Occult Open Pelvic Fracture in the Female Perineal Area: A Rare Case Report and Review

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Key Clinical Message

Open occult pelvic fractures in female perineal area are exceptionally rare and can be easily overlooked. If pelvic CT indicates the presence of the 'free black air bubble sign' and 'fracture blade sign', it is crucial to conduct a meticulous perineal physical examination and colposcopy. Immediate colostomy enhances treatment outcomes.

MeSH Keywords: Open pelvic fractures, Open acetabular fractures, Occult fractures, Perineal area injuries

INTRODUCTION

An open pelvic fracture refers to a fracture site exposed to the external environment. One specific type, which involves exposure through pelvic viscera such as the vagina, urethra, and rectum, constitutes only 2%-4% of pelvic fractures, yet it carries a mortality rate of 30%-50% [1]. Female perineal wounds are prone to being overlooked, leading to delayed treatment and severe infections. To enhance early detection and effective management, careful observation of the 'free black air bubble sign' and 'fracture blade sign' on pelvic CT, along with a thorough examination of the labia wound in the female perineum and colposcopy is essential.

We present a case of inconspicuous open pelvic fracture accompanied by a small wound in the nympholabial furrow. A 37-year-old woman experienced multiple fractures and soft tissue injuries in a car accident, with the left hip absorbing the primary impact and sustaining the most severe injury. The open wound in the perineal area went unnoticed initially due to the absence of apparent symptoms and the unique anatomical structure.

CASE PRESENTATION

A 37-year-old woman was struck by a container truck and subsequently run over twice by wheels. She presented at our emergency trauma center approximately 5 hours after the incident. Physical examination revealed a significant degloving injury on her right hand (Figure 1). In addition, her hips exhibited swelling with impaired mobility, and there was ecchymosis and swelling of the skin from the left groin to the upper left thigh. Both ankle joints were swollen and immobilized. CT (Figure 1) confirmed a comminuted fracture of the sacrum and obturator, left femoral neck combined with an intertrochanteric fracture, right fifth metacarpal fracture, dislocation of the right carpometacarpal joint, right lateral malleolar fracture, left distal tibiofibular fracture, and multiple fractures of the metatarsal tarsal in both feet. There was also injury to the left superior and inferior gluteal arteries, retroperitoneal hematoma, right kidney contusion, and a

horseshoe kidney. Emergency interventions included pelvic external fixation and left internal iliac artery embolization, along with bilateral ankle external fixation. Subsequently, the patient was transferred to ICU.

Pelvic CT revealed a sharp bone fragment from the lower sciatic branch piercing towards the vagina (Figure 1). Notably, the left hip joint, and the area underneath the abdominal wall exhibited an extensive 'free black air bubble sign' (Figure 2), indicating the entry of air into the body through an open wound. Sharp fracture fragments were identified in the pelvic floor near the urethra and vagina. Unfortunately, professionals in radiology, emergency departments, orthopedic trauma, general surgery, obstetrics, and gynecology overlooked this critical CT sign.

On the fifth day of admission, percutaneous drainage was performed on the Morel-Lavallée injury of the left thigh , resulting in the drainage of 1700 ml of bloody mixed fatty fluid. On the ninth day, extensive skin necrosis had become apparent on the left hip, anterolateral left thigh, right thigh, and lateral right calf (Figure 3). Physical examination indicated swollen labia and a blood clot at the external vagina, initially interpreted by the gynecologist as a menstrual blood clot. the general surgeon determined that there was no colonic, rectal, or vaginal rupture and concluded that there was no indication for colostomy. The second gynecological discovered contusion on the vaginal wall at the 5 o'clock position through colposcopy. Additionally, a 2.0 mm puncture wound was identified in the left nympholabial furrow (Figure 3). On the tenth day, debridement exploration and Vacuum-assisted Closure Drainage (VSD) were performed to remove necrotic skin from the left buttock and left thigh. The exploration revealed pus accumulation in the perineal area and the adductor femoral canal, along with necrosis of the iliotibial fascia, lateral femoral muscle. Black necrosis was observed in sacrococcygeal area (Figure 4). The wound infection and necrosis persisted and worsened due to continuous contamination from defecation, along with pus accumulation in the sacral, vaginal, and rectal fossa, despite debridement on the fourteenth day. Despite undergoing multiple debridements, the wound remained uncontrollably infected, primarily due to fecal contamination. Although nutritional support therapy was administered, the patient continued to experience anemia and low-protein levels. On the twentieth day, an exploratory laparotomy and colostomy were performed, the perineal area was clean without fecal contamination. Intravenous administration of 1.0g Vancomycin twice daily, coupled with adding Vancomycin to a 3-liter bag for wound irrigation and drainage, effectively brought the wound infection and necrosis under control. All laboratory indexes showed a tendency to normalize. Subsequently, the patient underwent right hand dorsal, left hip, and buttock flap transplantation, along with internal fixation of the right fifth metacarpal fracture. Throughout the hospitalization, the patient received a total of 54 units of RBCs, 1,200 ml of fresh frozen plasma, 2,870 ml of frozen plasma, and 865 g of human albumin. Three months post-trauma, pelvic CT and MR scans revealed necrosis of the left femoral head (Figure 5), with no 'free black air bubble sign'. The joint surgeon recommended Total Hip Arthroplasty (THA) after 3-6 months of wound healing.

