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TOTAL HIP REPLACEMENT IN A HEART TRANSPLANT RECIPIENT WITH MULTIPLE COMORBIDITIES: A CASE REPORT

V.Yu. Murylev[1, 2], P.M. Elizarov[1, 2], P.A. Drozdov[2, 3], G.A. Kukovenko[1, 2], M.P. Elizarov[1, 2], A.V. Muzychenkov[1, 2], G.S. Michailyants[3], S.S. Alekseev[2], A.I. Rudnev[1, 2], K.G. Yakovlev[2], D.O. Golubkin[1]

[1] Sechenov University, Moscow, Russian Federation
[2] Botkin Hospital, Moscow, Russian Federation
[3] Russian Medical Academy of Continuous Professional Education, Moscow, Russian Federation

Background. According to available literature, recipients of solid organ transplants have a progressively increased risk of developing aseptic necrosis and osteoarthritis due to long-term corticosteroid and immunosuppressive therapy. Approximately 5% of transplant recipients develop femoral head avascular necrosis (FHAN). In such cases, the gold standard of treatment is total hip replacement (THR). However, this approach carries a high risk of postoperative infectious complications. **Clinical case.** A patient was admitted in Moscow at the City Center for Bone and Joint Endoprosthetics, Botkin Hospital for a planned THR. Six years earlier, she had undergone a heart transplant. Her clinical profile was further complicated by multiple comorbidities, placing her in a high-risk category for perioperative complications according to the ASA classification. **Conclusion.** Despite the high intraoperative and postoperative risks, THR was the only viable option to improve the patient's quality of life, given the progression of FHAN.

Keywords: femoral head avascular necrosis, endoprosthetics, hip joint, osteoarthritis, organ transplantation, immunosuppression.

INTRODUCTION

According to the 26th official report of the International Society for Heart and Lung Transplantation, more than 85,000 heart transplantations have been performed worldwide to date [1]. Lifelong immunosuppressive therapy in these patients may put them at increased risk of postoperative complications. Among these, orthopedic complications occur in approximately 20% of heart transplant (HT) recipients, with femoral head avascular necrosis (FHAN) being the most prevalent [2]. Reported incidence rates of FHAN in this population range from 3% to 9% [3–5]. According to Leonard et al. [6], the average time to joint replacement surgery after HT is seven years, with patients diagnosed with FHAN often requiring earlier endoprosthetic replacements. There are reports indicating that FHAN may be associated with long-term use of high doses of immunosuppressants [3, 5, 7–9]. In such cases, total hip replacement (THR) remains the gold standard of treatment. Prior investigations have shown that solid organ transplant recipients who have undergone hip replacement surgery achieve pain relief, improved joint function, and enhanced overall quality of life [8].

Our paper presents a clinical case of a patient who underwent successful total hip prosthetic replacement and was followed up dynamically for four years after a heart transplant performed in 2017. A distinctive feature of this case was the patient's unfavorable comorbid profile, which contributed to a high anesthetic risk according to the American Society of Anesthesiologists (ASA) classification.

CLINICAL CASE

Patient V., female, born in 1946, had a long-standing history of arterial hypertension with maximum recorded blood pressure values reaching 200/100 mmHg, although in recent years she had noted a tendency toward hypotension. At the time of admission, her weight was 95 kg, height 179 cm, and body mass index (BMI) 29.6 kg/m^2. She first considered herself ill in 1994, when she began experiencing dyspnea during physical exertion. An electrocardiogram (ECG) at that time revealed frequent ventricular extrasystoles. In 2008, she was diagnosed for the first time with dilated cardiomyopathy, paroxysmal atrial fibrillation, and frequent ventricular and supraventricular extrasystoles. By 2012, the patient exhibited signs of intraventricular and interventricular dyssynchrony, prompting the implantation of a biventricular cardioverter-defibrillator (CRT-D). In March 2013, a disturbance of atrial pacing was detected, necessitating atrial lead implantation. Over the subsequent years, the patient was repeatedly hospitalized for decompensated chronic heart failure (CHF). She was placed on the HT

Corresponding author: Pavel Drozdov. Address: 15, apt. 8, Brusilova str., Moscow, 117148, Russian Federation.
Phone: (962) 985-04-41. E-mail: dc.drozdov@gmail.com

waiting list, and in 2017, underwent orthotopic HT at Shumakov National Medical Research Center of Transplantology and Artificial Organs. The postoperative course was uneventful.

