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Undercooked Leghorn Chicken is A Source of *Campylobacter Jejuni*, An Infectious Agent for Causing Prosthetic Joint Infection and Diarrhea

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ABSTRACT

Campylobacter species commonly cause diarrheal illness. As the *Campylobacter* species are found in chicken and beef, so utilization of contaminated undercook chicken and unpasteurized milk products is a significant reason for diarrhea. This case report describes a rare prosthetic joint infection caused by *Campylobacter jejuni*. The patient ate the undercook Leghorn chicken wings, and after 12h of the meal, he started suffering from a diarrheal illness that followed the prosthetic joint infection. The patient had undergone arthroplasty seven years ago. He started copious, watery stool output along with experiencing pain in his left hip and leg. After blood culture and synovial fluid culture trials, results revealed *C. jejuni*, identified by using MALDI-TOF MS (matrix-assisted laser desorption/ ionization time-of-flight mass spectrometry). The patient recovered after surgery and following a prescription of intravenous and oral ciprofloxacin therapy. This case describes the rare event in medical history that *Campylobacter jejuni* that may be causing prosthetic joint infection. Therefore, we should focus on destroying such infection-causing strains in a meal before eating chicken and beef.

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Introduction

Campylobacter species are found in the internal tissues and intestinal tract in broiler chickens and breeders. In the commercial Leghorn hens, *Campylobacter species* are present in ceca, reproductive track, liver-gallbladder, and lymphoid organs [1]. *Campylobacter jejuni* is a pathogenic strain, and it involves causing infections in humans like Diarrheal illness. Research declared that the virulence of *Campylobacter jejuni* and *the host's* susceptibility are crucial factors. Intake of contaminated unpasteurized milk and food can cause infection; the infective dose of *Campylobacter jejuni* can be as low as 800 bacteria.

This bacterium has very high motility, and its spiral shape also helps it penetrate. To initiate infection, *C. jejuni* has to penetrate through the gastrointestinal mucus. After penetration, the *C. jejuni* adheres to gut enterocytes and releases toxins that cause diarrhea. Different strains of *Campylobacter* species release different kinds of toxins, and the toxicity of these released chemicals varies from strain to strain. Mainly cytotoxins and enterotoxins are released, and they correlate with the severeness of enteritis. At the time of infection, the level of all immunoglobulins production increases in the host.

Among all these classes, IgA is most important as it has the potential to cross the gut wall. The receptors on IgA immobilize the infectious bacteria and also causes short-term immunity against them. To prevent bacteremia, remaining immunoglobulin classes also attack bacteria that enter blood streaming. *Campylobacter jejuni* not only triggers a humoral immune response but also activates the cellular immune system, but the activation of the cellular immune response plays a minor part in the prevention of disease [2]. *C. jejuni* causes gastrointestinal illness due to consuming unpasteurized dairy items and contaminated uncooked food. In this case report, we are discussing the rare joint space infection caused by uncooked chicken consumption. The patient first showed diarrheal illness and then followed to prosthetic joint infection.

Case report

The patient was an older man of approximately 59 years. He had undergone arthroplasty of his left hip seven years before the infection. Even though he was advised to do revision

arthroplasty after 1year of surgery, that was not due to infection. However, that surgery did not cause any limitations in activities and complications in the past seven years. The patient's past medical history comprised of nephrolithiasis, atrial fibrillation, gout, hypertension, asthma, and gastroesophageal reflux. He was taking pantoprazole, rivaroxaban, metoprolol and lisinopril. As a lawyer, he came to attend the Zhejiang conference and stayed in the hotel for the night.

In the preliminary investigation, he said he ate undercooked Leghorn chicken wings, raw cucumber, and broccoli for dinner. On the following day, approximately after 11-12 hours of dinner, he started lower abdominal cramping and copious watery. However, a non-bloody stool, followed by the onset of chills roughly about 8 hours later, and these symptoms were continuously observed in the next two days (48h), but the intensity of chills and stool output began to slow down in the following 24 hours. While improving these symptoms, he started experiencing pain in his left hip that was intensified by walking and weight-bearing. He claimed that is unusual for him; in his big toes, gout flares occurred, but no inflammatory arthritis of his hips was observed in his past medical history. He also explained there was no other joint pain except pain in the big toes. When he arrived at the hospital, his initial temperature was measured at 39C. When he was physically examined, there were no sensational findings other than the pain in the left hip. Initial laboratory tests were done. Reports declared the WBC count of the patient was 12,150cells/mm, while platelets and hemoglobin count were normal [3].

He had routine chemistries, fluctuating carbon dioxide of 21mmol/L and serum sodium of 128mmol/L. CRP (C-reactive protein) of 15.6mg/L and ESR (erythrocyte sedimentation rate) of 71mm/hr was revealed by inflammatory marker assessment. A patient's blood sample was also used in culture, but no growth was observed in blood cultures. His left hip joint was also undertaken with ultrasound-guided aspiration, and dark fluid was taken. The WBC's count was 185,750cells/mm [4]. After these reports, he started receiving vancomycin through the intravenous route; in the following two days, gram-negative rod shape bacteria were reported in joint fluid culture. After the report revealed that the intake of vancomycin was stopped, and Ciprofloxacin was started through the intravenous route.

His blood count was normal for the next four days, and his temperature was 37°C. Other lab test reports showed that serum sodium of 134 mmol/L, hemoglobin of 13 g/dL, albumin of 2.3 g/dL, platelet count, and renal function was normal. Once again, blood samples were collected from the patient, and two sets of cultures were done.

