

Early Clinical and Functional Outcomes Following Minimally Invasive Total Hip Arthroplasty: A Prospective Study

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Abstract

Background: Minimally invasive total hip arthroplasty has been developed with the aim of reducing soft-tissue trauma, blood loss and postoperative pain while facilitating early mobilization, functional recovery and improved scar appearance. Evaluation of early postoperative outcomes is important for assessing the clinical benefits of this approach.

Aim: To evaluate the early outcomes of minimally invasive total hip arthroplasty, with particular emphasis on blood loss, transfusion requirement, postoperative pain, mobilization, functional recovery, hospital stay and scar appearance.

Methods: A prospective observational study was conducted among 52 patients undergoing minimally invasive total hip arthroplasty. Demographic and clinical characteristics were recorded. Intraoperative blood loss, duration of surgery and transfusion requirement were assessed. Early postoperative outcomes including pain, time to mobilization, duration of hospital stay, wound complications and readmission were documented. Functional recovery and ability to perform basic daily activities were evaluated during early follow-up. Scar appearance was also assessed.

Results: The study included 28 males and 24 females, with most patients aged 61–70 years. Primary osteoarthritis was the most common indication for surgery (61.53%). Mean operative duration was 92.4 ± 16.8 minutes and mean blood loss was 285.6 ± 78.4 mL. Blood transfusion was required in 11.53% of patients. Mean time to first mobilization was 24.6 ± 8.2 hours and mean hospital stay was 3.8 ± 1.2 days. Mean VAS pain score decreased from 7.2 ± 1.1 preoperatively to 3.1 ± 1.0 postoperatively ($p < 0.001$), while the mean hip function score increased from 48.6 ± 9.4 to 78.3 ± 10.2 ($p < 0.001$). Independent walking was achieved by 84.6% of patients, and 90.3% had satisfactory scar appearance.

Conclusion: Minimally invasive total hip arthroplasty was associated with favourable early postoperative outcomes, including reduced pain, early mobilization, functional improvement, acceptable blood loss and satisfactory scar appearance. The findings support MIS THA as an approach capable of facilitating early recovery in appropriately selected patients.

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Introduction

Total hip arthroplasty (THA) is one of the most successful orthopaedic procedures for the management of end-stage hip disorders, particularly when pain, stiffness and functional limitation significantly affect quality of life. Although conventional THA provides predictable pain relief and restoration of hip function, increasing emphasis has been placed on reducing surgical trauma and facilitating early postoperative rehabilitation. This has led to the development and increasing use of minimally invasive surgical (MIS) approaches to total hip arthroplasty. The fundamental principle of MIS hip replacement is to achieve the objectives of

conventional arthroplasty while limiting damage to the surrounding muscles and soft tissues through smaller incisions and less extensive surgical exposure [1,2].

The proposed advantages of minimally invasive THA include reduced intraoperative blood loss, decreased requirement for blood transfusion, less postoperative pain, shorter hospital stay, earlier mobilization and faster return to normal activities [3]. Chimento et al. reported favourable early outcomes with minimally invasive THA, including reduced postoperative pain and improved early recovery [3]. However, the benefits of smaller incisions have not been consistently demonstrated across all studies. Ogonda et al., in a prospective randomized controlled trial,

found that a minimal-incision technique did not necessarily result in improved early postoperative outcomes compared with conventional THA [4]. These findings suggest that the clinical benefits of MIS may depend not only on incision size but also on the surgical approach, soft-tissue handling, surgeon experience and patient-related factors.

Cosmetic appearance is another potential advantage of minimally invasive THA. Smaller incisions may result in shorter and less conspicuous scars, which can contribute to postoperative patient satisfaction [5]. Different minimally invasive approaches, including mini-posterior, anterolateral and direct lateral approaches, have been described, with each technique attempting to preserve soft tissues while providing adequate exposure for accurate component positioning [6,7]. Early functional recovery is particularly important because rapid restoration of mobility may reduce complications associated with prolonged immobilization and allow patients to return more quickly to their usual activities. Lawlor et al. demonstrated differences in early postoperative functional recovery following minimally invasive and conventional THA, highlighting the potential role of MIS in accelerating rehabilitation [8].

Pain reduction following minimally invasive THA is also an important consideration. Dorr et al. reported early pain relief and functional recovery following minimally invasive posterior THA, although the magnitude of benefit requires consideration alongside the technical demands of the procedure [9]. Similarly, studies evaluating muscle strength and walking ability have suggested that less extensive soft-tissue disruption may contribute to earlier restoration of hip function [10]. Nevertheless, minimally invasive THA is technically demanding, and concerns have been raised regarding restricted surgical visualization, component positioning and the potential for complications during the learning curve.

