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Outcomes of Hip Arthroplasty in Patients with Preoperative Thrombocytopenia

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Background: Thrombocytopenia is a condition where platelet counts are below the normal range (< 150 ×10^3/μL), resulting in a higher risk of bleeding and affecting the results of hip arthroplasty. We assessed the impact of preoperative platelet counts on the clinical results of patients who underwent hip arthroplasty.

Methods: Between April 2003 and March 2023, 437 patients (451 hips), who had preoperative thrombocytopenia of less than 150 ×10^3/μL platelets, underwent hip arthroplasty. Preoperative platelet levels were categorized into severe thrombocytopenia (< 50 ×10^3/μL) and non-severe thrombocytopenia (50–149 ×10^3/μL). Total blood loss, operation time, requirement of transfusion, amount of transfusion, duration of surgical wound oozing, length of hospital stay, mortality rate at 1 year after surgery, and any complication were compared between the 2 groups.

Results: No notable differences were observed in the surgery time or the total amount of blood loss between the groups. The requirement of transfusion and the amount of transfused blood were higher in the severe thrombocytopenia group. Prolonged oozing was found in around 18% in both groups, while periprosthetic joint infections occurred in 3 of the non-severe thrombocytopenia group. No significant difference was noted in the duration of hospital stay (25.6 ± 18.3 days vs. 19.4 ± 16.6 days, p = 0.067) and 1-year mortality (22.2% vs. 11.8%, p = 0.110).

Conclusions: Hip arthroplasties are safe for patients with low platelet counts and do not lead to prolonged hospital stays. On the other hand, patients with severe thrombocytopenia tend to need blood transfusions more frequently than those with less severe thrombocytopenia.

Keywords: *Thrombocytopenia, Hip arthroplasty, Complications, Treatment outcome, Liver cirrhosis*

Hip arthroplasty is a procedure performed to relieve pain and improve mobility in patients with advanced hip joint arthritis or hip fractures.[1] However, the success of this surgery can be affected by several factors, including preexisting medical conditions such as thrombocytopenia, which is a condition of a low platelet count in the blood.[2]

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Thrombocytopenia is an abnormally low level of blood platelets (< 150 $\times 10^3$/μL), and this condition can arise from insufficient production of platelets in the bone marrow, the creation of antibodies that attack platelets, or the trapping of platelets in the spleen.[3,4] It can be relatively mild (100–149 $\times 10^3$/μL) and asymptomatic, moderate (50–99 $\times 10^3$/μL), or severe (< 50 $\times 10^3$/μL).[3]

Thrombocytopenia may increase the risk of bleeding during surgery[2,4,5] and is associated with postoperative complications including hematoma, wound problems, surgical site infection, renal injury, adverse pulmonary events, and early mortality in patients undergoing surgical procedures.[4-6] In patients with thrombocytopenia, hip arthroplasty requires careful planning and management to minimize the risk of bleeding complications, because hip arthroplasty is one of the major orthopedic surgeries, inevitably resulting in substantial bleeding during and after the surgery.[7] However, there are only few studies evaluating the effects of thrombocytopenia on hip arthroplasty.

Hence, the aim of this research was to assess the impact of preoperative platelet counts on the clinical results of patients receiving hip arthroplasty regarding the length of stay, transfusion, wound problems, and periprosthetic joint infection.

METHODS

After obtaining approval from the Institutional Review Board of Seoul National University Bundang Hospital (IRB No. B-2312-873-101), we conducted a retrospective analysis of all patients who received primary total hip arthroplasty (THA) or hemiarthroplasty (HA) between April 2003 and March 2023 at Seoul National University Bundang Hospital. Informed consent was waived due to the retrospective nature of the study design. The criteria for inclusion were (1) a primary THA or HA, (2) being older than 18 years at the time of the operation, and (3) thrombocytopenia (platelet count of 150 $\times 10^3$/μL or less) before the surgery. Patients receiving simultaneous bilateral arthroplasties and staged bilateral arthroplasties were excluded.

From April 2003 to March 2023, we performed a total of 5,283 THAs in 4,390 patients, and 1,991 HAs in 1,907 patients. Among these patients, preoperative thrombocytopenia of less than 150 $\times 10^3$/μL platelets was observed in 437 patients (451 hips). No patients in the entire cohort met the specified exclusion criteria. Among these enrolled patients, there were 116 patients (123 hips) who underwent THA and 321 patients (328 hips) who underwent HA (Fig. 1).

All hip arthroplasty candidates routinely underwent complete blood count screening for medical clearance. Reasons for thrombocytopenia (< 150 $\times 10^3$/μL) were specified based on previous medical history, preoperative consultation by a hematologist, and preoperative assessment by an anesthesiologist.

