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Modern Approaches to Preparing Patients with Tuberculosis of the Hip Joint for Total Endoprosthesis Surgery

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Abstract Twenty-eight patients (mean age of 41.75 ± 2.13 years) with hip joint tuberculosis (HJTB) received comprehensive examination and treatment at the department of osteoarticular tuberculosis. The results showed that in patients with HJTB, muscle contracture and deformities occur frequently and can lead to unsatisfactory treatment outcomes. However, complex diagnostic measures, conservative therapy, and a combination of spine and hip surgical procedures improve treatment results.

Keywords Hip joint tuberculosis, Endoprosthetics, EMG

1. Introduction

Bone and joints tuberculosis (TB) is the most common form of extra pulmonary TB. Hip joint tuberculosis (HJTB) is the second in prevalence after TB of the spinal column, accounting for 25% of cases [2]. Etiological agent of the TB in the human body is Mycobacterium tuberculosis. Bone marrow rich bones are more susceptible to TB infection. A specific process begins with primary infection in the bone marrow regions of the bones forming the hip joint [7]. The synovial membrane of the joint has resistance to the hematogenous spread of TB infection, the secondary infection of the synovium occurs after spreading of TB infection from bone foci into the joint [4,6].

The basis of the treatment of tuberculosis of the hip joint is anti-tuberculosis chemotherapy depending on the drug sensitivity of mycobacteria [3,8].

But diagnosis of HJTB is complicated by underdeveloped clinical manifestations. Even when the process spreads to the joint gap, and occur clinical symptoms like swelling and sharp pains in the joint appear, increasing with the slightest movement, and radiologically bone destruction, sequestration, narrowing of the joint space, synovitis are revealed, differential diagnostics of tuberculosis of the hip joint, aseptic necrosis, osteoarthritis and arthritis of various etiologies, including autoimmune arthritis, are necessary. Even diagnostic samples taken from paraarticular abscesses do not always allow for an accurate diagnosis due to the oligobacillary phenomenon of extrapulmonary tuberculosis [10]. Late diagnosis of tuberculosis of the hip joint leads in many cases to the development of complicated forms and disability in 67% of patients [5], with leg shortening, scoliotic deformity and muscle contracture.

As a result, surgical treatment of complicated forms of tuberculosis of the hip joint has become one of the most important and urgent problems of phthisiology and orthopedics.

Currently, the most optimal method for restoring the function of a destroyed hip joint is its total endoprosthetics, which has become increasingly used in phthisioorthopedics [6].

In HJTB, after its total endoprosthetics, the mechanical load on the resected surface of bone tissue increases [5,8], for the complete restoration of which metabolic and immune reserves of the body are required [9]. In addition, deformities and muscles contracture in HJTB lead to development of hip-spine syndrome [10], that worsens total hip endoprosthetics surgery outcomes.

Thus, to prevent unsatisfactory outcomes of total endoprosthetics of the hip joint in patients with complicated forms of HJTB requires further improvement.

2. Purpose

To improve outcomes of total endoprosthetics of the hip joint in patients with complicated forms of HJTB.

3. Materials and Methods

The research was carried out at the Republic Specialized Scientific-Practical Medical Center of Phthisiatry and

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Pulmonology, involving 28(100%) patients diagnosed with HJTB between 2020 and the end of 2024. The patients' ages varied from 27 to 65 years, with a mean age of 41.75 ± 2.13 years.

Before surgery, a comprehensive examination of patients is conducted, which included orthopedic examination and assessment of range of motion in affected hip joint, contractures, leg shortening and deformities.

Plain radiography and CT of the lumbar spine, pelvis and hip bones performed to evaluate spine scoliosis, pelvic rotational deformities, sequestration and bone structure beyond affected hip joint.

MRT was performed to identify abscesses, synovitis and soft tissue around the hip joints.

EMG mean amplitude and frequency of oscillation repetition values of MGMax and MGMed on both sides measured to evaluate muscular and neurologic function before and after surgery.

Radiologically revealed excessive destructive lesions of the joint surfaces, complete resorption or destruction of the femoral head along with the neck, significant joint deformities caused by specific inflammation, that cannot be restored reconstructive surgery like necrectomy and autogenous bone grafting were indications for total hip endoprosthesis surgery. Rigid scoliotic deformities with Cobb's angle more than 20 degrees were indication for surgical correction and fixation.

