Outcome of Six Millimeters Core Decompression in Avascular Necrosis of the Femoral Head

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Core decompression is the accepted method of treatment of early femoral avascular necrosis (AVN). However, its result in advanced stage AVN is varied and it frequently ends up with artificial joint replacement. The three femoral heads with AVN Ficat stage 2B/3 were treated with the core decompression procedure. Menatetrenone, vitamins and minerals supplement was administered post operatively. The outcomes were evaluated by Harris hip score, the combined necrotic angle of the involved area of the femoral head and Ficat staging. At 24 months follow up, the Harris hip score was improved in all compared to that value at the pre operative period. No hips showed any sign of femoral head further collapse or changing of AVN stage. In conclusion, core decompression can be used in the treatment of advance stage AVN. Menatetrenone was given in order to help with bone mineralization during healing stage after core decompression. When combined both treatments together, the natural history of advanced stage AVN is modified and the natural hip joint is preserved.

Keywords: *Avascular necrosis, Femoral head, Core decompression, Outcome, Menatetrenone, Ficat stagin*

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Avascular necrosis (AVN) of the femoral head is one of the most common hip disorder frequently affected patients in their 3rd to 5th decade of life. Treatment of the AVN in pre-collapse or early collapse stage (Ficat stage 2B/3) was generally unfavorable with the higher rate of artificial joint replacement surgery if conservative treatment was elected[1-3]. Preserving the patient natural joint was an interesting option thus allowed the patient to ambulate with their natural joint. In order to relieve the pressure in the femoral head, various techniques of core decompression of the femoral head was described[4-7]. The procedure allowed the circulation reestablished in the femoral head and the necrotic area healed. The procedure was accepted as a standard treatment for early stage of the AVN but the experience with this procedure in advanced stage of the AVN is still limit. Menatetrenone-4, a synthetic vitamin K, is a co-enzyme in the process of bone mineralization. Its actual role in treatment of avascular necrosis of the femoral head has not been studied. It might facilitate healing process of the necrotic area after core decompression. It should help maintaining the femoral head integrity and decreasing the chance of femoral head collapse.

The purposes were to review the mid term outcome of the core decompression procedure combined with Menatetrenone-4 administration in the treatment of AVN, Ficat stage 2B/3, of the femoral head. The postulation was that the natural history of AVN will be modified with the procedure.

Material and Method

Medical record review was performed. Three hips in two patients affected by AVN of the femoral head associated with alcohol consumption were enrolled into the study. The first patient was 39 years old male with right hip involvement. The second patient was 63 years old male with both hips involvement. They were a regular alcohol drinker who presented with groin pain and limping resisted to conservative treatment.

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The diagnosis was made by upright antero-posterior and lateral Sugioka[8] radiographic pictures of the hip. The stage of AVN on the radiographic pictures were classified by Ficat[9] classification. All 3 hips underwent the core decompression procedure. The radiographic outcome was evaluated by the combined necrotic angle of the involved area in the femoral head measured at the pre operative period and the most recent follow-up[10,11]. Functional outcome was rated by Harris[12] hip score at the pre-operative period and the most recent follow-up. The treatment was considered successful if the Ficat staging was not change, the femoral head was not further collapse and the combined necrotic angle of the involved area was not increase at the most recent follow-up period.

Treatment procedure: The patient was positioned supine with affected hip elevated on a regular operative table (Fig. 1). The procedure was performed under fluoroscopic guidance and regional anesthesia.

A 1 cm incision was made below the greater trochanter on the lateral aspect of the thigh. Guided Kirshner wire was inserted to the most superior part of the femoral head in the area of femoral head affected by AVN. The position of the K-wire was confirmed on anteroposterior and Sugioka lateral fluoroscopic picture then it was removed. The tip of the Kirshner wire was aimed to be within 5-10 mm short of the articular cartilage. Next, 6 mm drill bit was drilled in the femoral head followed the tract previously made (Fig. 1). The position of the tip of the drill bit was confirmed by fluoroscope, again. Only single large drill hole was made. Granulation tissue, cancellous bone and bone marrow in the involved area were curette thoroughly (Fig. 2). The drill hole was left opened. The wound was closed in layer without a suction drainage.

The patient was allowed to walk with assistive device on the first post operative day. They may walk on full-weight bear when they feel comfortable. Menatetrenone (15 mg) was administered orally three times a day. Multi vitamins and minerals supplement was given one tablet a day. These two medications were prescribed for 2 years after the procedure.