Therefore, evaluation of early postoperative outcomes is important to determine whether the theoretical advantages of minimally invasive THA translate into clinically meaningful benefits. Assessment of parameters such as postoperative pain, blood loss, requirement for transfusion, duration of hospital stay, time to mobilization, functional recovery and wound or scar-related outcomes can provide a comprehensive understanding of the early results of the procedure. The present study was therefore undertaken to evaluate the early outcomes of minimally invasive total hip arthroplasty, with particular emphasis on postoperative recovery, pain, blood loss, functional improvement and other immediate postoperative outcomes.

Material and Methods

This prospective observational study was conducted among patients undergoing minimally invasive total hip arthroplasty for indications requiring primary hip replacement. Patients fulfilling the predefined eligibility criteria and providing informed consent were included in the study. Demographic and relevant clinical information was recorded before surgery. All patients underwent minimally invasive total hip arthroplasty using the selected surgical technique under appropriate anaesthesia. Intraoperative parameters, including duration of surgery and estimated blood loss, were recorded. The requirement for postoperative blood transfusion was also documented.

Patients were assessed during the early postoperative period for pain, mobility, wound condition and functional recovery. Postoperative pain was evaluated using an appropriate pain assessment scale, while early mobilization and ability to perform routine activities were documented. Duration of hospital stay and postoperative complications were also recorded. Functional outcome was assessed using an appropriate validated hip-function assessment tool at the predefined follow-up period. Scar appearance and wound-related outcomes were evaluated during follow-up where applicable. All observations were systematically recorded and analysed to determine the early clinical outcomes of minimally invasive total hip arthroplasty. Continuous variables were expressed as mean with standard deviation, while categorical variables were presented as frequencies and percentages. Appropriate statistical tests were applied, and a p-value of <0.05 was considered statistically significant.

Results

The study included 52 patients undergoing minimally invasive total hip arthroplasty. As shown in **Table 1**, the largest proportion of patients belonged to the 61–70-year age group (38.46%), followed by those aged 51–60 years (26.92%). Males constituted 53.84% of the study population, while females accounted for 48.07%. Right-sided procedures were performed in 51.92% of patients and left-sided procedures in 48.07%. Primary osteoarthritis was the most common indication for surgery (61.53%), followed by avascular necrosis (23.07%).

As presented in **Table 2**, the mean duration of surgery was 92.4 ± 16.8 minutes, while mean intraoperative blood loss was 285.6 ± 78.4 mL. Blood transfusion was required in 11.53% of patients. The mean time to first mobilization was 24.6 ± 8.2 hours, and the mean duration of hospital stay was 3.8 ± 1.2 days. Postoperative wound complications occurred in 5.76% of patients, whereas 1.92% required readmission during the early follow-up period.

According to **Table 3**, substantial improvement was observed in postoperative pain and functional status. The mean VAS pain score decreased from 7.2 ± 1.1 preoperatively to 3.1 ± 1.0 during early postoperative follow-up, with the difference being statistically significant ($p < 0.001$). The mean hip function score increased from 48.6 ± 9.4 to 78.3 ± 10.2 ($p < 0.001$). Independent walking was achieved by 84.6% of patients compared with 7.69% preoperatively. Similarly, the proportion of patients able to perform basic daily activities increased from 17.3% to 78.8%. Satisfactory scar appearance was reported in 90.3% of patients during early follow-up.

Table 1: Demographic and baseline characteristics of patients undergoing minimally invasive total hip arthroplasty (n=52)

Characteristics	Number of patients	Percentage (%)
Age (years)		
≤50	6	11.53
51–60	14	26.92
61–70	20	38.46
>70	12	23.07
Sex		
Male	28	53.84
Female	24	46.15
Side of surgery		
Right	27	51.92
Left	25	48.07
Indication for THA		
Primary osteoarthritis	32	61.53
Avascular necrosis	12	23.07

Other indications	8	15.38
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Table 2: Intraoperative and early postoperative outcomes following minimally invasive total hip arthroplasty (n=52)

Outcome parameter	Mean ± SD / Number (%)
Duration of surgery (minutes)	92.4 ± 16.8
Intraoperative blood loss (mL)	285.6 ± 78.4
Patients requiring blood transfusion	6 (11.53%)
Time to first mobilization (hours)	24.6 ± 8.2
Duration of hospital stay (days)	3.8 ± 1.2
Postoperative wound complications	5 (5.76%)
Readmission within early follow-up	1 (1.92%)

Table 3: Early postoperative pain and functional outcome following minimally invasive total hip arthroplasty (n=52)

Outcome	Preoperative	Early postoperative follow-up	P value
Pain score (VAS, 0–10)	7.2 ± 1.1	3.1 ± 1.0	<0.001

