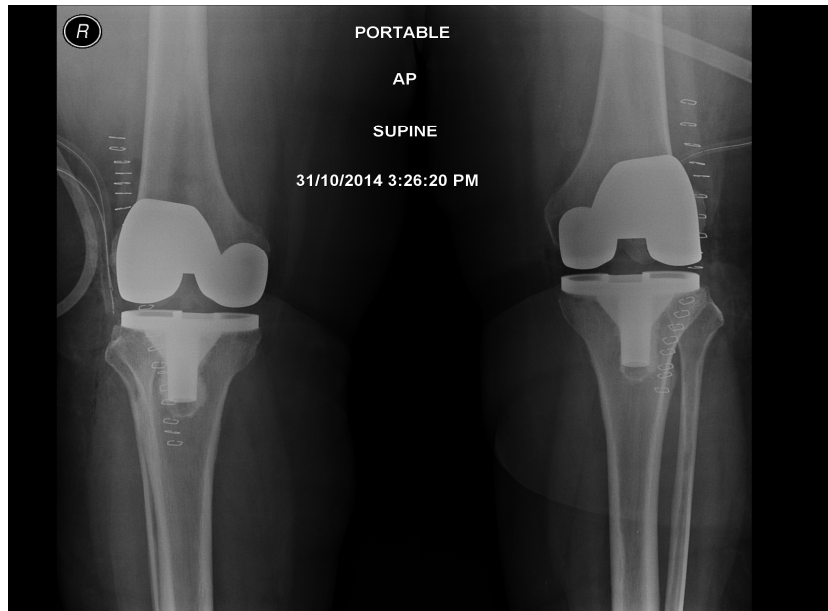
Periprosthetic Joint infection(PJI) is a devastating complication and can result in Amputation. *Staphylococcus Aureus* is commonest organism [1-2], PJI with salmonella species being culprit only for 0.2-1% of cases [3-4], *Salmonella* infection is common in immunocompromised patients [5-6]. Other species of salmonella-like enteritis and typhimurium have been reported in such patients [7]. There have been 4 prior instances of PJI [8] with *Salmonella typhi* in the English Literature but none of them had an acute presentation. We present a rare case of early periprosthetic joint infection of bilateral total knee arthroplasty with *Salmonella typhi*. To our knowledge this is the first case of Early bilateral simultaneous infection with *Salmonella typhi* described so far.

## 2. CASE REPORT

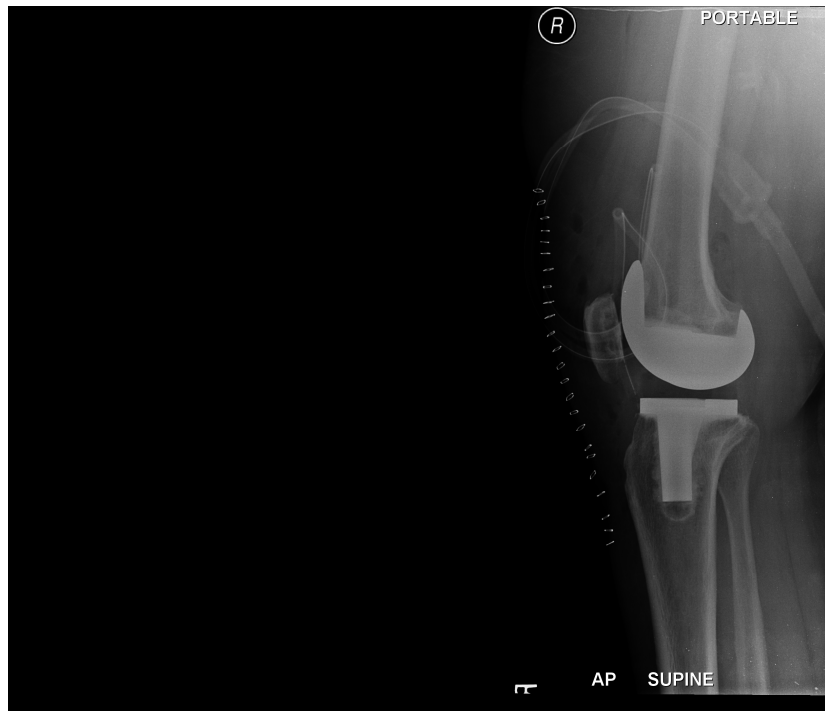
A 75 years old woman was diagnosed with severe osteoarthritis of both knee joints. Medical history was not significant. Simultaneous bilateral total knee replacement was performed. Post-operative X-rays showed normal alignment (Figs.1-3) She was mobilized on day one. Her post-operative recovery was uneventful. She was discharged from the hospital on 7<sup>th</sup> post-operative day.

