Treatment of Femoral Head Necrosis with Chinese Medicine

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Osteonecrosis of the femoral head is now a commonly recognized irreversible disorder with significant morbidity if the lesion is large and has some collapse. In many patients, even early identification and intervention do not alter the result.

In femoral head necrosis the osteocyte of femoral head die along with the bone marrow; resorption of the dead tissue by new but weaker osseous tissue can lead to subchondral fracture and collapse. Radiologic manifestations of AVN occur in the late stages of the disease. Patients affected with osteonecrosis are young, usually in the third to sixth decades of life. Essentially, nonoperative treatment for symptomatic AVN of the hip yields unfavorable results. Protected weight bearing alone is never an adequate treatment for femoral head necrosis nor will it result in cure of the condition, no matter how long it is maintained, and is useful only in controlling relief
of discomfort symptoms. Physical therapy provides only symptomatic control and does little to alter disease progression. Medical therapy for AVN of the hip is principally indicated for Nonsteroidal anti-inflammatory drugs (NSAIDs) and, on occasion, narcotics, form the basis of pharmacotherapy. Investigations into vasoactive lipid-lowering agents and anticoagulants are ongoing and hold promise; however, these medications currently are not recommended. Surgical treatment of AVN can be broadly categorized as either prophylactic measures (to retard progression) or reconstruction procedures (after femoral head collapse). The most commonly performed prophylactic surgical intervention is core decompression. Core decompression is applicable for mild to moderate degree of involvement that has not yet progressed to collapse. Pain relief from this procedure has been excellent, but it has not been as
effective at delaying the progression of the disease in the long term. Core decompression often is supplemented with bone grafting (cancellous autograft or structural allograft) to enhance mechanical support and augment healing. Biologic augmentation of core decompression recently has become introduced and includes the addition of demineralized bone matrix, bone morphogenic proteins, or electric/electromagnetic stimulation. These agents are purported to either enhance bone formation or decrease bone resorption in hope of maintaining the structural integrity of the femoral head. The addition of demineralized bone matrix to core decompression confers little (if any) clinical response, while the effects of bone morphogenic protein remain uncertain. The addition of a vascularized fibular graft to core decompression offers promise in more advanced lesions but involves considerable morbidity.
Total hip arthroplasty (THA) is perhaps the most commonly performed and successful surgery for advanced AVN of the hip. Despite recent improvements in prosthetic replacement, replacement arthroplasty precludes further participation in impact activities (running, jogging) because these activities greatly decrease implant longevity.

Up to now we have not found a report about effect bone repair in which radiography demonstrated restoration of bone structure, recovery of femoral head sphericity and reform of articular surface and space in late cases.

Fifteen patients in whom restoration of bone structure, recovery of femoral head sphericity and reappearance of articular surface and articular space are demonstrated after treatment with Chinese medicine by us.
Figure 1a. Frontal radiograph of the right hip demonstrates a cleft (arrow) after nailed fracture of femoral neck.

Figure 1b. Radiograph shows union of fracture and increasing sclerosis of the whole femoral head (arrow).
Figure 1c. Radiograph depicts the shrunked oval femoral head with a lucency area in the middle of the femoral head (arrow) and local flattening (long arrowhead).

Figure 1d. Follow-up frontal radiograph of the right hip obtained 1 year after treatment shows recovery of femoral Head sphericity.
Figure 1 e. The film taken 18 months later shows good bone reconstruction with quite distinct trabeculae and thick cortex (arrow).
Figure 1 f. Note the change of thickness of cortex in different time that reflect the change of power of weight-bearing.
Figure 2a. Radiograph demonstrates local flattening of femoral head (blue arrow), increasing sclerosis (red arrow) and large lucent area (white arrow) above fracture line.

Figure 2b. Radiograph shows some thick bone pillar traversed the lucent area (arrow) and recover of femoral Head sphericity.
Figure 2c. A great of thick bone trabeculae appeared in the middle of femoral head.

