



Salmonella sp. as the Cause of Periprosthetic Joint Infection of the Hip: Report of a Rare Case and Review of Past 10-year Literatures

Asep Santoso^{1,2*}, Pamudji Utomo^{1,2}, Iwan Budiwan Anwar^{1,2}, Tangkas Sibarani^{1,2}, Bintang Soetjahjo^{1,3}, Hanif Andika Wardhana¹

¹Department of Orthopaedic and Traumatology, Faculty of Medicine Universitas Sebelas Maret, Solo, Indonesia; ²Department of Orthopaedic and Traumatology, Prof. Dr. R. Soeharso Orthopaedic Hospital, Solo, Indonesia; ³Department of Orthopaedic and Traumatology, Dr. Moewardi General Hospital, Solo, Indonesia

Abstract

Edited by: Igor Spiroski

Citation: Santoso A, Utomo P, Anwar IB, Sibarani T, Soetjahjo B, Wardhana HA. *Salmonella* sp. as the Cause of Periprosthetic Joint Infection of The Hip: Report of a Rare Case and Review of Past 10-year Literatures. Open Access Maced J Med Sci. 2020 Sep 20; 8(C):117-120. <https://doi.org/10.3889/oamjms.2020.4585>

Keywords: Periprosthetic joint infection; Hip joint; *Salmonella* sp.

***Correspondence:** Asep Santoso, Department of Orthopaedic and Traumatology, Faculty of Medicine Sebelas Maret University, Prof. Dr. R. Soeharso Orthopaedic Hospital, Jl. Jenderal Ahmad Yani Pabelan, Solo, Indonesia. E-mail: asepsantoso@gmail.com

Received: 08-Mar-2020

Revised: 10-Jul-2020

Accepted: 18-Aug-2020

Copyright: © 2020 Asep Santoso, Pamudji Utomo, Iwan Budiwan Anwar, Tangkas Sibarani, Bintang Soetjahjo, Hanif Andika Wardhana

Funding: This research did not receive any financial support

Competing Interests: The authors have declared that no competing interests exist

Open Access: This is an open-access article distributed under the terms of the Creative Commons Attribution-NonCommercial 4.0 International License (CC BY-NC 4.0)

BACKGROUND: Periprosthetic joint infection (PJI) due to *Salmonella* sp. is rare. It is sometimes difficult to treat and need prolonged antibiotic treatment.

CASE REPORT: We reported a case of PJI of the hip in a 67-year-old female who received prior left total hip arthroplasty. Two-stage revision surgery with antibiotic-loaded cement spacer had been performed to the patient and successfully control the infection.

CONCLUSION: Although literature review showed that there has been no consensus for the treatment of *Salmonella* PJI, a two-stage revision procedure has been more commonly performed to control the infection by previous authors and might be the safest way to control *Salmonella* PJI recently.

Introduction

Periprosthetic joint infection (PJI) is one of the difficult complications after joint replacement. The treatment is sometimes needed repeated surgery, which causes further morbidity to the patient. While a causative organism is most commonly Gram-positive cocci, rarely Gram-negative bacteria are also reported as isolated organism [1]. *Salmonella* sp. is one of the rare gram-negative causatives of organisms of periprosthetic infection after total joint replacement. We present a case of a patient with *Salmonella* sp. infection after total hip arthroplasty (THA) who had been treated with two-stage revision surgery.

Case Presentation

A 67-year-old female complained of pain and continuous fistula drainage on her left hip. She received

THA surgery at 6 years back due to left hip osteoarthritis. She had been able to mobilize without an assistive device. The patient began to feel pain again at her left hip since 1 year ago. Her wound was swelling and purulent material was come out. No history of fever, diarrhea, or any other illness before the recent complaint. She has no specific routine medication for any illness. History of diabetes mellitus and hypertension also denied. Physical examination showed active fistula drainage from the previous surgical wound (Figure 1a) and a limited range of hip joint movement. Serum laboratory examination showed: Hemoglobin level 10.9 g/dL, white blood count (WBC) 10.3×10^3 /uL, erythrocyte sedimentation rate / ESR-1: 73 mm/h, ESR-2: 94 mm/h, positive qualitative C-reactive protein (CRP), and blood glucose 184 mg/dL. We also performed a microbiological culture and antibiotic sensitivity examination from the pus material which resulted an isolation of *Salmonella* sp. Pelvic radiograph examination showed a sign of loosened cemented hip prosthesis with protrusion of the acetabular component (Figure 1b). We diagnosed this patient in having a chronic PJI of the hip and planned to perform a two-stage revision procedure with the use antibiotic cement spacer.



