

A rare case of avulsion fracture of the iliac crest apophysis in a young male patient: a case report

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Case Report

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Abstract

Background

Avulsion fractures of the iliac crest in adolescents are rare injuries that remain insufficiently described in the literature. Their low incidence, combined with the late ossification of the iliac crest apophysis, may result in delayed diagnosis or inappropriate management. Available case reports and small case series describe favorable outcomes following both conservative and surgical treatment.

Case presentation

We present the case of a 16-year-old German male adolescent who sustained an avulsion fracture of the right iliac crest caused by a skiing accident. Due to significant fragment displacement and persistent pain, the patient was treated surgically with open reduction and screw osteosynthesis and achieved a good clinical outcome. This report discusses the mechanism of injury as well as diagnostic and therapeutic considerations.

Conclusions

This case illustrates that markedly displaced iliac crest avulsion fractures in adolescents can be successfully treated with operative fixation, allowing anatomical reduction, early mobilization, and rapid return to activity. Given the rarity of this injury, further studies are required to define clear surgical indications; however, substantial displacement may represent a reasonable threshold for considering operative management.

Background

Avulsion fractures of the pelvic apophyses are uncommon injuries that occur predominantly in adolescents.[1–2] Among these injuries, avulsion of the iliac crest apophysis is considered the rarest, accounting for approximately 2% of all pelvic avulsion fractures in skeletally immature patients.[1–3] The vulnerability of the iliac crest apophysis during adolescence is related to its delayed ossification, which renders the cartilaginous growth plate weaker than the attached musculotendinous structures.[4] Most iliac crest avulsion fractures result from sudden, forceful muscle contractions involving the abdominal wall muscles, including the external oblique, internal oblique, and transversus abdominis, often during activities requiring explosive movements such as running, jumping, or kicking.[4–5] Following avulsion, displacement of the fragment may occur due to traction forces exerted by the tensor fasciae latae and gluteus medius muscle, although the broad muscle insertions of the pelvis typically limit the extent of displacement. Repetitive microtrauma has also been suggested to predispose the apophysis to acute avulsion injuries caused by comparatively lower traction forces.[2] In addition, direct trauma has been reported as a less common but possible mechanism of injury.[4–6] Clinically, patients usually present with acute, localized pain and tenderness over the iliac crest, frequently accompanied by functional impairment and difficulty with weight bearing.[7–8] Diagnosis may be challenging, as the iliac crest

apophysis can be radiolucent at early stages of skeletal development, making additional imaging necessary when clinical suspicion persists despite inconclusive radiographs.

For avulsion fractures of the iliac crest, only small case numbers have been reported in the literature, and general recommendations regarding operative management are lacking. In contrast, the evidence base for anterior superior iliac spine (ASIS) avulsion fractures is considerably more robust. Currently, conservative management remains the mainstay of treatment for this injury and typically includes analgesia, rest, temporary immobilization of the affected limb, and structured physical rehabilitation.[1, 3, 9–10] However, clinical recovery is often prolonged, commonly requiring 6–10 weeks or even up to 12 weeks, which may not meet the rehabilitation demands of highly active patients.[11] However, significant fragment displacement, persistent pain, or functional demands may justify surgical intervention in selected patients.[7–8, 12] We present a rare case of an adolescent patient with an avulsion fracture of the iliac crest apophysis sustained after a traumatic fall while skiing, managed operatively, and discuss the mechanism of injury, diagnostic approach, and treatment considerations.

Case presentation

A 16-year-old male adolescent presented to our emergency department with severe right hip pain and inability to bear weight due to a skiing accident. The injury occurred after a direct traumatic impact to the right pelvic region during the fall, with immediate onset of pain and functional limitation.

Physical examination revealed marked tenderness over the right iliac crest and restricted active hip motion due to pain. Active hip flexion and straight leg raise were not possible. No groin pain was reported, and there were no signs of hip joint block or limb length discrepancy. Neurovascular examination was unremarkable.