For total hip endoprosthetics we used standard direct lateral approach. For spinal fusion we used piramesh cages by lateral trans-psoas approach from the concave side of the deformity.

The diagnosis of HJTB was established through a combination of medical history, disease progression, histological and bacteriological evaluation of surgical samples, joint puncture samples, immunological, and radiological evaluations.

4. Results

Prior to total endoprosthesis surgery, 28(100%) (17(60,7± 0,92%) male, 9(39,2±0,9%) female patients) patients underwent EMG and ENMG testing. Bilateral HJTB presented in 3(10,7±0,6%), 13(46,4±0,94%) patients were diagnosed with right HJTB and 12(42,9±0,93%) patients had left HJTB.

Mild anemia presented in 12 (42.8±0,93%) patients, while 5(17,9±0,7%) had moderate anemia. Administration of intravenous iron (III) hydroxide sucrose complex at a dose of 100 mg daily for 5-10 days, along with erythropoietin 4000 IU three times a week, promoted erythropoiesis and alleviated anemia.

Seven (25,0±0,8%) suffered from type II diabetes mellitus, and 2(7,14±0,48%) patients received insulin therapy, others were on sugar reducing drugs (metformin, gliclazide). Three (10,7±0,58%) diabetic patients suffered from leg pain, EMNG tests revealed peripheral neyropathy, thioctic acid 600 mg intravenously and antioxidant therapy (arginine, meldonium), and gabapentin administration reduced the pain.

Based on radiological examinations, 8(28,6±0,8%) patients had metatuberculosis changes in their lungs.

None of the patients diagnosed with drug-resistant TB or had a history of it. All patients were administered the first-line anti-tuberculosis therapy: isoniazid 5-10 mg/kg, rifampicin 15-25 mg/kg, ethambutol 15-25 mg/kg, and pyrazinamide 15-20 mg/kg based on body weight. No adverse effects of these drugs were observed in the patients.

Based on the disease duration, these patients were divided into two groups: the first (main) group included 18(64,3± 0,9%) patients (mean age 47.8), who had disease progression for over 12 months and were subsequently diagnosed with HJTB. The second (control) group included 10(35,7±0,9%) patients (mean age 43.9), whose diagnosis was made within a year (Table 1).

The orthopedic condition of the patients was characterized by severe pain in the affected joint area and significant impairment in the functional-supportive activity of the affected leg. Additional support devices, such as crutches or a walking stick, for mobility required 24(85,7±0,6%) patients. Functional and/or anatomical deformities resulting in 2 cm to 7 cm shortening of the leg found in 21(75±0,8%) patients, no deformities were found in the affected leg in 7(25±0,8%) patients. All 28(100%) patients exhibited varying degrees of flexion (average 118.6°) and adduction contractures (average 157.4°).

Regarding the degree of deformity in the affected leg due to HJTB, the main group had leg shortening up to 7 cm, while the control group had leg shortening up to 4 cm. However, considering the maximal stretchability of the surrounding muscles and nerve fibers during surgery, it was not possible to extend the leg by more than 4 cm without causing atrophy of the muscles and nerves. As a result, for patients with deformities of 7 cm or more, an increase of 3-4 cm in the affected leg's length was achieved after surgery. After total hip replacement surgery, shortening of the affected leg were maintained in 10(35,7±0,9%) patients from the main group. In the control group, 70% of patients achieved alignment of the affected leg with the length of the healthy leg after surgery.

Table 1

Disease duration	Patients number	Gender		Diseased joint		
		Male	Female	right	left	both
2-12	10(35,7±0,9%)	6(21,4±0,77%)	4(14,3±0,66%)	4(14,3±0,66%)	6(21,4±0,77%)	-
12-24	6(21,4±0,77%)	4(14,3±0,66%)	2(7,14±0,48%)	2(7,14±0,48%)	4(14,3±0,66%)	-
2-4	9(32,1±0,8%)	5(17,8±0,72%)	4(14,3±0,66%)	4(14,3±0,66%)	5(17,8±0,72%)	1(3,5±0,35%)
More than 4 years	3(10,7±0,58%)	2(7,14±0,48%)	1(3,5±0,35%)	1(3,5±0,35%)	2(7,14±0,48%)	2(7,14±0,48%)

