Intravenous Bisphosphonate Therapy for Children Who Have a Traumatic Fracture Neck of Femur and Osteonecrosis: A Case Report

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Background: Prognosis of traumatic osteonecrosis of femoral head in children is poor for either conservative treatment or surgical intervention. Intravenous bisphosphonate is an expecting medication to reduce femoral head resorption and to prevent femoral head collapse after traumatic osteonecrosis. This mechanism will reduce development of osteoarthritis and disability in the future.

Objective: Report the result of the effectiveness of intravenous bisphosphonate in treatment of a child with traumatic fracture neck of femur and developed osteonecrosis.

Material and Method: A case report was done between May 2008 and June 2010. The patient developed traumatic osteonecrosis of the right femoral head after multiple screws fixation in treatment of femoral neck fracture. Intravenous bisphosphonate was given every other month for two years.

Results: A 13-year-old girl who had a motorcycle accident developed avascular necrosis after multiple screws fixation of femoral neck fracture. After an intravenous bisphosphonate was given every other month for two years, the last follow-up showed good prognosis.

Keywords: Traumatic osteonecrosis in children, Intravenous bisphosphonate, Femoral head resorption, Avascular necrosis, Fracture neck of femur
early onset osteoarthritis. Ratliff classification of avascular necrosis in children was classified as type I, diffuse increased density (sclerosis) accompanied by total involvement and complete collapse of the femoral head. Type II, increased density localized to a portion of the epiphysis and accompanied by minimal collapse of the femoral head. Type III, increased sclerosis of the femoral neck from the fracture line to the epiphyseal plate but sparing of the femoral head.

Complications were monitored for uveitis, osteonecrosis of jaw, fever, headache, nausea, vomiting and discomfort.

Case Report

On May 14, 2008, 10.30 in the morning, a 13-year-old girl who had a motorcycle accident was transferred from Thepha community hospital to Hat Yai center hospital with multiple injuries. She was diagnosed with an open fracture of left shaft femur, a fracture neck of right femur, a fracture of left shaft tibia, and a fracture lateral condyle of right tibia. On that day of arrival, debridement of left femur was done and multiple screws fixation in right femoral neck was performed. She was immobilized with left short leg cast and traction and right long leg cast. Nine days after that, open reduction and internal fixation with plate of left femur was performed. Since the injury, she has been admitted for two weeks. Finally, she was discharged with a wheelchair for non-weight bearing on both legs.

At ten weeks post operation follow-up visit, because the patient attempted to walk without any cane support, she came up with her right hip pain. The plain radiography showed failed multiple screws fixation at the right femoral neck. On that day, open reduction and internal fixation with plate of left femur was performed. Since the injury, she has been admitted for two weeks. Finally, she was discharged with a wheelchair for non-weight bearing on both legs.

At two years follow-up, the Harris Hip score was excellent at 97 scores. Radiographic assessment using Stulberg classification was class II, spherical head of femur has a minor abnormality at the neck of the femur, showing a good prognosis. Limb length discrepancy was 1 centimeter. Fracture shaft of left femur, which was done as an open reduction and internal fixation with plate, showed a good result. In addition, fracture of left shaft tibia and fracture of lateral condyle of right tibia had good healing.

Complications such as uveitis, osteonecrosis of jaw, fever, headache, nausea, vomiting and feeling discomfort were not found during and after treatment.

Discussion

Bisphosphonate used in the treatment of osteoporosis worked as an antiresorptive agent and a decrease in activity of osteoclast resulted in slowing the process of bone resorption(11). Both oral and intravenous forms of bisphosphonate have been widely used and recommended for the treatment of osteoporotic fracture, bony metastasis tumor, fibrous dysplasia, Paget’s disease, and hypercalcaemia of malignancy(12). Recently, there has been an increased number of using medications in a bisphosphonate group for treatment other diseases such as using zolendronate or palmidronate in Perthe’s disease and osteogenesis imperfecta(13-15). Using of alendronate in nontraumatic osteonecrosis showed that it was able to slow the process of femoral head resorption(16-18). The benefit of bisphosphonate for traumatic osteonecrosis of the femoral head showed in adolescents that patients who received intravenous bisphosphonate had slower process of femoral head resorption and osteonecrosis than those who did not receive this medication(10).

