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Original article

Comparative Study Between Core Decompression in Low Grade AVN Of Femoral Head and Core Decompression with Intraosseous Ibandronate at a Teaching Hospital

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Abstract

Background: Many options for treatment of avascular necrosis have been described, including core decompression, vascularised and non-vascularised bone grafting, muscle pedicle bone grafting, bisphosphonates and various osteotomies. In present study we compared core decompression alone with core decompression & intraosseous ibandronate in low grade AVN of femoral head at a teaching hospital. ***Material and Methods:*** Present study was a prospective, interventional study conducted in patients with low grade AVN of Femoral head, Ficat Stage I or II, fit for surgery, willing to participate. Preoperatively patients were randomly divided into two groups as core decompression alone & core decompression with intraosseous ibandronate. ***Results:*** During study period total 30 patients underwent surgery; patients were randomly divided into two groups as core decompression (n=15) & core decompression with intraosseous ibandronate (n=15). General characteristics such as age, gender, side, co-morbidities, Ficat Staging & Pre-Operative Harris Hip Score were comparable in both groups & difference was not significant statistically. Post-Operative Harris Hip Score was more than 60 in 9 (60%) patients from core decompression with intraosseous ibandronate group as compared to 6 (40%) patients from core decompression group & difference was significant statistically. Minor complications were observed in both groups, managed conservatively. None of study patients required THA during study period. ***Conclusion:*** Better results were noted in core decompression with intraosseous ibandronate group as compared to core decompression group.

Keywords: ***core decompression, intraosseous ibandronate, avascular necrosis, Harris hip score***

Introduction

Osteonecrosis, also known as avascular necrosis or aseptic necrosis, is a disease of impaired osseous blood flow, the bone structures then collapse, resulting in bone destruction, pain, and loss of joint function. The non-prosthetic treatment of avascular necrosis have many options including core decompression, vascularised and non-vascularised bone grafting, muscle pedicle bone grafting, bisphosphonates and various osteotomies.

A high index of suspicion and improved radiographic evaluation allow identification of femoral head osteonecrosis at its early stages. An optimal management modality would foster healing without sacrificing the structural integrity of the bone or the health of the overlying articular cartilage, thus managing symptoms while preserving femoral head anatomy and maximizing posttreatment function [1].

In the treatment of osteonecrosis of the femoral head (ONFH), core decompression is used in the earliest precollapse stages of disease in an attempt to delay and/or prevent the need for total hip arthroplasty (THA) [2]. Core decompression (CD) reduces the pressure in the bone, opens up the hardening zone that hinders the repair of osteonecrosis, stimulates the formation of blood vessels around the decompression tunnel, enhances the replacement of the new bone, and delays the progression of osteonecrosis [3,4].

On a cellular level, bisphosphonates retard the osteoclastic resorption of necrotic bone during repair, thereby helping in maintaining femoral head sphericity and allowing for the revascularization and prevention of the collapse of the femoral head. In adults with femoral head osteonecrosis, intermediate term studies suggest bisphosphonates may have a role in reducing pain, increasing hip function, preventing further femoral head collapse, and delaying the need for joint arthroplasty [5]. In present study we compared core decompression alone with core decompression & intraosseous ibandronate in low grade AVN of femoral head at a teaching hospital.

Material and Methods

Present study was a prospective, interventional study conducted in department of orthopedic surgery, at a tertiary hospital attached to a medical college. Study period was of 1 year, during April 2018 to March 2019. Study was approved by institutional ethical committee.

Patients with low grade AVN of Femoral head, Ficat Stage I or II, fit for surgery, willing to participate in study were considered

for present study. Study was explained to patients & relatives & a written informed consent was taken for participation & follow up.

Patients surgically unfit, Ficat stage more than 2, contraindications for bisphosphates, not willing to participate, follow up & lost to follow up were excluded.

Demographic & clinical details were noted. Detailed general examination was done & Modified Harris hip score was calculated. Surgical fitness was taken. Preoperatively patients were randomly divided into two groups.

1. Core decompression
2. Core decompression with intraosseous ibandronate

All the patients underwent standard surgical procedure for above surgeries. Intraoperative notes, postoperative course, any complications were noted. A complete follow up was taken for 24 months.

Data was entered in Microsoft excel sheet. The statistical analysis was done by un-paired t-test calculated by SPSS 21 version software. p value less than 0.05 was considered as statistically significant.

Results

During study period total 30 patients underwent surgery; patients were randomly divided into two groups as core decompression (n=15) & core decompression with intraosseous ibandronate (n=15). General characteristics such as age, gender, side, co-morbidities, Ficat Staging & Pre-Operative Harris Hip Score were comparable in both groups & difference was not significant statistically.

Table 1. General characteristics of patients before operative procedure.

