



Comparison of the Effectiveness of Local Corticosteroid Injection and Extracorporeal Shockwave Therapy in Patients With Pes Anserine Bursitis: An Open-Label Randomized Clinical Trial

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Received: 24 Jun 2022

Published: 21 Feb 2023

Abstract

Background: The success rate of extracorporeal shock wave therapy (ESWT) in treating epicondylitis, plantar fasciitis, rotator cuff tendonitis, Achilles tendonitis, and Jumper knee has been reported to be 60% to 80%. Most published studies have compared focused ESWT at different intensities with local corticosteroid injection (LCI). We only identified a few studies that specifically compared ESWT with LCI in patients with pes anserine bursitis (PAB). This study aimed to compare the effectiveness of ESWT and LCI in patients with PAB.

Methods: The present study was a randomized clinical trial. Patients diagnosed with PAB who were referred to the physical medicine and rehabilitation clinic underwent a complete physical examination. They (n = 60 patients) were randomly assigned to the ESWT and LCI groups if they met the study criteria. In the ESWT group, 1 ESWT session was performed weekly for 3 consecutive weeks. In the LCI group, 1 injection was performed under an ultrasonography guide. Pes anserine thickness, pain intensity, and treatment satisfaction were measured with visual analog scale (VAS) and quality of life (Short Form-12). A paired-samples t test was used to compare the results obtained in the pre-and posttests. Analysis of variance for repeated measures was used to detect differences over time. The null hypothesis would not be confirmed if the P value was less than the 0.05 level of significance.

Results: Pes anserine thickness and pain intensity decreased significantly during the study in both groups ($P < 0.001$). However, the mean difference of pes anserine thickness was more in the LCI group the ESWT group [(-0.6; 95% CI, -1.0 to -0.3) than (-0.1; 95% CI, -0.5, -0.2); $P = 0.008$]. Also, the mean difference of pain intensity was lower in the ESWT group than the LCI group [(-2.9; 95% CI, -3.7 to -2.1) (1.0; 95% CI, 0.1 to 1.8); $P < 0.001$]. Patients' quality of life in both groups increased significantly during the study period ($P < 0.001$), but the increase in quality of life in patients in the ESWT group (mean difference, 15.3 [95% CI, 10.6-19.9]) was considerably more than in the LCI group (mean difference, -5.3 (95% CI, -10.0 to -0.6).

Conclusion: Overall, the results of this study showed that both local corticosteroid injections and extracorporeal shock wave therapy are safe and effective in PAB patients.

Keywords: Corticosteroid, Extracorporeal Shockwave, Pes Anserine Bursitis

Conflicts of Interest: None declared

Funding: None

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Cite this article as: Majidi L, Saeb F, Alaei B, Khateri S, Ezzati Amini E, Nikoo MR. Comparison of the Effectiveness of Local Corticosteroid Injection and Extracorporeal Shockwave Therapy in Patients With Pes Anserine Bursitis: An Open-Label Randomized Clinical Trial. *Med J Islam Repub Iran.* 2023 (21 Feb);37:10. <https://doi.org/10.47176/mjiri.37.10>

Introduction

Pes anserine bursitis (PAB) is one of the knee's most common soft tissue disorders, which is clinically characterized by pain around the inside of the knee and tenderness

of the upper and medial tibia. Based on previous studies, the prevalence of PAB in the magnetic resonance imaging (MRI) of patients with knee pain complaints was reported

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↑What is "already known" in this topic:

Most published studies have compared focused ESWT at different intensities with LCI. We only identified a few studies that specifically compared ESWT with LCI in patients with PAB. This study aimed to compare the effectiveness of ESWT and LCI in improving the condition in patients with PAB. It is hoped that the results of this study will lead to better treatment and increased quality of life for patients with PAB.

→What this article adds:

This study showed that both local corticosteroid injections and ESWT are safe and effective in PAB patients.

at 2.5% (1-3). Several risk factors are influential in the prevalence of PAB around the world. Results of related published studies show that the prevalence of PAB is higher in women, people with obesity, and patients with anatomical abnormalities of the knee (4-6).