On the 12<sup>th</sup> post-operative day she complained of severe pain in both the knee joints associated with high grade intermittent fever and generalised weakness. Clinically she presented a reduction in the knee range of motions on both sides. The symptoms progressed. She presented to us on 15<sup>th</sup> day. On examination she was febrile with tachycardia and her blood pressure was 120/70 mm of Hg. Local examination showed redness and warmth. Active discharge was seen in the right knee surgical wound which was purulent in nature. Her total White blood cells (WBC) count was 19,000/ cu-mm with increased Neutrophil count of 79%. (Fig-)X-ray of both knee joints showed no signs of loosening osteolysis. Preliminary culture from wound swab obtained from the right knee grew moderate growth of Gram negative bacilli on culture which was identified as *Salmonella typhi* (Table 1); the isolate was sensitive to ampicillin, ciprofloxacin, levofloxacin, cefotaxime, ceftriaxone, nalidixic acid and cotrimoxazole.

Debridement, lavage and polyethylene insert exchange was done for the right knee and the implants were stable. Purulent material and synovial tissue were sent for microbiological examination. Purulent material was aspirated from the left knee and similar procedure was done as well. Both the samples grew scanty growth of *Salmonella typhi*, the isolate had same



**Fig. 1. Immediate post-operative x rays-AP view**



**Fig. 2. Immediate post-operative x rays-lateral view**



**Fig. 3. Lateral view of left knee**

antibiogram. Further diagnostic work up was done on 5<sup>th</sup> day of admission with Widal test which revealed antibody titres of up to 1: 160

dilutions and 1: 5120 dilutions for O and H antigen respectively which was suggestive of acute typhoid fever. No pathogenic organisms

were isolated on stool and urine culture. Antibiotic therapy was started with intravenous ceftriaxone for 2 weeks and oral ciprofloxacin for 6 weeks immediately after the culture report was obtained.

Postoperatively, the patient's general condition improved. The fever had subsided and pain in the knees decreased. She was mobilized and knee range of motion was started. Her blood parameters returned to normalcy. She had delayed wound healing which required regular dressings. Intravenous ceftriaxone was administered for two weeks and oral ciprofloxacin was continued for six weeks. Subsequent microbiological examination with wound swab cultures (on day 10<sup>th</sup> and 13<sup>th</sup> of admission) from both knees showed no growth. At 6<sup>th</sup> week, serological follow up with Widal test showed reduced antibody titres to O and H antigens up to

