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Research Article

The Change with Thermal Water Therapy in Pain, Depression, and Self-Esteem in Patients with Lumbar Disc Herniation: Study from a Single Center Database

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Abstract

Low back pain, is an important symptom that reduces the individual's quality of life. Lumbar disc hernias are first in the identifiable etiology of low back pain. Physiotherapy and rehabilitation modalities are important in treating lumbar disc hernias, so they can often be treated without surgery. **Background:** This study aimed to evaluate the contribution of hydrokine to therapy performed in oligo-mineral thermal water in the modification of pain, depression and self-esteem in patients with lumbar disc herniation. **Methods:** 80 patients with lumbar disc herniation were included in the study. 40 patients took thermal therapy, hydro-kinetotherapy and physical therapy named study group, and 40 patients did only physical therapy named control group. Pre and post-evaluations were conducted. Pain was assessed with visual analog scale, depression levels were assessed with the Hamilton Scale, and self-esteem was evaluated with the Morris-Rosenberg scale. Also, differences between groups are evaluated. Effect size is calculated. **Results:** The pain score, the depression score and the score for self-esteem evaluation improve significantly in both groups. Self-esteem increases significantly more in the study group, after the 10 days of treatment. **Conclusions:** Hydrokinetotherapy is a useful physiotherapy modality to reduce pain and in-crease psychological status in patients with lumbar disc hernias. The combination of hydrokinetotherapy is beneficial for increasing the self-esteem of patients with lumbar disc herniation.

Keywords: Intervertebral disc displacement; Balneology; Chronic pain; Depression; Self-esteem

Introduction

Low Back Pain (LBP) is one of the most common conditions; approximately 80% of the population has at least one episode of LBP. From an anatomical point of view, the intervertebral disc consists of a pulpy nucleus (composed of 80% water, collagen type 2 and proteoglycans), a fibrous ring (stratified fibrous connective tissue) and cartilaginous structures for fixing the disc [1]. The causes are very varied, but degenerative etiology and disc herniation are the most common; the most frequent location is at the L4-L5 level [1].

Aging, obesity, sedentary lifestyle, prolonged driving of vehicles and mechanical stress (physical effort and rotation) are favorable factors for disc herniation.

Lumbar disc herniation is based on a series of pathophysiological changes that occur at the level of the intervertebral disc: increasing the activity of the degrading systems, changing the type 1 collagen content, reducing the water content of the nucleus pulposus, changing the matrix structure and triggering the inflammatory cascade. Local irritation and inflammation are the causes of local pain.

The herniated material (mainly the nucleus pulposus) exceeds the edges of the annulus fibrosus. The literature describes 3 forms: protrusion, extrusion or sequestration [2].

The extruded material will exert pressure on the nerve root and lead to inflammation and ischemia of the nerve root. The hernia occurs more frequently at the postero-lateral level; at this level the radical conflict appears [1].

Disc herniation is the most common spinal condition of intervertebral discs. Herniation often occurs in mobile and load-bearing vertebrae therefore, the cervical and lumbar vertebrae are most commonly affected. MRI examinations of the spinal structure reveal that 90% of people aged 50-55 have disc problems [3]. A disc herniate can put pressure on nearby nerves, causing pain, numbness, tingling, or weakness in the area supplied by those nerves [4]. They should be treated if disc herniations cause pain, limitation of movement, and motor and sensory loss. The symptoms of disc herniation can vary depending on the location and severity of the herniation. Treatment approaches generally include a combination of conservative measures such as physiotherapy, pain management, and rest. In severe cases, surgical intervention may be necessary [5].

Depending on the severity of symptoms, lumbar disc herniation can affect a patient's ability to work, fulfill family responsibilities, and enjoy favorite activities [6]. Early treatment and proper management can help reduce symptoms and improve the patient's quality of life [7]. Hydrotherapy is a recommended treatment for lumbar disc herniation [8]. Hydrotherapy is a worldwide treatment for people with musculoskeletal disorders for pain management and rehabilitation [9]. Thermal water therapy is a kind of hydrotherapy using natural hot springs. Thermal centers are reported as suitable environments for rehabilitation [10]. Many people believe that natural warm springs have healing properties [11]. The human being, who is biopsychosocial, is also affected psychologically and socially when a biological effect occurs in his body. Therefore, the perspective of treatment is important.

