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Total Hip Arthroplasty in Patients with Idiopathic Thrombocytopenic Purpura

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Background. There are no national clinical guidelines for the perioperative management of patients with idiopathic thrombocytopenia in hip arthroplasty. Most of the publications are presented in the context of general surgery, the distinguishing feature of which is the good achievement of hemostasis. However, it is impossible to achieve such a level of hemostasis with hip arthroplasty.
The aim of the study was to evaluate the mid-term results of total hip arthroplasty in patients with primary idiopathic thrombocytopenia.
Methods. Randomized monocenter clinical trial of 38 patients with idiopathic thrombocytopenia hip arthroplasty was performed. These patients was include in group I. As a control group, the outcomes of surgical treatment of 40 patients without thrombocytopenia over the same observation period were analyzed (group II). The mean follow-up period was 4.3 years. Exclusion criteria for the study were heparin-induced thrombocytopenia, a severe form of idiopathic thrombocytopenia in the acute stage with platelet counts less than 25×10^9/L.
Results. The average length of hospitalization was longer in patients with idiopathic thrombocytopenia (11.1 days). The results indicate a longer preoperative preparation, including the transfusion of hemocomponents with repeated monitoring of the parameters of the clinical blood test and coagulogram. There was no significant difference in the duration of the surgical intervention, but there were differences in the amount of intraoperative blood loss and the volume of blood transfusion. Among the patients of the group II, only 3 patients required intraoperative transfusion of one dose of erythrocyte suspension, patients of the group I more often underwent blood transfusion. In the group I, complications were noted in 5 patients, in the group II — in one patient ($p = 0.067$), but the relative risk of complications was 5.2. Functional results 12 months after surgery didn't differ.
Conclusions. The mid-term results of hip arthroplasty in patients with idiopathic thrombocytopenia are comparable to the results in patients of the general population. A distinctive feature of surgical intervention is an increase in the average volume of intraoperative blood loss and the need for a significantly larger transfusion of hemocomponents not only during the operation, but also in the preoperative period, which increases the duration of hospitalization.

Keywords: total hip arthroplasty, idiopathic thrombocytopenia, blood transfusion.

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Эндопротезирование тазобедренного сустава у пациентов с первичной идиопатической тромбоцитопенией

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Актуальность. В настоящее время отсутствуют национальные клинические рекомендации о периоперационном ведении пациентов с идиопатической тромбоцитопенией (ИПТ) при эндопротезировании тазобедренного сустава. Большинство публикаций, посвященных выполнению артропластики у данной категории пациентов представлено в контексте общей хирургии, отличительной особенностью которых является хорошее достижение гемостаза. Однако при эндопротезировании тазобедренного сустава достичь такого уровня гемостаза невозможно.

Цель исследования — оценить среднесрочные результаты тотального эндопротезирования тазобедренного сустава у пациентов с первичной идиопатической тромбоцитопенией.

Материал и методы. Выполнено рандомизированное моноцентровое клиническое исследование 38 пациентов с ИПТ, которым в период с 2015 по 2021 г. была выполнена артропластика тазобедренного сустава. Эти пациенты составили группу I исследования. В качестве контрольной группы были проанализированы исходы эндопротезирования тазобедренного сустава 40 пациентов без тромбоцитопении за аналогичный период наблюдения (группа II). Средний период наблюдения составил 4,3 года. Критериями невключения в исследование были гепарин-индуцированная тромбоцитопения, тяжелая форма идиопатической тромбоцитопении в стадии обострения с количеством тромбоцитов менее 25×10^9/л.

Результаты. Средние сроки госпитализации были больше в группе I — 11,1 койко-дней по сравнению с 7,7 в группе II. Результаты свидетельствуют о более длительной предоперационной подготовке, включающей трансфузию гемокомпонентов с повторным выполнением клинического анализа крови и коагулограммы. Не получено статистически значимой разницы в продолжительности хирургического вмешательства, однако между группами имелись отличия в величине интраоперационной кровопотери и объеме гемотрансфузии. В группе II только 3 пациентам потребовалось интраоперационное переливание одной дозы эритроцитарной взвеси, пациентам группы I чаще производилась гемотрансфузия. Осложнения в группе I отмечены у 5 пациентов, во группе II — у одного пациента, что не является статически значимым отличием (p = 0,067), однако относительный риск развития осложнений составил 5,2. Функциональные результаты через 12 мес. после операции между группами не отличались.

