

The results of core decompression treatment in patients with avascular necrosis of femoral head in patients at Isfahan City educational hospitals in 2010-2011

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Abstract

Background: Avascular necrosis (AVN) of femoral head is one of the multifactorial pathologies, which can disturb hip joint and its range of motion. There have been several therapeutic methods for this pathology, but the results are controversial. Some studies show that core compression prevents the progress of the disease and its symptoms. This study aims to explore this issue.

Materials and Methods: This clinical trial was conducted on patients who were diagnosed with AVN of femoral head stage I, II_A at educational hospitals of Isfahan in 2010. The patients who met the inclusion criteria and suffered from AVN of femoral head stage I, II_A for any reason (primary or secondary), entered the study. Six and 12 months after surgery, final assessment in terms of range of motion, return to work, and severity of pain based on vancouver associated score (VAS) was made and recorded. The duration of hospitalization and rate of infection were also recorded. The data were entered into and analyzed by the SPSS software.

Results: Mean and standard deviation of pain severity before surgery was 6.82 ± 1.74 in the participants. After 6 months, pain severity reduced to 4.05 ± 1.29 , and after 12 months, it reached 2.41 ± 1.82 . On the basis of analysis of variance with repeated observation, the severity of pain was significantly reduced in 1 year ($P < 0.001$).

Conclusion: It can be concluded that core decompression in patients with AVN of femoral head stage I, II_A can improve pain in hip area and increase range of motion.

Key Words: Avascular necrosis of femoral head, core decompression surgery, corticosteroids

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INTRODUCTION

Avascular necrosis (AVN) of femoral head is one of the common problems in orthopedic patients across the globe because there is controversy among orthopedic surgeons for both trend of the disease and appropriate treatment. On one hand, most patients are young. On the other hand, in case of complete destruction of femoral head, it must be changed, but most authors do not agree on joint replacement at young ages.^[1]

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AVN of femoral head, or osteonecrosis, is also locally known as blackening of femoral head or hip joint. In this disease, blood supply to the head of femur is interrupted for certain reasons, and consequently the bone dies. The dead bone loses its hardness and power, and deforms under the pressure of the body in that it flattens little by little. After the bone deforms, the movement of the femur head and acetabulum wears away the joint because the curve of the femoral head and acetabulum has changed. During the process of necrosis, the cartilage that covers the head of femur is destroyed, which intensifies the wearing. Major underlying causes of the disease are using steroids, scuba diving disease, some drugs and trauma to the joint.^[2,3] The etiology of the disease is unknown, but it can be caused in following situations: using corticosteroids, consuming alcohol or injected drugs, hip dislocation, femoral neck fracture, hip joint infection, complication of congenital dislocation of hip, complication of femoral head slip, professional scuba diving for a long time, rheumatoid arthritis, sickle cell anemia, Gauche disease, pancreatitis, Crohn's disease, and lupus.

Patient's chief complaint is pain in hip, which is felt mostly in front of the joint and in the groin. Little by little, the joint is frozen and has limited motion, and after a while the patient's hip becomes stiff. As femoral head deforms, its height reduces, so the lower limb shortens. In chronic cases, hip and thigh muscles weaken and atrophy.^[4]

Treating this disease depends on its severity (stage of the disease) and the extent of the involvement. The more advanced the disease, the more extensive the intervention. In advanced cases (Stage IV), where both femoral head and acetabulum are destroyed, we have no choice but total joint replacement or freezing the joint. All authors agree on this treatment.^[5]

Doctors agree on the treatment in stage III to a large extent. If the involvement is extensive, treatment is like that in stage IV, but if the involvement is less than 30%, the injured part can be excised by osteotomy.^[6] The highest controversy exists in the preferred treatment for stage I and II. If the progress of the disease is stopped, femoral head and hip joint can be saved. To do so, there are various treatments like simple drilling and implanting different types of bone grafts (cancellous or cortical like fibula).^[7,8] The results of different types of treatments are different.

