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Early clinical and radiological outcomes of cases undergoing cementless total hip arthroplasty

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Ethics Committee Approval
Ethical approval for the study was obtained from the Samsun University Non-Interventional Clinical Research Ethics Committee (Approval No: 2025/24/39, Date: December 22, 2025).
All procedures in this study involving human participants were performed in accordance with the 1964 Helsinki Declaration and its later amendments.

Conflict of Interest
No conflict of interest was declared by the authors.

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Abstract

Background/Aim: Cementless total hip arthroplasty was developed to eliminate the disadvantages of cemented systems and to provide long-term biological fixation. It is widely used in the treatment of advanced coxarthrosis. This study aimed to evaluate early clinical and radiological outcomes of patients who underwent cementless primary total hip arthroplasty (THA) for different etiological reasons and to discuss the findings in light of the literature.
Methods: This retrospective study evaluated 56 hips of 53 patients who underwent cementless primary THA and had regular clinical and radiological follow-up between August 1991 and November 1995. The mean follow-up duration was 16.9 months. Clinical evaluation was performed using the Modified Harris Hip Score (mHHS). Radiological evaluations were performed according to the criteria recommended by the American Hip Society for cementless prostheses. Heterotopic ossification (HO) was assessed using the Brooker classification.
Results: The mean mHHS was 29 before surgery and 88.8 after surgery, and this increase was statistically significant (P<0.001). Good or very good clinical outcomes were achieved in 83.8% of hips. Radiological examination showed preserved stability in the vast majority of femoral and acetabular components. Acetabular component migration was detected in 2 (3.5%) hips, and femoral component migration in 2 (3.5%) hips. Activity-related thigh pain was reported in 10 hips (17.8%). Intraoperative femoral fractures occurred in 6 hips (10.7%). HO was detected in 13 hips (23.2%), mostly Brooker grade I–II. Dislocation, deep infection, and deep vein thrombosis each occurred in 1 hip (1.78%).
Conclusion: Cementless THA is a reliable surgical method that yields successful early clinical and radiological outcomes when applied with appropriate patient selection and correct surgical technique. Larger series and longer follow-up are required to evaluate long-term outcomes.

Keywords: cementless total hip arthroplasty, clinical and radiological outcomes, heterotopic bone

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Introduction

The hip joint is one of the major load-bearing joints in the human body and is subjected to forces averaging up to six times body weight during daily activities [1]. Structural abnormalities of the hip joint caused by degenerative, traumatic, or inflammatory diseases may lead to pain, restricted motion, and functional loss, adversely affecting daily activities and quality of life [1-3]. Therefore, effective and durable functional solutions are essential in the treatment of advanced hip pathologies [2, 3].

Total hip arthroplasty (THA) has been performed successfully for many years to relieve pain and restore function when conservative treatment is insufficient, and it is considered a gold-standard surgical option for advanced coxarthrosis [4-6]. Cemented systems were long regarded as the standard approach; however, cement-related mechanical loosening, particle-induced osteolysis, and technical challenges during revision surgery have been reported over time [7]. In response, cementless THA systems based on biological fixation were developed.

The aim of cementless systems is to achieve sufficient primary mechanical stability in the early period and to obtain durable biological fixation through osseointegration at the bone–prosthesis interface over the long term [8-10]. Implant designs have been improved with respect to surface coatings, porosity, and geometry, and successful clinical and radiological outcomes have been reported with cementless THA [11-13]. Although cementless THA may offer advantages in implant survival in selected patient groups, early stability, thigh pain, component migration, and heterotopic ossification remain debated. Accordingly, detailed evaluation of the early clinical and radiological performance of cementless systems is warranted.

This study aimed to evaluate early clinical and radiological outcomes of patients who underwent cementless primary THA for different etiological reasons in our clinic and to discuss the findings in light of the literature.

Materials and methods

Participants

In this retrospective study, cementless primary THA was performed on 60 hips of 57 patients diagnosed with coxarthrosis due to various etiological causes between August 1991 and November 1995. Considering the follow-up duration, 56 hips of 53 patients were included in the analysis. Of the 56 hips evaluated, 34 (60.7%) belonged to female patients and 22 (39.3%) to male patients. The mean age was 52 (range: 30–75) years, and the mean follow-up period was 16.9 (range: 6–36) months. Primary (idiopathic) coxarthrosis was present in 24 hips, and secondary coxarthrosis in 32 hips. Inclusion criteria were cementless primary THA for various etiological reasons, adequate clinical and radiological follow-up data, and a minimum follow-up of 6 months.