An anteroposterior (AP) radiograph of the pelvis demonstrated an avulsion fracture of the right iliac crest apophysis with significant displacement ($> 3\text{cm}$) of the fragment (Fig. 1a). A subsequent computed tomography (CT) scan with 3D reconstruction was performed to better understand the fracture morphology and plan the operation. (Fig. 1b). It revealed a long avulsion of the iliac crest, starting at the anterior superior iliac spine and extending dorsally over more than 5cm. The apophysis itself was not fractured, but sheared off from the apophysis junction and displaced laterally and inferiorly. Magnetic resonance imaging (MRI) was performed to assess the apophyseal growth plate and surrounding soft tissues and revealed associated edema without additional intra-articular pathology (Fig. 1c).

Given the degree of displacement and persistent pain, surgical treatment was indicated.

The patient underwent open reduction and internal fixation under general anesthesia in the supine position with the right leg freely draped (Fig. 2). After sterile preparation, an incision was made slightly lateral to the residual iliac crest, and the subcutaneous tissue was dissected. The fasciae and attached muscles were intact both in the abdominal direction (external oblique muscle) and in the gluteal direction (tensor fasciae latae muscle, gluteus medius muscle). To gain visualization of the fragment, an

incision of the abdominal muscle fascia was necessary. The displaced iliac crest fragment was identified, mobilized, and the periosteum and surrounding fascia were gently elevated (Fig. 3). The fragment was reduced using a lever maneuver with the hip flexed and adducted (Fig. 4), temporarily fixed with Kirschner wires, and definitively stabilized with three 3.5 mm cannulated screws with washers under fluoroscopic guidance. Soft tissues, including the oblique fascia and periosteum, were meticulously reconstructed. Intraoperative imaging confirmed anatomic reduction and correct implant placement (Fig. 5a-b).

Postoperatively, the patient was allowed partial weight bearing. Active hip movements involving forced flexion, abduction, or internal rotation, as well as passive hip hyperextension, adduction, or external rotation, were restricted for six weeks. Analgesics were prescribed for pain management.

At the 6-week follow-up in our outpatient clinic, the patient reported a significant reduction in pain. Passive hip flexion was possible up to 90°, while internal and external rotation remained slightly restricted. At this point, the patient was cleared to begin more intensive physiotherapy. In addition, progressive weight bearing was permitted, with an increase of 15 kg every three days until full weight bearing was achieved.

At the 3-month follow-up in our outpatient clinic, the patient reported an excellent clinical recovery. He was able to move the hip freely and was completely pain-free during everyday activities and physical examination. Apart from a mild pulling sensation in the area of the surgical scar, he reported no residual symptoms. The range of motion of the hip was unrestricted, and there were no functional limitations. Given the favorable clinical course, the patient had already resumed sporting activities and was able to participate without significant discomfort. Overall, the patient demonstrated a satisfactory recovery with restoration of hip function and return to physical activity.

At the 8-month follow-up in our outpatient clinic, the patient reported complete resolution of pain and had returned to unrestricted participation in all sporting activities. He reported no residual functional limitations and expressed a high level of satisfaction with the clinical outcome. Radiographically, minor ossifications had developed region of the osteosynthesis; however, these were not associated with any clinical or functional impairment.

Discussion and Conclusions

Avulsion fractures of the iliac crest apophysis are rare injuries in the adolescent population and account for only a small fraction of all pelvic avulsion fractures.[1–3] Their rarity, combined with the late ossification of the iliac crest apophysis, can lead to delayed diagnosis or mismanagement, particularly in cases with subtle displacement or in patients presenting after trauma outside of high-impact sports.[4]

Conservative management remains the standard treatment for minimally displaced iliac crest avulsion fractures and generally results in satisfactory outcomes. However, recovery is often prolonged, typically lasting 6–12 weeks, which can significantly disrupt the training and competitive schedule of high-level

athletes.[11] Moreover, conservative treatment carries risks such as symptomatic malunion or cosmetically unappealing exostoses.[11, 13] In cases with significant displacement, persistent pain, or high functional demands, surgical intervention can provide stable fixation, allow early mobilization, and shorten the convalescence period.[7–8, 12]