A few months after the HT, the patient began experiencing progressively increasing pain in the right hip joint and her limp worsened. The pain gradually became constant and debilitating, necessitating the use of additional walking support. Over time, she developed pain in the lumbar spine, which was attributed to pelvic obliquity resulting from a developing flexion-adduction contracture of the right hip joint. Outpatient magnetic resonance imaging (MRI) of the pelvis was performed, revealing characteristic features of aseptic necrosis of the femoral head (ANFH) (Fig. 1). An incidental radiographic finding revealed FHAN.

On physical examination, the patient ambulated with a cane in her left hand, demonstrating pronounced limping of the right lower limb, persistent external rotation of the right hip by approximately 10 degrees, and a sharp decrease in weight-bearing capacity on the right leg. Movement within the right hip joint was restricted and elicited sharp pain.

Radiographic evaluation revealed asymmetry of the pelvic ring and uneven narrowing of the right hip joint space, with sclerosis of the subchondral bone. The right femoral head is mushroom-shaped with bone structure changes in the form of lucencies alternating with areas of thickening. In the lateral aspect, a cystic lucency with partial cortical destruction was identified. The femoral head was positioned in an anterolateral subluxation, and massive marginal osteophytes were present (Fig. 2).

At the time of referral to the endoprosthetics center, the patient was receiving maintenance immunosuppressive therapy consisting of tacrolimus 1.5 mg twice daily and mycophenolic acid 360 mg twice daily. In addition to her history of HT, she had experienced deep vein thrombosis of the lower extremities, which progressed to post-thrombophlebitic disease. Her comorbid conditions included polyosteoarthrosis (nodular, erosive variant), secondary gout, secondary hyperparathyroidism, and hypothyroidism – the latter being medically compensa-

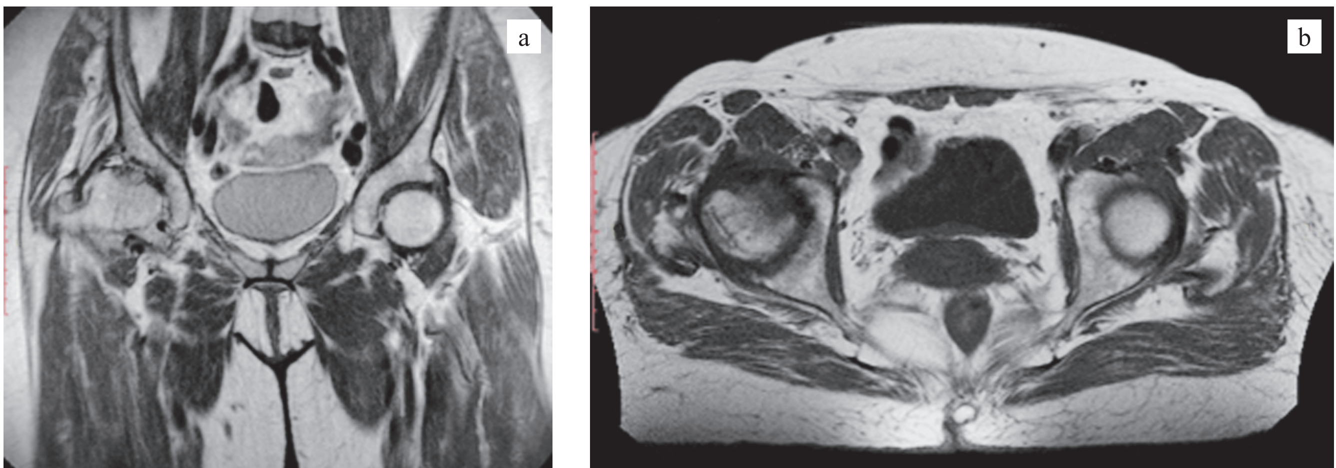

Fig. 1. MRI of the right hip joint showing the FHAN area: a, frontal projection; b, axial projection