Заключение. Среднесрочные результаты эндопротезирования тазобедренного сустава у пациентов с ИПТ сопоставимы с результатами эндопротезирования пациентов общей популяции. Отличительной особенностью хирургического вмешательства является увеличение объема интраоперационной кровопотери и необходимость значимо бóльшего переливания гемокопонентов не только во время операции, но и в предоперационном периоде, что увеличивает продолжительность госпитализации.

Ключевые слова: эндопротезирование тазобедренного сустава, идиопатическая тромбоцитопения, гемотрансфузия.

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BACKGROUND

Idiopathic thrombocytopenia (IT) is an immune disease characterized by a transient or constant decrease in platelet count, accompanied by an increased risk of hemorrhage. According to the criteria of the International Working Group of Experts, IT is defined as an autoimmune disease characterized by isolated thrombocytopenia (platelet count less than 100×10^9/L) in the absence of other causes or diseases that may be accompanied by thrombocytopenia [1]. Glucocorticosteroids are widely used as first-line therapy for IT [2]. Moreover, the number of steroid-induced avascular necrosis of bones ranges 9-40% with a predominant lesion of the femoral head [3]. Patients with IT requiring surgical interventions need blood transfusion of a larger amount of blood components, especially if the surgery is performed for emergency indications.

Given the increased blood loss, more complications should be expected during total hip arthroplasty (THA) in patients with IT, such as periprosthetic infection, acute renal failure, septicemia, or pneumonia [4].

In this regard, special perioperative management of patients is necessary to prevent complications when planning hip THA; however, the available literature presents only a few reports on its results. Nezu et al. described a case of arthroplasty in a patient with refractory IT under the colchicine cover [5]. Kim et al. presented a case series of patients with IT who had undergone THA arthroplasty. In the study, the authors indicated a higher need for hemotransfusion of erythrocyte mass and platelet suspension. Moreover, the time of surgery, length of hospital stay, and levels of complications were not different from those in patients without IT [6]. Singhal et al. reported on the treatment of a 61-year-old patient with IT who underwent replacement of the knee joint. The authors noted a significant increase in the preoperative period, during which immunoglobulin transfusion was performed until the platelet level reached 280×10^9/L. In the course of treatment, anticoagulants and antiplatelet agents were not administered because of bleeding risk, and nonsteroidal anti-inflammatory analgesics were not used, as they reduce platelet function. The patient was discharged on day 8 after the surgery; however, he was under the supervision of hematologists for another 3 days. When the platelet count is greater than 80×10^9/L, the risk of bleeding is low. At a platelet count lower than 50×10^9/L, bleeding should be expected during or after surgery, and at a level lower than 25×10^9/L, bleeding can occur spontaneously; therefore, the surgery cannot be performed [7].

Currently, there are no national clinical guidelines for the perioperative management of patients with IT in THA. A systematic review of publications on the aspects of surgical interventions in patients with IT indicates the need to achieve good hemostasis during surgical interventions. Many publications are cited in the context of general surgery. With THA, it is impossible to achieve such a level of hemostasis. In this regard, Kojouri et al. warned of an increase in the expected perioperative blood loss [8]. Thus, to date, many issues related to THA remain unresolved, and there are no algorithms for perioperative management of patients with IT.

The study aimed to evaluate the mid-term results of total THA in patients with primary IT.

METHODS

Study design

The authors conducted a randomized monocenter clinical trial of 38 patients with IT, who underwent THA between 2015 and 2021. These patients constituted group I of the study. For group II (control), we analyzed the outcomes of hip arthroplasty in 40 patients without thrombocytopenia over the same period. The mean follow-up period was 4.3 (min 3; max 6) years in group I and 4.1 (min 3; max 6) years in group II.

For the representativeness of the analysis results, the patients of both groups were comparable in age, scope of the preoperative examination, nature of the THA pathology (Table 1), surgical interventions performed, type of hip endoprosthesis components, and postoperative management. All surgeries in both groups were performed by the same surgical and anesthetic teams.

The exclusion criteria for the study were heparin-induced thrombocytopenia, history of splenectomy, severe form of IT in the exacerbation phase, and platelet count less than 25×10^9/L in the blood serum in the preoperative period.