The beneficial effects of thermal water are related to physical and chemical factors, but the mechanism of its action is not fully understood [12]. The physical and chemical properties of water have beneficial influences on the neuroimmuno-endocrine system. Previous studies have obtained results that demonstrated the activities anti-inflammatory and chondroprotective properties of thermal waters, as well as their antioxidant and immunomodulatory functions [13,14]. A significantly large number of studies support the beneficial effects of hydrotherapy in improving clinical signs in patients with LBP [15]. The meta-analysis published by T. Bender (2014) identified four studies that followed the effects of thermal water on inflammatory indices. The decrease in the level of C-reactive protein and the beneficial effect on the antioxidant status of thermal water compared to tap water have been proven [16].

Exercises performed in pools with thermal water of 36 degrees favor toning the paravertebral muscles, increasing mobility and range of motion. The thermal factor contributes to the relaxation of the paravertebral muscles and the intensification of local blood circulation. Thus, the pain at this level is reduced. In-creased mobility and decreased pain lead to increased quality of life and self-esteem.

This study aimed to evaluate the contribution of hydrokinetotherapy per-formed in oligo mineral thermal water in the modification of pain, depression and self-esteem in patients with lumbar disc herniation.

Materials and Methods

Study Design and Participants

We conducted an observational study, between October 2020 and January 2021. Hospitalized patients were recruited to the Băile Felix Clinical Medical Rehabilitation Hospital in Romania. The study was approved by the local Ethics Committee (opinion no. 9406/13.10.2020) and was carried out in accordance with the Helsinki Declaration principles. Before beginning treatment, all patients signed consent to use the data collected from the assessments.

Criteria for inclusion in the study: definite diagnosis of lumbar disc herniation at L4-L5 level, confirmed by imaging (MRI, protrusion/extrusion), without root conflict, patients without surgical indication, age between 15-69 years, patients with laminectomy (older than 1 year).

Exclusion criteria: lack of consent, the presence of an associated pathology that does not allow follow-up of recovery treatment, other etiology of lumbar pain (spondylisthesis, tumors, infections), associated diseases that do not allow hydrokinetotherapy (organ failure, neoplasia), disc herniation with surgical indication. After applying the exclusion criteria, the patients were assigned to two groups, depending on the recovery treatment followed (Figure 1).

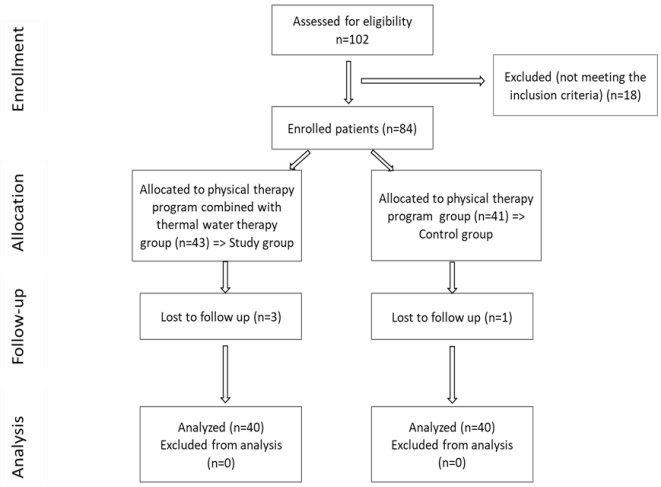

Figure 1: CONSORT flow diagram of the study.

Assessments

The Visual Analog Scale (VAS) was used to determine the level of pain. VAS is a valid tool and is widely used to measure pain. The pain intensity is ranged from 0 to 10 (0= no pain and 10= the worst) from the patient's perspective [17].

To determine the depression level, Hamilton Depression Rating Scale (HDRS) was used. The scale has 21 items, but the scoring is based on 17 of them. Nine of those (items; 1-3,7-11 and 15) are rated form 0 to 4, item 16 is rated from 9 to 3 and seven items (4-6,12-14, and 17) are rated from 0 to 2. The total score ranges from 0 to 63, with higher scores indicating more severe depression. The scores between 0 and 7 are accepted as normal and a score of 20 or higher indicates at least moderate severity [18,19].