Study Design and Procedures

This study was designed as a retrospective observational study and was conducted in accordance with the Declaration of Helsinki. Ethics approval was obtained from the Samsun University Non-Interventional Clinical Research Ethics Committee (Approval No: 2025/24/39, Date: December 22, 2025).

Cementless fixation principles were applied in all procedures, and primary stability was achieved using the press-fit method. Forty-one hips were operated on in the full lateral decubitus position via a posterolateral incision, and 15 hips were operated on in the supine or lateral decubitus position via a lateral incision. The standard press-fit technique was used for primary coxarthrosis. In patients with secondary coxarthrosis due to developmental dysplasia of the hip (DDH), surgical modifications were required to address acetabular bony defects. In dysplastic hips, acetabular roof reconstruction was performed using an autograft from the femoral head in 7 hips, and medial acetabular defects were filled with a chip graft harvested from the femoral head in 3 hips.

Implants included Omnifit PSL acetabular cups, Omniflex AD titanium-coated stems, and Omniflex H.A. stems (Osteonics) (n=41), as well as Harris/Galante porous acetabular cups and Zimmer anatomical femoral stems (n=15). Although different implant designs were used, cementless press-fit fixation was the standard principle across all procedures. Due to the limited sample size and retrospective design, subgroup analyses comparing implant designs with respect to thigh pain or secondary stability were not performed. All patients received antibiotic prophylaxis and deep vein thrombosis (DVT) prophylaxis with low molecular weight heparin.

Clinical assessment was performed preoperatively and postoperatively using the Modified Harris Hip Score (mHHS) [14]. Clinical and radiological follow-up was performed at 6 weeks, 3 months, 6 months, and 1 year postoperatively. Standard anteroposterior and lateral radiographs of both hips were obtained from a distance of 1 meter, and all measurements were performed on these images. Preoperative osteoporosis was assessed radiologically using the Singh index, and proximal femoral cortical structure was evaluated using the morphological cortical index. Postoperative radiological evaluation followed the criteria recommended by the American Hip Society for cementless prostheses. Radiolucent lines and osteolysis were documented using the DeLee and Charnley zones for the acetabular component and the Gruen zones for the femoral component [15]. HO was graded according to the Brooker classification [16]. Patients were monitored for early and late complications. Functional outcomes were assessed clinically, and component position, stability, and the bone–prosthesis relationship were assessed radiologically.

Statistical analysis

Demographic and clinical characteristics were summarized using descriptive statistics. Continuous variables are presented as mean (SD) and median (minimum–maximum), according to distributional characteristics. The Wilcoxon test was used to compare preoperative and postoperative quantitative values, and the McNemar test was used to analyze categorical variables. The first (Q1) and third (Q3) quartiles were reported to describe distribution across quartiles. Categorical variables are presented as number (n) and percentage (%).

Results

Descriptive data are presented in Table 1. The mean age of the patients was 51.3 (11.6) years. Of the cases, 60.7% were female and 39.3% were male. Secondary coxarthrosis (57.1%) was more common than primary coxarthrosis (42.9%).

Table 2 summarizes early complications after cementless THA. Postoperative dislocation occurred in 1 hip (1.78%) and required cup revision due to insufficient acetabular anteversion. Intraoperative femoral fractures were observed in 6 hips (10.7%): four type I fractures (cerclage required in two cases), one type II fracture, and one type III fracture; the type II and type III fractures were treated with cerclage fixation. HO developed in 13 hips (23.2%), predominantly Brooker grade I. HO was more frequent in hips operated via the lateral approach than the posterolateral approach and was more common in male patients. Thigh pain was reported in 10 hips (17.8%) during follow-up. DVT and early deep infection were each observed in 1 hip (1.78%).