Figure 1: (a) Infected surgical wound with active pus drainage; (b) radiograph of the left infected total hip prosthesis with a sign of loosening on both femoral and acetabular components associated with acetabular protrusion. (c) Radiograph after the first-stage surgery, articulated antibiotic cement-spacer was inserted. (d) Radiograph after the second-stage revision THA

Surgical procedure [1]

The first stage of surgery consists of removal of all the prosthesis, debridement, and implantation of antibiotic-loaded cement spacer. After opening the wound and excision of wound fistula, all the purulent material and biofilm should be removed. Pus and tissue material were sent for the repetition of microbiological examination. Repeated irrigation with the use of normal saline, 10% povidone-iodine, and 3% hydrogen peroxide was then performed. Pre-sterilized femoral prostheses retrieved from previous cases were used to provide an endoskeleton for the spacers. A collar of antibiotic-loaded cement (1 pack, 40 g) was given to the femoral component, while the acetabular components were made by inserting a bolus of cement (1 pack, 40 g) into the acetabular cavity and molded into the shape of the cup. Screws were used as an Anchore for acetabular cement spacer to prevent cement dislodgement (Figure 1c). One gram of vancomycin (Vancep[®], Fahrenheit, Tangerang, Indonesia) was used on each acetabular and femoral cement spacer. Antibiotic cement Gentafixal[®] (Teknimed, France) impregnated with gentamicin was used for both the femoral and the acetabular component. A suction drain was used after wound closure. Regarding the result of the microbiological examination, ciprofloxacin (200 mg b.i.d) was given intravenously for 2 weeks followed by oral (500 mg b.i.d) for 6 weeks. Total WBC counts, ESR, and CRP were examined at 2 weekly intervals. Postoperatively, the patient was allowed to perform hip joint movement and partial weight-bearing with walker aid for mobilization.

At around 14 weeks after the first stage surgery, the surgical wound has been healed with no sign of

inflammation. Laboratory examination also resulted a normal ESR level and negative of qualitative CRP. After confirming the medical fitness of the patient, the second stage revision surgery was then proceed. During the second stage of the surgery, a repeat microbiological examination was performed from tissue inside the hip joint for confirmation of the eradication state. Then, repeated wound irrigation with normal saline, 10% povidone-iodine, and 3% hydrogen peroxide was done. We prefer to use cemented fixation for the revision THA due to a lack of bone stock (Figure 1d). A Kerboul-type acetabular cage (AK Medica, Beijing, China) was needed to address the central acetabular defect. A cemented acetabular shell (U-2 acetabular system, United, Taiwan) was used in combination with Calcar-replacement femoral prosthesis (GTF-II STEM, United, Taiwan). Antibiotic cement Gentafix[®] (Teknimed, France) was used both for acetabular and femoral component fixation.

Postoperatively, parenteral ciprofloxacin (200 mg b.i.d) was administered for 3 days followed with oral ciprofloxacin (500 mg b.i.d) for 1 week. Patients were allowed to walk with a walker as soon as the pain was tolerated. At 1 year after the second-stage surgery, a good hip functional outcome was obtained with no sign of recurrence of the infection.

Discussion and literature review

Salmonella sp. as the cause of PJI has been reported by several previous authors during the past 10-years period [2], [3], [4], [5], [6], [7], [8], [9], [10]. It can occur after total knee arthroplasty (TKA) [2], [3], [5], [6], [9], [10] or THA [4], [5], [6], [7], [8]. In a series reported by Gupta *et al.* [6], during 44 years study period (1969–2013) at Mayo Clinic (Rochester, USA), they only found six cases of *Salmonella* PJI. Five of the six cases occurred at the hip joint, with one case at the knee joint. There were several patterns of infection have been reported. Most of the authors reported a single hip or knee joint involvement of *Salmonella* PJI. However, a bilateral involvement of PJI of the knee also has been reported by Kobayashi *et al.* [2] and Rajgopal *et al.* [9]. de la Torre *et al.* [5] reported a different pattern of infection, which *Salmonella* PJI occurred on the knee then followed by involvement of the hip (Table 1).

