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Osteomyelitis pubis caused by *Pseudomonas aeruginosa* secondary to surgical site infections subsequent to vulvar cancer surgeries: A case report

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ABSTRACT

Secondary osteomyelitis pubis is rare, particularly when it arises due to genitourinary postoperative infections, such as those occurring after vulvar cancer surgeries. Diagnosis and treatment of secondary osteomyelitis pubis are challenging. Here, we report on two cases of osteomyelitis pubis caused by *Pseudomonas aeruginosa* secondary to surgical site infections after of vulvar cancer surgeries. Both patients were in their 80 s and underwent vulvectomy and vulvar reconstructive surgery using skin flaps. The patients were discharged from the hospital after postoperative antimicrobial treatment for surgical site infections and continued self-cleaning of the wound dehiscence. Both patients presented, respectively, with gait disturbance due to pain in the pubic bone postoperatively at 24 and 7 weeks. Computed tomography (CT) and magnetic resonance imaging (MRI) were performed to confirm the diagnosis of osteomyelitis pubis. The patients underwent pubic bone debridement, and tissue culture revealed the presence of *Pseudomonas aeruginosa* that required several months of antimicrobial therapy. Pubic pain and gait disturbance improved with treatment, and no osteomyelitis pubis relapse has been observed in both cases 12 and 9 months since treatment initiation. CT and MRI were useful in diagnosing osteomyelitis pubis. Early debridement helped identify the causative organism and appropriate antibiotics selection.

1. Introduction

Osteomyelitis is an inflammatory process caused by an infectious microorganism in which the bone marrow is infected, and the intramedullary pressure increases, causing impaired blood flow and necrosis. Osteomyelitis is most common in the lumbar spine and long bones, while osteomyelitis pubis is rare (Lew and Waldvogel, 2004).

Osteomyelitis pubis can be caused via two mechanisms that include non-hematogenous infections, such as local spread of infection to the bone tissue after pressure ulcers, trauma, or surgery; and hematogenous infections resulting from intravascular operations or drug abuse (del Busto et al., 1982; Lew and Waldvogel, 2004). Pelvic radiation therapy is also considered to be a risk (Becker et al., 2020).

Postoperative osteomyelitis pubis has been reported in cases of urological surgery, such as in women undergoing suprapubic vesicourethral suspensions for urinary stress incontinence (Burns and Gregory, 1977; del Busto et al., 1982; Rosenthal et al., 1982; Sexton et al., 1993; Ross and Hu, 2003; Gilbert et al., 1975) and in men undergoing prostatectomies (Samellas and Finkelstein, 1962). Wound complications, including wound infections, cellulitis, and wound breakdowns are common in patients undergoing vulvar cancer surgery; however, secondary osteomyelitis pubis is rare (Wills and Obermair, 2013). Only six such cases have been reported following gynecologic cancer surgery (Hoyme et al., 1984; Kiselow et al., 1967), including three after radical vulvectomy for vulvar cancer. Diagnosis is often delayed, becuase osteomyelitis pubis typically develops several months after a surgical site infection, and fever may be absent

(Rosenthal et al., 1982; Hoyme et al., 1984). Treatment is often difficult, because of the need for bone tissue sampling to confirm the causative organism, and the poor transfer of antibiotics and