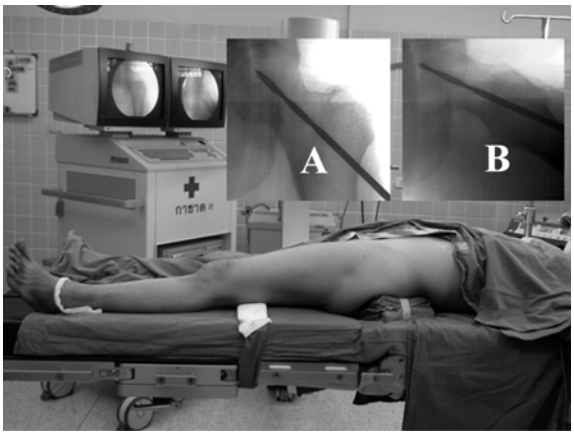

Fig. 1 The patient was placed in a supine position with the affected hip elevated. Inset A and B are the fluoroscopic pictures showing the position of the drill bit in anteroposterior and lateral views of the left hip, respectively

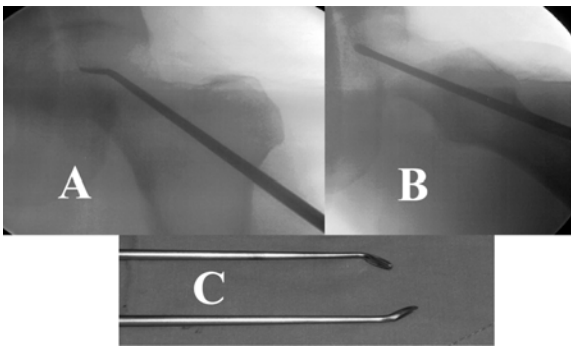

Fig. 2 Panel A and B are the anteroposterior and lateral fluoroscopic pictures of the curette in the femoral head. Panel C is the up-bite and down-bite curettes used in the core decompression procedure

Results

Harris hip score, Ficat classification and the combined necrotic angle of the treated hips was obtained at the pre operative period and 24-month follow-up visit. The data is shown in Table 1.

Harris hip score was improved at 24-month follow-up period in all operated hips compare to those from the pre-operative period. There was no evidence of further femoral head collapse or deteriorating of the articular surface following the core decompression procedure. The Ficat staging of the AVN remained the same in all cases. The area of head involvement was not significantly increased as measured by the combined necrotic angle (Fig. 3). The average operative time was 30 minutes. The amount of blood loss in each case was negligible. No complication occurred during the study period.

Discussion

The etiology of the AVN in alcohol abuse was believed to be associated with fat emboli and

Table 1. Harris hip score, Ficat staging and combined necrotic angle were evaluated at the preoperative period and 24-month follow-up

Pt./side	Harris hip score		Ficat staging		Combined necrotic angle (degrees)	
	Pre-op	Follow-up	Pre-op	Follow-up	Pre-op	Follow-up
1/R	52.9	89.775	3	3	222	240
2/R	40.5	92.450	3	3	272	282
2/L	51.2	92.875	2B	2B	236	282

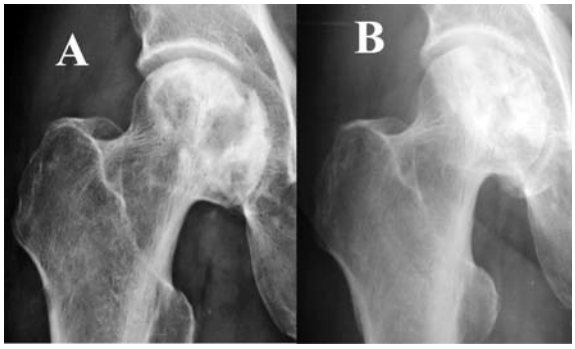

Fig. 3 Panel A and B are the radiography of the right femoral head in the anteroposterior view from the same patient. Panel A shows the AVN of the femoral head, Ficat 3, before the core compression procedure. Panel B shows the femoral head at 24 months after the procedure. No evidence of articular surface collapse was observed

increasing of the local tissue pressure thus the microcirculation was compromised and necrosis of bone marrow cell and osteocyte took place[1]. The repair process of the body made the cancellous bone soft and vulnerable to mechanical loading which led to articular surface collapsed. The core decompression was designed to relieve the pressure in the femoral head by making a drill hole through the lateral femoral cortex then the circulation of the femoral head was re-established. Ficat[9] categorized the radiographic picture of AVN of the femoral head into 4 types. He biopsied the central part of the femoral head with 6 mm diameter trephine and found that the pressure in the femoral head returned to normal. The encouraging result occurred in early stage of disease. However, Ficat 2B and 3 (Pre-collapse/early collapse) lesion usually progressed and ended up with artificial joint replacement if non-operative treatment was chosen[2,13]. Size and location of the lesion in the femoral head and radiographic staging were among the factors that determined the result of the core decompression[2,5,7,14-16]. Reported result of Ficat 2/3 treated by the core decompression was mixed. Bozic[17] reported a very high failure rate of the core decompression in pre collapsed/collapsed lesion. He advised that the differentiation between sclerosis and cystic type lesion was needed. Marker[18] studied various techniques of core decompression and found that multiple drill holes were safe. The success of the procedure came from careful patient selection especially with Ficat stage 3 hips. About 60% of the hip with Ficat 2 or larger was failed. Ha[10] reported femoral head collapse in 50% of cases with the combined necrotic angle between 190-240 degrees and all hip with the combined necrotic angle more than 240 degrees. Song[6] used multiple Steinman pin making multiple drill holes and obtained 77 and 35% in Ficat 2 and 3, respectively.