After a 122-day hospitalization, the right abdominal colostomy showed no signs of infection. All wounds had successfully healed (Figure 6).

DISCUSSION

In emergency situations, orthopedic surgeons may be heavily occupied with life-saving measures, potentially leading to limited attention to obvious wounds and fractures. This oversight can be particularly problematic in cases of occult open pelvic fractures in the female perineal area. It is characterized by a blood clot in the perineal wound, often mistaken for a menstrual blood clot. Failing to diagnose and treat promptly can result in the spreading and progressive worsening of the infection, posing a life-threatening situation. The diagnosis and management of this specific damage involve five key points as below.

Characteristic images on pelvic CT

In pelvic CT scans, the 'free black air bubble sign' and 'fracture blade sign' distributed around the urethra and vagina. Open pelvic fracture diagnosis is established when both of these signs are observed.

Female Perineal Area Examination

If 'free black air bubble sign' is detected on pelvic CT, and there are no wounds in the lower abdomen, pelvis, hips, buttocks, and sacrococcygeal area, the perineal area should be examined for skin wounds. Blood in the perineal area might be misdiagnosed as menstrual clots and need colposcopy.

One-stage colostomy

Faringer [2] suggested that injuries involving zone I (pubic node, perineum, sacrum, rectum, and vagina) should undergo colostomy. In 1997, Jones-Powell [3] proposed categorizing injuries to the peripelvic soft tissue and organs as injuries to the rectal and perineal area. In 2015, Fu et al [4] introduced a modified classification, dividing the perineal area into the genitourinary and rectal-anal area. Those involving injuries in the rectal-anal area should undergo colostomy. Open pelvic fractures with fracture site puncturing the rectum and vagina can lead to extensive deep contamination, triggering pelvic infections, sepsis and even multiple organ failure (MOF). The mortality rate is as high as 26% [5-6]. Performing colostomy proactively can improve outcomes and reduce the mortality rate [7-12]. It is also a prerequisite for subsequent internal fixation [13]. According to Jones et al [3], performing colostomy within 48 hours after injury can reduce the morbidity and mortality rate from 75% to 20%.

This case may support the indications for colostomy, emphasizing the rationale for a one-stage colostomy. Fecal bacteria entering the perineal wound can lead to infection. Accumulated fecal bacteria in the intestines may infiltrate the wound area through the colon wall and greater omentum, causing secondary infection. Toxins from feces and bacteria can potentially damage the patient's liver and kidney function. Colostomy prevents absorption of fecal toxins, enables an early resumption of eating, promotes the recovery of digestive tract function, and effectively absorbs nutrients from food.

Timely and correct management of Morel-Lavallee injuries Hudson et al [14] reported that approximately one-third of patients experienced an early missed diagnosis. This oversight can lead to complications such as infection, skin necrosis, sepsis, and the potential development of septic shock, posing a serious threat to the patient's life and influencing the course of fracture treatment. The following cases should be heightened vigilance. There is a clear history of blunt trauma, such as wheel crushing or heavy impact, particularly involving the thigh and pelvic acetabulum. Abnormal skin color in the affected area, loss of sensation, and swelling may be observed. Additionally, ovoid liquid mass under the skin with distinct fluctuating sensations could be present. MRI suggests mixed high and low signals in both T1WI and T2WI. Both CT and MRI examinations can accurately confirm the injury's location and assess the extent of its cystic wall [15-16]. Ultrasound reveals anechoic characteristics located between the subcutaneous fat and deep fascia. These characteristics may be combined with strong echogenic nodular imaging manifestations of fat globules distributed along the capsule wall. For subcutaneous effusions with a diameter of less than 15.0 cm and no skin necrosis, negative pressure drainage and elastic bandages can be employed to prevent the fluid accumulation and promote close apposition of the skin to the deep tissues. This facilitates re-establishing the subcutaneous blood circulation pathway. If the diameter is more than 15.0 cm, irrigation are necessary. In the case of skin necrosis, scab removal and debridement are required. Minimal invasive debridement with closed suction drainage has the advantage of the evacuation of the hematoma, providing drainage, reducing the bacterial burden, and preserving the soft-tissue envelope [17]. Due to the accumulation of necrotic tissue and exudate in the wound, leading to the blockage of the sponge hole of the VSD, requires regular flushing 2-3 times a day.