In the present case, open reduction and internal fixation with cannulated screws enabled precise anatomical reduction of the displaced fragment, preservation and reconstruction of the surrounding fascia and periosteum, and early controlled mobilization. The patient achieved rapid pain relief, progressive fracture healing, and gradual return to activity within six weeks. This outcome aligns with previous reports suggesting that operative management may be particularly advantageous in adolescent patients who require early return to activity or have significant fragment displacement. While there is no strong evidence demonstrating superior long-term functional outcomes compared to conservative treatment, surgery offers the benefit of faster rehabilitation and reduced risk of displacement or secondary complications.

This case highlights the importance of early recognition, appropriate imaging including CT and MRI when needed, and individualized treatment planning. It also emphasizes that, although rare, iliac crest avulsion fractures should be considered in adolescents presenting with acute hip or pelvic pain after trauma, even outside classical high-impact sports. Furthermore, long-term studies are needed to better understand the functional outcomes and potential complications of both conservative and surgical management, which could help guide treatment decisions.

In our case, a marked displacement of several centimeters was present, which made operative treatment for anatomical reduction a reasonable choice. Specifically, the fragment was displaced by more than 5 cm. However, to facilitate future treatment decisions, additional case reports and larger studies are required to establish a reliable cut-off value for surgical indication. In our case, a displacement exceeding 5 cm served as the threshold for operative management.

Abbreviations

AP

anteroposterior

ASIS

anterior superior iliac spine

CT

computed tomography

MRI

Magnetic resonance imaging

Declarations

Clinical trial number

not applicable.

Ethics approval and consent to participate

Institutional Review Board approval was not required, but informed written consent was obtained and all patient confidentiality rights preserved.

Consent for publication

Written informed consent was obtained from the patient's legal guardian for publication of this case report and any accompanying images. A copy of the written consent is available for review by the Editor-in-Chief of this journal

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Author Contribution

A.E. conducted the literature review, contributed to the clinical investigations of the patient, participated in the surgical procedure, and wrote the main manuscript text. T.G. contributed to the clinical investigations of the patient and documented the patient's clinical course. M.M. supervised the clinical investigations, contributed to the conceptualization of the case, and participated in the surgical procedure. P.B. performed the surgical procedure as the primary surgeon and contributed to the conceptualization of the case report. All authors reviewed and approved the final manuscript

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Availability of data and materials

Not applicable

Competing interests

All authors declare that they have no competing interests.

