

Case report

An unexpected pathogen causing prosthetic joint infection following screening colonoscopy

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ARTICLE INFO

Article history:

Received 24 April 2019

Received in revised form

4 July 2019

Accepted 14 August 2019

Available online 20 September 2019

Keywords:

Prosthetic joint infection

Total knee arthroplasty

Prophylactic antibiotics

Endoscopy

ABSTRACT

A 61-year-old woman with a right total knee arthroplasty presented with 1 week of atraumatic right knee swelling, pain, and fevers 2 weeks following a routine screening colonoscopy. Aspiration was concerning for prosthetic joint infection and she underwent definitive treatment with irrigation and debridement with polyethylene exchange followed by a 6-week course of oral metronidazole. Cultures speciated as *Bacteroides fragilis* with the presumed source being the colonoscopy causing transient bacteremia and subsequent seeding of the right knee. This case highlights the need for consideration of guidelines regarding prophylactic antibiotics to prevent prosthetic joint infection after endoscopic procedures.

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Introduction

An estimated 4.7 million Americans currently have a total knee arthroplasty (TKA) and approximately 4.6% of the population above the age of 50 has a TKA [1]. Up to 2% of knee replacements are complicated by prosthetic joint infections (PJIs) [2]. Currently, there are limited guidelines for the use of prophylactic antibiotics in patients with prosthetic joints and even more limited data to guide the use of prophylactic antibiotics with endoscopic procedures. Here, we describe a case of a 61-year-old woman who sustained late PJI of a TKA with *Bacteroides fragilis*, likely a result of gut translocation leading to transient bacteremia and subsequent seeding of her TKA following a routine screening colonoscopy. This case raises the question of the utility of antibiotic prophylaxis for endoscopic procedures and highlights several factors that may be useful in identifying patients who are candidates for prophylaxis. The patient provided consent for the submission and publication of

this case report and the use of deidentified data and images concerning this case.

Case history

In July 2017, a 61-year-old woman with a past medical history of obstructive sleep apnea, hypertension, hypothyroidism, gastrointestinal (GI) reflux disease, depression, and class 3 severe obesity (body mass index 40.0–44.9 kg/m²) presented with a 1-week history of atraumatic polyarthralgia, right knee swelling, and fevers. Her American Society of Anesthesiologists Score was 3. Her arthroplasty history was notable for a right TKA for osteoarthritis with valgus deformity in 2000 that was subsequently twice revised for PJI (Salmonella PJI in November 2000 and Staphylococcus PJI in October 2005) with 2-stage exchange for each PJI episode (Fig. 1). She had been completely asymptomatic following the most recent 2-stage exchange in 2005. Three weeks prior to presentation, she had vacationed in Cape Cod, Massachusetts with her family. Two weeks prior to presentation, she underwent a routine screening colonoscopy without any biopsy or other intervention for which she did not receive prophylactic antibiotics; the results of her colonoscopy were normal with no report of diverticulitis or other potentially predisposing condition that might have compromised mucosal integrity. Ten days antecedent to her presenting right knee symptoms, she had undergone routine dental cleaning for which

No author associated with this paper has disclosed any potential or pertinent conflicts which may be perceived to have impending conflict with this work. For full disclosure statements refer to <https://doi.org/10.1016/j.artd.2019.08.006>.

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<https://doi.org/10.1016/j.artd.2019.08.006>

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she took prophylactic amoxicillin. She had previously had one prior colonoscopy in February 2014 which revealed a 1.5-cm adenomatous polyp; hence her second colonoscopy occurred within 3 years in July 2017.

She initially presented to an outside hospital and was given empiric ceftriaxone for presumed Lyme disease. Subsequent serology was negative for Lyme. However, given persistent symptoms and worsening right knee pain, she underwent right knee aspiration which was notable for 49,000 white blood cells/ μ L (WBCs) with 93% polymorphonuclear neutrophil (PMN) predominance. There was no record of Lyme polymerase chain reaction being run on the synovial aspirate [3]. She was initiated on vancomycin and ceftriaxone for broad-spectrum coverage of presumed PJI, which was then narrowed to ceftriaxone monotherapy for a planned 6-week course. She did not undergo surgical irrigation and debridement and the outside hospital records are not clear as to the rationale behind this treatment. Her polyarthralgias resolved with the exception of her right knee pain, and she was therefore transferred to our institution for further workup.

