

Is dislocation following total hip arthroplasty caused while suffering from delirium?

Takaomi Kobayashi, Tadatsugu Morimoto, Motoki Sonohata and Masaaki Mawatari

Department of Orthopaedic Surgery, Faculty of Medicine, Saga University, Saga, Japan

ABSTRACT

The mechanisms and pathologies of dislocation following total hip arthroplasty (THA) in patients with postoperative delirium remain unclear. Therefore, we conducted a retrospective study of 738 patients (738 hips) who underwent unilateral THA for the treatment of hip osteoarthritis. The patients were divided into two groups; with ($n = 8$) and without postoperative delirium ($n = 730$). Patients with postoperative delirium had a higher rate of dislocation following THA due to falling from a standing position on hospitalization than those without postoperative delirium (1/8 [12.5%] patients vs. 0/730 [0%] patients, $p = 0.011$). A power of 80.2% was provided for the rate of dislocation following THA due to falling from a standing position on hospitalization. Postoperative delirium after THA could be a cause of falling from standing position, leading to dislocation following THA during hospitalization. Therefore, postoperative delirium and its associated falls and injuries during hospitalization should be avoided by the elimination of patient's preventable conditions and adjustment of the hospital environments, particularly in patients with the risk factors for postoperative delirium (eg. older age, general anesthesia, medications given [intraoperative opioids and ketamine and postoperative ketamine and benzodiazepines], higher comorbidity burden [diabetes mellitus, renal diseases, depression, anxiety, and psychoses], and blood transfusions). Further investigations with a larger cohort are needed to clarify this issue.

Keywords: total hip arthroplasty, dislocation, postoperative delirium

Abbreviations:

THA: total hip arthroplasty

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INTRODUCTION

Recently, the rate of dislocation following total hip arthroplasty (THA) in patients with postoperative delirium has reportedly been increased.¹ However, the mechanisms and pathologies involved remain unclear. We hypothesize that postoperative delirium after THA may be one of the causes of falling or accidental injury, resulting in dislocation following THA during hospitalization. The purpose of the present study is to investigate the etiologies of dislocation during hospitalization in patients who underwent unilateral primary THA for the treatment of

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Corresponding Author: Takaomi Kobayashi, MD

Department of Orthopaedic Surgery, Faculty of Medicine, Saga University, 5-1-1 Nabeshima, Saga 849-8501, Japan

TEL: +81-952-31-6511, Fax: +81-952-34-3157, E-mail: m10036tk@jichi.ac.jp

hip osteoarthritis with postoperative delirium.

MATERIALS AND METHODS

Patients

Of the 852 consecutive patients (888 hips) who received a THA implant in our institution between January 2010 and September 2011, 738 patients (738 hips) who underwent unilateral primary THA (using the posterolateral approach) for the treatment of primary hip osteoarthritis (52 patients, 52 hips), developmental dysplasia of the hip (623 patients, 623 hips), avascular necrosis of the femoral head (28 patients, 28 hips), rapidly destructive coxarthrosis (13 patients, 13 hips), rheumatoid arthritis (9 patients, 9 hips) post-traumatic osteoarthritis (7 patients, 7 hips), and Perthes' disease (6 patients, 6 hips) were considered eligible for this study. These included 105 male patients and 633 female patients, with an average age at the time of surgery of 62.8 years (range, 22–92 years). The exclusion criterion was revision THA (77 patients, 113 hips) or THA performed for hips after pelvic osteotomy (29 patients, 29 hips) and ankylosed hips (8 patients, 8 hips). The hospital Institutional Review Board approved the study design (registration number: 2020-01-R-06).

Postoperative delirium

The presence of postoperative delirium on hospitalization was determined using the Diagnostic and Statistical Manual of Mental Disorders, 4th Edition, Text Revision,² assessed postoperatively by doctors and nursing staff. The patients were divided into two groups; with ($n = 8$) and without postoperative delirium ($n = 730$). Information on the patients with postoperative delirium is shown in Table 1.

Table 1 Clinical data of the patients who suffered from postoperative delirium

Case	Age (years)	Sex	Content	Limb restraint	Place	Treatment	Duration (days)	THA dislocation	Outcomes
1	82	Female	Disorientation	None	On the bed	None	2	None	Full recovery
2	77	Male	Fall	None	In the hospital room	None	1	Present	Full recovery
3	82	Female	Disorientation	None	On the bed	Pentazocine 15mg intramuscular	19	None	Full recovery
4	76	Female	Rampage	None	On the bed	None	2	None	Full recovery
5	76	Male	Rampage	None	On the bed	Haloperidol 2.5 mg intramuscular	3	None	Full recovery
6	76	Female	Took off her pants	None	In the hospital room	None	1	None	Full recovery
7	65	Female	Rampage	None	On the bed	Pentazocine 15mg intramuscular	4	None	Full recovery
8	80	Male	Abuse	None	On the bed	None	2	None	Full recovery

