International Journal of Surgery Case Reports 85 (2021) 106209

Contents lists available at ScienceDirect

International Journal of Surgery Case Reports

journal homepage: www.elsevier.com/locate/ijscr

Case report

Legg–Calvé–Perthes disease following Ender nail fixation of a pediatric femoral fracture

Tomohiro Matsumura [a], Tomohiro Saito [b,*], Hideaki Watanabe [c], Ichiro Kikkawa [c], Katsushi Takeshita [b]

[a] Department of Emergency, Jichi Medical University, Tochigi, Japan
[b] Department of Orthopaedic Surgery, Jichi Medical University, Tochigi, Japan
[c] Jichi Children's Medical Center, Tochigi, Japan

ARTICLE INFO

Keywords:
Case report
Femoral shaft fracture
Pediatric
Complication
Legg–Calvé–Perthes disease

ABSTRACT

Introduction and importance: Legg–Calvé–Perthes disease (LCPD) sometimes occur in children, however it is difficult to diagnose it at the early stage especially in the cases there are no complaints of symptoms. Femoral shaft fractures in children cause various complications such as leg-length discrepancy, nonunion and malunion, refracture, and osteonecrosis of the femoral head. We presented a rare case in which a pediatric patient developed LCPD after femoral shaft fracture.

Case presentation: A healthy 8-year-old boy sustained a left femoral diaphyseal fracture following a pedestrian car accident. Fixation was achieved using retrograde Ender nails; bone union was confirmed at 3 months postoperatively, and the Ender nails were removed at 8 months postoperatively without any problems. Unfortunately, the morphological change of the ipsilateral femoral head and subtle symptoms were missed until the femoral head collapsed. LCPD was successfully treated with intertrochanteric varus osteotomy, which achieved a good clinical result.

Clinical discussion: Although the reason for the ipsilateral LCPD after the femoral shaft fracture is unclear, this case highlights the need for close postoperative follow-up of pediatric femoral fractures resulting from high-energy trauma to prevent the misdiagnosis of this coincidental complication.

Conclusion: This case report describes a missed ipsilateral LCPD after a femoral diaphyseal fracture caused by high-energy trauma. Close postoperative follow-up with a detailed assessment and vigilant interpretation of postoperative radiography is imperative to avoid delayed/missed diagnosis of conditions for which early management may provide better outcomes.

1. Introduction

Femoral shaft fracture is relatively uncommon in children and comprises less than 1.6% of all pediatric fractures [1]. Although femoral shaft fractures in children tend to unite rapidly and have tremendous remodeling potential, various complications such as leg-length discrepancy, nonunion and malunion, refracture, and osteonecrosis of the femoral head have been reported [2].

Legg–Calvé–Perthes disease (LCPD) is the insidious onset of idiopathic avascular necrosis of the hip in the pediatric population [3]. The cause of ischemia remains unclear. In addition, the reason for LCPD usually occurring between 5 and 8 years of age is unclear [4]. A pediatric patient with a hip pathology might initially present with only thigh pain or gonalgia, thus obligating the physician to maintain awareness about the hip during examination. In the current report, we present a case of a pediatric patient who developed LCPD after undergoing treatment for femoral shaft fracture.

2. Case report

A healthy 8-year-old boy sustained a left femoral diaphyseal fracture following a pedestrian car accident. He was brought to our university hospital by an ambulance. At the emergency room, the patient was fully conscious and has normal vital sign. His past medical and family history, surgical and social history were unremarkable. He did not take any medication. On local limb examination, the left thigh was remarkable

* Corresponding author at: Department of Orthopaedic Surgery, School of Medicine, Jichi Medical University, 3311-1 Yakushiji, Shimotsuke 329-0498, Japan.
E-mail address: tr-saitou@kkf.biglobe.ne.jp (T. Saito).

https://doi.org/10.1016/j.ijscr.2021.106209
Received 10 June 2021; Received in revised form 3 July 2021; Accepted 14 July 2021
Available online 17 July 2021

swollen, deformed, and the distal neurovascular status was normal. Femoral radiography and computed tomography performed in the emergency room showed a displaced fracture of the left proximal femoral diaphysis and no findings of the left femoral neck fracture (Fig. 1A, B). The procedure was performed by a board-certified orthopedic consultant (the author). Emergency closed reduction and internal fixation were performed using two 3.5 mm Ender nails as the patient was hemodynamically stable (Fig. 2A). Full weight-bearing was tolerated, and bone union was achieved 3 months postoperatively without any complications. The Ender nails were removed 8 months postoperatively (Fig. 2B). He was physically active after removing the nails same as preinjury status.