Figure 2d. Radiograph shows regular bone trabeculae in femoral head 18 months later after further remodeling of repaired trabeculae.
Figure 3a. Radiograph demonstrates increasing sclerosis of the femoral head top (long arrow) and large lucent area between the area of sclerosis and fracture line (short arrowhead).

Figure 3b. Some irregular bone trabeculae appeared in the middle of femoral head (arrow).
Figure 3 c. Reappearance of whole femoral head with regular trabeculae and intact contour outline

Figure 3 d. Radiograph shows normal femoral head with distinct regular trabeculae and the joint space seems wider than before
Figure 4a. Frontal radiograph of the right hip demonstrates huge infarction (arrow) surrounded by thin sclerosis in the middle of femoral head.

Figure 4b. The lucent area is more obvious and the width of surrounded sclerosis is increased (arrow) five months later.
Figure 4c  Increasing sclerosis developed within the lucent area, and the infarction is diminished slightly with a local deformity of the contour of femoral head (arrow).

Figure 4d  Radiography demonstrated marked diminish of the lesion and restoration of the sphericity of femoral head.
Figure 5a. Frontal plain radiograph showed a large lucent area with blurring and poor definition of the bony trabeculae within femoral head.

Figure 5b. Patchy sclerosis coexists with demineralization, appearing as alternating regions of increased density and increased lucency.
Figure 5c. Some new bone trabeculae was formed within the area of necrosis (arrow).

Figure 5d. The formation of new bone definitely reduced the size of the necrotic area and the lucent area was markedly diminished (arrow).
Figure 6a. Frontal radiograph of the right hip demonstrates impacted fracture of femoral neck (arrow).

Figure 6b shows increasing sclerosis of upper half of femoral head (above broken white line), crescent sigh (double arrow) and local absorption of joint surface (long arrow).
Figure 6c. Disappearance of the crescent sigh and reappearance of local joint surface, femoral head was repaired by irregular bone trabeculae.

Figure 6d. Radiograph shows regular bone trabeculae 18 months later after further remodeling of repaired trabeculae.
Figure 7a. Frontal plain radiograph showed a subchondral fracture line (black arrow) and a radiolucent area.

Figure 7b. Frontal plain radiograph showed two subchondral fracture line (white arrow) and enlargement of radiolucent area (black arrow) one month later after moving out of screws.
Figure 7c Blurring of two subchondral fracture line (double arrow) and diminution of radiolucent area.

Figure 7d, Disappearance of subchondral fracture line and evident diminution of radiolucent area.
Fig 8a. Radiography revealed femoral head necrosis with the formation of “nail trace”—a radiolucent trip with a sclerotic brim parallel to screw.

Fig 8b. Disappearance of the “nail trace” after treatment with Chinese medicine. “nail trace” is a sign of early collapse of the femoral head.
Fig 8c, Reappearance of lateral brim of femoral head

Fig 8d, Reappearance of bone trabeculae lateral located in the femoral head (arrow)
Figure 9a. Frontal radiograph of the left hip demonstrates a normal hip after tumble.

Figure 9b shows fracture line with mild malposition (arrow) 29 days later.
Figure 9c. Frontal radiograph depicts local necrosis (arrow) with local breakdown of bone structure and local collapse (long arrow).

Figure 9d. The film taken 18 months later shows good union of fracture and good repair process into the necrosis area.
Figure 9e. The femoral head shows normal bone structure.
Figure 10a. Radiograph shows patchy sclerosis (arrow) before moving out screws.

Figure 10a. Radiograph shows collapse (arrow) with uneven contour a month after moving out screws.
Figure 10c shows even contour after treatment with Chinese medicine.

Figure 10d shows rounded femoral head.
Figure 11a. Frontal radiograph of the left hip demonstrates fracture of femoral neck.

Figure 11b shows patchy sclerosis (long arrow) and demineralization (arrow) within the femoral head. The height of femoral head was reduced and the cleft between fracture ends was widened nine months later.
Figure 11c. Radiography shows good union of fracture and some trabeculae.