The Morris-Rosenberg scale (MRS) was used to assess self-esteem. MRS includes ten statements that assess a general level of self-esteem, including self-acceptance and self-perception. Each item is rating from 1 to 4 and the total score varies from 10 to 40. Twenty-seven and lower scores indicate low self-esteem and scores between 28 and 32 indicate average self-esteem and scores over 33 indicate high self-esteem [20].

Study Size

A total of 102 patients with LDH were dedicated to recovery but only 80 remain and willing to see their evolution by applying the treatment included in the research. The patients were treated according to two different therapeutic interventions. The study group benefited from a physical therapy program combined with thermal water therapy, and the control group only followed the physical therapy program that was similar to that followed by the study group. Using a block randomization method, participants were separated at random into a pair of groups (study n=40) and control n=40). Figure 1 summarizes the information provided above.

Protocol and Interventions

Băile Felix resort stands out for its thermal (20-48°C), oligo thermal, radioactive mineral water resources containing sulfur, calcium and sodium. The mineral waters of the Băile Felix resort belong to the group of acratothermal waters, that is, they have a mineral concentration of under one gram per liter. The temperature of the springs is between 32° and 49°. The waters are rich in beneficial chemical elements such as K, Ca, Mg, Fe. Sulfates also contribute to the elimination of Na, urea, and acid radicals [21,22].

The water temperature used in the thermal therapy procedure is 36°-37° and helps to improve the central and peripheral circulatory system, as well as the general state of the metabolism, muscles, and immune system. The locomotor and cardiovascular system is positively influenced by the hydrostatic pressure of the water in pools. The duration of the procedure of physical therapy was 30 minutes. During this procedure, the patients followed the Williams and McKenzie method and some exercises for toning the lower limbs muscles, for the abdomen, buttocks, and lumbar muscles in the positions decubitus (dorsal, lateral and ventral), quadrupeds, and orthostatism. The duration of the procedure of thermal therapy was 20 minutes. The patients who participated in the hydrokinetotherapy procedure performed exercises in the pool from the initial orthostatic position and from dorsal decubitus (only with support at the level of the bar on the edge of the pool). The method used in the exercises was adapted and based on the Williams and McKenzie method.

The treatment was carried out for 10 days in both the study group and the control group. The patients did the treatment for five days (from Monday to Friday), then took a two-day break (Saturday and Sunday), then resumed the ac-tivity (Monday to Friday). Each individual patient was hospitalized in the Baile Felix Rehabilitation Clinical Hospital, where the recovery treatment was carried out from the first day of admission.

Statistical Analysis

Data processing was carried out using the SPSS 20 program. Average values of the parameters, frequency ranges, standard deviations, and tests of statistical significance using the Student method (t-test) and c^2 were calculated. ANOVA was used to compare the means, and the level of statistical significance was 0.05.

Results

Table 1 shows that there are no significant differences in terms of age, gender, pain location. In both groups, women predominated (65.00% vs 62.50%, p=0.817), the women/men ratio being 1.9:1 and 1.7:1, respectively. The patients in the study group were aged between 15-69 years, and in the control group be-tween 15-73 years. The mean age was insignificantly higher in the study group compared to the control group (49.73 years vs 48.13 years, p=0.617). Pain localization was mainly bilateral (47.50 vs 52.50%, p=0.657), followed by right-sided localization (30.00% vs 32.50%, p=0.811). In over 40% of the patients in the two groups, the pain was subacute or chronic (42.0% vs 40.00%, p=0.821).

Characteristics		Study group		Control group	
		N	%	N	%
Gender	Female	26	65.00	25	62.50
	Male	14	35.00	15	37.50
	Average age	49.73±13.18		48.13±15.21	
	Average height (cm)	161±0.2		165±3	
	Average BMI (kg/m^2)	27.48±4.96		27.83±5.14	
Environment of origin	Rural	14	35.00	13	32.50
	Urban	26	65.00	27	67.50
Location of pain	Right	12	30.00	13	32.50
	Left	9	22.50	6	15.00
	Bilateral	19	47.50	21	52.50
The type of pain	Acutely	6	15.00	8	20.00
	Subacute	17	42.50	16	40.00
	Chronic	17	42.50	16	40.00

Table 1: Baseline patient demographic characteristics, comorbid conditions, clinical findings, and health status measures.