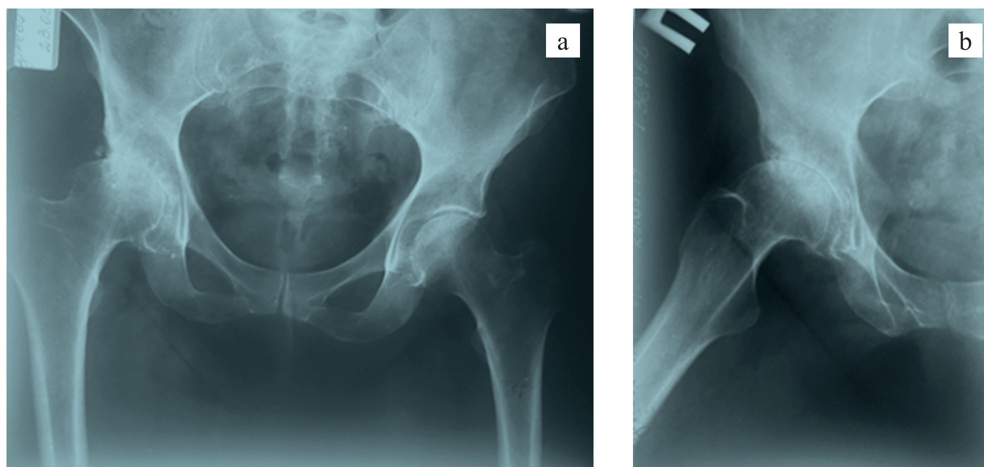

Fig. 2. Preoperative X-ray in anteroposterior projection demonstrating FHAN on the right and grade III coxarthrosis: a, general pelvic view; b, image of the right hip joint

ted. Cardiovascular assessment revealed ischemic heart disease (IHD) and transplant coronary artery disease, as well as chronic heart failure (CHF), stage IIA, functional class II (NYHA). Consequently, her anesthetic risk according to ASA classification was very high.

Despite these challenges, total hip arthroplasty represented the only viable option to relieve the severe pain syndrome that significantly impaired her quality of life, restore weight-bearing capacity of the right lower limb, and recover functional joint mobility.

Although the procedure carried substantial perioperative risks due to the patient's unfavorable comorbid background and ongoing immunosuppressive therapy, reports of successful surgical management of FHAN in solid-organ transplant recipients have been documented in international literature. Taking these precedents into account, a decision was made to proceed with THR surgery.

From a technical standpoint, the THR procedure in this patient did not differ significantly from that performed in the general population. A cementless endoprosthesis was implanted without technical difficulties (Fig. 3).

In the postoperative period, the patient received targeted antibiotic therapy with meropenem 1 g once daily and linezolid 300 mL (2 mg/mL). Anticoagulant therapy with enoxaparin sodium 4000 anti-Xa IU/0.4 mL subcutaneously once daily was initiated on postoperative day 1.

An important intraoperative objective was to minimize blood loss, as excessive hemorrhage could result in serious complications in a heart transplant recipient. Additionally, close monitoring for myocardial ischemia was essential, since denervation of the transplanted heart may mask typical anginal symptoms.

Preoperative hemoglobin levels were 121 g/L. Intraoperative blood loss was estimated at 350 mL, and within the first 24 hours postoperatively, an additional 480 mL of blood loss was recorded. As a result, hemoglobin levels decreased to 83 g/L. Despite comprehensive conservative therapy, including transfusion of 985 mL of red blood cells, 850 mL of fresh frozen plasma, and 300 mL of 10% albumin solution, hemoglobin levels only increased to 105 g/L.

On postoperative day 3, the patient's general condition deteriorated, and persistent edema was observed in the postoperative suture site. An ultrasound examination was performed to identify potential fluid collections. A hypoechoic interstitial lesion measuring up to 18 mL was detected at a depth of 7–8 cm, consistent with soft tissue hematoma. By evening, repeat ultrasound of the posterior surface of the right hip joint revealed a larger hematoma measuring approximately 350 mL.

A contrast-enhanced computed tomography (CT) scan of the right thigh confirmed the presence of a localized fluid collection (approximately 200 mL) along the posterior surface of the femur, with diffuse soft tissue edema. There were no clinical or laboratory signs of ongoing bleeding. A tendency toward hypocoagulation was noted; therefore, the anticoagulant therapy prescribed by protocol was discontinued.

A repeat contrast-enhanced CT scan of the right hip revealed persistent fluid accumulation within the muscle tissue of the operated limb, without evidence of extravasation. Two days later, an ultrasound-guided diagnostic puncture of the fluid collection was performed, yielding approximately 27 mL of hematoma consisting of dark coagulated blood. Laboratory tests revealed moderate hypocoagulation affecting the platelet component, with a hemoglobin level of 99 g/L. Based on these findings, a decision was made to withhold anticoagulant therapy. The postoperative wound healing process proceeded without complications.