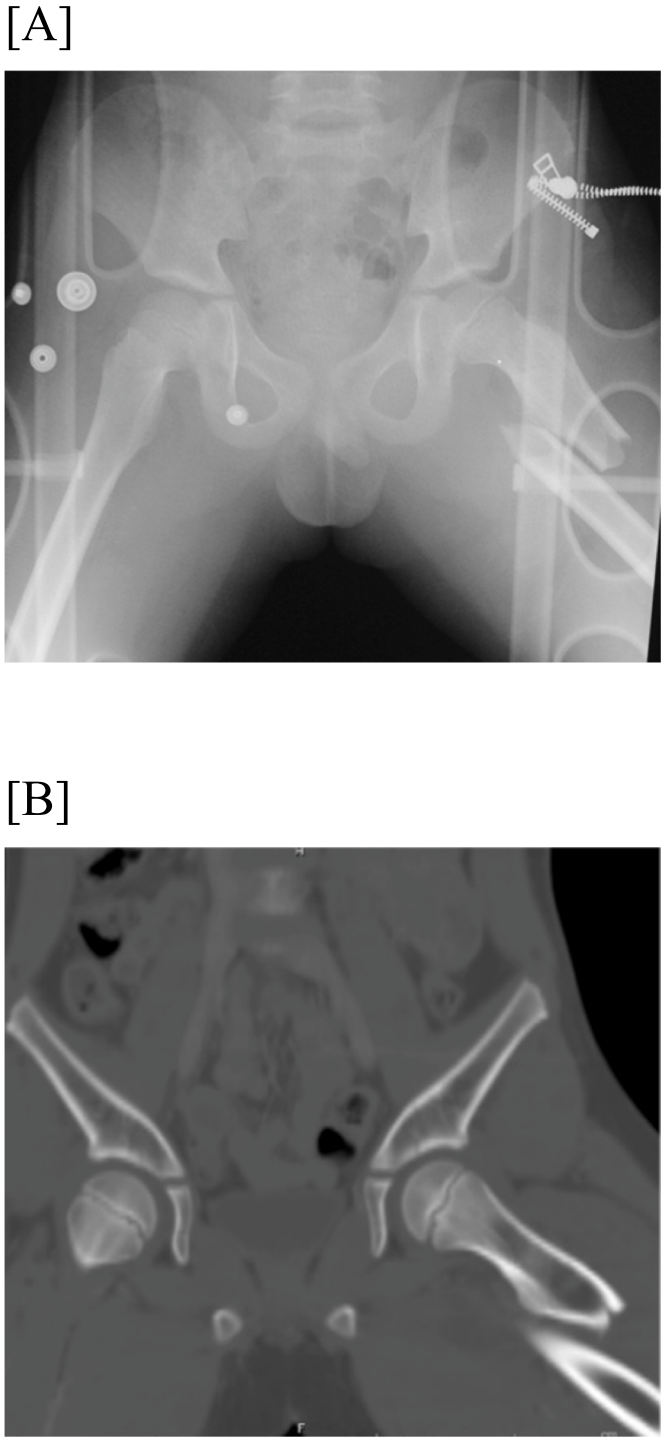

Fig. 1. [A] Anteroposterior (AP) radiograph of the left femoral shaft fracture and [B] coronal view of computed tomography imaging.

Ten months after the initial injury, a trainee surgeon under fellowship failed to recognize the flattening of the left femoral head on the radiography performed to investigate the cause of the limping observed in the patient gait, though he did not report any pain in the left hip (Fig. 2C). He also failed to recognize the progression of femoral head flattening during a medical examination performed 1 year after the initial injury (Fig. 2D). The femoral head collapse was recognized 18 months after the initial injury; however, the patient still did not complain of pain at the hip, despite the limping gait.