The PAB is about 5 cm below the medial line of the knee joint between the tibia and the junction of the tendon of 3 muscles—sartorius, gracilis, and semitendinosus—to the anterior-medial proximal tibia. The early manifestation is usually a relatively sudden onset of pain inside the knee, especially at night, in a person with an underlying disease (usually osteoarthritis) (7). Patients' pain is aggravated by climbing stairs or getting up. Local inflammation is rare, and the diagnosis of this common disease is based on local history and tenderness (8). Ultrasonography can facilitate diagnosis but, in many cases, is without specific findings (9-11). On an MRI, PAB is seen as a small collection of multilocular fluid in the direction of the PA tendon. In most cases, the diagnosis of PAB cannot be proven (11).

Rest, weight loss, nonsteroidal anti-inflammatory drugs, and physiotherapy are the first line of treatment (12). If the patients do not respond to the above treatment methods, other more invasive options are used. Local corticosteroid injection (LCI) is these patients' most common invasive treatment option, leading to improved function and pain relief (5, 13). A recent systematic review and meta-analysis revealed that beyond 8 weeks, the glucocorticoid injection was no more effective than a placebo (14). Therefore, more effective with low complication treatment options are still needed.

In recent years, extracorporeal shock wave therapy (ESWT) has been proposed as one of the effective treatment options in patients with tendinopathy. This method may effectively increase the blood flow to the treated area through electromagnetic stimulation and low-energy waves. Experimental studies show that ESWT increases neovascularization and angiogenesis growth index in the tendon, bone, and tendon junction with bone (15, 16). Neovascularization may improve blood circulation and tendon repair (16). The success rate of ESWT in treating epicondylitis, plantar fasciitis, rotator cuff tendonitis, Achilles tendonitis, and Jumper knee has been reported to be 60% to 80% (17). Most published studies have compared focused ESWT at different intensities with LCI. We only identified a few studies that specifically compared ESWT with LCI in patients with PAB. This study aimed to compare the effectiveness of ESWT and LCI in improving the condition in patients with PAB. It is hoped that the results of this study will lead to better treatment and increased quality of life for patients with PAB.

Methods

The present study was performed by an open-label randomized clinical trial (open-label RCT). This study was conducted between 2020 and 2021 in the physical medicine clinic of Besat hospital affiliated to Hamadan University of Medical Sciences. The local ethics committee of Hamedan University of Medical Sciences, Hamedan, Iran, approved the study (IR.UMSHA.REC.1400.069) and the study was registered in the Iranian Registry of Clinical Trials

(IRCT.ir); ID number: IRCT20151123025202N16. In this study, informed consent was received from all participants and their partners.

Population/Patients

All patients diagnosed with PAB were referred to the physical medicine clinic of Besat hospital from 2020 to 2021. The diagnosis was based on clinical presentation. Larson and Baum described some criteria for the diagnosis of PAB; feeling pain while climbing upstairs and downstairs, especially in the anteromedial part of the knee; morning stiffness of more than 1 hour; nocturnal pain; having difficulty while standing up; and sensitivity and edema over the anserine bursa (17, 18).

A total of 60 patients with PAB were referred to the physical medicine clinic of Besat hospital from 2020 to 2021. According to this study, the mean (SD) of postoperative pain was 2.1 (0.7) in the ESWT group and 2.9 (1.3) in the control group. Using the following formula (error rate, 0.05 and power rate, 0.8), the minimum required sample size was 27 people. Considering the 10% probable dropout rate, the sample size of 30 people in each group was obtained.

Demographic Information

First, 60 patients (30 patients in the LCI group and 30 patients in the ESWT group) were included in this study. Three patients in the ESWT group did not complete their treatment and were excluded from the study. Three patients in the LCI group did not come for local injection; the other did not come for follow-up visits and was therefore excluded from the study.

