Silent subperiosteal iliac hematoma with bone radiolucency in adolescent male athletes

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ABSTRACT

Background: Subperiosteal hematoma of the iliac bone is reported as a rare disorder that specifically occurs in young patients after obvious trauma. This report presents seven cases of male adolescent athletes with subperiosteal iliac hematoma without blunt trauma that was identified as an incidental radiolucent lesion on the iliac bone mimicking neoplasm. The purpose of this report is to describe clinical features and radiological findings of silent subperiosteal hematoma of the iliac bone.

Subjects and methods: We retrospectively reviewed the clinical data and radiological appearance of 7 patients who presented with subperiosteal hematoma of iliac bone.

Results: All seven patients had no obvious trauma and no serious symptoms. All patients were middle school or high school male students who regularly participated in vigorous sports activity; five soccer players, one baseball catcher, and one basketball player. The X-ray showed radiolucent lesion on the iliac bone. Lens-shaped mass without involvement of psoas muscle with ghost native cortex sign and overlying periosteal calcification on CT scan was characteristic radiological finding on subperiosteal iliac hematoma.

Conclusion: Subperiosteal iliac hematomas can be caused by vigorous sports activity in adolescence. This condition is not always associated with serious symptom. It can be identified as a radiolucent lesion mimicking a neoplasm.

1. Background

Subperiosteal hematoma of the iliac bone is reported as a rare disorder that specifically occurs in young patients after trauma such as a traffic accident^{1,2} or a nasty fall.^{3,4} However, it has not been known that subperiosteal hematoma of the iliac bone can develop without blunt trauma but with sports activity and that it can be identified as an incidental radiolucent lesion on the iliac bone.

This report presents seven cases of male adolescent athletes with subperiosteal hematoma of the iliac bone. They were referred to us with their radiolucent lesion on the medial aspect of iliac bone without obvious trauma and serious symptom. These lesions needed to be distinguished from neoplasms in bone and soft tissue. The purpose of this report is to describe clinical features and radiological findings of silent subperiosteal hematoma of the iliac bone.

2. Methods

We searched and reviewed clinical database at our medical center between May 2011 and July 2019. We identified seven cases of diagnosed subperiosteal hematoma of iliac bone. Clinical presentation, history of trauma, sports activity, laboratory data, and imaging data of those patients were reviewed. Six patients were investigated with computed tomography (CT) scan. Four patients had a magnetic resonance imaging (MRI). Four patients underwent both CT and MRI.

3. Results

3.1. Representative case: case 1

A 14-year-old boy who played soccer every day visited his primary

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Fig. 1. A 14-year-old boy with subperiosteal iliac hematoma who regularly plays soccer (Case 1). a. Radiograph shows radiolucent lesion on the iliac bone with clear sclerosing margin. b. MRI (axial T1-weighted image) confirms the hemorrhagic nature of the lesion. c. MRI (coronal T2-weighted image with fat suppression) shows a lens-shaped cystic mass replacing the iliacus muscle medially. d. Plain CT image 5 years after the first visit reveals ossification overlying the mass and the ghost native cortex sign (arrows), which is a dense line between the hematoma and iliac bone marrow.

care doctor for chronic left pubis pain. On the pelvic radiograph, a radiolucent lesion with a clear sclerosing margin on his right iliac bone mimicking a bone tumor was incidentally discovered. (Fig. 1a). He was referred to us for evaluation of this lesion. He had experienced no obvious traumatic event. He had no pain in his right pelvis without any limitation in range of motion of his hip joint. MRI showed a lens-shaped cystic mass with high signal intensity on T1-weighted imaging in contact with the anterior iliac bone and displacing the iliacus muscles medially (Fig. 1b and c). We diagnosed benign lesion most likely subperiosteal hematoma and took a wait-and-see approach. Four years later, he returned to us because he had pain in his right hip while playing soccer. His hip pain became obvious while extension of his hip. CT scan revealed periosteal ossification overlying the mass and a dense line between the hematoma and iliac bone marrow (Fig. 1d). CT-guided aspiration removed blood from the mass and cytology showed no malignancy. We confirmed this lesion as a subperiosteal hematoma of the iliac bone. The pain in his right hip was gradually relieved.

3.2. Other cases

Six other similar cases also presented (Table 1). They were referred to us because of radiolucent lesions on the iliac bone without obvious trauma and serious symptom. Their lesions were identified by X-ray to check for a slight pain on their groin or other parts of body. (Figs. 2 and 3). They had no obvious trauma and no serious symptoms. All patients were middle or high school students who regularly participated in vigorous sports activity; five soccer players, one baseball player who played the position of catcher, and one basketball player. MRI showed a lens-shaped cystic mass on the inner table of the iliac bone and shifting of the iliac muscle medially without involvement of psoas muscle. These lesions were hyperintensity on T2-weighted images and

intermediate or hyperintensity on T1-weighted images (Figs. 2b and 3b). CT scan showed a lens-shaped mass with clear margin in contact with the anterior iliac bone with periosteal ossification over the mass, and a dense line between the mass and iliac bone marrow (Figs. 2c and 3c). No abnormality of hemostasis was detected. We diagnosed these lesions as subperiosteal hematomas of the iliac bone.

4. Discussion

Subperiosteal hematoma of the iliac bone is reported as a rare disorder that occurs in children and young adults after obvious trauma such as traffic accident, and that can induce femoral nerve palsy.⁵ Guillin et al. reported cases of chronic subperiosteal hematomas of the iliac bone in adults which were incidentally discovered (4). The cause of these lesions has not been understood so far. Here, we represented 7 cases of silent subperiosteal hematomas of the iliac bone without blunt trauma in adolescent athletes. These lesions showed radiolucent lesions mimicking a neoplasm by compressing the iliac bone. We speculated that silent subperiosteal hematoma of ilia bone can be developed by vigorous sports activity in adolescence.