Hip function score	48.6 ± 9.4	78.3 ± 10.2	<0.001
Independent walking, n (%)	4 (7.69)	44 (84.6)	<0.001
Ability to perform basic daily activities, n (%)	9 (17.3)	41 (78.8)	<0.001
Satisfactory scar appearance, n (%)	—	47 (90.3)	—

Discussion

The present study evaluated the early outcomes of minimally invasive total hip arthroplasty in 52 patients, with particular emphasis on blood loss, transfusion requirement, postoperative pain, early mobilization, functional recovery, hospital stay and scar appearance. The findings demonstrated favourable early postoperative outcomes, including relatively low intraoperative blood loss, a low requirement for blood transfusion, early mobilization and significant improvement in pain and functional status. These findings are consistent with the growing evidence supporting minimally invasive approaches as an alternative to conventional total hip arthroplasty in appropriately selected patients.

Goosen et al. [11] compared minimally invasive and conventional procedures for total hip arthroplasty in a randomized controlled trial and reported that minimally invasive surgery could provide satisfactory clinical outcomes without compromising the fundamental objectives of hip replacement. Their findings support the observation in the present study that minimally invasive THA can be associated with satisfactory early recovery. In the current study, the mean time to first mobilization was 24.6 ± 8.2 hours,

suggesting that early mobilization can be achieved following a minimally invasive approach.

The reduction in postoperative morbidity associated with limited soft-tissue disruption is an important proposed advantage of MIS. Berstock et al. [12], in a systematic review and meta-analysis comparing standard and mini-incision posterior approaches, evaluated several perioperative and early postoperative outcomes. Their findings indicated potential advantages of minimally invasive techniques in selected perioperative parameters, although the magnitude of benefit varied between studies. In the present study, mean intraoperative blood loss was 285.6 ± 78.4 mL and only 11.53% of patients required blood transfusion. These findings suggest that minimizing surgical exposure may contribute to acceptable perioperative blood conservation.

Migliorini et al. [13] performed a meta-analysis of clinical trials evaluating minimally invasive versus conventional approaches for total hip arthroplasty. Their analysis demonstrated that MIS techniques may offer advantages in some early postoperative outcomes, although differences were not uniformly observed across all evaluated parameters. This variability is important because the benefits of MIS may be influenced by surgical approach, patient characteristics, surgeon experience and perioperative rehabilitation protocols. The present study nevertheless demonstrated substantial early improvement in pain and function, with the mean VAS score decreasing from 7.2 ± 1.1 preoperatively to 3.1 ± 1.0 postoperatively.

The functional improvement observed in the present study is also supported by more recent evidence. Migliorini et al. [14] reviewed factors influencing the outcomes of minimally invasive THA and emphasized that patient selection, surgical technique and perioperative management can influence postoperative recovery. In the current study, the mean hip function score improved from 48.6 ± 9.4 preoperatively to 78.3 ± 10.2 during early follow-up, while 84.0% of patients achieved independent walking. These findings indicate substantial early functional recovery following minimally invasive THA.

Recent comparative evidence has further emphasized the potential role of different surgical approaches in influencing early recovery. Wang et al. [15] reported differences in early clinical outcomes and safety across surgical approaches used for total hip arthroplasty. In the present study, the mean hospital stay was 3.8 ± 1.2 days, supporting the possibility of relatively rapid postoperative discharge following MIS THA. In addition, 90.3% of patients demonstrated satisfactory scar appearance, which is relevant because cosmetic improvement is one of the principal patient-oriented objectives of minimally invasive surgery.

Despite these favourable findings, the results should be interpreted in the context of the study design and early follow-up period. Minimally invasive THA is technically demanding and requires adequate surgical expertise. Smaller incisions alone do not necessarily guarantee superior clinical outcomes, and inappropriate patient selection or inadequate visualization may compromise component positioning and increase complications. Therefore, the benefits of MIS should be considered alongside surgical safety and appropriate patient selection. Longer follow-up studies and comparative randomized trials are required to determine whether the early advantages observed in the present study translate into sustained functional benefits.

Conclusion

Minimally invasive total hip arthroplasty demonstrated favourable early postoperative outcomes in the present study of 52 patients. The procedure was associated with acceptable intraoperative blood loss, a relatively low transfusion requirement, early mobilization and a short hospital stay. Significant improvement was observed in postoperative pain and hip function, with most patients achieving independent walking and satisfactory performance of basic daily activities during early follow-up. The high proportion of patients reporting satisfactory scar appearance also supports the potential cosmetic benefit of the minimally invasive approach. Overall, minimally invasive THA appears to be associated with encouraging early recovery when performed with appropriate surgical expertise and patient selection. Further comparative studies with larger populations and longer follow-up are warranted to establish its longer-term clinical benefits.

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