Randomization Process

Participants were randomly assigned into 2 groups using a computer-generated random number.

Inclusion and Exclusion Criteria

Patients had to be between the ages of 18 and 65, have PAB that has been present for at least 3 months, have been diagnosed with the condition using imaging and clinical standards, and experience pain that is at least >3 on the visual analog scale (VAS). The exclusion criteria were as follows: (1) concurrent infection with other knee diseases, such as advanced osteoarthritis or infection; (2) neurological and motor diseases (stroke, Parkinson, myopathies, neuropathies, etc); (3) other systemic diseases that could have an impact on the study's findings, such as rheumatoid arthritis; (4) history of surgery or recent knee trauma; (5) vascular diseases; and (6) current or recent corticosteroid therapy.

Interventions

Group A patients underwent ESWT. For patients in this group, one ESWT session per week was performed for 3 consecutive weeks. ESWT was performed while the patient was lying on a quiet bed, and the procedure was performed at the point where the most incredible intensity of tenderness was found. Device settings: frequency 4 Hz, pulse 1500, energy 0.15 MJ / mm².

Local corticosteroid injections were performed for patients in group B. First, a knee ultrasonography was completed, and the appropriate point for injection (the tenderest and the most sensitive point of the pes anserine region point determined with palpation) was marked. Then, 40 mg of methylprednisolone and 1 mL of 1% lidocaine were injected under the ultrasonography guide at the symptom site.

Data Collection Method

Written informed consent was obtained from all eligible patients before enrollment. All patients underwent a complete physical examination as soon as they entered the study, and a checklist of demographic (age, gender, ethnicity, occupation) and clinical information (signs and symptoms, duration of symptoms, etc) was completed.

Out-of-body shock wave therapy was done using ESWT device made by İNCELER MEDİKAL company, Modus model, produced in Turkey, 2018, with a frequency of 4 Hz, pulse 1500, energy 0.15 MJ / mm².

Additionally, each patient in the LCI group received 1 mL of 1% lidocaine and 40 mg of methylprednisolone for local injection under an ultrasonography guidance. To gather clinical and demographic data, a checklist was developed. The overall satisfaction of the physician and the patient with the treatment was measured using the Likert scale as follows: 0 = worsening of pain, 1 = similar condition before treatment, 2 = relative response, a slight reduction of pain, 3 = good response, significant reduction of pain, and 4 = excellent responses, complete elimination of pain.

A visual pain scale VAS was used to assess the severity of the knee pain in patients. On this scale, the patient uses a ruler to express the degree of pain with his tongue. The score on this scale varies between 0 (analgesia) to 10 (maximum pain intensity experienced).

The SF-12 standardized questionnaire was used to assess the quality of life. This questionnaire includes 12 questions related to 8 dimensions: physical performance, role limitation due to biological or physical problems, role limitation due to mental health problems, psychological and physical, energy/physical, psychological, and physical health. According to this questionnaire, the minimum and maximum possible scores for each dimension of quality of life and total quality of life are between 0 and 100. This means that 100 is the best and 0 is the worst quality of life score.

Examined Variables

Ultrasonography examination of the knee was performed for all patients in this study. The above information was recorded: pes anserine thickness, evidence of pes anserine tendonitis, and proof of PAB. The overall satisfaction of the physician and the patient with the treatment was measured using the Likert scale (0 and 4). Pain intensity was measured using the VAS scale (score 0-10). The standardized questionnaire SF-12 (score 0 to 100) was used to assess the quality of life.

The aforementioned parameters were measured at the start of the research as well as in weeks 4, 8, and 12. Also, patients were observed continuously for complications. The evaluator was blinded to the patients' group therapy.