Our cases present two new clinical findings. First, a subperiosteal hematoma of the iliac bone can develop without any obvious trauma in adolescent athletes. Five of seven patients were avid soccer players and the others were a baseball catcher and a basketball player, suggesting that subperiosteal hematomas of the iliac bone may develop by contraction of the iliacus muscle while kicking a ball, squatting, or jumping. Subperiosteal hematomas have also been reported in the calvarium⁶ and orbit.⁷ Most of these lesions occur in children and young adults. This particular distribution is believed to result from the loose attachment of the periosteum to the bone in young patients leading to subperiosteal hemorrhage by trigger events.⁸ We speculate

Table 1
Patient and imaging characteristics.

Case	Sports	Age	Sex	Side	Obvious traumatic event	Image examination	Shape of mass	Involvement of psoas muscle	Ghost native cortex sign	Overlying periosteal calcification
1	Soccer	14	M	R	No	X-ray, CT, MRI	thick lens-shaped	No	Yes	Yes
2	Soccer	13	M	L	No	X-ray, CT, MRI	thin lens-shaped	No	Yes	No
3	Soccer	19	M	L	No	X-ray, CT, MRI	thick lens-shaped	No	Yes	Yes
4	Soccer	17	M	R	No	X-ray, CT	thick lens-shaped	No	Yes	Yes
5	Baseball	15	M	R	No	X-ray, MRI	thin lens-shaped	No	N.A.	N.A.
6	Soccer	19	M	R	No	X-ray, CT	thin lens-shaped	No	Yes	Yes
7	Basketball	16	M	Bi	No	X-ray, CT, MRI	thick lens-shaped	No	Yes	Yes

Bi: bilateral, N.A.: not available.

Fig. 2. A 13-year-old boy with subperiosteal iliac hematoma who regularly plays soccer (Case 2). a. Radiolucent lesion with clear margin on X-ray. b. a thin lens-shaped cystic mass in contact with the anterior iliac bone on T2-weighted MRI image. c. CT image at the first visit shows the ghost native cortex sign (arrows), which is a dense line between the hematoma and iliac bone marrow.

that the male adolescent athletes, especially soccer player, have the large muscle power of the iliacus and that the contraction of their iliacus muscle during sports activity causes a periosteal avulsion leading to subperiosteal iliac hematoma. There are some case reports of intramuscular iliopsoas hematoma after sports injury in adolescence and some of these causing femoral nerve palsy.^{9–11} We also had a case of iliopsoas hematoma leading to complete paralysis of femoral nerve in 18 years old male after karate training (data not shown). We suspect that the etiology of iliopsoas hematomas is similar to that of subperiosteal hematoma.

Second, subperiosteal iliac hematomas can cause radiolucent lesions on radiographs, which mimicking several neoplasms such as aneurysmal bone cysts, solitary bone cysts, or fibrous dysplasia, by compressing the anterior surface of the iliac bone. The differential diagnosis is not easy, especially when the patients have not experienced any traumatic events or severe symptoms. Carter et al. reported that iliac hematomas mimicking neoplasms could be diagnosed by biopsy.¹² In

Fig. 3. A 19-year-old boy with subperiosteal iliac hematoma who regularly plays soccer (Case 3) a. Radiolucent lesion with sclerosing margin on X-ray. b. a lens-shaped cystic mass is hyperintensity on T1-weighted MRI images. c. CT image at the first visit shows ossification overlying the mass and the ghost native cortex sign (arrows), which is a dense line between the hematoma and iliac bone marrow.

fact, their cases may be difficult to diagnose without biopsy. However, if we recognize silent subperiosteal iliac hematoma or intramuscular iliopsoas hematoma often occurs in adolescent athletes, we can avoid unnecessary invasive exploration in some cases.

The imaging appearance of subperiosteal iliac hematoma was well described by Guillin et al.⁴ They reported lens-shaped appearance, an absence of involvement in the psoas muscle, and ghost native cortex sign on the CT scan, which is a dense line between the hematoma and iliac bone marrow, are important clues for the diagnosis of subperiosteal iliac hematoma.^{4,13} We could see these features in the cases of subperiosteal hematomas but not in that of intramuscular iliopsoas hematoma or other disorders. This study supports that these features could help in the diagnosis of subperiosteal hematomas.

5. Conclusion

Subperiosteal iliac hematomas may be caused by periosteal avulsion during vigorous sports activity, especially soccer, in adolescence. This condition may be silent and incidentally identified as a radiolucent lesion mimicking a neoplasm on radiograph. The lens-shaped appearance, an absence of involvement in the psoas muscle, and the ghost native cortex sign during follow-up CT can serve as diagnostic information of subperiosteal iliac hematoma.

Ethics approval and consent to participate

All procedures performed in studies involving human participants were in accordance with ethical standards of the institutional and national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards. Informed consent was not applicable due to study design, only involving retrospective review of radiographs and medical charts. This study was

approved by the Osaka University Ethics Committee, registration number 14240.

Consent for publication

Consent to publish the data was obtained from the patients and their parents.

Availability of data and materials

The datasets used in this study are not publicly available due to patient integrity but are available from the corresponding author on reasonable request.

Conflicts of interest

The authors declare that they have no conflict of interest.

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Author's contributions

ST and HT contributed to the concept and design of the study under supervision of YH. ST, HO, KH and NN collected all data. All authors participated in the development of and approved the final manuscript. Acknowledgements

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The authors declare that there are no conflicts of interest.

Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.jor.2019.08.011>.

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