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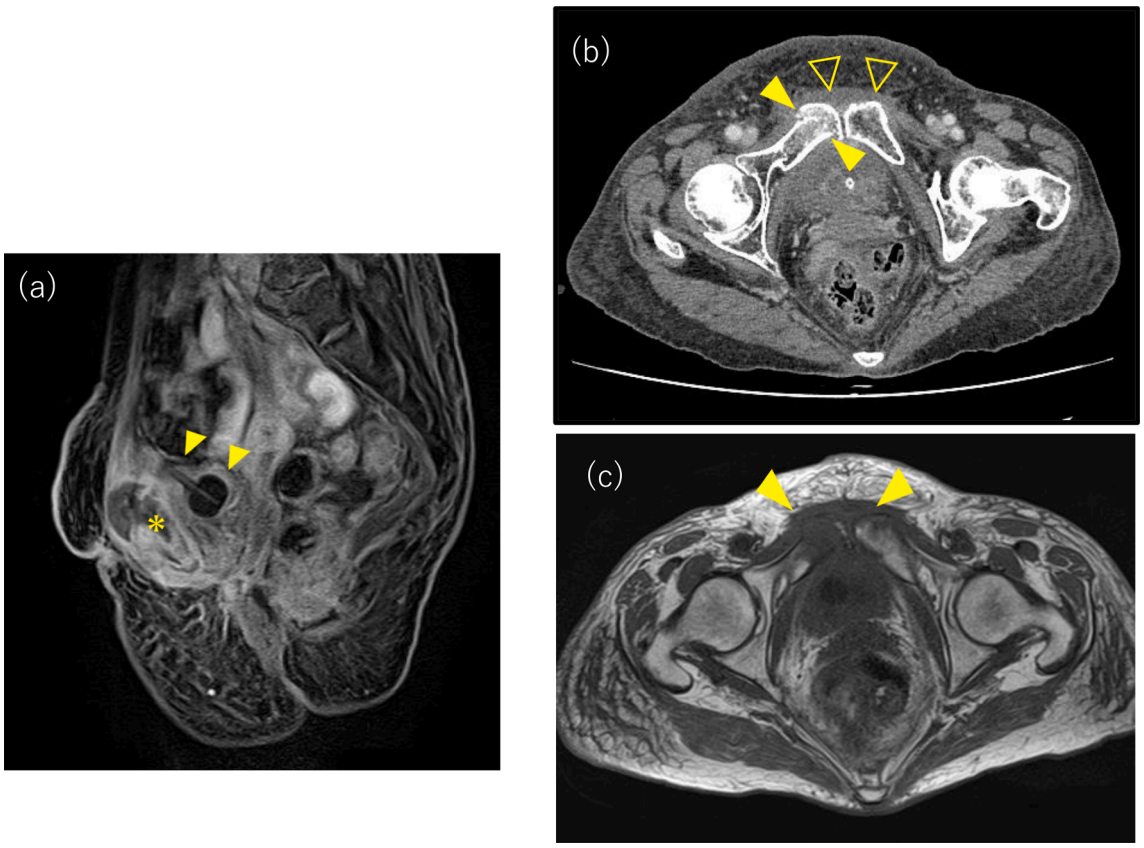

Fig. 1. Case1. (a) A cystostomy (▲) is performed suprapubically (*). (b) CT scan shows soft tissue swelling(△) and right pubic fracture (▲). (c) MRI T1-weighted image demonstrates low-signal areas in bilateral pubic bone marrow (▲).

inflammatory cells to the avascular osteonecrotic tissue (Lew and Waldvogel, 2004).

Here, we report on two cases of postoperative osteomyelitis pubis that was successfully diagnosed and treated. To our knowledge, this is the first case report of osteomyelitis pubis that developed after surgery for vulvar cancer that was diagnosed using computing tomography (CT) and magnetic resonance imaging (MRI).

Ethics approval and consent to participate and consent for publication.

The study was conducted in accordance with the Declaration of Helsinki. Consent was obtained from the patients for publication of this case report and accompanying images.

2. Case report

Case 1. An 81-year-old female patient with a past medical history of complications resulting from a peripheral venous thrombosis, and hypertension was admitted for concurrent chemoradiotherapy as the initial treatment for Stage II (cT2N0M0) squamous cell vulvar carcinoma. Eight months after the initial treatment, the cancer recurred locally, and seven weeks of weekly paclitaxel was administered. Because paclitaxel caused drug-induced pneumonia, the patient opted for surgical treatment. For local residual disease, the patient underwent extensive vulvectomy, urethrotomy, cystostomy, and vulvar reconstructive surgery with gracilis myocutaneous flaps. A cystostomy was performed suprapubically (Fig. 1a). On the third postoperative day, a surgical site infection was observed. Wound culture showed *Pseudomonas aeruginosa* and intravenous piperacillin-tazobactam (4.5 g every 6 h) was administered for 2 weeks. The patient was discharged from the hospital and continued self-cleaning of the wound. Four months after surgery, the patient presented to the hospital with difficulty in walking due to pubic pain. Vital signs at the time of this admission included a body temperature of 36.5 °C, blood pressure of 169/80 mm Hg, and heart rate of 76 beats/min. The blood test results revealed a white blood cell (WBC) count of 7700 μL, C-reactive protein (CRP) level of 10.03 mg/dL, and serum squamous cell carcinoma (SCC) antigen level of 0.5 ng/mL (normal range, 0–1.5 ng/mL). A CT scan (Fig. 1b) showed soft tissue swelling and a right pubic fracture, and MRI T1-weighted images (Fig. 1c) revealed low signal areas in the bilateral pubic bone marrow. Pubic bone debridement was performed with the purpose of treatment and identifying the causative organism. Blood culture results were negative; however, the urine culture revealed the presence of *Pseudomonas aeruginosa* and *Serratia marcescens*. In addition, analysis of a percutaneous bone biopsy and debridement tissue revealed the presence of *Pseudomonas aeruginosa*. Subsequently, 6 weeks of intravenous cefepime and 2 months of oral ciprofloxacin were administered. The patient was hospitalized for 8 weeks and recovered to walking with the use of a walker. No relapse of osteomyelitis pubis was observed during the 9-month follow-up after the administration of antimicrobial therapy.