Statistical Methods

After collecting research data, the relevant data were analyzed in SPSS software Version 25. Mean and standard deviation were used to describe quantitative variables, and frequency and percentage were used to describe qualitative variables. Parametric analyzes (t test, analysis of variance for repeated measures [ANOVA], etc) were used to analyze the variables with normal distribution, and nonparametric analyses (Mann-Whitney U, chi-square, etc) were used to analyze the variables with abnormally distributed. A paired t test was used to compare the results obtained in the pre- and posttest. ANOVA was used to detect differences over time. The null hypothesis is not confirmed if the p-test result is less than the test significance level of 0.05.

Results

Finally, 53 patients (34 women and 19 men), with a mean age of 54.1 ± 8.3 years were included in this study. A total of 27 patients entered the ESWT group, and 26 patients joined the LCI group (Figure 1 & Table 1).

Comparison of Pes Anserine Thickness Changes Between the 2 Groups

Then, using the ANOVA statistical test, we compared the trend of pes anserine thickness changes during the study. Due to the nonconfirmation of the sphericity of the Machuli test ($P < 0.001$), the Greenhouse-Geisser line statistics were considered.

According to the RM-ANOVA test results, the time effect was significant ($P < 0.001$). This finding means that pes anserine thickness was significantly reduced in patients during the study. Also, group-time interaction was significant ($P < 0.001$). This result indicates a significant difference between ESWT and LCI groups regarding pes anserine thickness changes during the study period. Then, using the Bonferroni post hoc test, we compared the changes in Pes anserine thickness during the study within and between groups (Table 2). The mean thickness of pes anserine in the first, second, and third months after the intervention in the LCI group was significantly lower than ESWT group ($P < 0.001$). In both ESWT and LCI groups, the mean thickness of pes anserine in the first, second, and third months after the intervention was significantly reduced compared to baseline ($P < 0.001$). In the ESWT group, the mean thickness of Anserine in the third month of the intervention was not significantly different from the second month of the intervention ($P = 1.000$) (Figure 2 and Table 2).

Table 1. Demographic Characteristics of the Participants According to Groups

Variable	ESWT group (n=27)	Injection group (n=26)
Age (means) (years)	52.50 ± 8.70	55.80 ± 7.60
Gender (%)		
Female	17(63 %)	17 (65.4 %)
Male	10 (37 %)	9 (34.6 %)
BMI	29.50 ± 2.00	28.80 ± 1.90

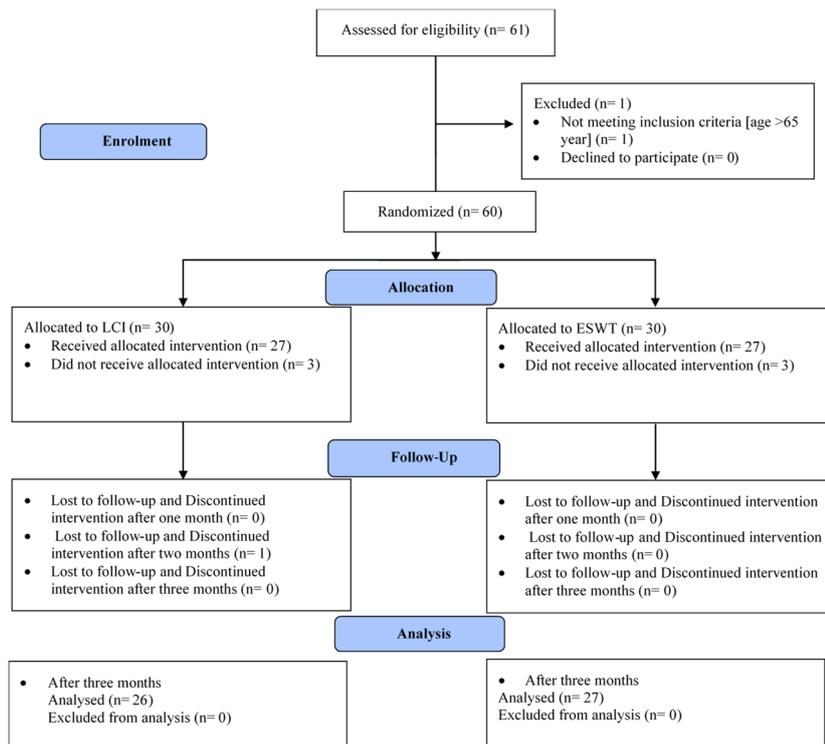


Figure 1. CONSORT flow diagram

Comparison of Changes in Pain Intensity Between the 2 Groups

Using the RM-ANOVA test, we compared the trend of pain intensity changes during the study. Due to the no confirmation of the spatial hypothesis of the Machuli test ($P = 0.001$), Greenhouse-Geisser line statistics were considered.