Laboratory Indicators Blood routine, liver and kidney function, CRP, ESR, PCT and IL-6 levels should be monitored to detect any signs of systemic sepsis or MODS. It is crucial to comprehensively assess the severity of the infection, along with the patient's immune, nutritional, dietary, defecation, and sleep status.

CONCLUSION

This case highlights the risks to overlook open occult female pelvic fractures in the perineal area. Detection becomes more feasible when features such as the 'free black air bubble sign' and 'fracture blade sign' on CT, and perineal wounds are identified. These signs help prevent missed diagnoses. Once the diagnosis is confirmed, the necessity of colostomy arises to prevent fecal contamination of the wound, thereby averting

widespread infection and safeguarding the patient's life. In instances of combined MLL injury, immediate considerations for puncture-negative pressure drainage or incision and drainage, along with pressure bandaging, should be explored to achieve optimal therapeutic outcomes.

AUTHOR CONTRIBUTIONS

Jingwei Xiao: Data curation; writing–original draft.

Ding Xu: Supervision; writing–review & editing.

Ming Li: Conceptualization; writing–review & editing.

Dian Wang: Data curation;writing–review & editing.

Guoping Pan: Data curation;writing–review & editing.

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None to declare.

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None.

CONFLICT OF INTEREST STATEMENT

The authors declare no conflicts ofinterest.

DATA AVAILABILITY STATEMENT

Data analyzed are included in the published report.

ETHICS STATEMENT

Written informed consent was obtained from the patient in our study. The purpose of this research was completely explained to the patient and was assured that her information will be kept confidential by the researcher. The present study was approved by Ningbo No.6 Hospital Ethics Committee.

CONSENT

Written informed consent was obtained from the patient to publish this report in accordance with the journal's patient consent policy.

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Figure Legends

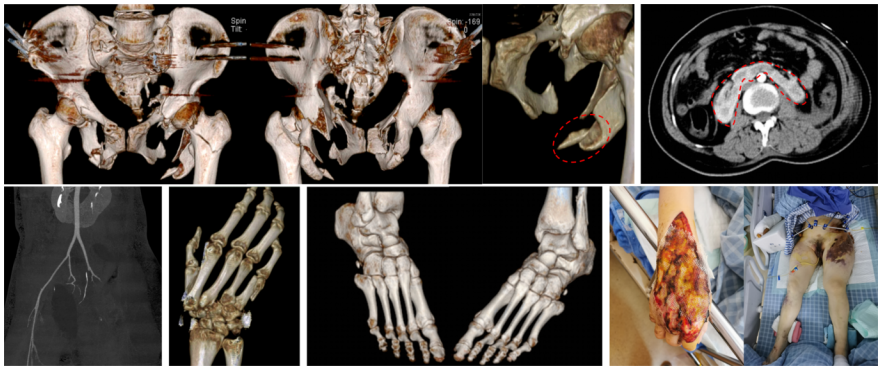

Figure 1. Post-injury imaging. A. Comminuted fracture of sacrum and obturator, and left femoral neck combined with intertrochanteric fracture. B. Right renal contusion with horseshoe kidney. C. CTA showed injury to the left superior and inferior gluteal arteries. D/E. Right hand and double foot injuries. F. Degloving injury of the right forearm and the buttocks to thighs, bilaterally.

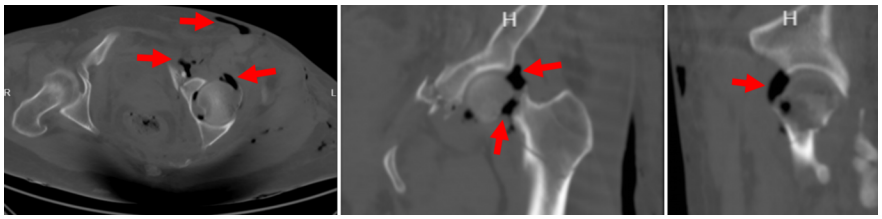

Figure 2. Pelvic CT revealed the 'free black air bubble sign', indicates external air invasion and the presence of a superficial wound.