In terms of thrombocytopenia, preoperative medical clearance revealed diagnoses of liver cirrhosis (LC), immune thrombocytopenia (ITP), hematologic disease, end-stage renal disease (ESRD), drug-induced thrombocytopenia (anticancer drug, antibiotics, and phenytoin), rheumatic diseases such as systemic lupus erythematosus (SLE), and consultation with a specialist of internal medicine, if needed. The diagnosis of ITP was identified based on the criteria set by the International Working Group, following an extensive hematologic assessment that included a consultation with a hematologist.[8] Out of the 45 patients, 31 were diagnosed with ITP following the preoperative hematological assessment. The remaining 14 patients had been previously diagnosed with chronic ITP and were under the management of a hematologist. Hematologic diseases included hematologic malignancies such as lymphoma, leukemia, multiple myeloma, and aplastic anemia. When we could not find any reason for thrombocytopenia in trauma patients, it was considered trauma-related thrombocytopenia.[9]

Preoperative platelet levels were classified as < 50 $\times 10^3$/μL (se-

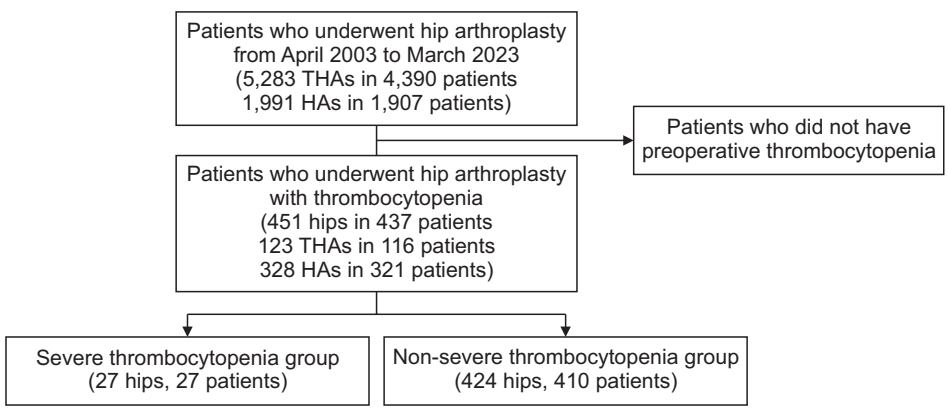

Fig. 1. Enroll flowchart. THA: total hip arthroplasty, HA: hemiarthroplasty.

vere thrombocytopenia) and 50 to 149 $\times 10^3$/μL (mild to moderate thrombocytopenia). Among 437 patients, 27 patients (27 hips) were classified into the severe thrombocytopenia group (ranging from 7 to 49 $\times 10^3$/μL), and 410 patients (424 hips) into the non-severe thrombocytopenia group (ranging from 51 to 149 $\times 10^3$/μL). The preoperative platelet count was 34.1 ± 13.5 $\times 10^3$/μL in the severe group, whereas 105.9 ± 24.9 $\times 10^3$/μL in the non-severe group ($p < 0.001$) (Table 1).

Table 1. Demographics of Patients with Preoperative Thrombocytopenia

Variable	Severe thrombocytopenia (n = 27)	Non-severe thrombocytopenia (n = 424)	*p*-value
Sex			0.899
Female	16 (59.3)	246 (58.0)	
Male	11 (40.7)	178 (42.0)	
Age (yr)	66.9 ± 12.4	74.5 ± 14.3	0.007
Body mass index (kg/m^2)	23.8 ± 3.7	22.2 ± 3.5	0.023
Koval class	2.6 ± 2.0	2.2 ± 1.8	0.335
ASA physical status classification score	2.7 ± 0.7	2.4 ± 0.6	0.018
Preoperative platelet counts (×10^3/μL)	34.1 ± 13.5	105.9 ± 24.9	< 0.001
Reason of thrombocytopenia			< 0.001
LC	11 (40.7)	76 (18.0)	
ITP	7 (25.9)	38 (9.0)	
Hematologic disease	3 (11.1)	9 (2.1)	
ESRD	1 (3.7)	62 (14.6)	
Drug-related	4 (14.8)	12 (2.8)	
Trauma-related	1 (3.8)	221 (52.1)	
SLE	0	6 (1.4)	
Anesthesia			< 0.001
Regional	15 (55.6)	361 (85.1)	
General	12 (44.4)	63 (14.9)	
Reason of surgery			< 0.001
ONFH	9 (33.3)	69 (16.3)	
Osteoarthritis	2 (7.4)	29 (6.8)	
Hip fracture	14 (51.9)	317 (74.7)	
Miscellaneous	2 (7.4)	9 (2.2)	
Type of surgery			0.039
THA	12 (44.4)	111 (26.2)	
HA	15 (55.6)	313 (73.8)	
Follow-up period (mo)	40.9 ± 48.4	39.3 ± 38.3	0.840

Values are presented as number (%) or mean ± standard deviation.
ASA: American Society of Anesthesiologists, LC: liver cirrhosis, ITP: immune thrombocytopenia, ESRD: end-stage renal disease, SLE: systemic lupus erythematosus, ONFH: osteonecrosis of the femoral head, THA: total hip arthroplasty, HA: hemiarthroplasty.