According to the RM-ANOVA test results, the time effect was significant ($P < 0.001$). This finding means that pain intensity in patients was significantly reduced during the study. Also, group-time interaction was significant ($P < 0.001$). This result indicates a significant difference between ESWT and LCI groups in pain intensity changes during the study period. Then, using the Bonferroni post hoc

test, we compared the changes in pain intensity during the study within each group and compared them between groups (Table 3). In both ESWT and LCI groups, the pain intensity in the first, second, and third months after the intervention was significantly reduced compared with the initial visit ($P < 0.001$). In the first month of the intervention, the pain intensity in the LCI group was significantly lower than in the ESWT group ($P < 0.001$), and the rate of pain intensity reduction was significantly higher than at the beginning ($P < 0.001$). In the ESWT group, the pain score was significantly lower than the LCI group in the third month after the intervention ($P < 0.001$). The trend of changes in pain intensity in the ESWT group was steadily decreasing.

Table 2. Comparison of pes anserine thickness changes in the 2 groups of extracorporeal shock wave therapy and local corticosteroid injection

Thickness of Pes Anserine	ESWT	LCI	P-value Intergroup comparison
First visit	4.2 ± 0.5	4.3 ± 0.4	0.403
One month after the intervention	3.7±0.3	2.5±0.8	<0.001
Changes since the first visit	-0.5 (-0.9, -0.2)	-1.8 (-2.2, -1.4)	<0.001
P value (intragroup comparison)	<0.001	<0.001	<0.001
Two months after the intervention	3.1 ± 0.6	1.9 ± 0.8	<0.001
Changes since the first visit	-1.1 (-1.6, -0.7)	-2.4 (-2.6, -1.9)	<0.001
P value (intragroup comparison)	<0.001	<0.001	<0.001
Changes compared to the first month	-0.6 (-0.8, -0.4)	-0.6 (-0.9, -0.3)	0.909
P value (intragroup comparison)	<0.001	<0.001	<0.001
Three months after the intervention	3.0 ± 0.6	1.3 ± 0.07	<0.001
Changes from the first visit	-1.2 (-1.7, -0.8)	-2.9 (-3.4, -2.6)	<0.001
P value (intragroup comparison)	<0.001	<0.001	<0.001
Changes compared to the first month	-0.7 (-1.2, -0.2)	-1.2 (-1.7, -0.7)	0.037
P value (intragroup comparison)	<0.001	<0.001	<0.001
Changes compared to the second month	-0.1 (-0.5, -0.2)	-0.6 (-1.0, -0.3)	0.008
P value (intragroup comparison)	<0.001	<0.001	<0.001
Adjusted final pes anserine thickness changes mean (SE) ^a	3.09 (0.7)	1.92 (0.8)	<0.0001

^a Adjusted for baseline pes anserine thickness using ANCOVA analysis.

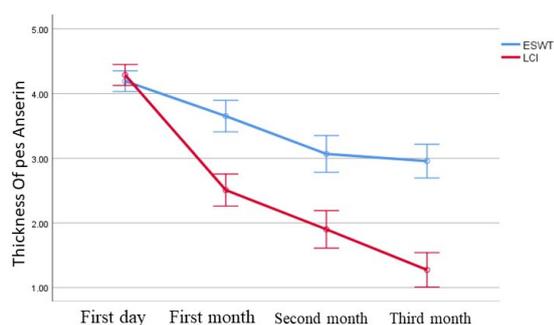


Figure 2. Pes anserine thickness changes during the study in ESWT and LCI groups

In the LCI group, pain intensity decreased significantly in the first month of the intervention. Still, the trend of pain intensity increased in the second and third months after the intervention (Figure 3, Table 3).

