

# Use of ESWT in avascular necrosis of bilateral femoral heads: case report

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## ABSTRACT

A 57-year-old female patient was admitted to the department of physical medicine and rehabilitation with lumbar and left hip pain lasting for 1.5 months. Physical examination and magnetic resonance imaging revealed stage 1 avascular necrosis of bilateral femoral heads. Extracorporeal Shock Wave Therapy (ESWT) was utilized for early stage disease and a significant reduction in pain and functional recovery was noted.

*Key words: Avascular necrosis; conservative; extracorporeal shockwave; femoral head.*

Avascular necrosis (AVN) of the femoral head is a progressive disease with sequelae which can cause complete destruction of the femoral head, and requires surgery a few years after its onset [1]. The etiopathogenesis of the avascular necrosis of the femoral head involves histological death of the osteocytes because of insufficient supply of blood flow [2]. Based on our current information about AVN of the femoral head, increased intraosseous pressure developed following an ischemic attack in addition to enhanced edema in functionally constrained region of the bone marrow compartment creates a vicious cycle just like a compartment syndrome which compresses venules, and arterioles [3]. Essentially, diagnosis of AVN of the femoral head is made based on radiograms obtained at antero-

posterior, lateral, and frog leg positions. However, in the early stage AVN of the femoral head these radiograms have lower diagnostic sensitivity. Magnetic resonance imaging (MRI) has a 99% diagnostic sensitivity, and 98% specificity even in the early stage of AVN of the femoral head [4]. International classification system proposed by Association Research Circulation Osseous (ARCO) in 1993 also includes previous classifications [5, 6].

Though current treatments in the management of AVN of the femoral head are still debatable, in cases of failed conservative treatment, as surgical methods, osteotomy, vascularized or non-vascularized bone grafting, and femoral head preservation surgery as core decompression are used, while in advanced stages (especially ARCO III, and IV) total

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**TABLE 1.** Indications, and Containdications according to the Guidelines of International Society of Musculoskeletal Shock Wave Treatment (ISMST)

Indications	Contraindications
Pseudoarthrosis/nonunion	Soft tissue / acute infections of the bone
Tendinosis of the shoulder joint	Malignancy
Chronic radial epicondylitis	Coagulopathies
Plantar fasciitis (± heel spur)	Pregnancy
	Previously implanted pacemaker
	Epiphysiolysis at the site of application
	Lung tissue at the site of application
	Presence of cerebral, spinal cord tissue or major vessels at the site of application

hip prosthesis is preferred [7]. Conservative treatments include prostacycline analogues, enoxaparine, and alendronate therapies. The most frequently used treatment agents include pulsed electromagnetic field (PEMF), and extracorporeal shock wave therapies (ESWT) Essentially ESWT is thought to activate cellular processes critical for neurovascularization, and tissue regeneration [7-10]. Ma et al. concluded that therapeutic effects of ESWT might be associated with vascular endothelial growth factor (VEGF). VEGF has a mitogenic effect on vascular endothelial cells, and stimulates neovascularization. Still another study performed by Ma et al. in the year 2008, detected that expression of BMP-2 (bone morphogenic protein) increased on femoral heads of the patients treated with ESWT. BMP-2 mobilizes osteoprogenitor (precursor) cells inducing osteoblastic differentiation process leading to stimulation of new bone formation [9]. Other current studies have also emphasized favourable effects of ESWT in the management of AVN of the femoral head [10, 11, 12]. In summary, ESWT exerts its effectiveness in the management of avascular necrosis of femoral head through neovascularization, and regeneration of the bone.

## CASE REPORT

A 57-year-old female patient was admitted to the department of physical medicine and rehabilitation with lumbar and left hip pain present for 1.5

months. Patient indicated that she hadn't any pain at night, and her pains aggravated with movement. Physical examination revealed restricted internal rotation, tense left tensor fascia lata band (+) Fabre Fader, and Laseque test negativity. Magnetic resonance imaging demonstrated subchondral edematous ring on both femoral heads, and interpreted as stage I AVN of the femoral head. For preprocedural indication, containdications, and application methods, ESWT protocol published by International Society for Musculoskeletal Shock Wave Therapy was taken into consideration (Table 1). Under regional anesthesia, the patient was transferred on operation table in supine position. For maximum visualization of the femoral head the affected hip was brought into "frog leg" position. Priorly the place of the femoral artery was determined by ultrasonography, and marked with a pencil. Then k-wire was placed on the course of the femoral artery so as to facilitate its visualization under scopy. The site of the necrotic changes on the femoral head where therapy will be applied was determined with the aid of fluoroscopy, and marked on the headpiece with 4 dots. Then k-wire was removed, then using a Zimmer® brand ESWT device, from a site far away from the artery, 3 times 2000 impacts at 0.11 to 0,28 mJ/mm<sup>2</sup> were applied. Before, and after the procedure, hip muscles demonstrated full muscular strength. Before the procedure the patient complained of pain when she ascended two stairs, while after the procedure she climbed 4 stairs, and walked for 30

minutes without pain. Evaluation with Visual Analogue Scale (VAS) demonstrated marked alleviation in her hip pain, and 15 days after she didn't use her walking stick any more.

## DISCUSSION

The functional state of the hips affected by AVN of the femoral head tends to worsen because of progressive collapse of the femoral head. Most frequently AVN causes articular destruction which consequently leads to requirement for hip arthroplasty. In a study performed by Ohzono et al., the authors reported that the lesions were localized on the weight-bearing areas of the femoral head, and incidence of collapsed femoral head within 5 years ranged between 94, and 100 percent [13]. Even though AVN treatment was debatable, generally, surgery is used in cases with failed conservative treatment. Non-surgical treatment alternatives in the management of early stage AVN include controlled weight-loading, ESWT, and PEMF. Though complete mechanism of activity of the ESWT is not already known, in various studies performed, it has been associated with increases in the levels of BMP-2, and VEGF. Increases in both of these markers stimulate neovascularization together with new bone formation [9, 14]. In a recent study performed by Hausdorf et al., the authors reported that ESWT penetrates into targeted femoral head in proportion with the distance between the ESW device, and the femoral head. The authors also indicated that despite 10 mm safe bone margin, ESWT achieves a 50% decrease in the therapeutic effect, and they also asserted that adequate clinical evidence was available suggesting the presence of a biological response characterized by increased bone formation by means of neovascularization process [15]. Besides, ESWT plays an important role in the alleviation of hip pain, recovery of functions, and increase in the quality of life of the patient especially in the management of early stage femoral head AVN (ARCO stage I, and II) [7, 10, 11, 12]. In a study by Wang et al., the authors reported that ESWT was more effective than core-decompression, and non-vascularized fibula grafting [12]. In a study conducted in 2008 in the treatment of AVN of the femoral head synergistic therapeutic effects of ESWT, and alendronate were reported [10]. Finally, Wang et al. evaluated effec-

tiveness of ESWT in the management of AVN of the femoral head in a long-term (8-9 years) follow-up study, and reported that in the early stage AVN, ESWT was more significantly effective than surgical alternatives including core decompression, and non-vascularized fibula grafting [16].

In conclusion, substantial amount of information in the current medical literature advocates effectiveness of ESWT especially in the early stage of AVN of the femoral head. Also we have obtained improved treatment outcomes in the early stage (Stage 1) AVN of the femoral head, and pain, and functional restriction of the patient resolved markedly.

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