A follow-up ultrasound conducted three days later showed two organized soft tissue hematomas measuring 152 mL and 38 mL. Five days later, the ultrasound

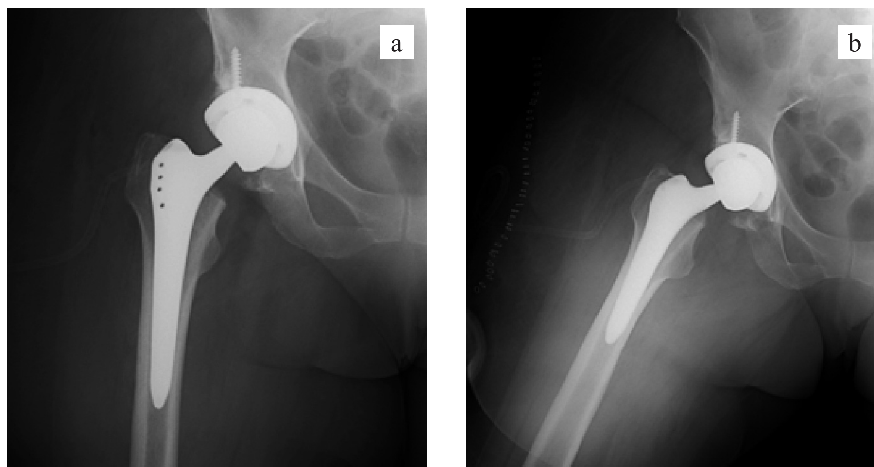

Fig. 3. X-ray on the first postoperative day following total hip arthroplasty of the right hip using a Zimmer–Biomet cementless endoprosthesis (IT cup, Alloclassic stem): a, hip joint in neutral position; b, hip joint in abduction position

showed positive dynamics, with a reduction in hematoma volume to 35 mL and 15 mL on the day before suture removal.

The patient's mobilization and rehabilitation followed the standard activation protocol used for individuals undergoing similar arthroplasty procedures. On postoperative day 1, the patient was able to sit up independently, and by day two, she stood and walked unassisted. Sutures were removed on postoperative day 14, with primary intention wound healing observed.

RESULTS

The Harris Hip Score (HHS) questionnaire was used to assess hip joint function before and after THR. According to standard interpretation, scores of 90–100 indicate excellent results, 80–89 good, 70–79 fair, and below 70 unsatisfactory outcomes [10]. In the preoperative questionnaire, the patient's HHS score was 43.8 points. Postoperatively, the patient was followed up for four years, with comprehensive evaluations conducted at 3, 6, 12, and 24 months, and subsequently annually after surgery.

Preoperative and postoperative examination of the range of motion (ROM) of the operated hip joint over time is presented in Table.

During the first two years following surgery, ROM in the operated hip joint showed a progressive increase. Over the subsequent two years of follow-up (total observation period: four years), ROM indicators remained within the previous estimated range.

Although the patient's HHS remained below 70 during the first 6 months postoperatively, she reported a high level of satisfaction with the surgery owing to marked pain relief and restoration of limb support. One year after THR, the HHS had improved to 82 points, and the ROM in the joint further increased. After two years, the score reached 84 points.

It is noteworthy that the patient's complete rehabilitation within four months was somewhat limited by pain in the contralateral hip joint, where coxarthrosis had developed secondary to FHAN. This was followed by unloading of this joint due to the operated leg, and the pain in it decreased.

Throughout the observation period, we followed a uniform postoperative protocol, the same as for non-transplant patients. X-rays were performed both pre- and postoperatively. Early postoperative imaging confirmed proper implantation, stable fixation and possible malposition of the endoprosthesis, while long-term follow-up radiographs demonstrated satisfactory osseointegration of the prosthetic components, possible osteolysis, polyethylene wear, and possible heterotopic ossification around it. At later stages, it was used to assess the position of the implant and its stability (Figs. 4, 5).