Salmonella spreading is mostly hematogenous [6]. Although we did not perform blood culture, our presented case also believed to be hematogenous spreading as the onset of infection occurred at a long period (5 years) after the surgery. Direct contamination most probably suspected when the onset of infection is early (<4 weeks) [7]. However, early post-operative hematogenous spreading, although unlikely, may also possible, especially for the patient with the carrier of *Salmonella*, which has to be proved with a fecal culture [6], [7]. The incidence of *Salmonella* infection increases in an immunosuppressed patient includes:

Table 1: List of past 10 years previously reported *Salmonella*-PJI cases

No	Authors	Number of cases	Description of case	Onset of infection	Bacteria	Risk factors	Treatment	Antibiotics
1	Kobayashi et al. (2009)	1	TKA (Bilateral)	11 years (R) 6 years (L)	<i>Salmonella enterica</i>	RA	DAIR (Both knee)	Ciprofloxacin
2	Carlile et al. (2010)	1	TKA	5 years	<i>Salmonella choleraesuis</i>	ND	Two-stage exchange	Cefotaxime Ciprofloxacin
3	Toth et al. (2010)	2	THA	2 years 7 years	<i>Salmonella enteritidis</i> <i>Salmonella choleraesuis</i> , + <i>Acinetobacter haemolyticus</i> <i>Salmonella enteritidis</i>	Cardiovascular problems, anemia, hypoalbuminemia, MOF RA	One-stage exchange (1) Two-stage exchange (1)	Ciprofloxacin (2) Clindamycin (1)
4	de la Torre et al. (2012)	1	TKA (first) THA (second)	TKA (11 month) RTHA (16 years)	<i>Salmonella enterica</i> (5) <i>Salmonella bongori</i> (1)	DM, RA, CKD, Bladder Ca, Colitis Ulcerative, Skin Ca, Colonic Polyp	Two-stage exchange (both hip and knee) Two-stage exchange (4) Removal + Debridement + arthrodesis (2)	Ceftriaxon TMP-SMX Ceftriaxon (2) Ampicillin (2) Ciprofloxacin (2) TMP-SMX (1) Amoxycillin (1) Vancomycin (1) Ciprofloxacin (2)
5	Gupta et al. (2014)	6	TKA (1) THA (5)	5 month – 9 years	<i>Salmonella enterica</i> (5) <i>Salmonella bongori</i> (1)	DM, RA, CKD, Bladder Ca, Colitis Ulcerative, Skin Ca, Colonic Polyp	Two-stage exchange (4) Removal + Debridement + arthrodesis (2)	Ceftriaxon (2) Ampicillin (2) Ciprofloxacin (2) TMP-SMX (1) Amoxycillin (1) Vancomycin (1) Ciprofloxacin (2)
6	Jeroense et al. (2014)	2	THA	7 days 13 years	<i>Salmonella</i> type E <i>Salmonella enteritidis</i>	CKD, Carcinoid tumor of lung, Adenoma pituitary	One-stage exchange + DAIR (1) One-stage exchange	Ciprofloxacin (2)
7	Ekinci et al. (2017)	2	THA	1 years 6 years	<i>Salmonella typhimurium</i> <i>Salmonella</i> type C	Azathioprine and Prednisolone Induced-immunocompromised DM, RA	Two-stage exchange (2)	Cefazolin (1) Ciprofloxacin (2)
8	Rajgopal et al. (2017)	1	TKA (Bilateral)	10 months	<i>Salmonella</i> Typhi	DM, RA	Two-stage exchange	ND
9	Sebastian et al. (2017)	1	TKA	4 years	<i>Salmonella typhimurium</i>	Tubercular meningitis, DM	Two-stage exchange	Cefuroxime Levofloxacin
10	Present report	1	THA	5 years	<i>Salmonella</i> sp.	Hyperglycemia	Two-stage exchange	Gentamycin + Vancomycin (spacer) Ciprofloxacin

DAIR: Debridement and implant retention.

Rheumatoid arthritis, malignancy, diabetes mellitus, chronic kidney disease, a prolonged steroid medication, and history of gastrointestinal system disease [6], [7], [8]. In our recent case, although the patient denied any history of diabetes mellitus, blood glucose examination revealed a high glucose level. Therefore, an immunosuppressed state also maybe occurs to our patient.