The severe thrombocytopenia group included younger patients (66.9 ± 12.4 vs. 74.5 ± 14.3, $p = 0.007$) than the non-severe thrombocytopenia group. The severe thrombocytopenia group showed higher body mass index (23.8 ± 3.7 vs. 22.2 ± 3.5, $p = 0.023$), and higher American Society of Anesthesiologists scores (2.7 ± 0.7 vs. 2.4 ± 0.6, $p = 0.018$).

General anesthesia was more commonly performed in the severe thrombocytopenia group, compared with the non-severe thrombocytopenia group (44.4% vs. 14.9%, $p < 0.001$) (Table 1). Regarding the underlying causes of thrombocytopenia, in the severe thrombocytopenia group, LC was the most common reason (11 patients, 40.7%), followed by ITP (7 patients), drug-related thrombocytopenia (4 patients), hematologic disease (3 patients), ESRD (1 patient), and trauma (1 patient). In the non-severe thrombocytopenia group, trauma was the most common reason (221 patients, 52.1%), followed by LC (76 patients) and ESRD (62 patients) (Table 1).

Throughout the duration of the study, if the hemoglobin (Hb) level fell below 8 g/dL or if there were preoperative symptoms or signs of acute anemia, such as dizziness, chest pain, rapid heart rate, and ongoing low blood pressure, the patient underwent a blood transfusion. Following surgery, monitoring was conducted for symptoms or signs of anemia, as well as Hb levels. If patients displayed symptoms or signs of anemia, or if their Hb level dropped below 8 g/dL within the first 3 days after surgery, they received a postoperative transfusion.[10] Transfusion of platelet concentrates was indicated when the platelet count fell below 80 $\times 10^3/\mu L$.[11] The patients with severe thrombocytopenia received platelet supplementation before surgery. The mean amount of preoperative platelet transfusion was 11.0 ± 16.2 units.

All the operations were performed by 5 surgeons (KHK, YCH, YKL, WLJ, and JWP). Among 451 procedures, the majority (n = 449) were performed through a posterolateral approach, 1 was conducted with a direct anterior approach, and the other employed a combined approach. In both groups, all hip procedures utilized cementless components. The amount of blood loss during the surgical procedure was quantified through the assessment of blood volume collected in the suction device, evaluation of the weight of blood-soaked surgical sponges, and visual approximation of hemorrhage in the surgical site. In every case, patients were provided with closed suction drains as a routine part of their care.

The postoperative management was consistent for both groups. The drains were extracted 48 hours following the surgery, and the amount of fluid collected was documented as postoperative blood loss. In both groups, only mechanical compression devices were employed for prophylaxis against deep vein thrombosis.[12-14]

Transfusions were carried out depending on the results from hematological analyses and the volumes of blood gathered via suction drains. Throughout the entire postoperative period, the transfusion thresholds were set at Hb levels of 8 g/dL for packed red blood cells and platelet count of 80 $\times 10^3/\mu L$ for platelet concentrates.[10]

All patients underwent identical postoperative rehabilitation protocols. Patients were permitted to stand on the second or the third day after the operation and gradually transitioned to partial weight-bearing with crutches when possible. Full weight-bearing was permitted between 4 to 6 weeks postoperatively. Total blood loss, operation time, requirement of transfusion, amount of transfusion, duration of surgical wound oozing, length of hospital stay, mortality rate at 1 year after surgery, and any complication were compared between the severe thrombocytopenia group and the non-severe thrombocytopenia group. Prolonged oozing was defined as oozing persisting for more than 4 days after the surgery.[15]

Statistical Methods

Categorical variables were assessed using chi-square or Fisher's exact tests for statistical significance. Continuous data were analyzed with the student *t*-test where applicable. Statistical significance was determined for *p*-values less than 0.05. All analyses were carried out with the SPSS software version 27.0 (IBM Corp.).

RESULTS

No significant differences were observed in operation duration, blood loss during surgery, postoperative fluid discharge, and overall blood loss between the 2 groups (Table 2). Transfusion was conducted in 26 patients (96.3%) in the severe thrombocytopenia group and in 260 patients (61.3%) in the non-severe thrombocytopenia group ($p < 0.001$). The non-severe thrombocytopenia group received a smaller volume of blood transfusions compared to the severe thrombocytopenia group (698.3 ± 1,052.4 mL vs. 1,597.0 ± 1,221.4 mL, $p = 0.001$) (Table 2).