The patient was referred to a pediatric orthopedist in our institution. Intertrochanteric varus osteotomy was performed using a pediatric locking plate by a pediatric orthopedic consultant to preserve the native hip joint. This was followed by a hip spica cast with abduction-external rotation for 4 weeks, as acceptable congruity of the femoral head was achieved during abduction of the affected hip, although the radiograph showed left Herring grade B LCPD (Fig. 3A–D) [5]. The subsequent course remained uneventful for 7 years and 6 months after the intertrochanteric varus osteotomy, and the final follow-up radiographs showed appropriate and satisfactory congruency and containment, although the morphology of the proximal femur was deformed (Fig. 4). This patient is taking a watch-and-see approach by a pediatric orthopedic consultant. The treatment approach was appreciated by the patient and his family. Reporting on the clinical parameters of the case were done in line with the SCARE 2018 criteria [6].

3. Discussion

Pediatric femoral fractures are treated via various surgical treatment methods, such as intramedullary nailing, plating, and external fixation. The goal of treatment is to achieve a healed fracture and avoid associated complications, such as leg-length discrepancy, nonunion, malunion, disruption of the growth plate, and osteonecrosis of the femoral head. Osteonecrosis is one of the worst complications of femoral fracture, as it causes functional loss and difficult surgical recovery. Therefore, it is important to avoid inserting nails into the piriformis and greater trochanter to ensure that the medial circumflex artery and trochanteric physes are not damaged [7]. In the current case, retrograde Ender nails were inserted, and a good bone union was achieved without any complications. However, the unpredicted complication of LCPD occurred within 1 year after the injury.

Ipsilateral femoral neck fracture may be present in patients with a femoral shaft fracture resulting from high-energy trauma. In adults, ipsilateral femoral neck and shaft fractures occur in as many as 9% of all shaft fractures resulting from high-energy trauma [8]. In contrast, the incidence of pediatric ipsilateral femoral neck and shaft fractures is reportedly 0.7% (two of 267 cases) of fractures resulting from high-energy trauma [9]. In the present case, no ipsilateral femoral neck fracture was detected during the observation period. However, although the risk of ipsilateral femoral neck with shaft fractures seem to be lower in children than in adults, orthopedic surgeons should pay close attention to changes in the entire femur during follow-up visits after pediatric femoral shaft fracture fixation.

LCPD is an idiopathic condition that leads to variable avascular necrosis of the proximal femoral epiphysis in children [10]. Although the etiology, pathogenesis, and pathology of LPCD have not been completely elucidated, there are several known risk factors such as positive family history, low birth weight, abnormal birth presentation, secondary smoke inhalation, and ethnicity. The prevailing view is that LCPD is a multifactorial disease caused by a combination of genetic and environmental factors [10]. In the current case, there is very little possibility that the development of LCPD was associated with the ipsilateral femoral shaft fracture resulting from high-energy trauma, because there were no associated risk factors for LCPD. As far as our recent literature searching, currently femoral diaphyseal fracture followed by LCPD has