Figure 11d. The femoral head shows more marked sclerosis eight years later after union of fracture.
The comparison of high of femoral head before and after treatment (fig 11b and c) indicated that the high of femoral head after treatment (right) is great in comparison with the high before treatment (left).
Figure 12a. Collapse of femoral head and superior femoral fragment was separated from the underlying femoral head. A thick sclerotic zone developed along the "no-man's land" between the living and necrotic bone.

Figure 12b. The necrotic bone was broadened slightly as a result of some sclerosis developed in the lucent area (arrow).
Figure 12c. The necrotic bone broadened markedly as a result of some sclerosis developed in the lucent area (arrow).

12d. Radiograph indicate that necrotic bone have became alive bone by the fact that new trabeculae appeared within the necrotic bone.
Figure 13a. Radiography shows severe destruction of the femoral head with ragged edge.

Figure 13b. Radiography shows mild increase of flatness of the margin of the femoral head.
Figure 13 c. Formation of natural surface of the femoral head.

Figure 13 d. Radiography shows smooth joint surface of the femoral head.
Figure 14a. Destruction of the femoral head and acetabular degeneration (DJD) with disappearing of joint space, marginal osteophyte formation, and intra-articular body.

Figure 14ab. The intra-articular body was absorbed and bone repair of femoral head and acetabulum was observed.
14c Bone repair and reappearance of a narrow joint space

14d Marked bone repair and formation of smooth new articular surface and joint space
Figure 15a shows a huge lucency with a small sequestra within the flattening epiphysis.

Figure 15b shows reconstitution of the outline and integrity of the epiphysis except for small area of lucency.
Figure 15c shows increment of the height of the epiphysis and decrease of lucency area.

Figure 15d shows normal hip joint, the ball reshapes well and fits well in the socket.
Discussion

Osteonecrosis is a disease of unknown pathogenesis that usually progresses to hip joint destruction necessitating total hip arthroplasty. The unspecific findings in ARCO stage I with negative radiographs are potential reversible. The "point of no return" already lies in the irreversible ARCO stage II in almost all cases. Prognosis for further progression for both early stages depends primarily on the extension and location of the lesion. Once the disease reaches the irreversible early stage, complete recovery cannot be expected. Only the rare, small to medium sized lesions in the medial or central location may have a good prognostic course over a period of more than five years. The much more common large sized and lateral located lesions will have a probability of about 80% to progress to femoral head collapse within two years.
To date, no therapeutical intervention exists which leads to complete healing of irreversible ON stages by reconstructive repair. Because the results of hip arthroplasty in patients with osteonecrosis are relatively poor, the goal of treatment for avascular necrosis is only to improve functionality or to stop further damage to the affected bone or joint. Radiologic manifestations of AVN occur in the late stages of the disease, as the bone attempts to repair itself. Once detected radiographically, collapse of the femoral head usually occurs later. Results are worse if surgery is performed after femoral head collapse has occurred. As it is impossible to restore original bone structure, the Harris hip score frequently is used to assess the outcome of a number of surgical approaches.
Necrotic bone has a modulus of elasticity that is ca. 70% less than that of normal living cancellous bone; and the ultimate breaking load of necrotic bone is about half that of viable bone. Trabecular fractures have been described even in healthy femoral heads; their numbers are increased in porotic heads. If the bone is necrotic, there should be even more fractured trabeculae; worse, these fractures in dead bone cannot heal. Once the osteonecrosis has been present for months, microfractures will accumulate in the dead bone to the point that one may see developing subchondral fractures. As a general rule in patient especially in late case there is a marked fibrosis that decrease the strength of femoral head. Thus, as bone repair occurs, weight bearing bone becomes mechanically weakened, the fracture burden will gradually increase, and in the maximally stressed zones of the femoral head, a subchondral fracture and collapse
may eventually occur.

