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Effect of Extracorporeal Shock Wave Therapy in Osteonecrosis of Femoral Head of Hip in Patients on Pain and Function: An Evidence Based Study

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ABSTRACT

OBJECTIVE: The aim of the study is to review the available literature on the use of Extracorporeal Shock Wave Therapy (ESWT) for the treatment of osteonecrosis of femoral hip (ONFH) to understand its therapeutic potential.
MATERIALS AND METHODS: A systematic review was performed on the PubMed, Scopus, Science Direct, and Research Gate databases with the following inclusion criteria: Studies published in last 08 years. (2015 to 2022) Studies that includes subjects with AVN of HIP.
RESULTS: 15 studies were reviewed from which 9 studies concluded that ESWT is effective in ONFH patients.
CONCLUSIONS: Based on the analysis of these 9 articles, it can be concluded that ESWT is an effective treatment regimen in individual with ONFH patients.

KEY WORDS: Extracorporeal Shock Wave Therapy (ESWT), Osteonecrosis of Femoral Head (ONFH), Pain, Hip Harris Score (HHS)

INTRODUCTION

Osteonecrosis of the femoral head (ONFH) was originally described in 1925 as an ischemic necrosis of the hip area [1]. It is also known as avascular necrosis, aseptic necrosis, and ischemic bone necrosis[2]. Its pathology is poorly understood; however, it is known to decrease blood flow to the femoral head leading to cellular death, fractures, and collapse of the articular surface [3,4]. ONFH is characterized by a compromised subchondral microcirculation, especially in the small retinacular vessels, which ultimately leads to necrosis of bone. An accumulation of microfractures is seen and, as there is no bone remodelling, a collapse of the subchondral bone occurs[5]. 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[6,7].

ONFH is a multifactorial disease with different etiologies ranging from genetic to idiopathic to certain risk factors such as trauma, hematological disorders, and steroid intake [8].

The clinical presentation is quite a specific and mainly concerns groin pain irradiating to the knee. There is some limited hip range of motion seen, especially in internal forced rotation. The alternative treatment are

Pharmacological agents, Surgical procedures, core decompression, femoral and tibial grafting, Vascularized fibular graft, proximal femoral osteotomies, necdotal surgical options and novel stretergies.[5]

In recent years, more and more clinical evidence and experimental studies have highlighted the interesting role of ESWT as a conservative approach for the treatment of local tissue degeneration in AVN. ESWT is thought to activate cellular processes critical for neurovascularization, and tissue regeneration. 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. [6,7]

The purpose of this study the scientific evidence regarding the effect of the ESWT in ONFH patients

METHODOLOGY

CRITERIA FOR CONSIDERING STUDIES

- **Inclusion criteria for this study were:**
  - Studies published in last 08 years. (2015 to 2022)
  - Studies that include subjects with AVN of HIP.
  - Studies that include physiotherapy interventions for same outcome measures.
- **Exclusion criteria for this study were:**
  - Studies based on animal data.
  - Studies published in languages other than English on AVN of hip.
  - Studies with Pain (VAS) and HHS as one of the primary
  - Used the other treatment for AVN of hip

Outcome measures: Any outcome such as Pain level measurement (VAS), HHS was present in the literature, was consider eligible for study.

- A total of 40 articles were found in the database search. After full article review, eight studies that met the inclusion criteria were considered for inclusion.
- Several studies were rejected after applying the inclusion and exclusion criteria. The primary reasons for the exclusion from the study were: (1) studies not published in the English language, (3) the absence of pain and HHS as outcome, (4) use the other treatment than ESWT, (5) use of animal data, (6) unavailability of the full text of the article.
- A summary of the sample and design characteristics, intervention, outcome measures and results from each study were presented on table.