Comparison of Quality of Life Changes Between the 2 Groups

Changes in quality of life scores during the study period in ESWT and LCI groups are shown in Figure 4.

Using the RM-ANOVA test, we compared the trend of changes in quality of life scores during the study period. The result of the Machuli test showed that the sphericity hypothesis was confirmed ($P = 0.145$).

The results of the RM-ANOVA test showed a significant effect of time ($P < 0.001$) and also the interaction of group and time ($P < 0.001$). Then, using the Bonferroni post hoc test, we compared the changes in quality of life scores during the study within each group and compared them between groups (Table 4). As can be seen, in both ESWT and LCI groups, quality of life scores increased significantly in the first, second, and third months after the intervention compared with the initial visit ($P < 0.001$). In the first month of the intervention, the quality of life score in the LCI group was significantly higher than the ESWT group ($P = 0.003$); but in the second ($P = 0.001$) and third ($P <$

0.001) months after the intervention, the quality of life score in the ESWT group was significantly improved compared with the LCI group. The trend of changes in quality of life scores in the ESWT group was steadily increasing. In the LCI group, quality of life improved in the first month of the intervention, but a decrease in quality of life was observed in the second and third months after the intervention (Table 4).

Comparison of Treatment Satisfaction Between the 2 Groups

Satisfaction scores of the patient and physician treatment in ESWT and LCI groups during the study period are shown in Table 5. In the first month after the intervention, the level of patient and physician satisfaction with LCI treatment was significantly higher than in the ESWT group ($P < 0.001$). Satisfaction of the patient and the physician in the second month after the intervention in 2 groups ($P = 0.984$) and the third month of the intervention in the ESWT group was significantly higher than the LCI group ($P < 0.001$) (Table 5).

Discussion

PAB is one of the most common causes of knee pain, leading to pain and tenderness in the front of the knee. Although there are several options for treating PAB, many are not satisfactorily effective, and some are associated with risks. One of the new ways to reduce tendon injuries is to use shock wave therapy. Most studies only examined the short-term effects of LCI (1 month) in patients with PAB. Several previous studies have reported the short-term and transient therapeutic results of LCI in patients with osteoarthritis and soft tissue diseases (19-22). Also, the possibility of complications, such as subcutaneous tissue atrophy, skin depigmentation, and tendon rupture, is among the disadvantages of this treatment (23).

In the ESWT group, a steady decrease in pain was observed, followed by an increasing trend in the quality of life scores and satisfaction with treatment, indicating longer and more stable effectiveness. These findings are in line

Table 3. Comparison of pain intensity changes in the 2 groups of extracorporeal shock wave therapy and local corticosteroid injection

The thickness of pes Anserine	ESWT	LCI	<i>p</i> Intergroup comparison
First visit	9.0 ± 0.9	9.6 ± 0.5	0.007
One month after the intervention	6.1 ± 1.7	3.8 ± 2.1	<0.001
Changes since the first visit	-2.9 (-1.9, -4.0)	-5.87 (-6.9, -4.7)	<0.001
P value (intragroup comparison)	0.001	<0.001	
Two months after the intervention	4.7 ± 1.6	5.2 ± 1.7	0.243
Changes since the first visit	-4.3 (-5.2, -3.4)	-4.3 (-5.3, -3.4)	0.978
P value (intragroup comparison)	<0.001	<0.001	
Changes compared to the first month	-1.4 (-2.4, -0.4)	-1.4 (-2.5, -0.5)	<0.001
P value (intragroup comparison)	0.002	0.001	
Three months after the intervention	1.8 ± 1.1	6.2 ± 1.0	<0.001
changes from the first visit	-7.3 (-7.9, -6.6)	-3.4 (-4.0, -2.7)	<0.001
P value (intragroup comparison)	<0.001	<0.001	
Changes compared to the first month	-4.3 (-5.5, -3.2)	2.4 (1.3, 3.6)	<0.001
P value (intragroup comparison)	<0.001	<0.001	
Changes compared to the second month	-2.9 (-3.7, -2.1)	1.0 (0.1, 1.8)	<0.001
P value (intragroup comparison)	1.00	0.017	-
Adjusted final pain intensity changes mean (SE) ^a	1.72 (0.9)	5.99 (0.9)	<0.0001