Table 2

Disorders	Before total hip replacement surgery		After total hip replacement surgery	
	1-group	2-group	1-group	2-group
Duration of the disease	**N-18**	**N-10**	**N-18**	**N-10**
≤12 month	-	10(35,7±0,9%)	-	10(35,7±0,9%)
12-24 months	11(39,3±0,92%)	-	11(39,3±0,92%)	-
≥24 months	7(25±0,8%)	-	7(25±0,8%)	-
Pain				
1-3 score	5(17,8±0,72%)	2(7,14±0,48%)	2(7,14±0,48%)	2(7,14±0,48%)
4-6 score	9(32,1±0,88%)	1(3,5±0,3%)	4(14,2±0,66%)	-
7-9 score	3(10,7±0,58%)	4(14,2±0,66%)	-	-
10 score	1(3,5±0,35%)	3(10,7±0,58%)	-	-
Shortening of the lower limb				
≤2 см	1(3,5±0,35%)	6(21,4±0,77%)	2(7,14±0,48%)	2(7,14±0,48%)
3-4 см	3(10,7±0,58%)	3(10,7±0,58%)	5(17,8±0,72%)	1(3,5±0,35%)
5-6 см	8(28,6±0,85%)	1(3,5±0,35%)	-	-
≥7 см	6(21,4±0,77%)	-	-	-
Scoliosis				
Level 1	-	2(7,14±0,48%)	2(7,14±0,48%)	2(7,14±0,48%)
Level 2	1(3,5±0,35%)	-	2(7,14±0,48%)	-
Level 3	4(14,2±0,66%)	-	-	-
Level 4	1(3,5±0,35%)	-	-	-
Contracture				
Muscular	11(39,3±0,92%)	6(21,4±0,77%)	4(14,2±0,66%)	1(3,5±0,35%)
Neurogenic	5(17,8±0,72%)	4(14,2±0,66%)	3(10,7±0,58%)	3(10,7±0,58%)

Table 3. EMG average amplitude values and frequency of oscillation repetition of MGMax and MGMed in patients with HJTB before and after total hip replacement surgery

EMG parameters	Limb	n	Tested muscle group			
			Musculus gluteus maximus		Musculus gluteus medius	
			Before treatment	After treatment	Before treatment	After treatment
Main group						
Amplitude mean value, mkV	diseased	18	176,5±25,2	190,2±28,	207,3±25	312,4±42,1
	healthy		260,8±10,3	245,2±41,9	388,8±42,5	465,5±72,3
Frequency of oscillation repetition, per second	diseased	18	125,4±21,1	68,2±12,5	178,4±17,2	152,4±24,1
	healthy		152,5±14,3	164,5±18,3	171,5±12,3	181,3±18,2
Control group						
Amplitude mean value, mkV	diseased	10	249,3±37,4	220,1±41,3	261,1±55,7	288,7±45,4
	healthy		446,2±120,5	336,5±68,4	427,3±81,5	365,4±120,2
Frequency of oscillation repetition, per second	diseased	10	149,3±18,5	78,6±19,6	208,4±26,9	140,7±37,9
	healthy		123,4±16,6	65,2±7,6	204,3±25,8	182,3±44,5

Spinal pathological curvatures (scoliosis) were more common in the main group and correlated with disease duration, with 5(17,8±0,7%) patients having 2nd to 3rd degree scoliosis, and 1(3,5±0,3%) patient had 4th-degree scoliosis. Patients with persistent pain and spinal instability, as well as 3-4 degree scoliotic deformities, underwent a first-stage spinal fixation surgery of the top segment(s) of the deformity from the concave side of the deformity. Five (17,8±0,7%) patients underwent this procedure and improved from 3-4 degree scoliotic deformities to 1-2 degree. In these patients, the second-stage surgery for total hip replacement with prostheses was performed 6-12 months after the spinal operation (Table 2).

The main group included 11(39,3±0,9%) patients with HJTB duration up to 24 months, while 7(2517,8±0,7%0,8%) patients' HJTB duration was longer than 24 months. Greater pain syndrome was presented in the main group patients.