Author	Sample design/ no of article & subject	Intervention	Outcome Measure	RESULT	LEVEL OF EVIDENCE
SCONZA et al 2022 [3]	Extracorporeal shock wave therapy for the treatment of osteonecrosis and bone vascular diseases: a systematic review of randomized controlled trials in 199 patients in total (68 female and 131 male)	1,500 pulses at 28 kV, equivalent to an EFD of 0.62 mJ/mm2 , in 4 different areas of the femoral head, for a total of 6,000 pulses, in a single session.	VAS, HHS	ESWT Has the Potential to Be A Useful Conservative Treatment In Bone Osteonecrosis	1A
Abdulrahman D. Algarni et al 2018 [1]	Clinical and Radiological Outcomes of Extracorporeal Shock Wave Therapy in Early-Stage Femoral Head Osteonecrosis. Case control study, Total no. of subject = 21 pts	3000–4500 pulses in a single session FOR 8 months	VAS, HHS	ESWT showed significance effect in reducing pain and HHS In patient with Early Stage of AVN of hip joint	1b
Gao et al 2015 [9]	High-Energy Extracorporeal Shock Wave for Early-Stage Osteonecrosis of the Femoral Head: A Single-	Electromagnetic Dornier Compact DELTA II Rx guided N°: 3000-4000 Fq: 2-3 Hz Pw 0.44 mJ/mm²	VAS, WOMAC, SF-36 score	ESWT superior in VAS, WOMAC and SF-36 in every times of follow-up. ESWT produces rapid pain relief and functional	

	Center Case Series. 335 patients (528 hips), RCT			improvement.	4
Yangquan Haoet al 2018 [4]	Meta-analysis of the potential role of extracorporeal shockwave therapy in osteonecrosis of the femoral head in 230 patients of AVN	Not mension	VAS, HHD	ESWT may be safe and effective for relief of pain and improvement of motor function	1b
Qingyu Zhang,et al 2016 [8]	Extracorporeal shockwave therapy in osteonecrosis of femoral head A systematic review of now available clinical evidences, total 19 article were considered.	0.18mj/mm^2 - 0.62mj/mm2	VAS, HHD	ESWT Provides a conservative modality to improve the motor function and relieve the pain of patients with osteonecrosis of femoral head.	1A
Ching-Jen Wang et al 2015 [10]	Extracorporeal shockwave therapy for avascular necrosis of femoral head.	1500 impulses at an energy flux density of 0.4 mJ/mm2 and each patient undergoes 5 therapy sessions.	VAS, HHD	ESWT has shownbeneficial effects in ONFH. ESWT improves pain and function of the hip and regression of the ONFH lesion. ESWT is more effective than core decompression	1b
Yong Han, et al.2016 [13]	Effectiveness of Lower Energy Density Extracorporeal Shock Wave Therapy in the Early Stage of Avascular Necrosis of the Femoral Head.	Group A (n=15; 1,000 shocks/session, EFD per shock 0.12 mJ/ mm2 , the middle output) or group B (n=15; 1,000 shocks/ session, EFD per shock 0.32 mJ/mm2 , the maximum out)	VAS, HHS, HOOS, and WOMAC	ESWT may be an effective method to improve the function and to relieve pain in the early stage of AVN.	1b
Jin-Young Lee et al 2015 [11]	Osteonecrosis of Femoral Head Treated with Extracorporeal Shock Wave Therapy: Analysis of Short-term Clinical Outcomes of Treatment with Radiologic Staging.	each patient received 6,000 shocks of extracorporeal shock (27 kV strength) per session	VAS, HHD	ESWT can be considered as an interventional option before surgical treatment in patients with not only early stage AVNFH but also with mid stage.	3
Ching-Jen Wanget al 2016 [12]	Dosage effects of extracorporeal shockwave therapy in early hip necrosis, A Comparative study- RCT Thirty-three patients (42 hips)	Group A received 2000 impulses of ESWT at 24 Kv to the affected hip. Group B received 4000 and Group C received 6000 impulses	VAS, HHS	High dosage ESWT is more effective in early stage ONFH.	1b

CONCLUSION

There is different level of evidence found of ESWT in patients with Avascular necrosis of hip. It can be concluded that there is strong evidence supporting the improving functional capacity, decrease pain and improve ADL Activity.

Declaration by Authors

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