Table

Clinical assessment of the range of motion in the right hip joint

	Flexion	Extension	Abduction	Adduction	Rotation	
					Internal	External
Before surgery	120	175	20	5	0	5
3 months after surgery	100	180	30	5	5	15
6 months after surgery	90	180	40	10	10	15
1 year after surgery	70	180	40	15	15	15
2, 3, and 4 years after surgery	70	180	45	15	15	20

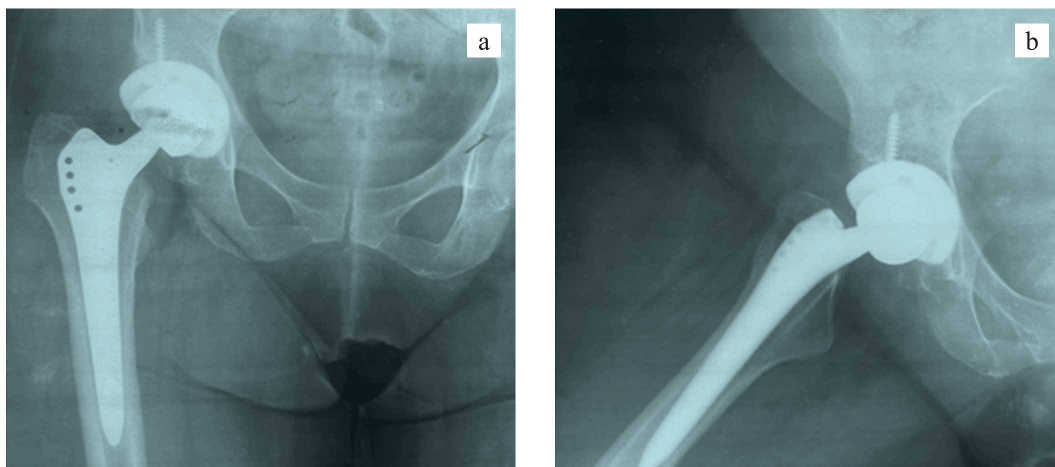

Fig. 4. X-ray six months after total hip arthroplasty of the right hip (Zimmer–Biomet cementless endoprosthesis, IT cup, Alloclassic stem): a, hip joint in neutral position; b, hip joint in abduction position

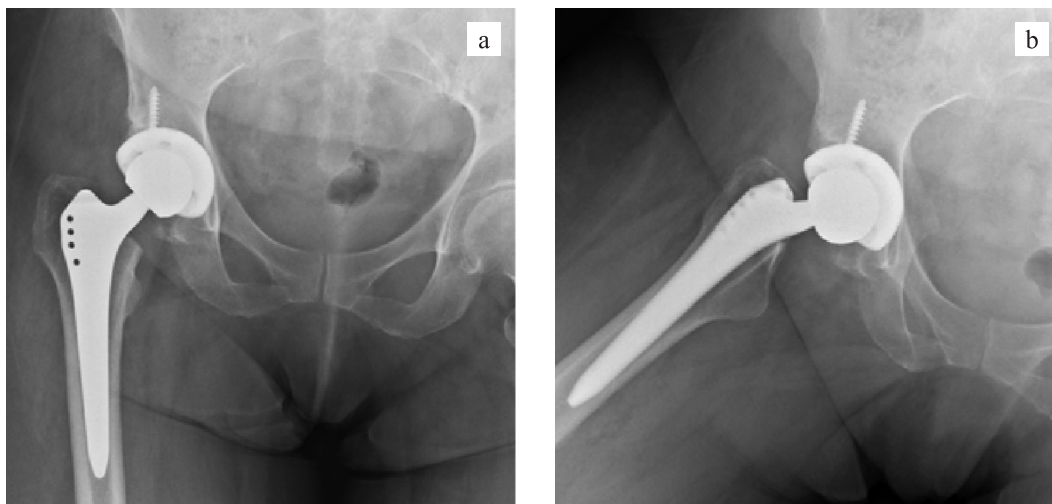

Fig. 5. X-ray four years after total hip arthroplasty of the right hip showing a correct and stable position of the endoprosthesis with evidence of osteointegration: a, hip joint in neutral position; b, hip joint in abduction position

DISCUSSION

The incidence of hip arthroplasty in patients with previous heart transplantation remains relatively rare, and there are limited reports in the international literature addressing this clinical situation. Nevertheless, available studies indicate that organ transplant recipients are at an increased risk of developing FHAN and osteoarthritis, primarily due to long-term corticosteroid and immunosuppressive therapy, with approximately 5% of patients developing FHAN after transplantation [5, 11–12].