THA: total hip arthroplasty

Outcome parameters

We extracted data on patient age at THA, gender, body mass index, indications for THA, risk factors for falls (visual deficit, age >80 years, hemiplegia after cerebral infarction, use of postoperative ketamine and benzodiazepines, use of intraoperative opioids and ketamine, three or more medications, and depression and anxiety),³ THA (approach, surgical time, and blood loss), and postoperative blood transfusion. Visual acuity was assessed based on medical records and/or visual acuity screening.^{3,4} Depression and anxiety were defined as follows^{3,5}: symptoms of anxiety and depression are both present, but neither is clearly predominant, and neither type of symptom is present to the extent that it justifies a diagnosis if considered separately. When both anxiety and depressive symptoms are present and severe enough to justify individual diagnoses, both diagnoses should be recorded and this category should not be used. The number of patients who received blood transfusions during hospitalization was recorded.

The primary outcome of this study was THA dislocation on hospitalization. The behavior just before the sudden onset of hip pain and/or difficulty in standing/walking was defined as a cause of dislocation.

Statistical analysis

Fisher's exact test was used to compare qualitative data between the two groups. The normality of distribution of quantitative data was determined using the Kolmogorov-Smirnov test. For normally distributed variables, the equality of variance between groups was tested using Levene's test. Since the age at THA and surgical time did not exhibit a normal distribution, their descriptive statistics were shown as the median [minimum - maximum] and the Mann-Whitney U-test was used for comparing the groups. Since body mass index and blood loss showed normal distribution with equal variance, the descriptive statistics were shown as the mean \pm standard deviation and Student's *t*-test was used for the comparison of independent groups. A value of $p < 0.05$ was considered statistically significant. The analyses were performed using the Statistical Package for Social Sciences software program, version 19 (IBM Corp., Armonk, NY, USA). In addition, a post hoc power analysis for Fisher's exact test, Student's *t*-test, or Mann-Whitney U test (setting of $\alpha = 0.05$) was performed based on the outcome parameters with a significant difference between the two groups, using G*Power v.3.1.2.

RESULTS

Patient demographics

The results are shown in Table 2. Patients with postoperative delirium were significantly older (77 [65–82] years vs. 62 [22–92] years, $p < 0.001$) and included a higher percentage of patients > 80 years of age (3/8 [37.5%] patients vs. 46/730 [6.3%] patients, $p = 0.012$) and a lower incidence of developmental dysplasia of the hip (4/8 [50.0%] patients vs. 619/730 [84.8%] patients, $p = 0.024$) than those without postoperative delirium. A power of 100%, 79.1%, and 70.5% were provided for age, percentage of patients > 80 years of age, and rate of developmental dysplasia of the hip.

Table 2 Patient demographics, indications for total hip arthroplasty (THA), comorbidities, preoperative medication, THA, postoperative blood transfusion, and THA dislocation on hospitalization

Characteristics	With postoperative delirium (<i>n</i> = 8)	Without postoperative delirium (<i>n</i> = 730)	<i>p</i> value
Patient demographics			
Age at THA (years)**	77 [65–82]	62 [22–92]	<0.001
Gender (men / women ratio)	3 / 5	102 / 628	0.092
Body mass index (kg/m ²)*	22.8 ± 5.2	24.3 ± 4.0	0.446
Indications for THA			
Primary hip osteoarthritis, <i>n</i> (%)	2 (25.0)	50 (6.8)	0.104
Developmental dysplasia of the hip, <i>n</i> (%)	4 (50.0)	619 (84.8)	0.024
Avascular necrosis of the femoral head, <i>n</i> (%)	1 (12.5)	27 (3.7)	0.267
Rapidly destructive coxarthrosis, <i>n</i> (%)	0 (0)	13 (1.8)	1.000
Rheumatoid arthritis, <i>n</i> (%)	0 (0)	9 (1.2)	1.000
Post-traumatic osteoarthritis, <i>n</i> (%)	1 (12.5)	6 (0.8)	0.074
Perthes' disease, <i>n</i> (%)	0 (0)	6 (0.8)	1.000
Risk factors for falls			
Visual deficit, <i>n</i> (%)	1 (12.5)	20 (2.7)	0.207
Age > 80 years, <i>n</i> (%)	3 (37.5)	46 (6.3)	0.012
Hemiplegia after cerebral infarction, <i>n</i> (%)	1 (12.5)	21 (2.9)	0.216
Use of postoperative ketamine and benzodiazepines, <i>n</i> (%)	2 (25.0)	39 (5.3)	0.068
Use of intraoperative opioids and ketamine, <i>n</i> (%)	0 (0)	0 (0)	1.000
Three or more medications, <i>n</i> (%)	5 (62.5)	306 (41.9)	0.292
Depression and Anxiety, <i>n</i> (%)	0 (0)	8 (1.1)	1.000
THA			
Posterolateral approach, <i>n</i> (%)	8 (100)	730 (100)	1.000
Surgical time (minutes)**	41.0 [27.0–53.0]	42.0 [23.0–180.0]	0.334
Blood loss (mL)*	240.4 ± 117.5	274.9 ± 119.4	0.436
Postoperative blood transfusion, <i>n</i> (%)	2 (25.0)	116 (15.9)	0.621
THA dislocation on hospitalization			
Falling from a standing position, <i>n</i> (%)	1 (12.5)	0 (0)	0.011
Moving in a deep-seated position on the bed, <i>n</i> (%)	0 (0)	3 (0.4)	1.000

THA: total hip arthroplasty

Normally and non-normally distributed variables are presented as the mean ± standard deviation and median [minimum - maximum] and were compared using *Student's *t*-test and **the Mann-Whitney U-test, respectively.