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Figures

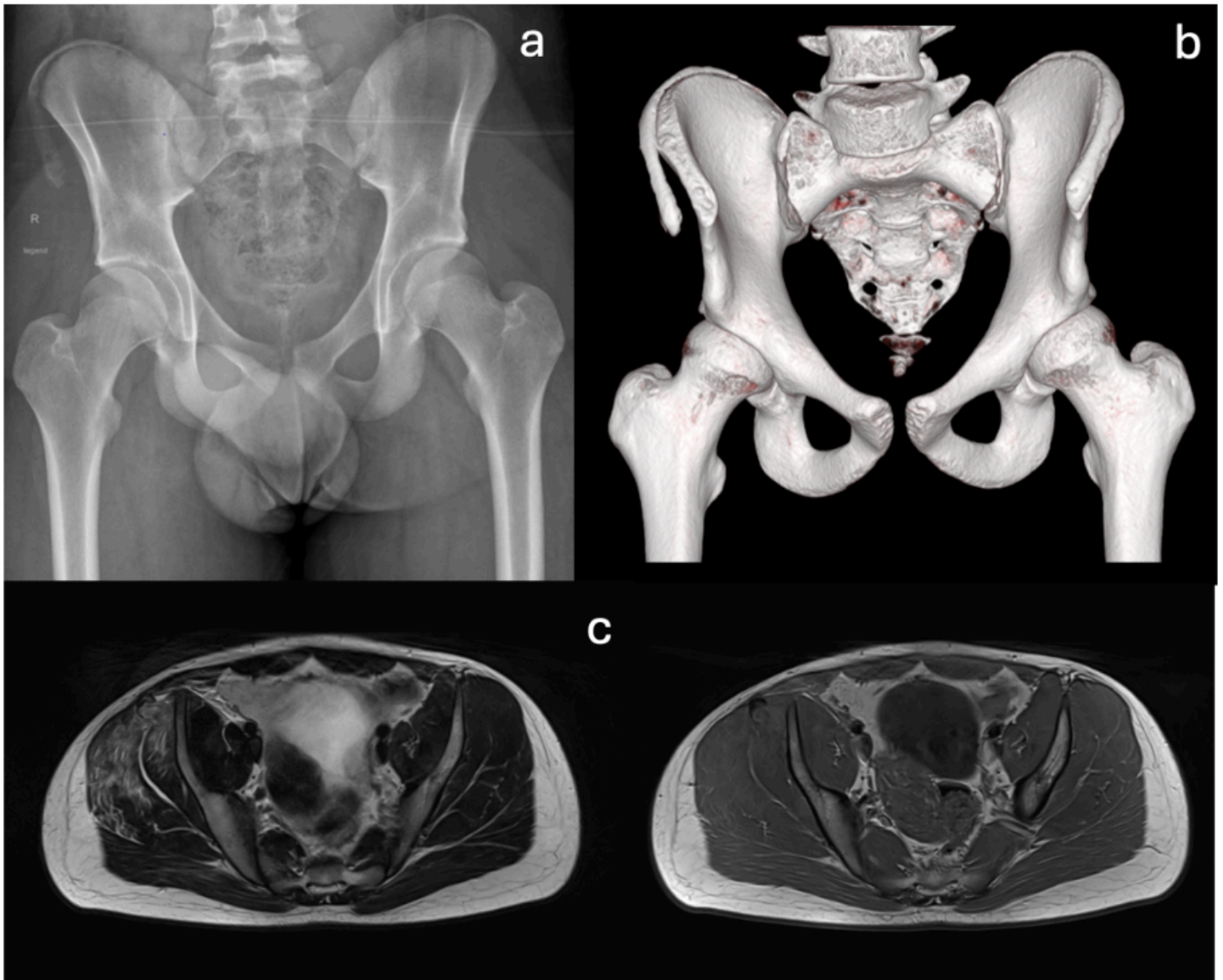


Figure 1

Preoperative imaging of the right iliac crest. (a) Anteroposterior radiograph, (b) Computed tomography scan with three-dimensional reconstruction, and (c) Magnetic resonance imaging demonstrating a displaced avulsion fracture of the iliac crest apophysis.



Figure 2

Positioning of patient in the operation theatre and anatomic landmarks



Figure 3

Intraoperative findings showed a displaced avulsed fragment of the iliac crest apophysis.



Figure 4

Intraoperative photograph demonstrating the reduction maneuver of the displaced iliac crest fragment achieved by hip flexion and adduction.