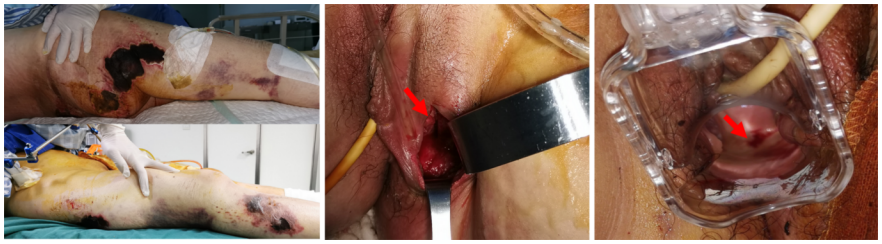

Figure 3. 9 days after admission. A. Photograph of ischemic necrosis of the skin of the Morel-Lavallée injury. B. Wound of the interlacrimal sulcus, punctured by the fractured end of the subpubic branch. C. Contusion wound on the vaginal wall, visualized through colposcopy.

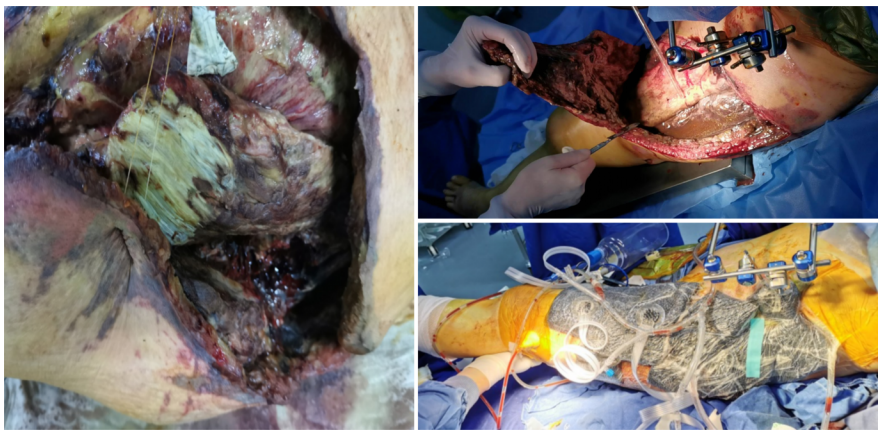

Figure 4. 10 days after admission. A. Wound infection spread with necrosis of huge areas of muscle in the left hip and thigh. B. Intraoperative photo of debridement of left thigh, extensive subcutaneous adipose tissue liquefaction, and necrosis. C. Vacuum Sealing Drainage (VSD).

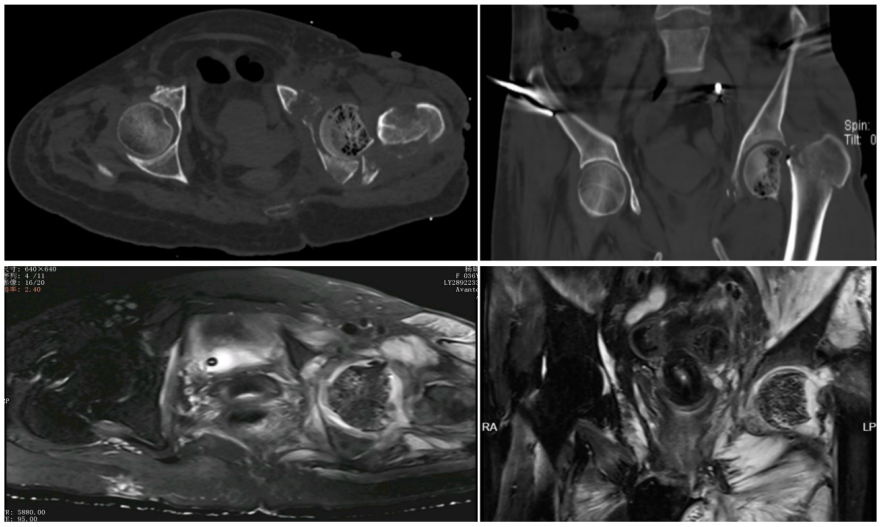

Figure 5. 100 days after injury, pelvic CT and MRI showed necrosis of the left femoral head. A. CT's axial and coronal sections. B. MRI's axial and coronal sections.

Figure 6. The wound of perineal area healed, and the flap of left hip and thigh healed well.

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