Different repair processes affect the clinical course of nontraumatic avascular femoral head osteonecrosis, and three forms of insufficient repair in the necrotic area can be distinguished: limited repair producing the diagnostic osteosclerotic rim with adjacent hypervascularity; Destructive repair predominant producing resorption of necrotic bone led to femoral head breakdown; Reconstructive repair producing reparative bone formation from subchondral fractures and/or the reactive interface, definitely reducing the size of the necrotic area (reconstructive repair). However, it cannot prevent progression into late stage ON (ARCO stage 4) with secondary joint interface, definitely reducing the size of the necrotic area. definitely reducing the size of the necrotic area (reconstructive repair).
However, it cannot prevent progression into late stage ON (ARCO stage 4) with secondary joint destructions. Up to now a number of surgical approaches have been employed to preserve the femoral head, none is completely satisfactory. In these cases only reduction of pain and retardation of the natural course of the osteonecrosis are possible to gain time until total hip replacement is unavoidable. Plakseychuk et al. provides important information regarding treatment options for osteonecrosis of the femoral head. The authors compared clinical results in two groups of patients with osteonecrosis: one group was treated with nonvascularized fibular grafting in Korea and the other group was treated with free vascularized fibular grafting in the United States. At a follow-up of approximately five years, the Harris hip scores improved
for 70% of the hips treated with free vascularized fibular grafting in comparison with such an improvement for only 36% of the hips treated with nonvascularized fibular grafting. The authors concluded that vascularized fibular grafting was associated with better clinical and radiographic results than was nonvascularized fibular grafting for osteonecrosis of the femoral head. One should note that of the Stage-III hips in this study, all fifteen hips that received the nonvascularized fibular graft were rated poor according to the Harris hip score. In authors opinion, this 73% failure rate does not justify the use of vascularized fibular grafting in Stage-III hips. These patients may have had better results after treatment with arthroplasty.
The experimental osteonecrosis in adult rabbits indicated that in cancellous bone new bone was first laid down on the surface of the dead trabeculae, and later extended out and filled in the spaces between the trabeculae. The central cores of dead bone in the trabeculae were then resorbed and replacement by living bone. In contrast to coarse cancellous bone, the primary response of the compact subchondral bone is bone resorption rather than bone formation. The penetration by capillaries, inciting a proliferative response of cartilage cells and changes in the matrix similar to those observed in osteoarthritis, and complete destruction of the joint ensues. At a word, Joint preservation measures have a much better prognosis, but even in rabbit it is impossible to restore the articular surface of femoral head.
As the risk for disease progression is greater with nonsurgical treatment than with surgical intervention. Nobody have tried to restore bone structure of affected bone and restore sphericity of collapsed femoral head with medical therapy. On the basis of treatment of nonunion with Chinese medicine we have paid attention on the treatment of femoral head necrosis with Chinese medicine. According ARCO stage of AVN of the femoral head. All Case from case one to case five are cases of stage II C, and case one is a necrosis of whole femoral head. In case one, two and three the restore of bone structure is complete. In case 4 and 5 the formation of mature trabecullae diminished markedly the area of necrosis.

Case six and seven presented crescent sign. Case, eight, nine and ten presented mild collapse. All these cases are cases of ARCO Stage III A. After treatment Case six, nine, ten returned to normal
and case 7 and 8 came back to stage II.

Case 11 and 12 are cases of ARCO stage IIIC in whom we discover the elevation of collapsed femoral and reappearance of bone trabeculae within the dead bone. In our case 13 radiograph demonstrated the process of reformation of articular surface of femoral head and in case 14 the radiograph demonstrated process of reformation of both articular surface and articular space. Case 15 is a Perthe's disease, the ball reshapes well and fits well in the socket after treatment.

These fifteen cases represent a new discover that it is possible to restore bone structure and to recover femoral head sphericity in some cases of femoral head necrosis of ARCO stage II and IIIa. Even in late cases of ARCO stage III C and IV, the revival of dead bone and reformation
of joint space and joint surface is helpful to patients. It is reasonable that our treatment is effective in some patients of femoral head necrosis and the ARCO stage is better than the Harris hip score to assess the outcome of treatment.

Reference

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