On presentation to our institution, the patient was febrile to 102°F and diaphoretic. Initial laboratory analysis was notable for a WBC count of 13.0×10^9 cells/L (normal 4.0–10.0), an erythrocyte sedimentation rate of 43 mm/h (normal 0–18), C-reactive protein >300 mg/l (normal 0–3), normal uric acid, and mildly elevated liver function tests. Her outside ceftriaxone course was initially continued. She continued to have worsening right knee pain and was unable to bear weight on the right lower extremity. Radiographs of the right knee were unremarkable for any acute periprosthetic fracture or complication (Fig. 2). A repeat aspiration was therefore performed which yielded 69,000 WBCs with 71% PMNs, and 40,000 red blood cells.

These results prompted surgical intervention and she subsequently underwent single-stage right knee irrigation and debridement with exchange of the modular polyethylene component. Intraoperative fluid analysis revealed 93,000 WBCs with 100% PMNs. While awaiting culture results postoperatively, ceftriaxone was continued and vancomycin was added per the infectious disease consulting team. Final intraoperative synovial fluid cultures speciated as *B. fragilis*, and the results were corroborated by the finalized cultures at the outside hospital where her knee was initially aspirated. The infectious disease consulting team postulated that her right knee was seeded by her routine colonoscopy given her use of routine prophylactic antibiotics prior to her preceding dental cleaning as well as the highly specific tropism of the PJI organism to

the intestinal microbiome. WBC, erythrocyte sedimentation rate, and C-reactive protein steadily decreased for the remainder of her postoperative course. The patient was transitioned to a course of oral metronidazole which was discontinued after a 6-week period and she remained afebrile off of any further antibiotics with resolution of her right knee pain and swelling at 1 year of follow-up with both orthopedic surgery and infectious diseases (Fig. 1) without any further issues both clinically or radiographically.

Discussion

It is estimated that 4 million hip and knee replacements will be performed annually by 2030 [4]. Of these, 0.5%–2% of knee replacements will be complicated by PJI [2]. Risk factors for PJI include immunosuppression, diabetes mellitus, rheumatoid arthritis, obesity, age, male sex, an American Society of Anesthesiology score of ≥ 3 , and prior PJI [5].

Our patient had a significant history of prior episodes of PJI (Salmonella PJI in November 2000 and Staphylococcus PJI in October 2005) and subsequent 2-stage revision even prior to her presentation to our institution. Notably, patients undergoing revision TKAs are at 2–3 times higher risk of infection than those undergoing primary joint replacement [6]. Although the standard practice of giving prophylactic antibiotics at the time of surgery [7] has been shown to reduce the rate of infection postoperatively [8,9], there are sparse data to guide the selection of prophylactic antibiotics in revision TKA [6].

One particularly interesting aspect of this case is the nature of the infectious organism identified in our patient's PJI. While *Staphylococcus aureus* and coagulase-negative *Staphylococcus* make up the most common pathogens causing PJI [10,11], enteric Gram-negative organisms are rarely associated with PJI [12,13]. *B. fragilis*, an uncommon causative organism for PJI, is an obligate anaerobic Gram-negative rod part of normal colonic flora but not oropharyngeal flora. It is also resistant to amoxicillin, and therefore the prophylactic antibiotics our patient received prior to her dental procedure did not impart protection. Given the specific location in which this organism resides in the human body, her oropharynx was felt to be an unlikely source of this pathogen. Notably, however, the patient had undergone routine screening colonoscopy and did not receive preprocedure antibiotics; though she did not undergo tissue biopsy or other intervention, it was postulated by the consulting infectious diseases team that gut translocation leading