Evaluation of psychological parameters

At the initial and final assessment of pain, assessed with the VAS score, there were no significant differences between the 2 groups (6.45 vs 6.78, p=0.507, respectively 3, 85 vs. 3.33, p=0.280). The mean value of the VAS score decreased significantly in both groups (from 6.45 to 3.85, p<0.001 and from 6.78 to 3.33, p<0.001, respectively). The treatment effect on the VAS score was major in both groups (ES=1.07, respectively ES=1.83) (Table 2).

Evaluation sale		Study group	Control group	p
VAS	Initial	6.45±2.44	6.78±1.89	0.507
	Final	3.85±2.25	3.33±2.07	0.280
Scale	p	<0.001	<0.001	
	ES	1.07	1.83	
Hamilton scale	Initial	29.25±14.48	24.70±15.51	0.179
	Final	20.03±12.70	16.05±14.55	0.197

	p	0.003	0.012	
	ES	0.64	0.56	
Morris Rosenberg scale	Iniţial	22.098 ±4.189	19.606 ±6.076	0.191
	Final	26.524 ±3.378	25.273 ±6.070	0.009
	p	<0.001	0.007	
	ES	1.51	0.69	
*p<0.05				

Table 2: Evaluation of psychological parameters.

The score obtained with The Hamilton scale was insignificantly higher in the study group than the control group in both assessments (29.25 vs 24.70, p=0.179, respectively 20.03 vs 16.05, p= 0.197). The mean value of the Hamilton score decreased significantly in both groups (from 29.25 to 20.03, p=0.003, respectively, from 24.70 to 16.05, p=0.012). The treatment effect on the Hamilton score was moderate in both, but higher in the study group (ES=0.64, respectively ES=0.56). The mean Morris Rosenberg score values were comparable for the two groups at the first assessment (p=0.191). At the second evaluation, with the reduction of pain, self-esteem increased, more marked in the hydrotherapy group (p=009).

The mean value of the Morris Rosenberg score increased significantly in both groups (from 22.098 to 26.524, p<0.001, respectively, from 19.606 to 25.273, p=0.007), i.e., self-esteem increased in both groups (Figure 2). The effect of the treatment on self-esteem was major in the study group (ES=1.51) and moderate in the control group (ES=0.69).