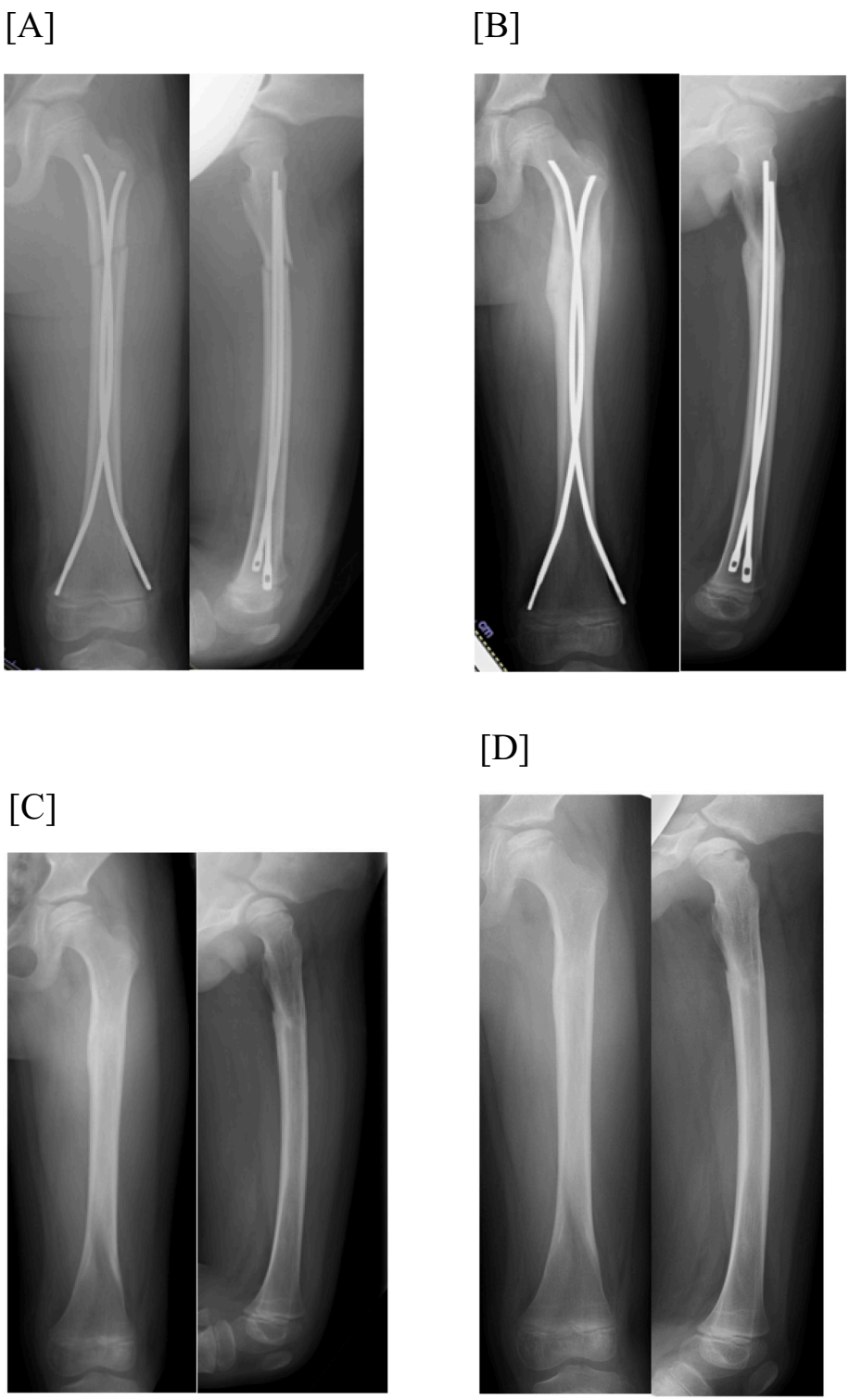

Fig. 2. Anteroposterior (AP) and lateral radiographs taken [A] immediately postoperatively, [B] 8 months postoperatively, [C] 10 months postoperatively, and [D] 1 year postoperatively.

not been reported. The precise etiology underlying this complication remains unclear. However, there is a possibility that we may face the similar situations. Therefore, in the follow-up of pediatric patients with femoral diaphyseal fractures caused by high-energy trauma, orthopedic trauma surgeons should carefully observe not only the fracture site but also the adjacent joints to avoid overlooking unusual complications that might require urgent treatment.

4. Conclusion

This case report describes a missed ipsilateral LCPD after a femoral diaphyseal fracture caused by high-energy trauma. Close postoperative follow-up with a detailed assessment and vigilant interpretation of postoperative radiography is imperative to avoid delayed/missed diagnosis of conditions for which early management may provide better outcomes.