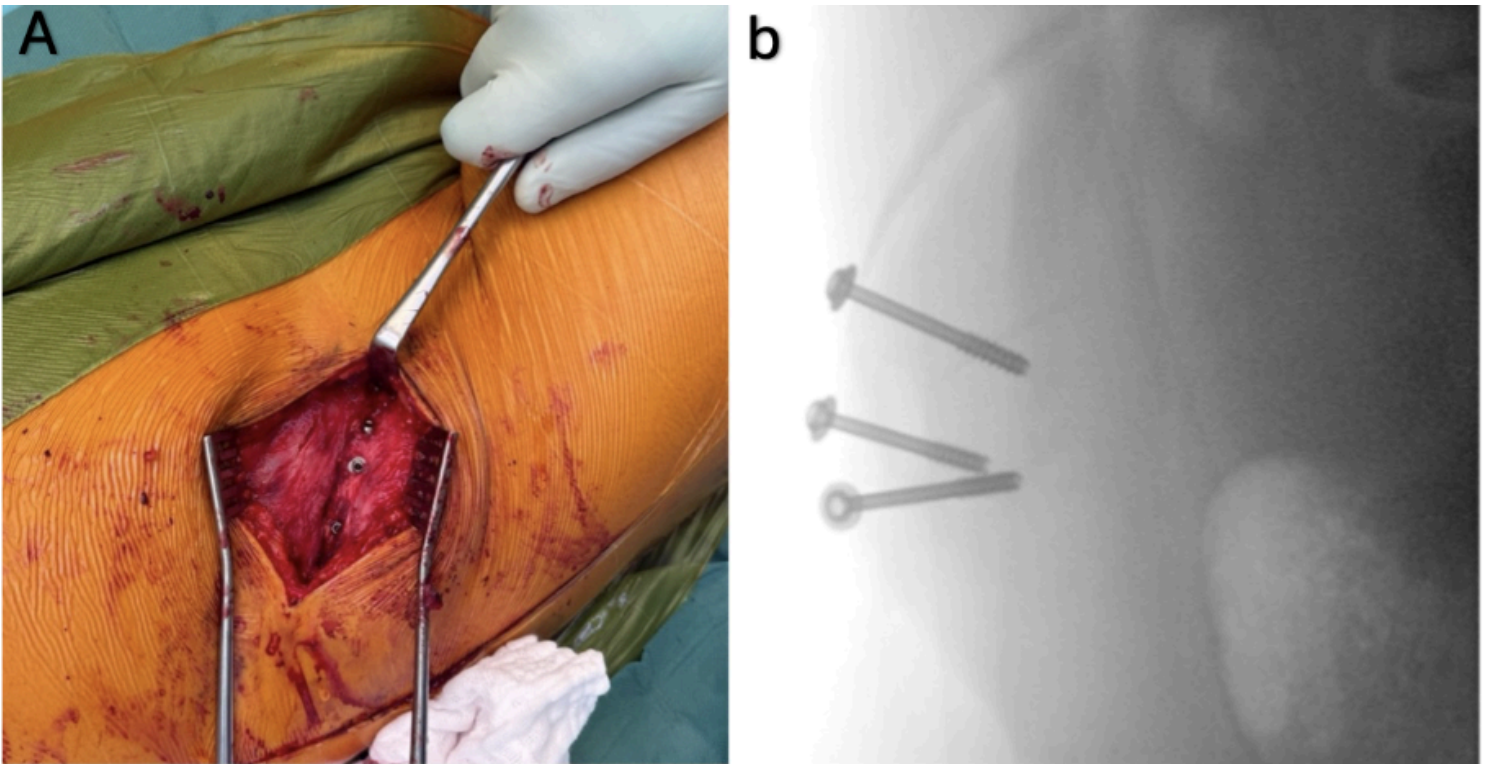


Figure 5

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(a) Intraoperative view of screw placement following reduction of the iliac crest fragment. b) Intraoperative fluoroscopic image confirming correct screw positioning.



Figure 6

Postoperative radiographic follow-up at 6 weeks. (a) Anteroposterior (AP) pelvic view. (b) Iliac ala view. (c) Pelvic outlet view. (d) Pelvic inlet view.