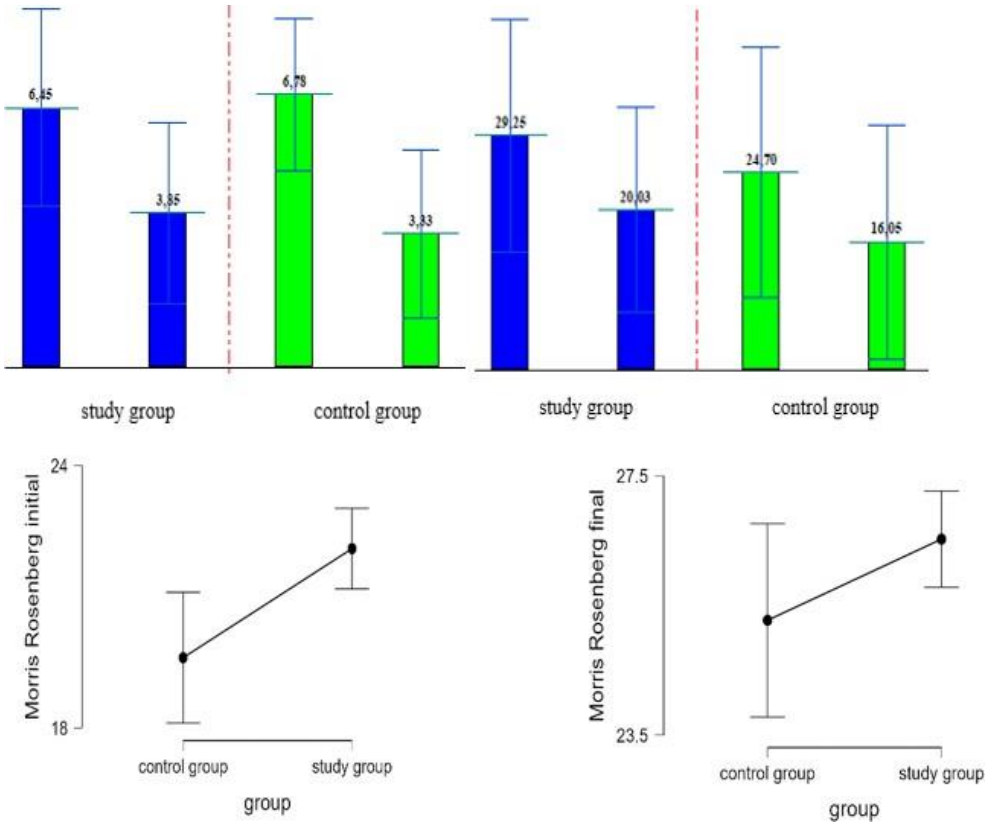

Figure 2: a. VAS scale initial versus final; b. Hamilton scale of both batches initial versus final; c. Morris Rosenberg scale of both batches initial; d. Morris Rosenberg scale of both batches final.

Discussion

Disc herniation is a frequent cause of lumbar pain associated with limiting daily activity and decreasing quality of life. The treatment of this condition involves high costs. The initiation of an early conservative therapeutic strategy is recommended. The retrospective study published in 2020 by D. T. Lilly et al (N= 277 941) [23], shows that 97% of patients were successfully treated conservatively. 40% of them followed treatment with physical therapy and anti-inflammatory and anti-analgesic medication, muscle relaxants and antidepressants.

The therapeutic benefits of natural healing factors, including thermal waters, have been known since ancient times [24].

Hydrothermotherapy is an effective complementary therapy in the treatment of various pathologies. Its mechanisms of action, insufficiently known, are based on neuroendocrine and immunological responses. These result in anti-inflammatory, analgesic, antioxidant, chondroprotective and anabolic effects. The action on the immune system is proven; there is a reduction in the level of pro-inflammatory cytokines (TNF-α and Interleukin, 1β and IL6). It also in-creases the level of IGF-1 (anti-inflammatory growth factor). All these changes lead to chondroprotective effects. Proinflammatory cytokines are involved in inflammatory and neuropathic pain, modulating the levels of substance P and PGE2, responsible for hyperalgesia and allodynia. Modulating the levels of these substances through hydrotherapy will reduce pain from herniated discs [25].

The therapeutic effects of the oligo mineral thermal water from Baile Felix [21] have been known since the 1700s. The effects of treatment with oligo mineral thermal water (from Baile Felix) are due to the combined action of chemical, thermal and mechanical factors. The mechanical effect consists in is the reduction of weight-bearing forces also, during water exercises, it can have a facilitating or resistance effect. The thermal effect (temperature of 36-37 degrees) has a muscle relaxation effect [25]. The thermal water from Baile Felix is trace mineral, but it is considered therapeutic, there is clinical evidence in this regard [26]. The study aims to evaluate the effects on pain and other associated clinical manifestations.

The main objective of this study was to see if the association of oligo mineral thermal waters with the classic recovery treatment leads to superior results in terms of pain, depression and self-esteem in people with lumbar disc herniation.

Back pain is a common condition in patients with a herniated disc. In our study, pain decreased significantly after 10 days of intervention, in both groups. There is already a consensus in the clinical approach to treat back pain, involving physical therapy and non-steroidal anti-inflammatory analgesics [27]. The results of the study show that the average pain score obtained initially and at the end is not significantly different for the 2 study groups ($p>0.05$). Also comparing the initial and final values for the same group, it is observed that the values de-crease significantly ($p<0.001$) for both groups.

The study published by Elif Yolgösteren in 2021 [26], supports the effectiveness and superiority of the results of applying balneotherapy, more precisely hydrothermotherapy (applied for 10 days) on pain, mobility, disability index, quality of life and depression, in patients with operated disc herniation.

Previous studies have shown the effectiveness of balneotherapy combined with physical therapy in reducing pain, but its superior effects compared to physical therapy alone were highlighted after 3 weeks [9]. The fact that in our study, there were no significant differences between groups may be due to the short intervention period (only 10 days).

Depression commonly results from back and neck pain [28,29]. For this reason, it is essential to evaluate psychological factors. It has been found that depression is constantly present in adult patients with back pain, although research in this regard is limited. Associations between low back pain and depression and somatization in a Canadian emerging adult population David Robertson, Kennedy et al published, in 2008, the results of a study conducted on 973 students, in which they show the presence of sadness, exhaustion and overwhelmed is directly associated with lumbar pain [30].