Table 1. Descriptive statistics

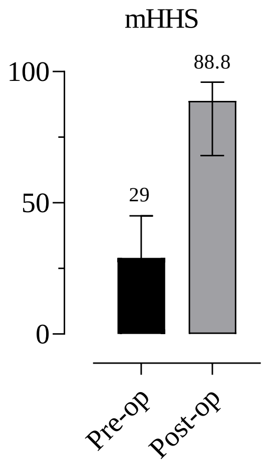
Variable	Mean (SD)	Median (IQR)
Age (years)	51.3 (11.6)	53 (48–58)
	n	%
Gender		
Male	22	39.3
Female	34	60.7
Diagnosis		
Primary coxarthrosis	24	42.9
Secondary coxarthrosis	32	57.1

Table 2. Postoperative complications (per hip, n=56)

Complication	n	%
Intraoperative femoral fracture	6	10.7
Activity-related thigh pain	10	17.9
Dislocation	1	1.8
Deep infection	1	1.8
Deep vein thrombosis	1	1.8
Heterotopic ossification (any)	13	23.2
Brooker grade I	9	16.1
Brooker grade II	3	5.4
Brooker grade III	1	1.8
Brooker grade IV	0	0

Figure 1 shows that the preoperative mHHS median was 29 (range: 8–45), and the postoperative score was 88.8 (range: 68–96). Postoperative mHHS scores increased significantly compared with preoperative values (*P*<0.001).

Figure 1. Preoperative and postoperative mHHS scores.



MHHs: Modified Harris Hip Score

Radiological Findings

Radiological evaluation at 12 months showed sclerotic areas in acetabular zone III and femoral zones II, III, IV, and V in one patient with coxarthrosis secondary to bilateral DDH who underwent right-sided THA. At 24 months, one patient with coxarthrosis secondary to bilateral DDH who underwent left-sided THA showed sclerotic areas in acetabular zones II and III and femoral zones I–VII. At 24 months, another patient with coxarthrosis secondary to bilateral DDH who underwent right-sided THA showed sclerotic areas in acetabular zones I–III and femoral zones II–V. In one patient followed for 24 months, a radiolucent area greater than 1–2 mm was detected around the acetabular component; radiolucent areas were noted around the screws, and sclerotic areas were present in femoral zones I, III, IV, and V. This patient experienced hip dislocation on postoperative day 2 and underwent cup revision. In 2 patients, sclerotic areas were observed only around the femoral component in zones II–V.

Acetabular component migration occurred in 2 patients (3.5%). In a patient who underwent THA for post-traumatic coxarthrosis, 4 mm vertical and 3 mm horizontal migration was detected at 18 months. In another patient, 4 mm vertical and 3 mm horizontal migration was detected at 24 months; this patient was the case with postoperative day-2 dislocation requiring cup revision. Femoral component migration assessment demonstrated 3 mm vertical migration in 2 patients, both of whom had intraoperative type II and type III femoral fractures.

The acetabular cup angle was measured on postoperative anteroposterior radiographs and evaluated for surgical suitability. The cup angle was 35°–55° in 44 hips, 20°–32° in 10 hips, 60° in one hip, and 72° in one hip.

Discussion

In this study, we evaluated early clinical and radiological outcomes after cementless primary total hip arthroplasty (THA). Overall, cementless primary THA was associated with marked early functional recovery, radiological stability in most components, and complication patterns that—when managed appropriately—did not appear to translate into persistent clinical impairment during the available follow-up. Although implant designs and surface technologies have evolved substantially over time, the debate regarding cemented versus cementless fixation persists. Nonetheless, cementless THA has gained wide acceptance, particularly due to favorable long-term fixation and survivorship reported in selected series [17-21].

The press-fit technique and biologically active surface principles used in this cohort remain central to contemporary cementless arthroplasty practice [22]. While the implants used represent earlier generations of modern designs, the fundamental biological mechanism targeted—osseointegration—has not changed [23]. From this perspective, the present data provide clinically relevant insight into the durability of core cementless concepts when applied with appropriate technique and patient selection.

The favorable functional recovery observed at the final follow-up is consistent with prior reports of good-to-excellent outcomes after cementless THA. Lord reported good or excellent outcomes in 87.5% of patients followed for 1–7 years without aseptic loosening [24]. Similarly, Kim et al. [25] reported very good or good outcomes in 88% of patients at mid-term follow-up. Other series have likewise documented high hip scores at follow-up, supporting reliable functional restoration with cementless fixation [19-21, 26]. The general concordance between radiographic assessments and clinical recovery in the current cohort is also in line with the concept that achieving early mechanical stability is a prerequisite for successful biological fixation [8-10].