In a study by Wu et al. in 2022 published data on 119 hip replacement surgeries performed over 20 years [13]. The leading indication for THR was FHAN (54.6%), followed by severe degenerative joint disease (39.4%), fractures (2.5%), arthritis (1.7%), Perthes disease (0.8%), and osteodysplasia (0.8%). The study further compared outcomes of arthroplasty among recipients of heart, kidney, liver, and lung transplants. Out of 182 hip and knee replacements performed, heart transplant recipients accounted for only 10% of cases.

Patients with transplanted hearts and kidneys tended to be younger compared to those who had undergone liver or lung transplantation, yet they presented with a higher anesthetic risk according to the ASA classification. Despite these risks, the overall outcomes of endoprosthetic replacement were encouraging: implant survival rates reached 95.6% at 1 year and 92.1% at 4 years. Revision surgery was necessary in only 8 cases, of which one patient was a heart transplant recipient.

In the study by Chalmers et al. [14], the 2-year implant survival rate was 95%, and the 5-year survival rate was 94%, with no significant differences depending on the type of implant. Importantly, the authors found no statistically significant association between implant survival and the type of transplanted organ.

A distinctive feature of THR in heart transplant recipients is the necessity for lifelong immunosuppressive therapy, which significantly increases the risk of postoperative infectious complications [9]. In managing such patients, a personalized approach is essential. Adjustment of immunosuppressive regimens and administration of any concomitant medications should be performed in coordination with the transplant center overseeing the patient's long-term care.

The highest incidence of postoperative infections among solid organ recipients is observed in kidney transplant patients [15–16]. This finding is supported by Cavanaugh et al. [17]. Klement et al. further corroborated these observations, demonstrating that patients with kidney transplants undergoing THR exhibit a significantly higher risk of infectious complications compared to non-transplant patients [18].

Comparative analyses between standard THR cohorts and patients with previous solid organ transplantation consistently indicate an elevated risk of infectious complications during the first 90 postoperative days. However, studies also show that by 2 years post-arthroplasty, there is no significant difference in the frequency of complications [19–20].

Given the increased risk of postoperative infectious complications in transplant recipients, perioperative antibiotic prophylaxis is indicated for this patient population. Leonard et al. analyzed 18 cases of total joint arthroplasty performed in HT recipients at Penn State Health Milton S. Hershey Medical Center, where antibiotic prophylaxis was administered intraoperatively and continued for 72 hours postoperatively. Cefazolin was the standard antibiotic of choice, while vancomycin or clindamycin was used in patients with penicillin hypersensitivity [6].

We concur with previous authors who argue that standard antibiotic regimens are generally sufficient for perioperative infection prevention in such cases [21].

However, our case presented unique clinical challenges due to the patient's extensive comorbidities. The development of a large postoperative soft tissue hematoma, despite adequate wound drainage, represented a significant risk factor for secondary infection, particularly in the context of ongoing immunosuppressive therapy and postoperative anemia. That is why we elected to extend the antibiotic course beyond standard practice, administering meropenem and linezolid for an additional 10 days.

N. Brown [22] reported a high postoperative mortality rate among transplant recipients undergoing arthroplasty. Conversely, Navalle et al. [23] found no significant increase in mortality compared to non-transplant patients undergoing similar orthopedic procedures. According to Wu [13], the mortality rate among solid organ recipients was 2.9% one year after arthroplasty and 23.7% four years postoperatively. Similarly, Chalmers et al. [14] reported mortality rates of 3.8% within the first two years and 13.3% within five years following arthroplasty in this patient population.

In our study, the heart transplant recipient underwent THR with favorable clinical and radiographic outcomes. Over a four-year follow-up period, the patient showed sustained implant stability and satisfactory joint function. She currently leads an active lifestyle, walks with a cane, and reports no discomfort in the operated hip joint.

Conclusion

From an orthopedic standpoint, hip replacement surgery in HT recipients does not present any specific technical deviations in terms of surgical access, implant selection, or procedural technique. In our observation, neither the duration of the operation, volume of intraoperative blood loss, nor postoperative recovery dynamics differed significantly from those seen in standard patients. Four years of follow-up demonstrated favorable functional outcomes, including complete resolution, and a marked improvement in the HHS score.

Successful orthopedic intervention in such high-risk patients is contingent upon a multidisciplinary approach within a specialized tertiary or transplant center, ensuring meticulous preoperative evaluation and preparation. This clinical case underscores that, despite the potentially high risk of possible complications in this patient cohort, THR in HT recipients can be considered a relatively safe and effective strategy to enhance overall quality of life and life expectancy.

The authors declare no conflict of interest.

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