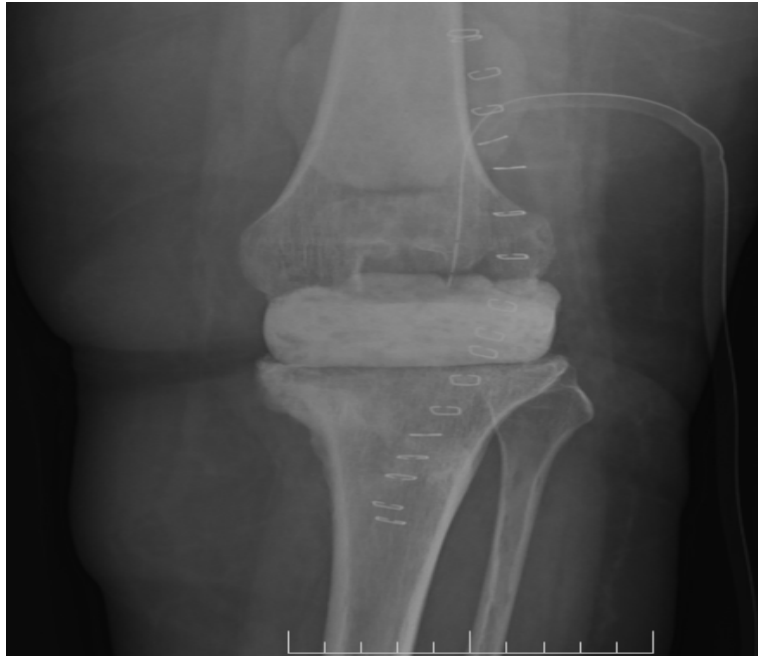
1:40 dilutions and 1:320 dilutions respectively. Her symptoms had considerably reduced and the surgical wound showed healing with no active signs of discharge. Stool culture done on follow up at 8<sup>th</sup> week was negative for *Salmonella typhi* and antibody titres on Widal test was less than 1:80 and up to 1:80 for O and H antigens respectively showing decrease which was suggestive for resolution. At 2 years follow up patient was asymptomatic and her range of motion was 0-95 degrees in both knees. There were no recurrences of *Salmonella typhi* infection (Figs.4 and 5). She presented at 2 and half years with pain and swelling of left knee, Aspirate of knee did not grow any organism -extensive work up did not reveal cause of infection and was treated with two stage procedure and underwent distal Femoral replacement. After 1 year of distal femoral replacement, she was asymptomatic (Figs. 6 and 7).



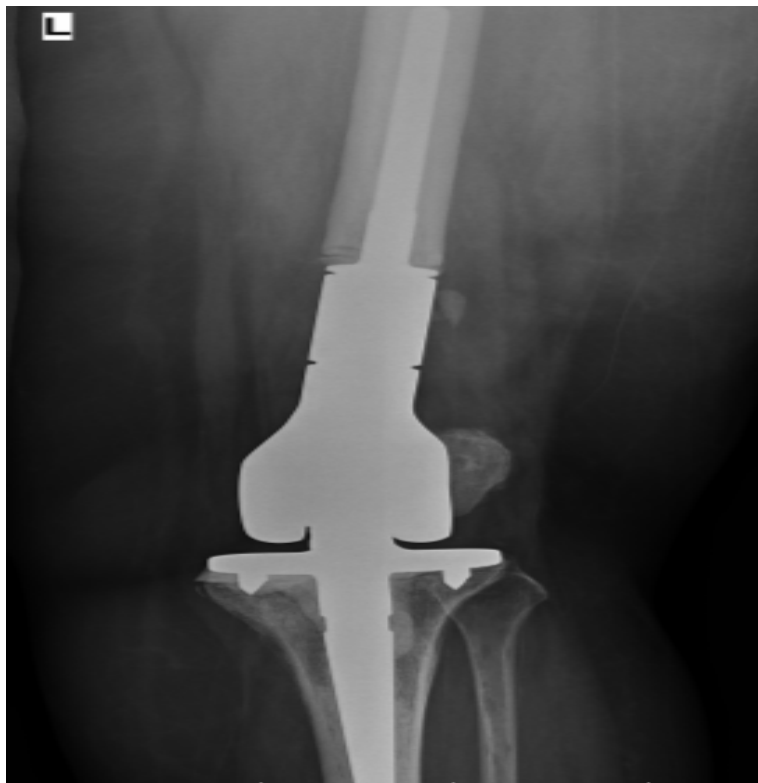
**Fig. 4. Knee range of movements at 12 weeks follow up**