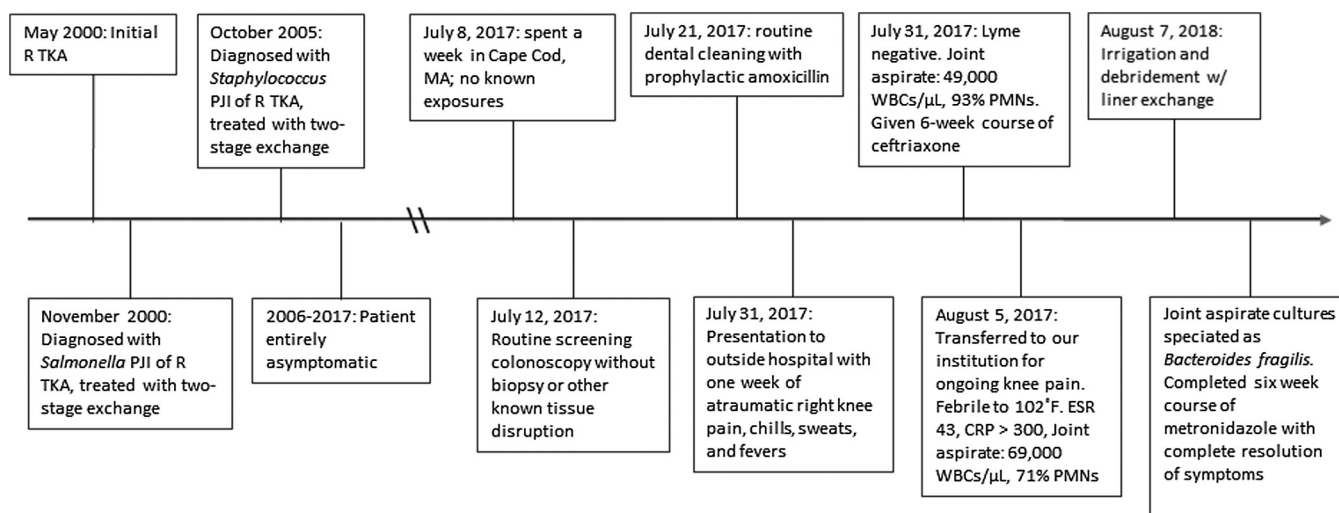


Figure 1. Timeline of events leading up to patient's presentation.

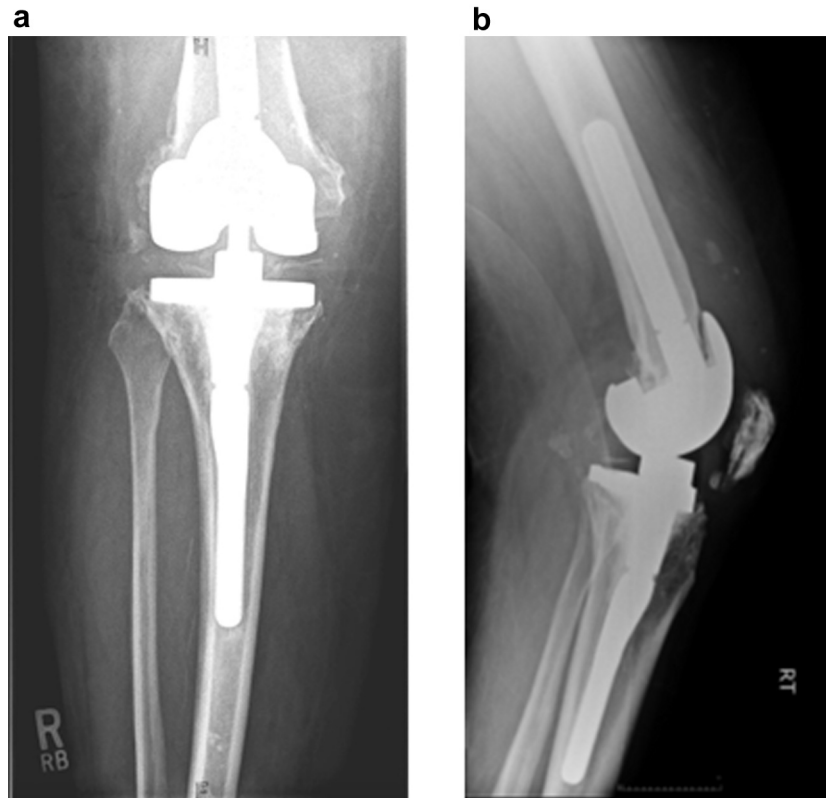


Figure 2. Anteroposterior and lateral radiographs of the right knee at presentation.

to transient bacteremia and subsequent seeding of her knee during this procedure led to her *B fragilis* PJI. This raises the question of whether antibiotic prophylaxis should be used in patients with TKA undergoing GI endoscopic procedures.