The result from the current report was considered success in all hips. All hips showed a radiographic sign of femoral head pre collapse or collapse before the treatment was performed. The lesions were graded as moderate to large size. These hips might not be a good candidate for the core decompression according to the previous published data. The promising result obtained from this study would have been attributing by two factors. Firstly was the core decompression technique and secondly was the modification of post operative care. Technique of core decompression described in this report was differed from previous reports[5,6,14] in that only one big drill hole (6 mm) was made. It was similar to the original biopsy technique proposed by Ficat[9]. Pressure in the femoral head returned to normal range after this size of core was made. Cancellous bone curettage was another advantage of this proposed technique. The granulation tissue can be removed thoroughly. Removal of bone might further decrease the pressure.

The subsequent reports did not identify any difference between one large drill hole and multiple small drill holes[5,6]. Subtrochanteric fracture occurred as one of the major complication in previous report but it did not take place in the recent study[6].

Menatetrenone, a vitamin K analogue, is a co-enzyme in the synthesis of many bone protein. These proteins help with calcium uptake and bone mineralization[19,20]. Result from the study in osteoporosis showed that Menatetrenone maintained the peripheral cortical bone density[19]. It helped prevent new vertebral fracture when used with etidronate compare to the group receiving etidronate alone[21]. In the situation where new bone formation is required such as repairing the cancellous bone in the femoral head, Menatetrenone may have an important role in bone mineralization process after the circulation was reestablished. Three-dimension architecture study of bone was shown that Menatetrenone preserved the trabecular bone pattern in animal model[22]. The effect on bone mineralization and trabecular bone preservation could have vital role in prevent femoral head collapse during repairing stage of AVN.

Natural history of the AVN of the femoral head is modified when combining the core decompression and Menatetrenone administration together. The procedure is simple and safe. The outcomes of these measures are better than those of conservative treatment especially when the pre collapsed/collapsed lesions are present. The integrity of the femoral head can be maintained at least 24 months after the index procedure. The patients ambulate with their own natural joints. Artificial joint replacement can be postponed.

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ผลการรักษาภาวะหัวกระดูกสะโพกขาดเลือดด้วยการเจาะรูระบายความดัน

ณพชาติ ลิมปพยอม, วัชระ วิไลรัตน์, ไพรัช ประสงค์จีน

การรักษาภาวะขาดเลือดของหัวกระดูกสะโพกด้วยวิธีเจาะรูระบายความดัน (Core decompression) เป็นวิธีการรักษามาตรฐาน อย่างไรก็ตามผลการรักษาในโรคนี้ ในระยะ Ficat 2B/3 ผลยังไม่เป็นที่น่าพอใจ ผู้นิพนธ์ได้ทำการรักษาภาวะหัวกระดูกสะโพกขาดเลือดด้วยวิธีเจาะรูระบายความดัน จำนวน 3 สะโพก และติดตามผลการรักษาเป็นระยะเวลา 24 เดือน โดยหลังการผ่าตัดได้ให้ยา menatetrenone และวิตามินและเกลือแร่เสริม พบว่าที่ระยะเวลา 24 เดือน ผู้ป่วยทุกรายมี Harris hip score เพิ่มขึ้น และไม่พบการเปลี่ยนระยะของโรค หรือพบการเปลี่ยนแปลงที่ผิวข้อสะโพกในทางที่ผิดปกติจากภาพรังสี

ยา menatetrenone ช่วยเรื่องการ mineralization ของกระดูก ซึ่งน่าจะมีส่วนช่วยการสร้างกระดูกใหม่ในหัวสะโพกภายหลังจากที่ความดันในหัวกระดูกลดลงจากการเจาะรูระบาย ดังนั้นเมื่อรวมข้อดีของการรักษาทั้งสองวิธีเข้าด้วยกัน การดำเนินโรคของภาวะขาดเลือดของหัวกระดูกสะโพกในระยะ Ficat 2B/3 น่าจะถูกเปลี่ยนแปลงไปได้ และเพิ่มโอกาสให้รักษาหัวกระดูกธรรมชาติของผู้ป่วยไว้ให้นานขึ้น