If the disease is discovered at an early stage, and femoral head is not deformed, some surgical procedures can resupply blood to it and prevent the progress of the disease. The most common surgery

is decompression of femoral head. In this surgery, one to several cannulas are drilled in the neck and head of femur. It seems that it reduces the pressure inside the bone, and thus decreases the pain. It is also possible that reduction of internal pressure opens up the capillaries and supplies more blood.

Most of the patients go from the early stages of the disease to advanced stages, so it is not possible to save femoral head in them. This study aimed to determine the therapeutic results of core decompression in patients with AVN of femoral head.

MATERIALS AND METHODS

This clinical trial was conducted in educational hospitals of Isfahan in 2010. The study population comprised patients with AVN of femoral head, who went to orthopedic centers.

All patients who were diagnosed with AVN of femoral head stage I, II_A who came to educational hospitals of Isfahan, and were willing to participate, entered the study. Exclusion criteria were systemic diseases, sickle cell anemia, and local bone diseases like osteogenesis imperfecta, impossibility of having core decompression for any reason, not returning for follow-up sessions, inaccessibility of patients, and force major events that disrupt cooperation such as death.

Among patients who had the inclusion criteria, and had AVN of femoral head stage I, IIA for any reason (primary and secondary causes), and came to educational hospitals in Isfahan, those who were willing to participate entered the study after learning about their disease, its course, expected results, and surgical procedure. Then, patients were interviewed and examined, and a base X-ray was taken to compare it with the results after surgery. Furthermore, the severity of pain and range of motion of hip joint was recorded using VAS criteria. If the disease is advanced to the point that femoral head is deformed, there is only one way left: hip replacement and using artificial joint. Patients receive general or spinal anesthesia, and then are bound to orthopedic bed. Then, standard lateral and proximal hip incision is made in the afflicted side. After incising subdermal tissue, lateral fascia, and relevant muscles, the insertion point of guide pin under the greater trochanter is exposed, and the guide pin (with a 135° guide) is inserted. After fixing the pin in the neck, it is reamed with reamer # 8.

After the surgery, patient's information was recorded in a specific checklist. Six and 12 months after surgery, final assessment of motion range, return to work, and severity of pain in thigh was performed.

The duration of hospitalization and rate of infection were also recorded. Standard Lat and A/P X-ray were taken at months 6 and 12 to evaluate patients' radiological improvement. All stages of the surgery were performed by the researcher and the orthopedic resident including incision and drilling. The data were entered into the SPSS software program version 18. Descriptive statistics like frequency distribution, frequency, mean and standard deviation were used. In order to compare recorded repeated measures, three measurements of analysis of variance of repeated measures were used. To compare different levels of qualitative variables, chi square test was used, and to compare mean of quantitative data between two groups, t test was used.

RESULTS

In this study, 22 cases of core decompression on patients with painful hip and AVN of femoral head were studied. Mean age of participants was 44.5 ± 7.7 years. Minimum and maximum age of participants was 25 and 52, respectively. Furthermore, four (18.2%) of these patients were under 40 years old, five (22.7%) were 40–44 years old, seven (31.8%) were 45–49 years old and six (27.3%) were 50 or over. Nine patients (40.9%) were male and 13 patients (89.1%) were female. Mean age of men and women was 51 ± 8.1 , and 53.6 ± 8.8 years, respectively. The t test showed no significant difference between men and women. ($P = 0.49$).

As for occupation, four people (18.2%) were workers, four (18.2%) were office clerks, two (9.1%) were self-employed, 11 (50%) were housewives, and one (4.5%) was retired.

Mean duration of disease was 35 ± 21.7 months. Minimum and maximum duration of hospitalization was 9 and 84 months, respectively. Mean duration of disease in the studied men and women was 38.3 ± 21.9 and 32.6 ± 22.4 months, respectively. On the basis of the t test, there was no significant difference between men and women. ($P = 0.55$).

Three patients (13.7%) had a history of lupus, four (18.2%) had a history of injected drug, five (22.7%) had a history of trauma, three (13.6%) had a history of CRF, and seven (31.8%) had no underlying diseases.