**Fig. 5. Healed surgical wound**



**Fig. 6. Had episode of infection 3 years after change of poly and debridement-underwent spacer placement**



**Fig. 7. Following placement of final implant**

**Table 1. Results showing culture of microbiological investigations**

Date	Test	Sample number	Lrn number	Result
13-11-2014	Wound Swab- Right Leg C& S	JN-2425	110781	<i>Salmonella typhi</i> - moderate growth Sensitive- Ceftriaxone, Ciprofloxacin, Nalidixic acid, Cotrimoxazole, Cefotaxime, Ampicillin, Levofloxacin
15-11-2014	Others C& S	JN-2437	111520	<i>Salmonella Typhi</i> - scanty growth Sensitive- Ceftriaxone, Ciprofloxacin, Nalidixic acid, Cotrimoxazole, Cefotaxime, Ampicillin, Levofloxacin
	Others C& S	JN-2438	111546	<i>Salmonella typhi</i> - scanty growth sensitive- Ceftriaxone, Ciprofloxacin, Nalidixic acid, Cotrimoxazole, Cefotaxime, Ampicillin, Levofloxacin
17-11-2014	Widal Test	JN-598	11981	TO- 1:160 Positive TH- 1:5120 Positive AH -<1:20 Negative BH - <1:20 Negative
20-11-2014	Stool C& S	JN-2487	113333	No pathogenic organism isolated
22-11-2014	Wound SWAB	JN-2503	114235	No growth
25-11-2014	Wound SWAB- Right Leg	JN-2526	115152	No growth
	Wound SWAB- Left Leg	JN-2527	115152	No growth
13-12-2014	Widal Test	JN-639	26090	TO- 1:40 Negative TH- 1:320 Positive AH -<1:20 Negative BH - <1:20 Negative
12-1-2014	Stool C& S	JN-124	BNR	No pathogenic organism isolated

### 3. DISCUSSION

Salmonella infection of TKR is very rare event, accounting for 0.2% of periprosthetic joint infections. A PubMed search reveals 44 published cases of salmonella species infections out of which 32 were in the Hip and 12 were in the Knee. Majority (43/44) of these were caused by Non- Typhoid Salmonella (NTS) and only one was caused by *S. Typhi* [8]. The higher incidence seen with NTS is because these bacteria have a wider distribution and can manifest with bacteremia and extra intestinal manifestations [9,10]. The usual presentation in patients without knee replacement is Reactive arthritis after Enteric fever and in very rare cases septic arthritis [11,12]. All the infections by Salmonella reported till date had presented between 4

months to 9 years s after post surgery9 [8,13,14] but none had an Early presentation with *S typhi*. In previously reported cases with Salmonella 50 percent had an underlying immunosuppressive condition [7,15]- *Sa typhi* is mainly acquired through orofecal contamination with Gastrointestinal tract being primary focus and then via hematogenous spread it can go to the joints [16,17]. There have been no reported cases following direct inoculation [18]. Our patient did not have preoperative symptoms to suggest *S typhi*, it is difficult to say if she was carrier of *S typhi* as that work up is not routinely done for Joint arthroplasty. Also, patient did not have Sickle cell trait or any other immunocompromised state [19]. The only other case of bilateral simultaneous infection with Salmonella Typhi was delayed presentation

at 10 months post-surgery and patient had underlying immunocompromised state and was on treatment with Immunomodulators [8] Treatment was directed based on culture sensitivity and as directed by infectious diseases consultations [17,20,21]. In absence of defined protocols infection was treated with 6 weeks of antibiotics [17,20,21]. Studies have reported that incidence of typhoid burden in India was 377 per 100,000-person years of typhoid [22]. Pachore et al [23] have reported that infection is the second commonest cause of revision knee surgery and with India being in endemic zone, one is bound to encounter cases of Prosthetic Joint infection with Salmonella. The fact that our patient had bilateral affection points towards haematogenous spread however patient did not have any preoperative symptoms suggestive of salmonellosis such as fever or diarrhea. Since this was acute event it was treated as early infection and debridement and appropriate antibiotics for 6 weeks cleared the infection and patient was doing well at her 2 years follow up.

#### 4. CONCLUSION

This is a rare event and can cause considerable morbidity. Based on our experience we propose that in areas where Salmonella is endemic /seasonal, one should ask a detailed history to see if patient had contact with typhoid patient and carry out stool cultures. If stool cultures pick up a salmonella carrier then patient should be treated accordingly. This might add cost upfront but it is better to treat infection prior to surgery and avoid PJI. To the best of our knowledge this is the only case report in English literature of early bilateral simultaneous infection with *Salmonella typhi*.

#### CONSENT AND ETHICAL APPROVAL

As per university standard guideline participant consent and ethical approval has been collected and preserved by the authors.

#### COMPETING INTERESTS

Authors have declared that no competing interests exist.