Postoperative thigh pain remains a clinically important issue after cementless THA and is variably reported in the literature [27-30]. Proposed mechanisms include stem–canal mismatch, distal micromotion, and fibrous tissue formation, which may contribute to subsidence and pain, although the exact pathophysiology remains incompletely defined [31, 32]. In this series, thigh pain was activity-related and improved with rest, suggesting a self-limited course in many cases. Notably, pain was more frequently observed among patients with radiographic migration, raising the possibility that early pain may serve as a clinical signal of mechanical concerns. However, given the relatively short follow-up, causality and long-term implications cannot be established definitively.

Intraoperative femoral fracture is a recognized complication of cementless THA [33]. Reported rates vary widely across series, reflecting differences in patient selection, bone quality, anatomy, and surgical technique [29, 30, 33-35]. In the current study, fractures appeared more frequent in hips with developmental dysplasia of the hip (DDH), which is consistent with the challenging proximal femoral anatomy and canal morphology in this population [35]. Excessive force during preparation or attempts to maximize press-fit fixation may further increase fracture risk [33, 37]. Contemporary evidence indicates that risk is influenced more by patient factors and technical considerations—such as bone quality, cortical thickness, age, sex, and complex femoral anatomy—than by implant design alone [38-40]. The lack of an apparent sustained adverse effect on early clinical status in this cohort likely reflects timely intraoperative recognition and stabilization (e.g., cerclage fixation), as recommended [34].

Heterotopic ossification (HO) is another well-recognized sequela after THA, with a broad reported incidence and variable clinical relevance [16, 41]. In most cases, low-grade HO is considered clinically benign, whereas higher grades may compromise function and range of motion [42]. The multifactorial etiology includes patient-related susceptibility and procedural factors such as surgical approach, operative trauma, infection, and biological predisposition [41, 43]. In this study, HO was more commonly observed after the lateral approach than the posterolateral approach, consistent with reports describing approach-related differences in HO formation [44-46]. HO also appeared more frequent in men, consistent with prior literature [41, 47]. Importantly, the predominance of lower Brooker grades suggests that the clinical impact of HO in this cohort was limited; thus, HO severity—rather than its mere presence—should be prioritized when interpreting functional implications.

Periprosthetic joint infection remains a serious complication after THA, with reported rates varying across settings and eras [27, 48-51]. Data have suggested higher infection rates in some contexts where structural grafts are used, potentially related to longer operative times or increased tissue handling [52]. In this series, femoral head autograft was used in a limited number of cases without subsequent infection, supporting the adequacy of operative conditions and perioperative prophylaxis in the present cohort.

Dislocation after THA is typically multifactorial and strongly linked to component positioning, patient factors, surgical approach, and surgeon experience [53-59]. Early dislocations are frequently attributed to malposition, and stability can often be restored with appropriately targeted revision [60, 61]. In this cohort, the dislocation was attributed to inadequate acetabular anteversion and was managed with cup revision, emphasizing the importance of acetabular orientation and biomechanical restoration [55]. Although some literature associates the posterior approach with higher dislocation risk, this risk can be mitigated substantially with correct component orientation, soft-tissue repair, and experience [55, 62, 63]. The low dislocation frequency in this cohort supports the view that technical execution is a key determinant.

Venous thromboembolism (VTE) remains a preventable but clinically meaningful risk after arthroplasty. Evidence consistently shows markedly higher symptomatic event rates without prophylaxis, whereas contemporary pharmacologic strategies reduce clinically evident deep vein thrombosis and pulmonary embolism to low levels in routine practice [64, 65]. The low frequency of clinically detected events in this series is consistent with the effectiveness of structured prophylaxis protocols.

Limitations

This study has several limitations, including its retrospective design, the relatively small sample size, and the short follow-up period, which preclude definitive conclusions regarding long-term fixation success and implant survivorship. The single-center nature may also limit generalizability. In addition, because implant groups were unequal (n=41 vs. n=15) and the overall sample was limited, meaningful comparative analyses of implant-specific associations (e.g., thigh pain by stem design) could not be performed.

Conclusion

When applied with appropriate patient selection and correct surgical technique, cementless THA provides favorable early clinical and radiological outcomes. Functional recovery and complication patterns were broadly consistent with the literature. Longer-term, adequately powered studies are needed to evaluate sustained fixation and implant survival.

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