A study by Kayhan et.al (2016) [31] indicates that major depression and anxiety disorders are the most common specific diagnoses in patients with lumbar and cervical herniations. The results of our study also show that patients with lumbar disc herniation have high depression levels. At the same time, our study's results show decreased depression levels of patients receiving physio-therapy and hydrotherapy. Applying the Hamilton questionnaire to the patients included in our study, shows a presence of depression in most patients, which fall into moderate-severe values. Hamilton score values decrease significantly for each group, without significant differences between the two groups.

Naumann shows in his study [32] that 2 weeks of balneotherapy added to usual care led to a decrease in the severity of depression, thus emphasizing that thermal water therapy can be a fast-acting, safe and easily accessible method for patients with moderate depression.

In their study in 2021, Mirmoezzi et al. reported that hydrotherapy caused a decrease in the intensity of low back pain and increased physical functionality after the 10th session. We think that depression levels decreased due to these reasons [32,33].

The study of Khanjari and Kalkhoran (2020) [34] reported a significant difference between the RMDS results of individuals with disc herniation who per-formed in-water exercise and the control group without exercise. Our results showed that the individuals who received hydrotherapy and physiotherapy were statistically significant.

The meta-analysis published by S. Mao et al. (2023) supports the therapeutic contribution of thermal water in improving pain, function, and quality of life in patients with LBP. 16 studies were reviewed in which 1656 patients with lumbar pain were included. Studies show the effectiveness of thermal water therapy to be superior in patients over 60 years of age, without significant differences being identified in patients under 60 years of age. In our study, the average age is under 60 years (49.73±13.18, respectively 48.13±15.21). There is a possibility that for this reason no statistically significant differences can be identified between the 2 study groups regarding the Hamilton score and VAS [35].

M. C. Maccarone et al published the results of a multicenter study (2023) in which a number of 160 patients with post-surgical and degenerative diseases were evaluated. The objective of the study was to track the therapeutic efficiency of the thermal waters. The favorable effect on patients' pain, mobility and quality of life is emphasized [36].

Another meta-analysis, published in 2014 (T. Bender et al.) highlights the beneficial effects of thermal waters on LBP (5 studies out of the 122 referred to) [16].

Self-esteem increases significantly in the study group compared to the control group, an aspect that can be explained by the increased mobility and the decontracting effect favored by the thermal water.

Strengths and Limitations of the Study

The study, carried out on a significant number of patients, evaluates the benefits of combining hydrotherapy with classic recovery treatment. From the research conducted, it appears that there is a small number of studies (performed on smaller samples than our study) that evaluate the benefits of thermal water on pain, depression and self-esteem. It is the first study in Romania that evaluates the change in the self-esteem score by associating the treatment with oligo-mineral thermal waters.

Weaknesses could be considered the inability to evaluate the factors that can influence pain, depression and self-esteem. Risk factors that have not been assessed are: inactivity, obesity, race and smoking. Also, the study is carried out in a single recovery center and the re-evaluation of the patients was done after 10 days of treatment. The consumption of anti-inflammatory and anti-analgesic drugs was not evaluated.

Conclusions

Thermal water therapy had a positive effect on the patients with lumbar disc herniation, but it is not statistically significantly different from the effect of the physical therapy program alone. It is necessary to plan studies on this subject in larger sample groups and to follow the long-term results.

Disclosure

Author Contributions

Conceptualization, I.M.E.; Methodology, I.M.E, I.D. AND L.L.; Software, S.T. and Y.M.; Validation, I.D, and L.L.; Formal Analysis, S.T. and Y.M.; Investigation, I.M.E.; Resources, I.M.E.; Data Curation, I.M.E.; Writing – Original Draft Preparation, I.D. and L.L.; Writing – Review & Editing, Y.M.; Visualization, S.T. and Y.M.; Supervision, I.D. AND L.L.; Project Administration, I.D. AND L.L. All authors have read and agreed to the published version of the manuscript."

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Institutional Review Board Statement

The study was conducted in accordance with the Declaration of Helsinki and approved by the local Ethics Committee (approval no. 9406/13.10.2020) of Baile Felix Recovery Hospital.

Informed Consent Statement: Informed consent was obtained from all subjects involved in the study.

Data Availability Statement: The corresponding author can provide access to the database upon reasonable request.

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Conflicts of Interest

The authors declare no conflicts of interest.

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