According to disease progression, 11(39,3±0,9%) patients

in the main group had myogenic contractures in the hip joint, while 5(17,8±0,7%) had neurogenic contractures. Following total hip replacement surgery, myogenic contractures decreased by 41%, and neurogenic contractures reduced by 11.2%. In the control group, joint contractures after surgery were less frequent, with mainly neurogenic contractures remaining. These results highlight the essential role of the surrounding soft tissues and nerve fibers in the complete restoration of joint function.

On EMG average amplitude values (AV) and frequency of oscillation repetition (FOR) of the musculus gluteus maximus (MGMax) and musculus gluteus medius (MGMed) were examined.

Anti-thrombosis stockings and Enoxaparin 0,4-0,8 mg according to the weight administered for thrombosis prophylaxis postoperatively.

In the early postoperative phase, 7(25±0,8%) patients in the main group experienced 6-7 score pain (VAS 10-point pain scale). Pain management consisted of NSAIDs, myorelaxants (tolperisone 100 mg i/m daily, tizanidine 2-4 mg twice a day), spasmolitics (drotaverine 40 mg 1-2 times a day), promidoli 1% 1ml, para-articular steroid and local anesthetics injection and immobilization were used.

For secondary infections, broad-spectrum antibiotics were given (Cefoperazone + Sulbactam 2 g twice a day, Levofloxacin 1000 mg).

The post-surgery immobilization period lasted 8-10 days for the control group and 58% of patients in the main group. The average hospital stay for the main group was 24.6±2.1 days, with a total treatment duration of 36.5±3.3 days. In contrast, the control group had an average hospital stay of 18.7±2.8 days and a total treatment duration of 28.4±2.4 days.

In the main group, EMG mean amplitude values of MGMax and MGMed preoperatively were 176±25 mkV and 207±25 mkV respectively. After total hip replacement surgery EMG mean amplitude values of MGMax and MGMed changed to 190±28 mkV and 312±42 mkV, respectively. EMG frequency of oscillation repetition changes before and after total hip replacement surgery of MGMax and MGMed showed 38% and 37% improvement, respectively.

In the control group, EMG mean amplitude values of MGMax and MGMed preoperatively were 249±37 mkV and 261±55 mkV respectively. After total hip replacement surgery EMG mean amplitude values of MGMax and MGMed changed to 220±41 mkV mkV and 288±45 mkV, respectively. Decrease in EMG frequency of oscillation repetition changes postoperatively showed 52% and 64% improvement in MGMax and MGMed, respectively.

Patients were advised to use crutches for 3-4 months after the operation.

After surgery, pain intensity reduced by 33.3% in the main group and by 20% in the control group.

Leg shortening on the surgery side < 2 cm remained in 2 (7,1±0,48%) patients of the main group and 2(7,1±0,48%) patients of the control group, >2 cm of affected leg shortening remained in 5(17,8±0,7%) patients of the main and 1(3,5± 0,3%) patients of the control group.

5. Discussion

Hip spine syndrome refers to the clinicopathological association between osteoarthritis of the hip and lumbar spine pain. The term was first described by Offierski and MacNab, almost 4-decades ago, in a retrospective study that described 35 patients with combined symptomatic osteoarthritis of the hip and lower back pain [14].

Gorobets K. A. et al, 2020 analyzed medical condition of 30 patients with scoliosis after hip endoprosthetics and found that 67% of patients had lumbar pain [13].

Aftab Younus et al, 2021 in their case series highlighted the association between osteoarthritis of the hip and degenerative lumbar stenosis, and that patients with hip spine syndrome are best managed through a multi-disciplinary approach [14].

Nociceptive impulses emanating from the damaged part of the hip joint slow down the activity of the muscles and their spinal cord centers. This protective system slows down the activity of the muscles directly involved in joint movements and increases the activity of other muscle systems.

The bioelectric activity of the muscles of the affected hip joint before surgery is lower than the bioelectric activity of the muscles of the contralateral side. In the period after total hip replacement, the bioelectric activity of the gluteus maximus and medius muscles decreases and returns to normal over time [11,12].

In our study both EMG mean amplitude and frequency of oscillation repetition values of MGMax and MGMed significantly improved postoperatively in both groups.

6. Conclusions

The results show that in patients with HJTB, muscle contracture and deformities occur frequently and can lead to unsatisfactory treatment outcomes. However, complex diagnostic measures, conservative therapy, and a combination of spine and hip surgical procedures improve treatment results.

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