Case 2. An 87-year-old female patient was admitted to our hospital, with Stage IB (T1bN0M0) squamous cell vulvar carcinoma. She had a medical history of myocardial infarction and peripheral venous thrombosis. Local vulvar excision, partial urethral resection, and vulvar reconstructive surgery with rotation femoral myocutaneous flaps were performed. Intravenous cefazolin was administered from the second postoperative day for 8 days to treat the surgical site infection. This patient had persistent postoperative urine leakage and the wound was constantly contaminated with urine. The patient was discharged from the hospital and continued self-cleaning the wound dehiscence and urine leakage. Two months after surgery, she presented at the hospital due to difficulty in walking, because of pubic bone pain. Vital signs at the time of this admission included a body temperature of 36.9 °C, blood pressure of 120/56 mm Hg, and heart rate of 74 beats/min. The blood test results revealed a WBC count of 9440 μL, CRP level of 13.26 mg/dL,

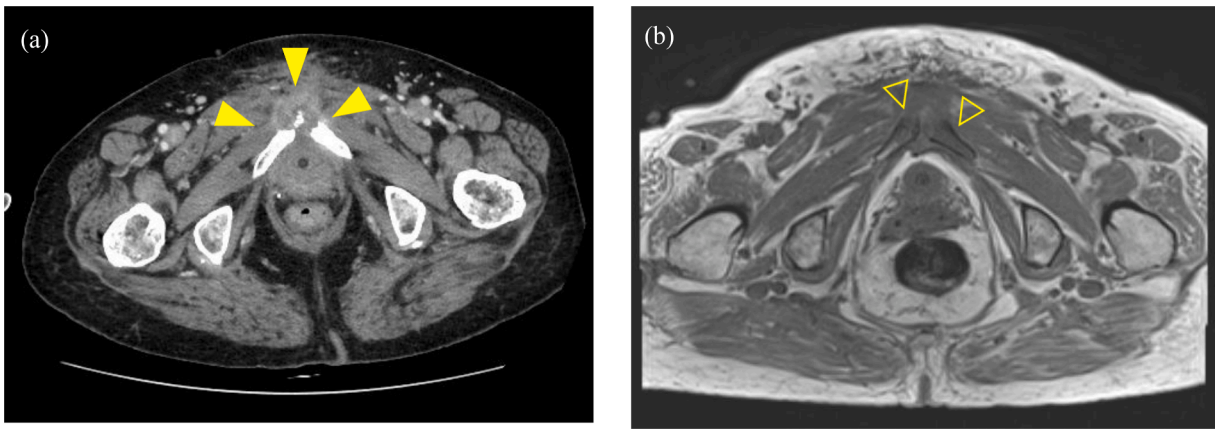

Fig. 2. Case2. (a) CT scan shows fracture of the pubic bone and fluid accumulation (▲). (b) MRI T1-weighted image demonstrates low-signal areas in bilateral pubic bone marrow (△).

and serum SCC antigen level of 0.8 ng/mL (normal range, 0–1.5 ng/mL). A CT scan (Fig. 2a) revealed a pubic bone fracture and fluid accumulation. MRI T1-weighted images (Fig. 2b) revealed low signal areas in the bilateral pubic bone marrow. Culture results of the blood, urine, and aspirate of the abscess were negative. Culture of the debridement tissue revealed the presence of *Pseudomonas aeruginosa*. Subsequently, intravenous piperacillin-tazobactam (4.5 g every 6 h) was administered for 7 weeks. Thereafter, the patient received oral ciprofloxacin and amoxicillin-clavulanate. The patient was hospitalized for 7 weeks, recovered well, and was able to walk using of walker. After 3 months of oral antibiotics, cancer recurrence in the right inguinal lymph node was detected and resected, and an additional 5 months of oral antibacterial therapy was scheduled, because the surgical field was close to the pubic bone. No relapse of osteomyelitis pubis was observed 9 months since the start of treatment.

3. Discussion

Urological procedures may cause pubic bone infection, due to urine leakage into the prevesical space during micturition. Injury to the os pubis from the pressure of the retractors, direct trauma from sharp dissection, and the use of electrocautery for hemostasis are considered as risk factors for infections (Hoyme et al., 1984). Pelvic radiation therapy is also considered to be a risk (Becker et al., 2020).