There is no consensus in the treatment of periprosthetic *Salmonella* infections. Kobayashi et al. [2] successfully control chronic *Salmonella* PJI by performing debridement and implant retention to bilateral TKA. de la Torre et al. [5] reported that two-stage revision is the best choice of treatment, conservative treatment with antibiotics alone is insufficient to control the infection. Gupta et al. [6] also reported four of six patients which treated with antibiotics alone or combined with debridement and implant retention were failed and needed implant removal to control the infection. The two-stage revision also has been successfully control the infection in cases reported by other authors [3], [8], [9], [10]. However, another report by Jeroense et al. [7] showed that one-stage revision also could be successful for the treatment of *Salmonella* PJI when the onset is acute.

Antibiotic is one of the most important parts of the treatment. In our recent case, we found that the *Salmonella* sp. is sensitive to amikacin, gentamicin, fosfomicin, imipenem, meropenem, ciprofloxacin, and levofloxacin. Similar to our reported case, ciprofloxacin was used as the antibiotic treatment by most previous authors [2], [3], [4], [6], [7], [8]. Gupta et al. [6] use ceftriaxon, ampicillin, trimetoprim-sulfametoxazol, and ciprofloxacin to treat their patients. Several previous authors also use cephalosporin antibiotics as the treatment choice for their cases [3], [5], [6], [9], [10]. In our case, it has been found that the *Salmonella* sp. was

resistant to most of the cephalosporin antibiotics include ceftriaxon, cefotaxime, cefixime, and cefadroxil, also for ampicillin-sulbactam and trimetoprim-sulfametoxazol. It is showed that the pattern of *Salmonella* antibiotic sensitivity might be different or has been changed by time. In summary, *Salmonella* infections are rarely seen after hip arthroplasty. Although literature review showed that there has been no consensus for the treatment of *Salmonella* PJI, two-stage revision procedure has been more commonly performed to control the infection by previous authors and might be the safest way to control *Salmonella* PJI recently.

References

- Santoso A, Park KS, Shin YR, Yang HY, Choi IS, Yoon TR. Two-stage revision for periprosthetic joint infection of the hip: Culture-negative versus culture-positive infection. *J Orthop*. 2018;15(2):391-5. <https://doi.org/10.1016/j.jor.2018.03.002> PMID:29881161
- Kobayashi H, Hall GS, Tuohy MJ, Knothe U, Procop GW, Bauer TW. Bilateral periprosthetic joint infection caused by *Salmonella enterica* serotype enteritidis, and identification of *Salmonella* sp using molecular techniques. *Int J Infect Dis*. 2009;13(6):e463-6. <https://doi.org/10.1016/j.ijid.2008.12.015> PMID:19269872
- Carlile GS, Elvy J, Toms AD. *Salmonella* infection of a total knee replacement. *Knee*. 2010;17(5):356-8. <https://doi.org/10.1016/j.knee.2009.10.003>
- Tóth K, Janositz G, Kovács G, Sisák K, Rudner E. Successful treatment of late *Salmonella* infections in total hip replacement-report of two cases. *BMC Infect Dis*. 2010;10:160. <https://doi.org/10.1186/1471-2334-10-160> PMID:20529326
- de la Torre B, Tena D, Arias M, Romanillos O. Recurrent prosthetic joint infection due to *Salmonella* Enteritidis: Case report and

- literature review. *Eur J Orthop Surg Traumatol*. 2012;22 Suppl 1:89-97. <https://doi.org/10.1007/s00590-012-0955-6>
PMid:26662756
6. Gupta A, Berbari EF, Osmon DR, Virk A. Prosthetic joint infection due to *Salmonella* species: A case series. *BMC Infect Dis*. 2014;14:633. <https://doi.org/10.1186/s12879-014-0633-x>
PMid:25424009
7. Jeroense KT, Kuiper JW, Colen S, Schade RP, Saouti R. One-stage revision in two cases of *Salmonella* prosthetic hip infection. *World J Clin Cases*. 2014;2(7):304-8.
PMid:25032209
8. Ekinci M, Bahyram S, Akgul T, Ersin M, Yazicioglu Ö. Periprosthetic joint infection caused by *Salmonella*: Case reports of two azathioprine and prednisolone induced-immunocompromised patients. *Hip Pelvis*. 2017;29(2):139-44 <https://doi.org/10.5371/hp.2017.29.2.139>
PMid:28611966
9. Rajgopal A, Panda I, Gupta A. Unusual *Salmonella typhi* periprosthetic joint infection involving bilateral knees: Management options and literature review. *BMJ Case Rep*. 2017;2017:bcr2017221221. <https://doi.org/10.1136/bcr-2017-221221>
PMid:29141925
10. 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):217-9. <https://doi.org/10.4103/0974-2727.208254>
PMid:28706395