^a Adjusted for baseline pain intensity changes using ANCOVA analysis.

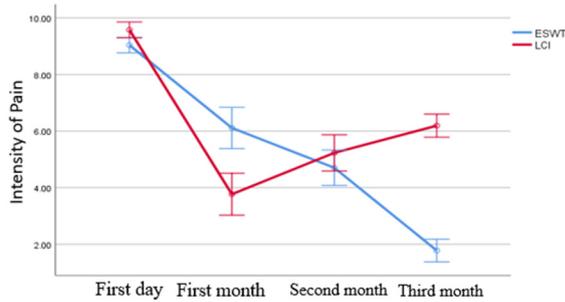


Figure 3. Changes in pain intensity during the study in the two groups

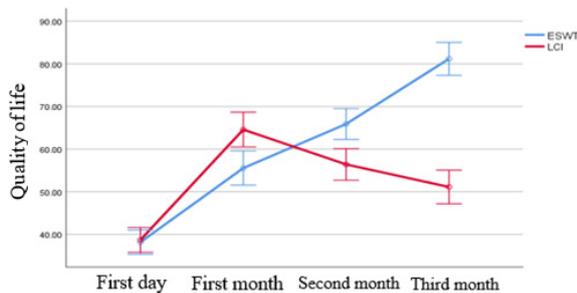


Figure 4. Changes in the average quality of life score during the study period

with the results of the study of Khosravi et al who examined and compared the trend of pain intensity in patients with PAB in ESWT and sham ESWT groups (1, 12, 24, 25). The authors of this study reported a significant and sustained

reduction in pain intensity (measured by the VAS and McGill questionnaires) immediately after treatment (the third week after intervention) and the second month after ESWT (1, 5, 23). The result of our study and that of Khosravi et al confirm previous studies that have pointed to the effectiveness of ESWT in joint and pericardial disorders (19, 25, 26). In a 12-week clinical trial of patients with osteoarthritis of the knee, Zhao et al showed that during the study, compared with placebo, ESWT reduced pain significantly and improved knee function (27). A systematic review and meta-analysis of 19 randomized clinical trials showed that ESWT greatly affected treatment success, pain relief, and ROM recovery in knee soft tissue diseases (28). This study also showed that the effectiveness of concentrated ESWT with a low energy level is higher in the success rate of therapy than concentrated ESWT with a high energy level (28, 29).

Significant reduction in pain in the first month after local corticosteroid injection and increasing pain in the following months of this study in the LCI group indicate this intervention's relative and transient effects in patients with PAB. As in our study, several other studies on soft tissue disorders have reported short efficacy of LCI (12, 23, 30). The results of a retrospective study by Grice et al recurred after 3 months (1, 5). To date, no study has compared the effectiveness of LCI and ESWT in patients with PAB. In a clinical trial study, Xu et al compared the effectiveness of LCI and ESWT in patients with plantar fasciitis (31). As in our study, a significant decrease in pain was observed in the LCI group in the first month of the intervention and an increase in the third and sixth months after the intervention, but the trend of pain intensity in the ESWT group was

Table 4. Comparison of changes in quality of life scores in the 2 groups of extracorporeal shock wave therapy and local corticosteroid injection