The authors reported the study of a patient with traumatic osteonecrosis after closed reduction and internal fixation surgery of femoral neck fracture. The presented patient received an intravenous bisphosphonate every other month for two years. At the end of protocol, her plain radiography showed no collapse of femoral head although coxa vara and shortening of femoral neck had occurred as a result of osteonecrosis. It was the best prognosis type classified to type III of Ratliff classification(1).
However, the authors were unable to indicate whether the process of femoral head antiresorption was treated by bisphosphonate mechanism or by remodeling process in avascular necrosis type III of Ratliff classification. The authors could not predict if during the process of remodeling, avascular necrosis would become type I, II or III (type I, II are bad prognosis and type III is good prognosis according to Ratliff classification). On the other hand, bisphosphonate might play a role in antiresorption of femoral head.

However, ideally, patients who received intravenous bisphosphonate after avascular necrosis would expect to have remodeling process; thus, the head of the femur will have revascularization. Bisphosphonate will inhibit activity of osteoclasts by slowing down the process of femoral head resorption. This mechanism would enhance femoral head strengthening and femoral head bones will repair and accumulate themselves to prevent femoral head resorption during remodeling.

Additional control study in the future should have more validated measurements for monitoring type of complication from traumatic osteonecrosis of femoral head such as angiography. The future study should verify blood vessel damaged and predict type of avascular necrosis according to Ratliff classification before starting the protocol for gaining more benefits. Since medical treatment may not be necessary in type III, it may slow down the process of femoral head resorption in type I and type II according to Ratliff classification.

**Conclusion**

The authors reported the benefit of bisphosphonate treatment in a pediatric patient with traumatic fracture of femoral neck and osteonecrosis. Intravenous bisphosphonate may help and reduce the process of femoral head resorption and improve long-term disability of a hip joint without major complications during two years of treatment. Future controlled study is needed to confirm this case report.

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**Potential conflicts of interest**

None.

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การใช้ยา bisphosphonate ในกรณีที่เกิดภาวะกระดูกหัวตะโพกตายจากอุบัติเหตุ แล้วมีกระดูกตะโพกหักหลังยึดตรึงด้วยสกรู

ศาสตราจารย์ ศรัทธิ์ชัยญาณน์ ศรีพล ปรีชา

การกระดูกตะโพกหักในเด็กเป็นภาวะที่เกิดจากการบาดเจ็บที่รุนแรง เช่น ตกจากที่สูงหรืออุบัติเหตุจากยานพาหนะซึ่งพบได้บ่อย และพบได้อยู่ในผู้ใหญ่ในแม้กระทั่งเด็กกัน และมักจะมีการเกิดการบาดเจ็บของกระดูกอื่นๆ ของร่างกายรวมถึงกระดูกคางเช่น ฯ ต่าง เมื่อเปรียบเทียบกับการเกิดกระดูกหัวตะโพกเสี่ยงในภาวะเด็ก พบว่าการกระดูกตะโพกหักในเด็กมีภาวะแทรกซ้อนที่สูง และผลลัพธ์ที่ไม่ดี เช่น การเกิดภาวะกระดูกหัวตะโพกตาย หรือกระดูกติดผิดขึ้น โดยเฉพาะภาวะที่เกิดภาวะกระดูกหัวตะโพกตายซึ่งเป็นภาวะที่มีประสิทธิ์ที่ดีที่สุด และมีความพิการของข้อผิดมาก ซึ่งแตกต่างจะต้องใช้ยา bisphosphonate ในการรักษาได้ปิดถนนนักเด็ก ๆ ปี ดังนั้นเราจึงได้ใช้ยา bisphosphonate ในกรณีที่เกิดภาวะกระดูกหัวตะโพกตายในเด็ก และได้ผลเป็นอย่างดี ทั้งที่ใช้ยา bisphosphonate อย่างไรก็ตาม ภาวะกระดูกตะโพกหักในเด็ก ที่เกิดภาวะกระดูกหัวตะโพกตายในเด็กมักจะมีภาวะแทรกซ้อนที่สูงมาก ทำให้ในการรักษาจะต้องใช้ยา bisphosphonate ในการรักษาดังกล่าว ครั้งหนึ่งว่าจะมีภาวะกระดูกหัวตะโพกตาย จากภาวะที่เกิดภาวะกระดูกหัวตะโพกตายในเด็กมากค่อนข้างมาก

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