Table 1

General characteristics of the patients in both groups

Parameter	Group I	Group II	*p*
Number of patients	38	40	
Mean age, Me (min/max)	47.24 (19/84)	45.38 (20/81)	0.430
Sex, M/F	9/29	19/21	
Body mass index, Me (min/max)	23.33 (14.5/32.7)	28.5 (23.2/31.7)	<0.001
Diagnosis			
– avascular necrosis of the femoral head	30 (79%)	21 (53%)	
– dysplasia	1 (3%)	9 (23%)	
– coxarthrosis	7 (18%)	10 (24%)	
Follow-up period, Me (min/max)	4.3 (3/6)	4.1 (3/6)	0.284

Standard cementless acetabular press-fit components were implanted in both groups, with the use of only cross-linked polyethylene liners of 32 mm in diameter and standard cementless femoral components of proximal fixation.

Avascular necrosis of the femoral head prevailed among the indications for total hip arthroplasty, whereas idiopathic and dysplastic coxarthrosis were less common. The average body mass index was significantly lower in group I (ME 23.3; min 14.5; max 32.7) than in group II (ME 28.5; min 23.2; max 31.7).

Assessment of result

The surgery duration, volume of intraoperative blood loss, and the transfused components of erythrocyte suspension, fresh frozen plasma, and platelet suspension were evaluated. The frequency and structure of general somatic and orthopedic complications were also assessed in both groups. Functional results were assessed using the 48-point Oxford Hip Score (OHS) scale.

Statistical analysis

Statistical processing of the research results was performed using the IBM SPSS Statistics for Windows, version 20 (IBM Corp., Armonk, NY, USA). The normality of quantitative values was tested based on the Shapiro-Wilk test as modified by Royston [9]. To identify significant differences in normally distributed indicators, Student's t-test was used for related and unrelated samples and the Mann-Whitney test for non-normally distributed indicators. The criterion $\chi 2$ was used to evaluate the qualitative indicators.

RESULTS

The mean length of hospital stay was significantly longer in group I than in group II. In a more detailed study of the reasons for such a long period of hospitalization, significant differences were noted in the indicators of preoperative bed-days (Table 2). Such results indicate the need for longer preoperative preparation, including transfusion of hemocomponents with repeated clinical blood tests, coagulogram, and production of platelet concentrate for each patient.

When evaluating intraoperative parameters, no significant difference was found in the duration of surgery; however, significant differences were found in the amounts of intraoperative blood loss and blood transfusion (Table 3).

Table 2

Length of hospital stay, bed-day, Me (min/max)

Parameter	Group I	Group II	*p*
Length of hospital stay	11.10 (6/17)	7.70 (4/12)	<0.001
Preoperative period	3.94 (1/9)	1.20 (1/3)	<0.001
Postoperative period	7.16 (3/14)	6.80 (4/10)	0.144

Table 3

Intraoperative parameters in patients of the study groups

Parameter	Group I	Group II	*p*
Surgery time, min (min/max)	95 (45/100)	100 (55/110)	0.124
Intraoperative blood loss, mL (min/max)	339.7 (200/1300)	213.0 (100/350)	0.001
Blood transfusion, mean volume in mL	11 patients, 140	3 patients, 220	
Platelet suspension, average volume in mL	5 patients, 350	0	
Fresh frozen plasma, mean volume in mL	3 patients, m 420	0	
Platelet count before surgery, $\times 10^9$/L	85±13	168±38	0.001

Functional outcomes

When evaluating functional results on a 48-point OHS scale, no significant difference in indices was found 12 months after the surgery. In group I, the average statistical indicators improved from 25.4±7.3 to 42.1±6.1 points, while in group II, these changed from 26.2±5.3 to 43±4.3 points (Fig. 1).

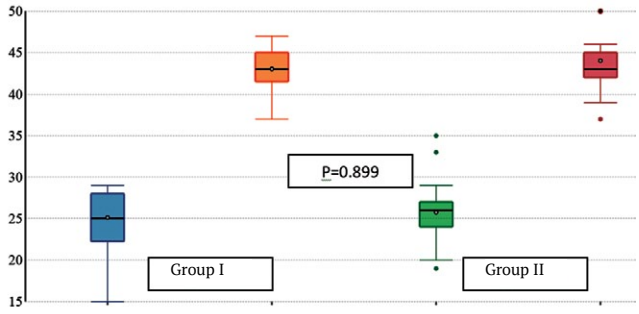

Fig. 1. Functional results on the Oxford Hip Score (48 points)

Complications

Complications were registered in five patients in group I and in one patient in group II, which is not significantly different (p = 0.067). The relative risk (RR) for complications was 5.2 (95% confidence interval 0.64-43) in the IT group. Three (7.9%) patients in group I had intraoperative bleeding, two (5.27%) had postoperative hematoma, and one had superficial periprosthetic infection secondary to a postoperative hematoma, which did not require two-stage revision arthroplasty and was stopped by secondary surgical treatment of the wound. No complications associated with hip arthroplasty were recorded in group II.