General characteristics	No. of Patients (%) / Mean ± SD		p value
	Core decompression (n=15)	Core decompression with intraosseous ibandronate (n=15)	
Age (in years)	43.6 ± 5.1	45.1 ± 4.9	0.65
Gender			0.71
Male	13 (87%)	12 (80%)	
Female	2 (13%)	3 (20%)	
Side			0.81
Right	10 (67%)	8 (53%)	
Left	5 (33%)	7 (47%)	
Co-morbidity			0.35
Hypertension	4 (27%)	5 (33%)	
Diabetes Mellitus	3 (20%)	2 (13%)	
Chronic Obstructive Pulmonary Disease	2 (13%)	1 (7%)	
BMI > 30 kg/m^2	1 (7%)	2 (13%)	
Ficat Staging of AVN			0.53
I	14 (93%)	13 (87%)	
II	1 (7%)	2 (13%)	
Pre-Operative Harris Hip Score			0.16
<40	2 (13%)	3 (20%)	
40-50	4 (27%)	5 (33%)	
50-60	7 (47%)	6 (40%)	
>60	2 (13%)	1 (7%)	

Post-Operative Harris Hip Score was more than 60 in 9 (60%) patients from core decompression with intraosseous ibandronate group as compared to 6 (40%) patients from core decompression group & difference was significant statistically. Minor complications were observed in both groups, managed conservatively. None of study patients required THA during study period.

Table 2: Post-Operative Harris Hip Score

Post-Operative Harris Hip Score after 24 months	No. of Patients (%) / Mean ± SD	
	Core decompression (n=15)	Core decompression with intraosseous ibandronate (n=15)
<40	2 (13%)	1 (7%)
40-50	1 (7%)	1 (7%)
50-60	6 (40%)	4 (27%)
>60	6 (40%)	9 (60%)

(p value 0.045 - significant)

Discussion

The clinical presentation of AVN depends on the age of the patient. In the elderly who have sustained a subcapital fracture, AVN is often heralded by increasing pain and a radiograph that shows fixation failure, collapse of the femoral head, or both. In younger patients, AVN usually arises without any fracture and pain is the most common presenting feature [6].

The aetiology and pathogenesis are still unclear, but a lot of risk factors have been identified through the years. Trauma, embolisation, smoking, corticosteroids, alcohol abuse, haemoglobinopathy, hyperbaric exposure, auto-immune disease, anti-tumour chemotherapy, Gaucher's disease and Caisson disease are some of the risk factors that could act individually or synergistically to produce death of bone cells [7].

Core decompression is the mainstay surgical technique for the management of stage 1 or stage 2 AVN of femoral head. It

reduces the intraosseous pressure in the femoral head and elevates the blood flow to the necrotic site, thus aiding the neobone formation [8].

Core decompression (CD) had promising results in very early stages of AVN, wherein cores of subchondral dead bone are removed by drilling, facilitating blood vessel ingrowth and restoration of vascularity. CD alone in FICAT Stage 1 has shown promising results with reversal rates of up to 97% to the normal anatomy of the hip, but as the volume of affected femoral head increases, the success of the same procedure in subsequent stages decreases; in FICAT Stage 2 it goes down to 77% [9,10].

Pharmacological management of AVN includes the use of bisphosphonates for the prevention of early collapse in AVN of hip joint and in advances stages to extend the requirement of total hip replacement surgery [11]. Ibandronate (IB) belongs to the third-generation nitrogen-containing BPs and is generated from the second generation by replacing hydrogen in the amino group with saturated hydrocarbon or the imidazole ring [11].

In study with 36 patients who were diagnosed with for grade I and II AVN of hip joint, patients were divided into three groups (n=12) & treated with core decompression alone, core decompression with bisphosphonates and core decompression with bisphosphonates, prolotherapy. The outcome of the study noted that the combined treatment of core decompression with bisphosphonates, prolotherapy showed fair outcome at the end of 2 year follow up with effective pain reduction during walking, squatting and cross leg. Meanwhile, core decompression alone and core decompression with bisphosphonates showed poor and good outcome. Thus, in patients with grade I and II AVN of hip joint combination of core decompression with bisphosphonates, prolotherapy would be effective in prevention of collapse and pain reduction [12].

Further study by Kang et al.[13] showed an 83.6% overall success rate after treatment with core decompression and bisphosphonate and reported a mean onset of progression of collapse at 23 months post-operatively.

A meta-analysis conducted by Li et al.[14] the authors found the mean epiphyseal quotient that stands for the height at the centre of the femoral head over the width, was improved in the bisphosphonate group. One of their conclusions was that the use of bisphosphonates exerts effects on protecting the femoral head morphology. Aya-ay et al.[15] evaluated the retention, distribution and effects of intraosseously administered Ibandronate (560 lg) in piglets and observed that only 5% of the total cumulative systemic dose (approx. 12000 lg) was sufficient for effective delivery.

Total hip arthroplasty (THA) is commonly utilized as a definitive treatment for high-grade osteonecrosis with articular collapse. However, as this disorder is commonly seen in young adults, joint-sparing therapeutic techniques have been studied extensively in the past decade and will be a major focus of orthopaedic research in the coming years.

Bisphosphonates are much cheaper than other described adjuvants and therefore, this affordable option if proven effective along with CD can lead to betterment for a large population of patients.

Present study sample was small & predominant younger age so results cannot be generalized to general population. A large scale multicentric study will probably give a larger picture and guide us for better service planning and delivery.

Conclusion

Better results were noted in core decompression with intraosseous ibandronate group as compared to core decompression group. There is a likelihood that along with core decompression which will stimulate new bone formation, intraosseous bisphosphonate like Ibandronate will stop the bone resorption, thereby enhancing the overall effect on bone formation.

Conflict of Interest

None to declare

Source of funding

Nil

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