Of the 22 studied patients, 12 (54.5%) had used corticosteroids, three of whom had lupus, two had a history of injected drug, three had trauma, three had CRF, and one had no underlying diseases. Fisher's exact test showed a significant relationship between using corticosteroids and the underlying cause of AVN

of femoral head ($P = 0.046$). The results are shown in Table 1.

Hip joint involvement was unilateral in 15 patients (68.2%) and bilateral in seven patients (31.8%). Furthermore, two men and five women had bilateral hip involvement (22.2% vs. 38.5%). Based on Fisher's exact test, no significant difference was found between two sexes in this regard. ($P = 0.65$).

Eight patients (36.4%) were stage I and 14 patients (36.6%) were stage II_A. Patients who were stage I had a normal x-ray, so their disease was diagnosed by MRI. For patients who were stage II_A, mostly an increased density of femoral head was reported, but no deformation was seen. According to Fisher's exact test, the stage was not different in two sexes. ($P = 0.25$).

The status of pain from the surgery to 12 months later:

Mean and standard deviation of severity of pain before surgery (baseline) was 6.82 ± 1.74 , but decreased to 40.5 ± 1.29 after 6 months, and to 2.41 ± 1.82 after 12 months. Based on analysis of variance with repeated observation, severity of pain significantly decreased within a year after surgery. ($P < 0.001$) Table 2 shows mean and standard deviation of severity of pain in the first year after surgery for each stage. Although pain reduction in stage I patients was more, according to analysis of variance with repeated measures, mean severity of pain was not significantly different in the two groups. ($P = 0.52$).

Range of motion of hip joint

Mean range of flexion before surgery was 63.9 ± 12.1 degrees in patients. After 6 months, it increased to 80.2 ± 12 degrees, and after 12 months it reached 88 ± 10.8 degrees. Based on analysis of variance with repeated measures, range of flexion was significantly different ($P < 0.001$).

Mean range of abduction before surgery was $16.8 \pm$

Table 1: Relationship between using corticosteroids and the underlying cause of AVN of femoral head

Corticon use	Yes		No		Total	
	Number	Percent	Number	Percent	Number	Percent
Underlying cause						
Lupus	3	25	0	0	3	13.6
Trauma	3	25	2	20	5	22.7
Unclear	1	8.3	6	60	7	31.8
Injecting drug use	2	16.7	2	20	4	18.2
CRF	3	25	0	0	3	13.6
Total	12	100	10	100	22	100

$P = 0.046$

8.5 degrees, but it increased to 27 ± 5.9 , and 31.8 ± 5.7 degrees after 6 and 12 months, respectively. This improvement in abduction was meaningful based on analysis of variance with repeated measures ($P < 0.001$).

Mean range of motion before surgery was 15.5 ± 8.6 degrees, but 6 months after, it improved and reached 25 ± 4.9 degrees. Furthermore, 12 months after surgery, the mean range of motion was 31.1 ± 4.6 . The trend of improvement was generally significant ($P < 0.001$).

Mean range of internal and external rotation of hip was 9.8 ± 6.5 degrees before surgery. After 6 months, mean of this motion increased to 17.3 ± 5.1 , and after 12 months, it increased to 24.8 ± 5.7 degrees. Based on the analysis of variance test, the difference was significant ($P < 0.001$).

Mean duration of hospitalization was 3.5 ± 1.06 days. Minimum and maximum duration of hospitalization were 2 and 6 days, respectively. Mean time of return to work in all patients was 2.59 ± 1.1 months, with a minimum of 1 and a maximum of 6 months.

After surgery, only one patient (4.5%) had superficial infection at the operation site, which improved with oral antibiotic. Other patients had no complications.

One year after surgery, 14 patients (63.6%) had been completely treated and returned to ordinary life, and eight patients (36.4%) had relatively improved.

Sixteen patients (72.7%) were completely satisfied with the result of the operation, three patients (13.6%) were relatively satisfied, and three others (13.6%) were dissatisfied.