Results showed no growth in both blood cultures. Therefore, the intravenous ciprofloxacin dose was continued. Normal prosthesis alignment was observed in the radiograph of the left hip, and no other abnormality of bone was examined. Again joint fluid culture was done. In that culture *C. jejuni* identified. It was observed that *C. jejuni* is susceptible to the drug ciprofloxacin. The patient was operated on following skin incision, and it was observed that there was a bulk amount of thick, darkish brown, and purulent liquid that was expanding to pseudo-capsule originating from joint space overlying the iliotibial band. Approximately 500ml of that thick, dark brown fluid was removed, and the left hip prosthesis was maintained in the body on the patient's requirement. Cultures after that operation were again done, but in those cultures, there were no acid-fast bacilli, bacteria, or fungi growth.

The patient showed fast recovery, and within three days, the medicine was given through the oral route, 750 mg of Ciprofloxacin twice daily. After one month of surgical debridement, the patient reported minimal pain and returned to his daily routine. In the second month after the operation, his blood cell count and chemistries were also normal. The C-reactive protein of 6.58mg/L and ESR of 19mm/h. After three months of operation, the patient-reported mild stiffness and a full range of motion. CRP of 3mg/dL and ESR of 3mm/h. For the completion of six months antimicrobial course, oral Ciprofloxacin was prescribed for the next three months. The patient recovered completely and joined his routine life and professional work again as usual.

Discussion

Campylobacter species cause prosthetic joint infection; rare cases are reported. In these cases, the infection has generally started and shows symptoms of diarrheal illnesses due to undercooked shellfish, chicken, or meat intake [5,6]. *Campylobacter* species are commonly known for causing gastrointestinal disorders. The literature review observed that *C. jejuni* is causing prosthetic joint infection, and one case was reported earlier. Infection was caused by the intake of contaminated oysters [3]. *C. jejuni* causes gastrointestinal disorders in 2-7 days after exposure to contaminated and undercooked food.

It is followed by chronic immuno-pathogenic sequelae involving reactive arthritis, Guillain-Barré syndrome, and functional bowel syndromes [7-9]. This case report discusses a unique case in which the patient ate undercooked Leghorn chicken and showed diarrheal illness followed by prosthetic joint infection. This case was distinguished from reactive arthritis as the fluid taken from joints when cultured, the positive growth of *C. jejuni* was observed.

Campylobacter genus contains 17 species. Among these 17 species, *Campylobacter coli* and *Campylobacter jejuni* are the most common human pathogens. These strains cause diarrhea and dysentery and cause severe abdominal cramps and fever in the host. Campylobacteriosis is a zoonosis, and an infectious agent is commensal for animals and birds. Therefore, the most common source of this infection is poultry items, but the infection can also spread through the consumption of contaminated water and unpasteurized milk [10].

Campylobacter species are also isolated from fresh products, but rare cases are reported [11,12]. *Campylobacter* species are isolated from poultry items as *Campylobacter* species are commonly found in the reproductive tract, lymphoid organs, ceca, and liver-gallbladder. *In addition*, *Campylobacter jejuni* is found in the gastrointestinal tracts [13-15]. If chicken is improperly stored above 20°C and it is contaminated, then the *Campylobacter* colony count is high in that stored chicken [16]. At low temperatures and long-term storage, the high colony count still presents in chicken juices [17]. *Campylobacter jejuni* is aero-tolerant as it shows unique behavior among microaerophilic bacteria. So they can survive in stressful environments and still survive in food storage conditions [18].

As the *Campylobacter* species are causing gastrointestinal disorders, the researchers focus on using various marinades and additives to decrease the colony count in processing undercooked food and before consuming contaminated food items. Through experimentation, it is observed that the acetic acid containing marinades minimizes the colony count [19]. *Campylobacter jejuni* is also isolated from bovine sources, and it is involved in causing infections in humans [20]. Similarly, *Campylobacter jejuni* is also

found in beef liver, and the percentage of occurrence in the liver is more than in other beef parts. One reason is bile contamination of the liver [21].

Patients suffering from gram-negative prosthetic joint infections, debridement, prosthesis, and oral fluoroquinolone therapy express beneficial results. Reports showed disease free and 80% long term survival [22]. Oral Ciprofloxacin of 750mg twice daily makes bioavailability 65-80% and bone penetration up to 50% of serum levels. The debridement, prosthesis removal, and use of Ciprofloxacin showed better results, with reported two years of disease-free survival [23].

The patient in this case selected prosthesis retention and took prolonged antibacterial therapy. However, long-term antibacterial therapy causes a risk of tendinopathy in patients [24-26]. Another risk also includes Clostridiodes difficile infection, which is more commonly observed when concurrent proton-pump inhibitor therapy is given to the patient [27,28]. Our patient had been taking Ciprofloxacin. *Campylobacter jejuni* isolates showed Fluoroquinolone resistance rates of approximately up to 60%. At the same time, this resistance rate is higher in *Campylobacter coli*, which is 70% [29]. However, calculating vulnerabilities is vital for all *Campylobacter jejuni* isolates from joint fluid and remaining sterile sites to ensure the administration route of respective antimicrobials.

Conclusion

At the end of this case report, we summarized this case as a rare prosthetic joint infection caused by the intake of undercooked Leghorn chicken. The chicken was stored above 20°C and was also contaminated with *Campylobacter jejuni*; when the patient ate the undercooked wings, he started experiencing diarrheal illness in the following 12h after a meal. This case also spotlights the consequences of eating undercooked shellfish, oysters, and meat and unpasteurized dairy items, especially for people with a prosthetic joint. Fluoroquinolone therapy is beneficial for treatment in this case. Successful outcome observed.

Data availability statement

The original contributions presented in the study are included in the article/supplementary material. Further inquiries can be directed to the corresponding author.

Potential conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationship that could be construed as a potential conflict of interest.

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