

Recent trends in Hip Joint Avascular Necrosis Salvage Procedures

Essay

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Orthopedic Surgery

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Abstract

Background: Osteonecrosis, in adults also known as aseptic necrosis, avascular necrosis (AVN), atraumatic necrosis, and ischemic necrosis, is a pathologic process that has been associated with numerous conditions and therapeutic interventions. In patients in whom there is direct damage to bone vasculature (e.g. femoral neck fracture) or direct injury of bone or marrow elements (e.g. radiation injury, dysbarism, or Caisson's disease), the cause is clearly identifiable. However, in many patients, the mechanisms by which this disorder develops are not fully understood.

Aims: Get a focus on recent trends in Joint-preserving procedures in avascular necrosis of the hip joint.

Methodology: Osteonecrosis is a pathologic process that has been associated with trauma, with numerous atraumatic conditions, and with therapeutic interventions, most commonly corticosteroid use and excessive alcohol intake. Compromise of the bone vasculature, leading to the death of bone and marrow cells (bone marrow infarction), and ultimate mechanical failure appear to be the common etiologies shared by the varied proposed causes. The mean age at diagnosis is less than 40 years.

Conclusion: Symptomatic hip osteonecrosis is a disabling condition with poorly understood etiology and pathogenesis. Numerous treatment options for hip osteonecrosis have been described including nonoperative modalities, joint preserving procedures, and THR. Nonoperative or joint preserving treatment may improve outcomes when an early diagnosis is made before the lesion has become too large, or there is radiographic evidence of femoral head collapse. The presence of a crescent sign, femoral head flattening, and acetabular involvement indicate a more advanced-stage disease in which joint preserving options are less effective than THR. The algorithm of ONFH management as presented is an effective treatment strategy which is practically feasible and based on sound evidence.

Keywords: Recent trends, Hip Joint, Avascular Necrosis, Salvage Procedures

بِسْمِ اللَّهِ الرَّحْمَنِ الرَّحِيمِ

قالوا

لسببائك لا علم لنا
إلا ما علمتنا إنك أنت
العليم العظيم

صدقة الله العظيم

سورة البقرة الآية: ٣٢



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List of Abbreviations

ABMT	: Autologus bone marrow transplantation
ACI	: Autologous chondrocyte implantation
ANFH	: Avascular necrosis of the femoral head
ARCO	: Association of Research Circulation Osseous
ARCO	: The Association of Research Circulation Osseous staging system
AVN	: Avascular necrosis
BMES	: Bone marrow edema syndrome
CD	: Core decompression
COL2A	: Alpha chain of type II collagen
CT	: Computerized tomography
DJD	: Degenerative joint disease
ESWT	: Extracorporeal shockwave therapy
HAART	: Highly active antiretroviral therapy
HBO	: Hyperbaric oxygen

List of Abbreviations

HCT	: Hematopoietic cell transplantation
HHS	: Harris hip score
HIV	: Human immunodeficiency virus
MFCA	: The medial femoral circumflex artery
MRI	: Magnetic resonance imaging
NSAIDs	: Non-steroidal anti-inflammatory drugs
OATS	: Autologous chondrocyte transplantation
ONFH	: Osteonecrosis of the femoral head
PAI-1	: Plasminogen activator inhibitor-1
PEMF	: Pulsed electromagnetic fields
SLE	: Systemic lupus erythematosus
THA	: Total hip arthroplasty
TOH	: Transient osteopenia of the hip

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Introduction

Osteonecrosis, in adults also known as aseptic necrosis, avascular necrosis (AVN), atraumatic necrosis, and ischemic necrosis, is a pathologic process that has been associated with numerous conditions and therapeutic interventions. In patients in whom there is direct damage to bone vasculature (e.g. femoral neck fracture) or direct injury of bone or marrow elements (e.g. radiation injury, dysbarism, or Caisson's disease), the cause is clearly identifiable. However, in many patients, the mechanisms by which this disorder develops are not fully understood.⁽¹⁾

Compromise of the bone vasculature, leading to the death of bone and marrow cells (bone marrow infarction), and ultimate mechanical failure appear to be common to most proposed etiologies. The process is most often progressive, resulting in joint destruction within a few months to two years in the majority of patients.⁽²⁾

The avascular necrosis (AVN) or osteonecrosis of the femur head (ONFH), a disease with many etiological factors, affects young population and if not managed timely, leads to the collapse of femoral head eventually requiring hip arthroplasty. Early presentation of avascular necrosis of femoral head may be painless; however the ultimate presentation is painful limitation of hip motion. Passive movements of hip are also restricted. There is a high chance of bilateral presentation. Careful clinical history is important to find any of the risk factors. The Harris hip score is one of the most common clinical scales used for assessing the hip status.⁽³⁾

The antero-posterior radiographs of the affected hip show the principal area of AVN. However, because the

anterior and posterior acetabular margins overlap the superior portion of the femoral head, subtle abnormalities in the subchondral region may be missed. So good quality lateral X-rays of the femoral head are very important. A cross table lateral radiograph is less satisfactory than a frog leg lateral to reveal the architectural details of the femoral head. Technetium 99m diphosphonate imaging (bone scanning) is a useful technique for detecting osteonecrosis. Multiple studies have demonstrated that MRI is the most accurate of all imaging modalities. Double line signal on T2-weighted image is virtually pathognomic for AVN. Also, the single density line, which is so often seen outlining the necrotic lesion on the T1 weighted image is thought to be highly specific for AVN. MRI can also show the re-vascularization front and can give objective evidence of tissue changes in response to treatment allowing sequential evaluation of AVN lesions on follow-up. In comparison Computerized tomography (CT) scanning, is useful only in separating the late pre-collapse stages of AVN from the early collapse stage.⁽⁴⁾

While patients with advanced AVN usually end up with hip arthroplasty, some of those with early diagnosis of the lesion (at pre-collapse stage) have been managed with hip salvage surgery. Newer modalities including variety of drugs have also been used for non-operative management of AVN. It is thus considered worthwhile to have a review of therapeutic modalities of AVN femoral head before the lesion reaches the stage when arthroplasty becomes an inevitable option.⁽⁵⁾

The failure of nonoperative management and initial relatively poor long-term survival of prosthetic devices created the need for other interventions aimed at preserving the femoral head and at slowing or halting the progression of osteonecrosis.⁽⁶⁾

Core decompression was initially used as a diagnostic tool to measure bone marrow pressure and to obtain biopsy specimens. It became a mode of therapy when it was noted that patients had pain relief following the procedure⁽⁶⁾.

Numerous small case series and retrospective studies looking at core decompression have been reported; few randomized controlled trials have been performed. In one prospective randomized trial that compared core decompression with nonoperative treatment of 55 hips in 36 patients with osteonecrosis, success (as judged by the Harris Hip Score) was achieved in 7 of 10 surgically treated Ficat stage I hips compared with one of five nonoperatively treated hips at this stage⁽⁶⁾.

Success was also higher with surgery in stage II hips (five of seven versus zero of seven) and in stage III hips (8 of 11 versus 1 of 10). Stage 0 and IV groups were too small to analyze differences. Less successful results were seen if roentgenographic criteria of success were used⁽⁶⁾.

Vascularized fibular grafting was popularized in the 1990s as an approach that not only provided structural support to the subchondral bone but that also provided a source of mesenchymal stem cells and a vascular supply to the necrotic tissue⁽⁷⁾.