Transient bacteremia subsequent to GI procedures has reported incidences from 0% to 5%, though certain studies report a rate of up to 25% for higher risk endoscopic procedures (eg, stent placement or stricture dilatation) [14–16]. Other studies have found, however, that even with colonic stent placement, rates of bacteremia are less than 10% [17]. These discrepant data confound the predictability of the risk of transient bacteremia following GI endoscopic procedures and, indeed, a retrospective analysis of patients who became septic following biliary stenting was unable to develop a model that could predict sepsis in all cases [18]. Nonetheless, the current data would suggest that the risk is likely non-zero [15–19], though it is difficult to determine the significance of this risk as it pertains to influencing clinical guidelines.

The data are even more scarce concerning prophylactic antibiotic use in joint arthroplasty patients who undergo endoscopic procedures. A prospective study of patients with TKA who underwent a GI endoscopic procedure within 2 years of arthroplasty found that endoscopy conferred an odds ratio for PJI of 4 times higher than those who did not [19]. These data, however, were not supported by a different study in which a prospective trial following 1000 patients for 6 years after TKA found that of 14 patients who underwent a GI endoscopic procedure, none developed PJI [20].

There is presently no consensus on evidence-based guidelines for the use of prophylactic antibiotics in patients with joint prostheses undergoing endoscopic procedures. The American Society for Gastrointestinal Endoscopy released guidelines on the use of antibiotic prophylaxis for endoscopy in a variety of clinical scenarios, recommending against administration of antibiotics prior to GI endoscopic procedures in patients with orthopedic implants, but

suggesting that patients with high-risk cardiac conditions or prosthetic cardiac valves receive prophylaxis [21]. The American Society of Colon and Rectal Surgeons and the British Society of Gastroenterology were unable to make specific recommendations regarding use of prophylactic antibiotics in patients with total joint arthroplasty [22]. With regard to ongoing studies, there are currently no randomized control trials or retrospective analyses investigating antibiotic prophylaxis prior to endoscopy or colonoscopy and PJI. One prior prospective trial of oral clindamycin to reduce bacteremia in esophageal dilation showed no benefit [23].

Currently, United States Preventative Services Task Force guidelines recommend screening colonoscopies once every 10 years for the general population over the age of 50 [24]. This has significant overlap with the population age of those receiving TKAs, which again highlights the question of whether antibiotic prophylaxis prior to recommended screening methodologies such as colonoscopy is warranted. The issue of antibiotic stewardship also is raised when considering the decision for prophylactic antibiotics. Indeed, one study modeled the effects of increasing antibiotic resistance on the efficacy of antibiotic prophylaxis and found that a 30% increase in resistance would lead to anywhere between 120,000 to nearly 300,000 more surgical site and post-chemotherapy infections [25]. The ongoing rise in antibiotic resistance makes it necessary to determine where their use is prudent. It is clear that more rigorous data are needed to aid in this discussion.

PJIs lead to significant morbidity and mortality [12,26], and identifying strategies for reducing PJIs is imperative. Although there are no official guidelines at present, certain patient groups felt to be higher-risk or possessing certain characteristics may still currently affect prophylactic antibiotics decision-making. These characteristics may include factors such as consideration of whether a tissue-disrupting procedure such as a biopsy is planned or whether the area in question is malignant or benign, as malignant sites may be

associated with a higher rate of bacteremia [14]. Nevertheless, until further data become available on the topic of prophylactic antibiotics in routine endoscopic screening procedures such as colonoscopy, it is likely that clinicians will have to exercise clinical judgment on the use of prophylaxis based on the patient's characteristics and the specific nature of the endoscopic procedure.

Summary

This case describes an unusual pathogen for PJI following a routine health maintenance intervention (colonoscopy) where the utilization of preprocedure antibiotic prophylaxis is not standardized. We suspect that bacterial translocation during colonoscopy was the source of *B fragilis* PJI. Although this case likely represents a rare clinical scenario, it raises the important question of whether antibiotic prophylaxis should be used in patients with prosthetic joints who undergo GI endoscopic procedures and highlights the gap in current knowledge and literature concerning the appropriate use of antibiotics in this scenario.

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