Primary outcomes

Patients with postoperative delirium had a higher rate of dislocation following THA due to falling from a standing position on hospitalization than those without postoperative delirium (1/8 [12.5%] patients vs. 0/730 [0%] patients, $p = 0.011$). A power of 80.2% was provided for a rate of dislocation following THA due to falling from a standing position on hospitalization.

Representative cases

A 77-year old man underwent THA for the treatment of primary hip osteoarthritis. He had taken Nifedipine (10 mg/day) for hypertension and had no medical history of weakness of the extremities, visual deficit, hemiplegia after cerebral infarction, depression or anxiety. He suffered from postoperative delirium at night on postoperative day 1, fell from a standing position in the hospital room while suffering from delirium, and subsequently felt hip pain; this led to difficulty in standing/walking. No treatment was given for delirium, which improved the next morning. An X-ray revealed THA dislocation, which was immediately treated under sedation. At three weeks after surgery, he had regained walking ability without any complications and was discharged to home.

DISCUSSION

The main finding of this study was that patients with postoperative delirium had a higher rate of dislocation following THA due to falling from a standing position on hospitalization than those without postoperative delirium.

Postoperative delirium after THA could be a cause of falling from standing position, leading to dislocation following THA during hospitalization. Therefore, postoperative delirium and its associated falls and injuries during hospitalization should be avoided by the elimination of patient's preventable conditions (eg, pain) and adjustment of the hospital environments (eg, fall prevention tools), particularly in patients with the risk factors presented here; older age, type of anesthesia (eg, general anesthesia), medications given (eg, intraoperative opioids and ketamine and postoperative ketamine and benzodiazepines), higher comorbidity burden (eg, diabetes mellitus, renal diseases, depression, anxiety, and psychoses), blood transfusions, etc.⁶⁻⁸

Postoperative delirium can persist for weeks to months after its initial recognition.⁹ Furthermore, postoperative delirium has been shown to be associated with an increased risk of long-term complications (eg, cognitive decline).^{1,9} However, a causal relationship between postoperative delirium and its associated long-term complications and dislocation following THA after discharge has not yet been definitively established. Further investigations are needed.

The present study was associated with some limitations. First, it involved a small number of subjects with postoperative delirium (8 patients) and dislocation (1 patient), possibly indicating that a significant difference observed in this study design is less clinically reliable. Nevertheless, a power of 80.2% was provided, and the representative case did not have risk factors for falls (visual deficit, age > 80 years, hemiplegia after cerebral infarction, use of postoperative ketamine and benzodiazepines, use of intraoperative opioids and ketamine, three or more medications, depression or anxiety).³ Therefore, postoperative delirium after THA could be a cause of falling from a standing position and subsequent dislocation following THA during hospitalization. The prevalence of postoperative delirium following THA is reported to be 0.6–1.7%,^{1,6,8} and thus more subjects are needed to clarify this issue. Second, the cognitive function (eg, Mini-Mental State Examination and Hasegawa Dementia Rating Scale-Revised) was not assessed in detail in this study. This could influence the primary outcome, as cognitive impairment has been reported

as a risk factor for falls.³

In conclusion, postoperative delirium after THA could be a cause of falling from standing position, leading to dislocation following THA during hospitalization. Therefore, postoperative delirium and associated falls and injuries during hospitalization should be avoided by eliminating the patient's preventable conditions and adjustment of the hospital environment. Further investigations with a larger cohort are needed to clarify this issue.

CONFLICT OF INTEREST

The authors declare that there are no conflicts of interest.

FUNDING

None.

INFORMED CONSENT

All patients and their family provided consent for submission of the case for publication.

IRB APPROVAL

All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional review board of Saga University Hospital (registration number: 2020-01-R-06) and with the 1964 Declaration of Helsinki and its later amendments or comparable ethical standards.

PERMISSIONS

This article partially includes patients' data from a study that has already been published: Takema Nakashima, Tadatsugu Morimoto, Yutaka Yonekura et al (2015) Delirium following total hip arthroplasty. *Orthopedics & Traumatology* 64(4):865–868 (in Japanese). <https://doi.org/10.5035/nishiseisai.64.865>. The authors have already obtained the relevant approval from the editors of *Orthopedics & Traumatology* (West-Japanese Society of Orthopedics & Traumatology).

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