In our cases, perioperative prophylactic antimicrobials were administered according to clinical practice guidelines (Bratzler et al., 2013). Cefmetazole Sodium was administered 30 mins before surgery and every 3 hours during surgery. In the current case report, these factors may have contributed to the development of osteomyelitis pubis. First, older adult patients self-cleaned their breakdown wounds; these wounds may not have been adequately cleaned. Second, the wound might have been continuously contaminated with urine. In Case 1, there may have been urine leakage from the cystostomy to the pubis; in Case 2, the wound was constantly contaminated by urine leakage. Third, radiation therapy to the pelvis was also a risk factor in Case 1.

Osteomyelitis pubis presents with a wide-based walking gait by the pubic pain and sometimes does not cause fever (Sexton et al., 1993; Ross and Hu, 2003). Tenderness in the pubic bone is a characteristic symptom that helps in diagnosis. Symptom onset is typically several months after surgical site infection (Rosenthal et al., 1982; Sexton et al., 1993; Becker et al., 2020, Hoyme et al., 1984).

In the present case report, several months after the initial surgery, the patients suddenly developed pubic bone pain and gait disturbance. Because both patients were afebrile, we suspected cancer recurrence or fragility fractures due to osteoporosis; however, there were no increases in tumor markers, and analyses of the bone tissue biopsies revealed no evidence of recurrence. CT and MRI showed osteolytic fracture in the pubic bone due to osteomyelitis, which ruled out a fragility fracture.

In the imaging diagnosis of osteomyelitis, CT is more sensitive than X-ray; however, bone erosion is not shown in the early stages. Nevertheless, CT is useful for assessing the extent of soft tissue inflammation, and it is also used at imaging-guided biopsies and abscess drainage. MRI is the most useful imaging modality, with a sensitivity and specificity of 96 and 82 %, respectively (Llewellyn et al., 2020), showing changes within 1–5 days of onset (Dinh et al., 2008). MRI reveals edematous changes (low signals on T1-weighted images, equivalent to the high signals on T2-weighted images) in the bone marrow before the erosive changes become evident (Lew and Waldvogel, 2004; Becker et al., 2020). These were the findings reported in diabetic foot ulcers; however, they were also seen in our cases of osteomyelitis pubis and led to early diagnosis. CT showed soft tissue edema and fluid retention around the pubic bone, and low-signal areas in the pubic bone marrow was demonstrated on MRI T1-weighted image.

Standard treatment for chronic osteomyelitis is debridement and long-term antimicrobial use. Early imaging diagnosis and therapeutic intervention are necessary because delayed intervention may result in instability and second gait problems. Bacteria isolated from the surface of an infected fistula or open wound tend to be contaminants and should not be treated. The true causative organisms of origin are best obtained from deep surgical specimens with debridement. The most common bacterium responsible for osteomyelitis is *Staphylococcus aureus*. *Pseudomonous aeruginosa* is often associated with nosocomial infections or drug abuse patients (del Busto et al., 1982; Ross and Hu, 2003; Lew and Waldvogel, 2004).

In our case, debridement of the pubic bone was performed by the orthopedic surgeon soon after the imaging diagnosis, and *Pseudomonas aeruginosa* was diagnosed as the causative organism. We hypothesized that duration and coverage of antimicrobial use for surgical site infections may have been inadequate for *Pseudomonas aeruginosa* and persistently infect the pubic bone. The urine culture in Case 1 also revealed the presence of *Pseudomonas aeruginosa*, suggesting the possibility of infection. Antimicrobial therapy to those targeting *Pseudomonas aeruginosa* was started as soon as it was identified. The patients showed decrease in CRP level and improvement in pubic pain, and with rehabilitation, the patients improved to where could walk independently with a walker.

In conclusion, we present two cases of patients who underwent surgery for vulvar cancer and developed osteomyelitis pubis, secondary to surgical site infection. This is the first case report of postoperative osteomyelitis pubis bone diagnosed using CT and MRI in patients with vulvar cancer. Confirming the diagnosis of osteomyelitis pubis by imaging enabled prompt drainage, identification of the causative

organism, and lead to appropriate treatment.

CRediT authorship contribution statement

Makiko Omi: Conceptualization, Data curation. **Yumiko Oishi Tanaka:** Conceptualization, Project administration, Writing – review & editing. **Taisuke Enokida:** Methodology, Resources, Writing – review & editing. **Brian Hayama:** Methodology, Resources, Writing – review & editing. **Keiko Hayakawa:** Methodology, Writing – review & editing. **Atsushi Fusegi:** Writing – review & editing, Supervision. **Hidetaka Nomura:** Visualization, Conceptualization, Writing – review & editing. **Hiroyuki Kanao:** Validation, Writing – review & editing.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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