The incidences of prolonged oozing were similar (18.5% in the severe group and 18.9% in the non-severe group). Three (0.7%) in the non-severe group experienced periprosthetic joint infections within 6 weeks after HA for hip fracture. In all 3 cases, Methicillin-resistant *Staphylococcus aureus* was identified in cultures and intravenous vancomycin was administrated following implant removal.

Table 2. Operative Parameters between Severe and Non-severe Thrombocytopenia Patients

Variable	Severe thrombocytopenia (n = 27)	Non-severe thrombocytopenia (n = 424)	*p*-value
Operation time (min)	89.4 ± 25.2	86.7 ± 33.4	0.671
Intraoperative blood loss (mL)	584.6 ± 369.2	445.0 ± 419.6	0.092
Postoperative blood loss (mL)	337.7 ± 451.7	277.4 ± 369.9	0.419
Total blood loss (mL)	922.3 ± 493.0	722.4 ± 647.0	0.116
Transfusion	26 (96.3)	260 (61.3)	< 0.001
Amount of Transfusion (mL)	1,597.0 ± 1,221.4	698.3 ± 1,052.4	0.001
ICU admission (%)	3 (11.1)	26 (6.1)	0.305
Prolonged oozing (%)	5 (18.5)	80 (18.9)	0.964
Periprosthetic joint infection (%)	0	3 (0.7)	NA
VTE (%)	0	9 (2.1)	NA
Hospital stay (day)	25.6 ± 18.3	19.4 ± 16.6	0.067
One-year mortality	6 (22.2)	50 (11.8)	0.110

Values are presented as mean ± standard deviation or number (%).
ICU: intensive care unit, VTE: venous thromboembolism.

No significant difference was observed in the duration of hospital stays (Table 2). Nine cases of venous thromboembolism (5 deep vein thrombosis, 3 pulmonary embolisms, and 1 stroke) occurred within 1 month after surgery only in the non-severe group. There was no significant difference between the 2 groups in terms of the 1-year mortality rate (Table 2).

DISCUSSION

This research offers insights into the results and issues related to hip arthroplasty in patients with low platelet counts before the operation. The proportions of preoperative thrombocytopenia (platelet < 150 $\times 10^3$/μL) in our patients were 2.3% (123 / 5,283) for THA and 16.5% (328 / 1,991) for HA. Patients with severe thrombocytopenia (50 $\times 10^3$/μL) had a significantly higher need for blood transfusions, despite having similar rates of prolonged bleeding (about 18%), duration of hospital stay, and 1-year mortality rates.

Our observations are in agreement with prior research, which showed an increased need for transfusions among patients with reduced preoperative platelet levels.[16-19] Our findings showed a gradual rise in the need for blood transfusions following hip arthroplasties as platelet counts decreased in the severe thrombocytopenia group (96.3% [26 / 27]) and the non-severe thrombocytopenia group (61.3% [260 / 433]). The overall rate of periprosthetic joint infection was 0.7% (3 / 460) among patients with thrombocytopenia. It seems similar to that of patients treated previously in our hospital.[20] On the other hand, the rate of prolonged oozing was above 18%. Considering prolonged oozing for risk of periprosthetic joint infection, prolonged oozing more than 18% could be a serious concern in patients with thrombocytopenia when planning hip arthroplasty. In this study, 9 patients (2.1%) in the non-severe thrombocytopenia group experienced postoperative VTE. This is similar to the results of studies from East Asia with mechanical prophylaxis alone for VTE prophylaxis.[12-14]

The present study found that the severity of preoperative thrombocytopenia did not affect the duration of hospitalization, while some studies showed controversial results regarding the length of hospital stay.[17-19] There are some limitations in this study. First, the study's broader applicability is constrained due to its single-center, retrospective nature. Nonetheless, it offers greater precision compared to database-driven studies because variables and outcomes can be confirmed through manual examination of medical records. Second, this study covered a 20-year period that saw evolving protocols related to the use of drains, transfusion thresholds, tranexamic acid, local hemostatic agents, and discharge criteria, impacting the patients involved. However, the proportion of severe thrombocytopenia was not changed during the study period. Moreover, well-designed prospective research examining

the effect of severe thrombocytopenia on hip arthroplasty is not always possible, because of the lack of patients with severe thrombocytopenia.

Although the sample size was small, there was no significant difference in terms of major complications after THA in patients with severe thrombocytopenia and those with non-severe thrombocytopenia. Nonetheless, there may be a need for more frequent transfusions, and the higher incidence of prolonged oozing remains a concern.

CONFLICT OF INTEREST

No potential conflict of interest relevant to this article was reported.

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