#### REFERENCES

1. Peersman G, Laskin R, Davis J, Peterson M. Infection in total knee replacement: A retrospective review of 6489 total knee

- replacements. Clin Orthop. 2001;392: 15-23.
2. Wymenga AB, van Horn JR, Theeuwes A, Muijtens HL, Slooff TJ. Perioperative factors associated with septic arthritis after arthroplasty. Prospective multicenter study of 362 knees and 2,651 hip operations. Acta Orthop Scand. 1992;63:665-671.
3. Trousdale RT, Hanssen AD. Infection after total knee arthroplasty. Instruct Course Lect. 2001;50:409-414.
4. Nelson CL. Primary and delayed exchange for infected total knee arthroplasty. Am J Knee Surg. 2001;14:60-64.
5. Whiteside LA. Treatment of infected total knee arthroplasty. Clin Orthop. 1994;299: 169-172.
6. Goldenberg DL, Cohen AS. Acute infectious arthritis: a review of patients with nongonococcal joint infections (with emphasis on therapy and prognosis). Am J Med. 1976;60:369-377.
7. Sebastian S, Dhawan B, Malhotra R, Gautam D, Kapil A. *Salmonella typhimurium* infection in total knee arthroplasty: A case report with review of literature. J Lab Physicians. 2017;9(3):217-219. DOI: 10.4103/0974-2727.208254.
8. Rajgopal A, Panda I, Gupta A. Unusual *Salmonella typhi* periprosthetic joint infection involving bilateral knees: Management options and literature review BMJ Case Rep; 2017. PII: bcr-2017-221221. DOI: 10.1136/bcr-2017-221221. Review.
9. Sánchez-Vargas FM, Abu-El-Haija MA, Gómez-Duarte OG. Salmonella infections: an update on epidemiology, management, and prevention. Travel Med Infect Dis. 2011;9:263–77.
10. Khan MI, Ochiai RL, von Seidlein L, et al. Non-typhoidal Salmonella rates in febrile children at sites in five Asian countries. Trop Med Int Health. 2010;15:960–3.
11. Hedberg CW, White KE, Johnson JA, et al. An outbreak of *Salmonella enteritidis* infection at a fast-food restaurant: implications for food handler-associated transmission. J Infect Dis. 1991;164:1135-1140.
12. Saphra I, Winter JW. Clinical manifestations of salmonellosis in man: an evaluation of 7779 human infections identified at the New York Salmonella Center. N Engl J Med. 1957;256:1128-1134.

13. Gupta A, Berbari EF, Osmon DR, et al. Prosthetic joint infection due to *Salmonella* species: A case series. *BMC Infect Dis.* 2014;14:633.
14. Andrews HJ, Arden GP, Hart GM, Owen JW. Deep infection after total hip replacement. *J Bone Joint Surg Br.* 1981; 63:53-57.
15. Musante DB. Ogden *Salmonella* Orthopedics. 2004;27(7):770-2.
16. Lowenstein MS. An outbreak of salmonellosis propagated by person-to-person transmission on an Indian reservation. *Am J Epidemiol.* 1975;102: 257-262.
17. Threlfall EJ. Antimicrobial drug resistance in *Salmonella*: Problems and perspectives in food- and water-borne pathogens. *FEMS Microbiol Rev.* 2002;26:141-148.
18. Davis N, Curry A, Gambhir AK, et al. Intraoperative bacterial contamination in operations for joint replacement. *J Bone Joint Surg Br.* 1999;81:886-889.
19. al-Salem AH, Ahmed HA, Qaisaruddin S, al-Jam'a A, Elbasher AM, al-Dabbous I. Osteomyelitis and septic arthritis in sickle cell disease in the eastern province of Saudi Arabia. *Int Orthop.* 1992;16:398-402.
20. Cohen JI, Bartlett JA, Corey GR. Extra-intestinal manifestations of *Salmonella* infections. *Medicine (Baltimore).* 1987;66: 349-388.
21. Hohmann EL. Nontyphoidal salmonellosis. *Clin Infect Dis.* 2001;32:263-269.
22. John J, Van Aart CJ, Grassly NC. The Burden of Typhoid and Paratyphoid in India: Systematic Review and Meta-analysis. *PLoS Negl Trop Dis.* 2016;10: e0004616.
23. Pachore JA, Vaidya SV, Thakkar CJ, et al. ISHKS joint registry: A preliminary report. *Indian J Orthop.* 2013;47:505-9.

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