Case Report

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*

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A hip fracture is a rare condition and it has accounted for less than 1% of all pediatric fractures[1-4]. A fracture neck of femur has poorer prognosis than other fractures in children. The management of this fracture with either conservative treatment or surgical treatment was associated with high risk of disability, pain and immobility because of osteonecrosis. Incidences of osteonecrosis after femoral neck fracture varied from none to one hundred percent depending on fracture types of the Delbelt's classification and age at time of injury[4-9]. A recent study of intravenous bisphosphonate therapy in adolescents found that it might have an adjunctive role in the treatment of traumatic osteonecrosis of femoral head by reducing bone resorption mechanism[10].

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The present study aimed to report the result of intravenous bisphosphonate therapy in a child who had traumatic fracture neck of femur and developed osteonecrosis after close reduction and internal fixation with multiple screws surgery.

Material and Method

A case report study was done between May 2008 and June 2010. Harris hip scores were classified as < 70 score = poor, 70-79 score = fair, 80-89 score = good and 90-100 score = excellent. Stulberg's classification was classified as class I = normal hip, class II = Spherical head, minor abnormality of neck or acetabulum, class III = nonspherical head but not flat, acetubular abnormality, class IV = flatten head with acetabular abnormality and class V = flatten head but normal acetabulum. Prognosis was graded as class I-II (spherical congruency), which had a good prognosis, class III-IV (aspherical congruency), late onset osteoarthritis and class V (aspherical incongruence),

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. At that time, multiple screws revision was done and hydroxyapatite bone graft was placed on July 24, 2008. Unfortunately, four months later on the scheduled visit December 9, 2008, her plain radiography showed early resorption of femoral head and the bone scan showed increased radioactivity around right femoral head with central photon deficit indicating avascular necrosis (December 24, 2008).

Palmidronate 60 mg intravenous was given as a first dose on January 6, 2009 then it was given every other month for two years. The last dose was given on June 2, 2010. $Caco_3$ 1,250 mg 1 tab and Vitamin D_2 20,000 units were given as supplements twice daily during the two years therapy. Before starting the protocol, medical complications were explained to the parents and an agreement was made with signatures in a consent form. There was a consensus of opinion on palmidronate treatment among orthopedic physicians in Hat Yai Hospital. Her baseline kidney ultrasound was normal. The renal function test of blood urea nitrogen was 5 mg/dl, creatinine was 0.6 mg/dl and her blood calcium was 9.7 mg/dl.

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 bisphophonate 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 ในการรักษาผู้ป่วยเด็กที่เกิดภาวะกระดูกหัวตะโพกตายจากอุบัติเหตุแล้วมีกระดูกคอตะโพกหักหลังยึดตรึงด้วยสกรู

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กระดูกคอตะโพกหักในเด็กเป็นภาวะที่เกิดจากการบาดเจ็บที่รุนแรงเช่น ตกจากที่สูงหรืออุบัติเหตุ จากยานพาหนะซึ่งพบได้ไม่บ่อย และพบได้น้อยกว่าในผู้ใหญ่แม้ในเหตุการณ์เดียวกัน และมักจะมีร่วมกับการบาดเจ็บของส่วนอื่น ๆ ของร่างกายรวมทั้งรยางค์ชิ้นอื่น ๆ ด้วย เมื่อเปรียบเทียบกับการหักของส่วนอื่นในร่างกายเด็ก พบว่าการหักของกระดูกคอตะโพก จะมีภาวะแทรกซ้อนที่สูง และผลลัพธ์ที่ไม่ค่อยดี เช่น การเกิดภาวะกระดูกไม่ติด หรือกระดูกติดผิดรูป โดยเฉพาะอย่างยิ่งการเกิดภาวะกระดูกหัวตะโพกตาย ซึ่งเป็นภาวะแทรกซ้อนที่พบบ่อยที่สุดและมีความพิการค่อนข้างมาก ซึ่งเด็กจะต้องใช้ข้อตะโพกนี้ไปอีกนานนับสิบ ๆ ปี ดังนั้นรายงานนี้จึงเป็นรายงานผู้ป่วย 1 ราย ที่เกิดอุบัติเหตุแล้วมีกระดูกคอตะโพกหัก ได้รับการผ่าตัดจัดและยึดตรึงกระดูกให้เข้าที่ด้วยสกรู หลังจากนั้นมีภาวะกระดูกหัวตะโพกตายเกิดขึ้น และได้ใช้ยา bisphosphonate ช่วยในการรักษาภาวะดังกล่าว โดยหวังว่าจะป้องกันหรือลดการยุบตัวของกระดูกหัวตะโพก ในกรณีที่เกิดภาวะกระดูกหัวตะโพกตายเพื่อลดความพิการในผู้ป่วยต่อไป