What non-arthroplasty options are viable for patients with early-stage femoral head osteonecrosis?

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Response/Recommendation: A multifaceted non-arthroplasty approach is available for patients with patients with early-stage osteonecrosis of femoral head (ONFH) that includes physical therapy, lifestyle modifications, pharmacological agents, core decompression with or without bone marrow aspirate, and osteotomy.

Rationale:

To address this topic a systematic review of the literature was conducted to identify all publications related to non-arthroplasty treatment of patients with osteonecrosis of femoral head (ONFH). We identified various treatment modalities that have been discussed in the literature.

Physical Therapy

Physical therapy is essential for managing early-stage ONFH. Structured programs aim to maintain joint function, reduce pain, and delay disease progression through strengthening exercises, range-of-motion exercises, and weight-bearing restrictions. Lifestyle modifications such as weight management, smoking cessation, and reduction of alcohol intake are critical in mitigating risk factors and improving overall outcomes[1–5].

Pharmacological Treatments

Patients treated with bisphosphonates had a slower progression of disease compared to untreated controls[6–10]. Teriparatide promotes bone formation and has demonstrated efficacy in reducing the rate of femoral head collapse compared to alendronate (33.3% vs. 59.1%, with a mean follow-up time of 18.7 months)[11]. Traditional Chinese Medicine (TCM) has been shown to significantly reduce pain and slow disease progression in ONFH patients. When combined with personalized weight-bearing restrictions, TCM significantly reduced the incidence of pain (38.3%) and the progression rate of collapse (32.1%) in asymptomatic ONFH patients[12]. A meta-analysis including 11 studies suggested that TCM as an adjunctive therapy to conservative hip-preservation surgery significantly alleviated pain and improved joint function[13]..

Core Decompression (CD)

Core decompression has shown superiority over conservative treatment for stage I lesions. A meta-analysis of 22 CD studies compared to eight conservative treatment studies indicated its effectiveness [14]. The combined use of autologous bone or bone marrow can significantly enhance success rates. A systematic review of 32 studies involving 2441 hips demonstrated success rates of 57% for isolated CD, 74% for CD combined with autologous bone, and 81% for CD combined with bone marrow[15]. A retrospective review highlighted an overall CD success rate of 58%, with Ficat I lesions showing a success rate of 93% and Ficat II lesions 46%. Imaging evaluation and

classifications based on imaging were identified as crucial predictors of success, with factors like alcohol consumption and specific classifications correlating with higher failure rates[16]. The success rates over 2-10 years varied widely: 78-93% for Ficat I and 46-77% for Ficat II lesions, across multiple studies[16–20].

Biological Therapies

Studies highlight the potential of Bone Marrow Aspirate Concentrate (BMAC) and Platelet-Rich Plasma (PRP) in enhancing traditional treatments like core decompression, showing significant improvements in hip survival rates and clinical outcomes for patients with early-stage ONFH. Comparative analyses reveal that BMAC therapy enhances patient outcomes more effectively than core decompression alone, demonstrating significant improvements in hip survivorship (34.8%-100%)[21–23]. BMAC therapy also shows a notable reduction in THA conversion rates, ranging from 16% to 49%[24]. Moreover, combining BMAC with PRP further improves clinical outcomes, with hip survival rates reported between 67%-100% over mid to long-term follow-ups. Clinical studies have shown PRP can improve Harris Hip Scores from 64 preoperatively to 84 at two years post-surgery, though 53% of treated hips required conversion to THA during follow-up[25]. Significant risk factors affecting THA conversion include higher preoperative Kerboul angles and ongoing corticosteroid use, with hazard ratios ranging from 3.96 to 4.15[22].

Osteotomy

Various types of osteotomies, such as curved varus osteotomy (CVO) and trans trochanteric rotational osteotomy (TRO), are commonly used to manage avascular necrosis of the femoral head. These procedures aim to redistribute weight-bearing forces away from the necrotic segment and preserve the blood supply to healthy bone. The follow-up duration for CVO is up to 10 years, with success rates up to 93% [26,27]. For TRO, the follow-up duration extends up to 15 years, with success rates ranging from 30% to 92.6%, with lower success rates associated with more extensive necrosis[28–30]. The ideal patient should be younger than 40 years and should have a body mass index of less than 24 kg/m^2, potential at risk co-morbidities should be sought[31].

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