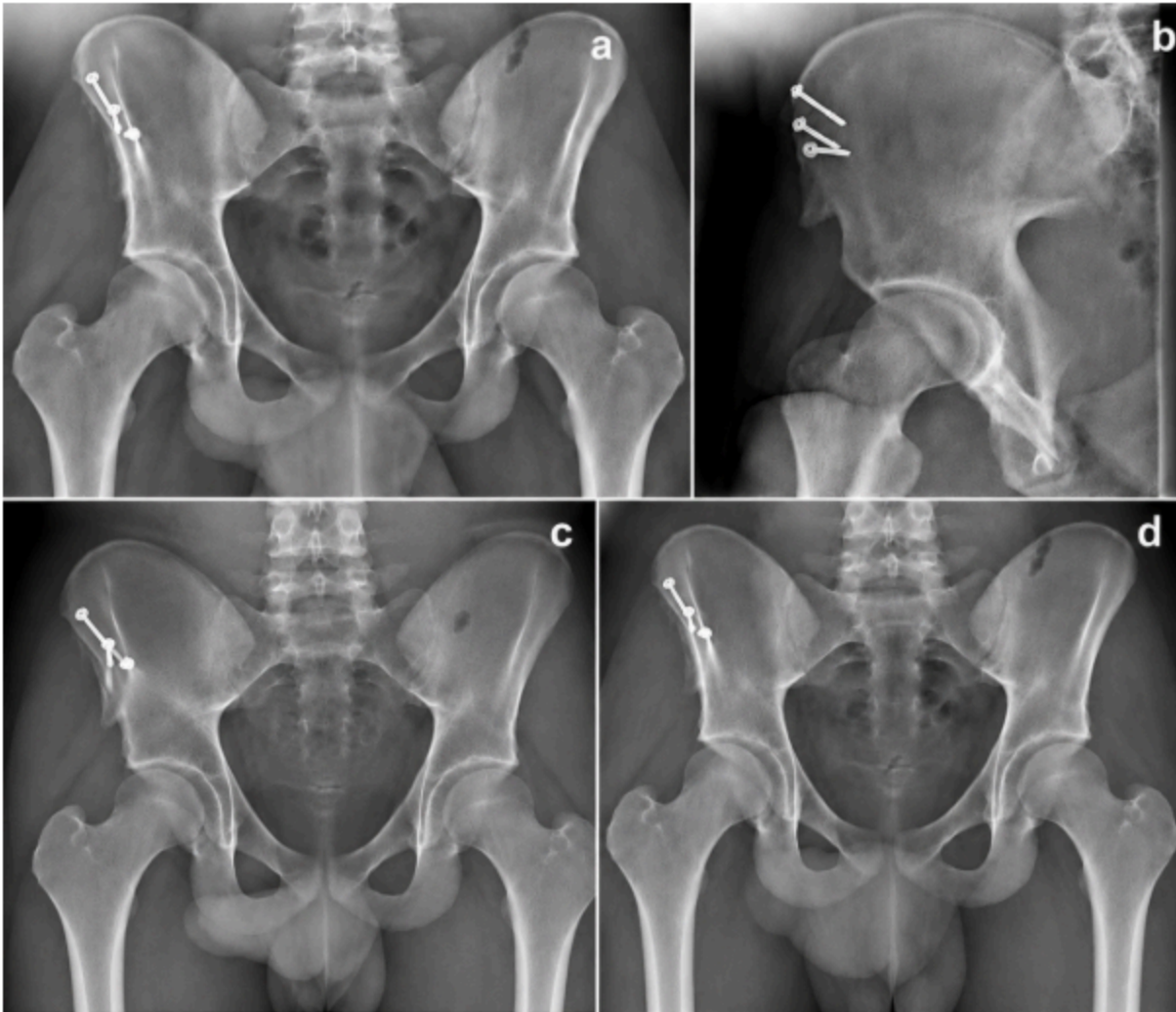


Figure 7

Postoperative radiographic follow-up at 3 months showing complete osseous healing without evidence of secondary displacement but minor ossifications in the region of the anterior superior iliac spine (a) Anteroposterior (AP) pelvic view. (b) Iliac ala view. (c) Pelvic inlet view. (d) Pelvic outlet view.