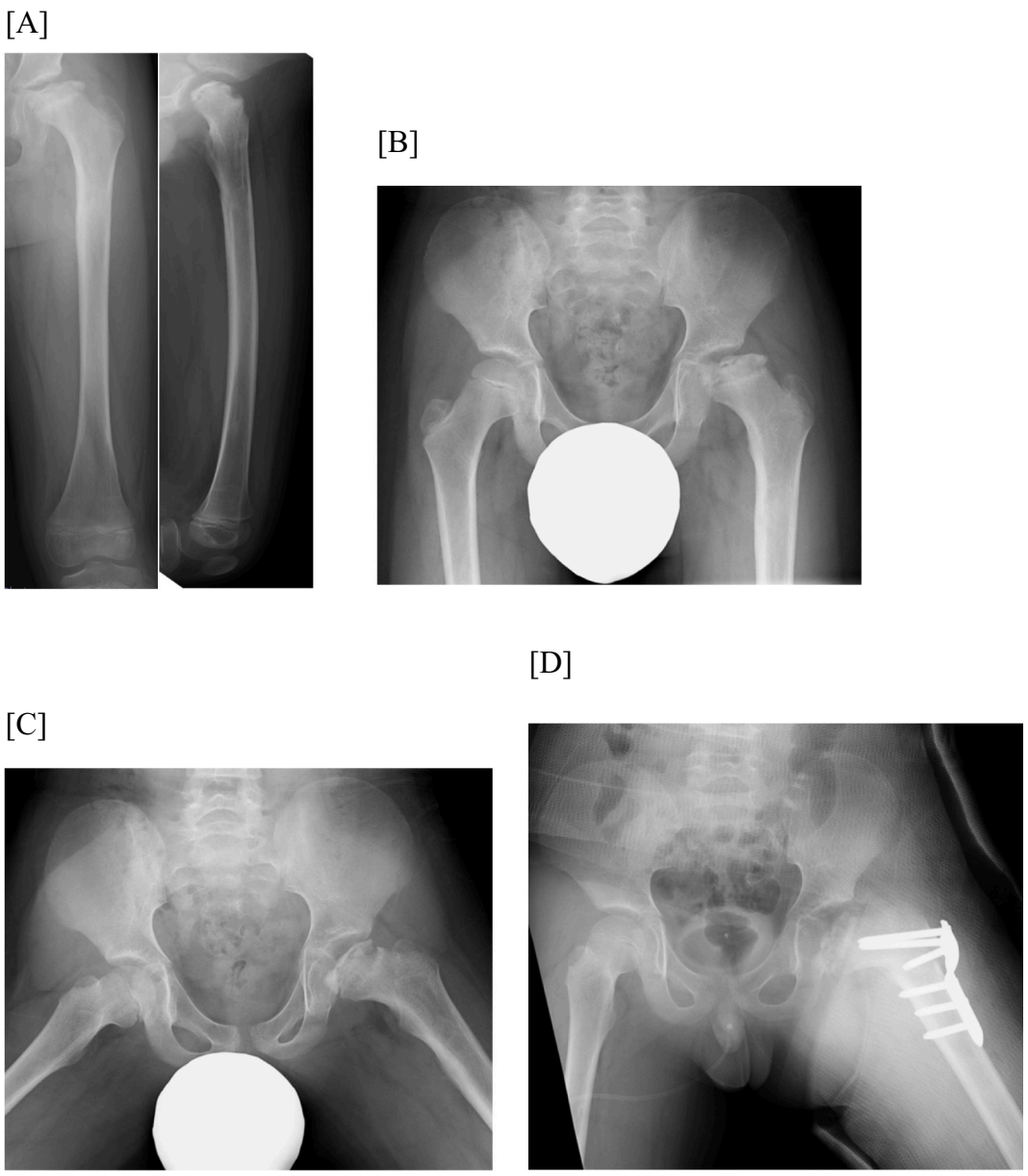

Fig. 3. [A] Anteroposterior (AP) and lateral radiographs taken 18 months postoperatively. [B] AP radiograph of the pelvis showing the left-sided Herring grade C Legg–Calvé–Perthes disease. [C] AP radiograph of the pelvis showing the abduction of the bilateral hip joints. [D] AP radiograph of the pelvis with the hip spica cast after the left intertrochanteric varus osteotomy.

Sources of funding

All authors did not use any funding from any source.

Ethical approval

This study is exempted from ethical approval.

Consent

Written informed consent was obtained from the patient for publication of this case report.

Author contribution

T.M.: Performed the procedure, literature review, writing – original draft.

T.S.: Literature review, case description and discussion, writing – review and editing.

H.W.: Literature review, case description and discussion.

I.K.: Literature review, case description and discussion.

K.T.: Literature review, case description and discussion.

All authors read and approved the final manuscript.

Registration of research studies

Not applicable.

Guarantor

Tomohiro Matsumura and Tomohiro Saito were the guarantor of the study.