Six months after surgery, patients had an X-ray, which showed that eight patients were stage I, one patient was stage II_A, and others were normal. Of 14 patients who were stage II_A, there was no change in the stage of the disease. After 12 months, eight patients were stage I, and only one patient progressed to stage II_A. Others remained in stage I. Furthermore, 12 months after surgery, of the 14 patients who were stage II_A, three patients progressed to stage II_B, and showed flattening of femoral head.

Table 2: Mean and standard deviation of severity of pain before surgery until 12 months after for each stage of the disease

Stage of the disease time	Stage I	Stage II _A	Total
Baseline	6.79 ± 1.93	6.88 ± 1.46	6.82 ± 1.74
6 months after surgery	4.14 ± 1.17	3.88 ± 1.55	4.05 ± 1.29
12 months after surgery	2.07 ± 1.64	3 ± 2.07	2.41 ± 1.82
<i>P</i>	0.52		<0.001

DISCUSSION AND CONCLUSION

The objective of this study was to determine the therapeutic effects of core decompression of patients with AVN of femoral head.

Mean age of patients was 44.5 ± 7.7 years. The results showed that patients with AVN of femoral head were not old, but young and middle aged.^[1]

Patients were 40.9% men and 59.1% women, which showed no significant difference between the two sexes. Frequency of the disease was nearly the same in both sexes, but it can be different in different societies because risk factors for each sex, for example, trauma, and long-term use of corticosteroids are different. In many parts of the world, musculoskeletal pains, especially during middle age, and at menopause in women, are more prevalent, so corticosteroids are used more in them, and this disease can be more prevalent in women too.

Most of the patients (50%) were housewives, which can be attributed to the fact that more than 90% of women in Iran are housewives. If job distinction is made in women, this distribution will change.

Mean duration of diseases was 35 ± 21.7 months, which was 38.3 ± 21.9 for men and 32.6 ± 22.4 months for women. There was no significant difference between men and women. Duration of the disease is one of the important factors in stage of the disease. In patients with AVN of femoral head, a long time passes before diagnosis, so as the head of femur erodes, patients enter higher stages. Moreover, in countries like Iran, where people ignore musculoskeletal pains, people might suffer from hip problem, but do nothing before it reaches a serious stage. In this study, patients with stage I and IIA entered the study, so the duration of their disease was not much.

Two of the causing factors in this disease were history of trauma (36.4%) and history of corticosteroid use (45.4%). Therefore, attention should be paid to informing people about uncontrolled use of corticosteroid and follow-up of traumas to the hip and thigh.

Follow-up of patients that had core decompression surgery showed that mean and standard deviation of severity of pain before surgery was 6.82 ± 1.74 , but it significantly reduced to 4.05 ± 1.29 after 6 months. Furthermore, it reached 2.41 ± 1.82 after 12 months, which is also significant. Therefore, a surgery to reduce the pressure on hip joint can significantly reduce patient's pain. Moreover, the reduction in pressure

on femoral head prevents progress of the disease and improvement of symptoms. In a similar study in 2008, 72 hips with AVN of femoral head were treated by multiple small-diameter drillings, which had a high rate of success. Patients with stage I had the best prognosis of 79%.^[5]

Limpaphayom *et al.* (2009) operated three patients with stage II—III, which showed a significant improvement after 24 months. They recommended that this surgery be used at higher stages of the disease.^[6]

Li and Zhang (2006) compared several treatments including core decompression, bone grafting and osteotomy. They found better results with bone grafting for AVN of femoral head.^[9]

In a meta-analysis by Castro *et al.*, core decompression and conservative treatments were compared. Results showed that the efficacy of core decompression for AVN of femoral head was 84%, 63%, and 29% for stage I, II, and III, respectively, while those for conservative treatment were 61%, 59%, and 21%, respectively.^[7]

Steinberg reached similar results, and described the efficacy of core decompression for stages I and II as excellent.^[8,10-12]

Range of motion of hip joint significantly improved in patients in that during the follow-up, hip's range of motion significantly increased.

In sum, it can be inferred that core decompression significantly improves pain and range of motion in patients with AVN of femoral head stages I and II_A.

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