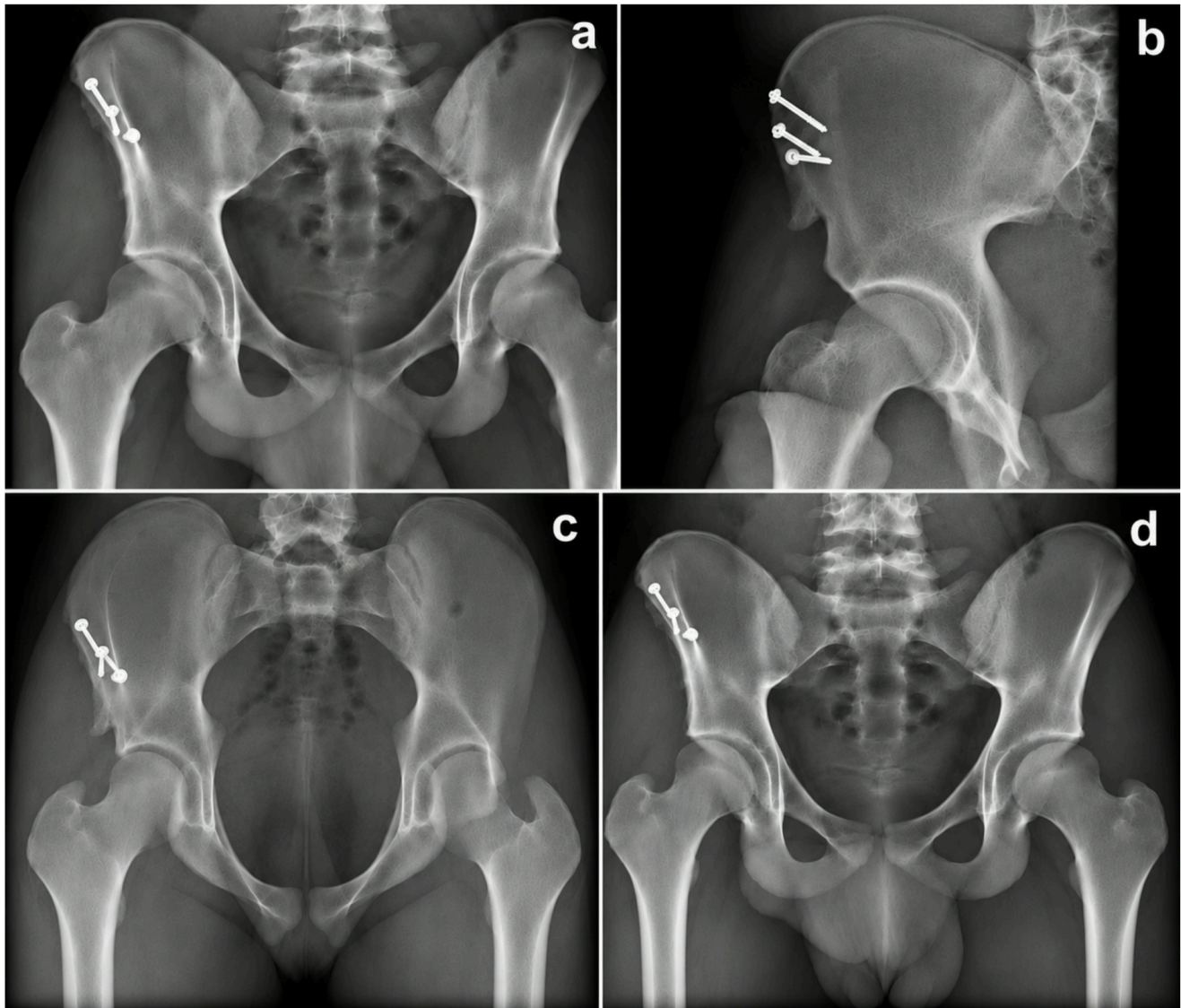


Figure 8

Final radiographic follow-up at 8 months demonstrating complete osseous consolidation of the iliac crest apophysis without secondary displacement. Minor ossifications are present in the region of the osteosynthesis. (a) Anteroposterior (AP) pelvic view. (b) Iliac ala view. (c) Pelvic outlet view. (d) Pelvic inlet view.