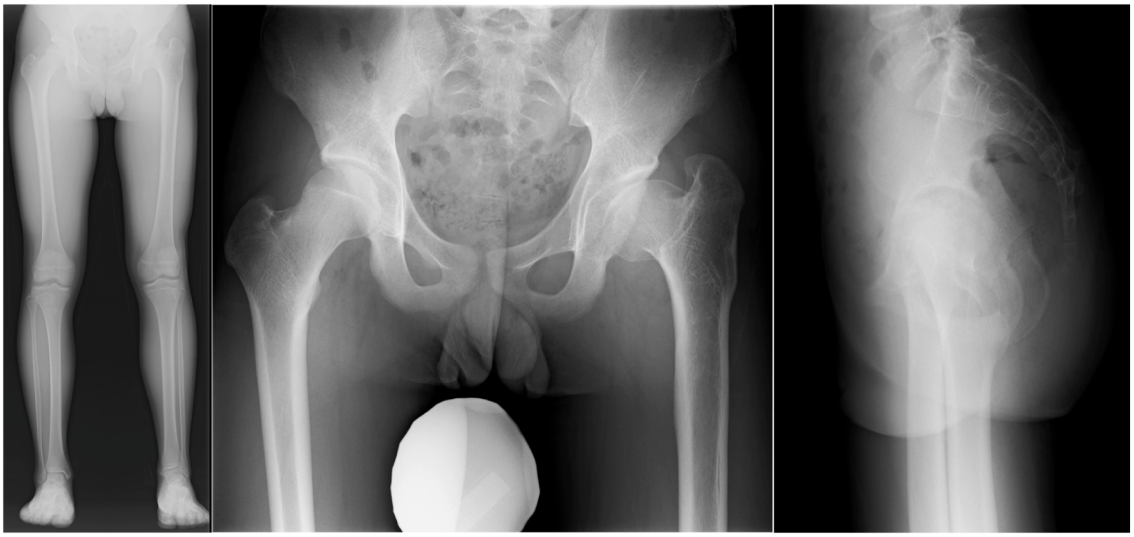

Fig. 4. Standing radiographs taken at 7 years and 6 months after the osteotomy showing no leg-length discrepancy and good congruency of the left-sided hip joint.

Provenance and peer review

Not commissioned, externally peer-reviewed.

Declaration of competing interest

All authors report no declarations of interest.

References

[1] R. Hedlund, U. Lindgren, The incidence of femoral shaft fractures in children and adolescents, J. Pediatr. Orthop. 6 (1986) 47–50, https://doi.org/10.1097/01241398-198601000-00010.

[2] W.P. Bassett, S. Safier, M.J. Herman, S.H. Kozin, J.M. Abzug, Complications of pediatric femoral shaft and distal physeal fractures, Instr. Course Lect. 64 (2015) 461–470.

[3] S.N. Divi, R.J. Bielski, Legg-Calvé-perthes disease, Pediatr. Ann. 45 (2016) e144–e149, https://doi.org/10.3928/00904481-20160310-03.

[4] J. Leroux, A.S. Abu, J. Lechevallier, Legg-Calvé-Perthes disease, Orthop. Traumatol. Surg. Res. 104 (2018) S107–S112, https://doi.org/10.1016/j.otsr.2017.04.012.

[5] J.A. Herring, H.T. Kim, R. Browne, Legg-Calvé-perthes disease. part I: classification of radiographs with use of the modified lateral pillar and Stulberg classification, J. Bone Joint Surg. Am. 86 (2004) 2103–2120.

[6] for the SCARE Group, R.A. Agha, T. Franchi, C. Sohrabi, G. Mathew, The SCARE 2020 Guideline: updating consensus Surgical CAse REport (SCARE) Guidelines, Int. J. Surg. 84 (2020) 226–230.

[7] J.O. Sanders, R.H. Browne, J.F. Mooney, E.M. Raney, B.D. Horn, D.J. Anderson, W. L. Hennrikus, W.W. Robertoson, Treatment of femoral fractures in children by pediatric orthopedists: results of a 1998 survey, J. Pediatr. Orthop. 21 (2001) 436–441.

[8] P. Tornetta 3rd, M.S. Kain, W.R. Creevy, Diagnosis of femoral neck fractures in patients with a femoral shaft fracture: improvement with a standard protocol, J. Bone Joint Surg. Am. 89 (2007) 39–43, https://doi.org/10.2106/JBJS.F.00297.

[9] L. Caldwell, C.M. Chan, J.O. Sanders, J.T. Gorczyca, Detection of femoral neck fractures in pediatric patients with femoral shaft fractures, J. Pediatr. Orthop. 37 (2017) e164–e167, https://doi.org/10.1097/BPO.0000000000000800.

[10] H.K. Kim, Leg-calve-perthes disease: etiology, pathogenesis, and biology, J. Pediatr. Orthop. 31 (2011) s141–s146, https://doi.org/10.1097/BPO.0b013e318223b4bd.