Thickness of pes Anserine	ESWT	LCI	P
First visit	38.2 ± 5.8	38.7 ± 8.7	0.803
One month after the intervention	55.6 ± 11.4	64.6 ± 9.1	0.003
Changes since the first visit	17.4(11.8, 22.9)	25.9(20.2, 31.6)	0.005
P value (intragroup comparison)	<0.001	<0.001	
Two months after the intervention	65.9 ± 10.3	56.4 ± 8.2	0.001
Changes since the first visit	27.7(22.2, 33.2)	17.7 (12.1, 23.3)	0.001
P value (intragroup comparison)	<0.001	<0.001	
Changes compared to the first month	10.3(5.8, 14.9)	-8.2 (-12.8, -3.6)	<0.001
P value (intragroup comparison)	<0.001	<0.001	
Three months after the intervention	81.2 ± 10.8	51.1 ± 9.1	<0.001
changes from the first visit	43.0 (37.8, 48.1)	12.4 (7.2, 17.7)	<0.001
P value (intragroup comparison)	<0.001	<0.001	
Changes compared to the first month	25.6 (19.8, 31.4)	-13.5 (-19.3, -7.6)	<0.001
P value (intragroup comparison)	<0.001	<0.001	
Changes compared to the second month	15.3 (10.6, 19.9)	-5.3 (-10.0, -0.6)	<0.001
P value (intragroup comparison)	<0.001	0.021	
Adjusted final quality-of-life scores changes mean (SE) ^a	77.03 (10.02)	49.33 (8.1)	0.004

^a Adjusted for baseline quality-of-life scores changes using ANCOVA analysis.

Table 5. Comparison of quality of life scores in the 2 groups of extracorporeal shock wave therapy and local corticosteroid injection

Group	Patient satisfaction with treatment			Physician satisfaction with treatment		
	The first month of intervention	The second month of intervention	Third month of intervention	The first month of intervention	The second month of intervention	The third month of intervention
ESWT	2.0±0.9	2.9±0.8	3.9±0.3	2.0±0.9	2.9±0.8	4.0±0.2
LCI	3.8±0.1	2.9±0.7	1.5±0.8	3.8±0.1	2.9±0.7	1.6±0.8
P	<0.001	0.984	<0.001	<0.001	0.984	<0.001

steadily decreasing (31). In both groups of this study, a decrease in plantar fascia thickness was observed during the study period. Still, unlike in our study, the reduction in plantar fascia thickness was more significant in the ESWT group than in the LCI group (6, 12, 19, 20, 28). Similarly, the results of another clinical trial performed on patients with carpal tunnel syndrome showed that the pain intensity in the third week after the intervention was significantly reduced in both ESWT and LCI groups. The pain intensity was similar in the 2 groups, but pain intensity at 9 and 12 weeks after the intervention in the ESWT group was significantly lower than in the LCI group (16).

Our study has some limitations. We did not use any imaging techniques; the diagnosis was based on clinical presentation. In addition, the follow-up period was short, and long-term efficacy was not evaluated.

Conclusion

Overall, the results of this study showed that both LCI and ESWT are safe in patients with PAB pain and thickness and increase patients' quality of life. However, the results of LCI are temporary, and ESWT treatment has a better and more stable rate of improvement in pain intensity and quality of life. As a result, it can be regarded as a more successful treatment choice for patients with PAB.

Acknowledgements

The authors thank the staff of Hamedan University of Medical Sciences. This research did receive a specific grant from an MD thesis of Mrs. Farzaneh Saeb carried out at Hamedan University of Medical Sciences, Hamadan, Iran.

Authors' Contribution

L.M., F.S., B.A., and M.R.N.: conception and design, L.M. and M.R.N.: acquisition of data, analysis, and interpretation of data. L.M., F.S., B.A., S.K., E.E.A., and M.R.N.: drafting the article or revising it critically for important intellectual content. All authors approved the final version to be submitted for publication.

Ethical Approval

This study was ethically approved by the local ethics committee of Hamedan University of Medical Sciences (IR.UMSHA.REC.1400.069).

Conflict of Interests

The authors declare that they have no competing interests.

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