As a result of the analysis of postoperative radiographs, no signs of aseptic loosening of the endoprosthesis components, osteolysis, or significant wear of the polyethylene liner in the average follow-up period of more than 4 years were found in both groups. Moreover, there were no cases of periprosthetic fractures and dislocations of the endoprosthesis. Thus, none of the patients in both groups underwent revision interventions for THA.

DISCUSSION

Currently, insufficient attention is paid to the problems of surgical treatment of patients with IT in Russian and international literature. According to Wang et al., the incidence of thrombocytopenia among patients undergoing hip arthroplasty is 1.43% and increases annually [10]. Several authors report an increase in the number of complications and postoperative mortality among patients who undergo hip arthroplasty in the presence of thrombocytopenia. For example, in their major population meta-analysis, Chang et al. reported an increase in 30-day mortality up to 1.89% after surgery in patients with thrombocytopenia [11]. Monreal et al. argued that platelet count correction before hip arthroplasty reduces significantly the risk of postoperative blood loss [12].

Our results are comparable with the mid-term results of shoulder and elbow arthroplasty in 25 patients with clotting disorders and secondary thrombocytopenia [13]. Zorenko et al. reported one infectious complication, one intraoperative periprosthetic fracture of the humeral condyle, and one case of aseptic instability of the elbow arthroplasty in the period up to 9 years after surgery.

Wang et al. presented interesting data on the characteristics of patients with thrombocytopenia undergoing joint replacement. They

reported that IT is more common in older men and is associated with several somatic diseases. In our study, middle-aged women predominated (Me 47.24 years; min 19 years, max 84 years), which indirectly indicates different epidemiological indicators of the prevalence of IT in the population. The average length of hospital stay of patients with IT undergoing THA increases by 26% [10]. In our study, the average length of hospital stay in group I was 14.5% longer than that in group II, but significantly lower than the data presented in the literature. Such low rates of the average number of bed-days in patients with IT who undergo hip arthroplasty are due to the pharmacological correction of drugs and preparation of patients for surgery, which is performed in the R.M. Gorbacheva Research Institute of Pediatric Oncology, Hematology and Transfusiology, which is part of the structure of the Pavlov State Medical University (Saint Petersburg).

The literature reports a higher incidence of complications in large joint arthroplasty in patients with IT, both general somatic (pneumonia, infection of the urinary system, postoperative shock, and sepsis) and surgical (hemorrhagic anemia, hematoma and seroma of the postoperative wound, wound infection, and instability of endoprosthesis components) complications. Specifically, Malpani et al. provided data on a twofold increase in the risk of complications during THA in patients with IT [14]. According to our data, the RR of all complications in patients with thrombocytopenia was 5.2 times higher. Such a significant increase in risks may be due to the small number of cases; therefore, cohort multicenter studies are needed.

Study limitations

The main limitation of the study was the small number of patients in group I, which was due to a rather rare combination of IT with deforming coxarthrosis requiring surgical interventions. Multicenter studies are necessary for more accurate study representativeness. Further prospects are associated with the formation of flows of such patients to specialized multidisciplinary centers.

CONCLUSIONS

The mid-term outcomes of hip arthroplasty in patients with IT are comparable with the results of THA in the general population. A characteristic aspect of surgical intervention in patients with IT is an increase in the average volume of intraoperative blood loss and the need for a significantly larger amount of transfusion of blood components not only during arthroplasty but also in the preoperative period, which increases the length of hospital stay

DISCLAIMERS

Author contribution

Tsed A.N. — the idea and design of the study, the collection and processing of material, writing the draft, editing.

Mushtin N.E. — data collection and analysis, manuscript writing, text editing.

Dulaev A.K. — research conception and design, analysis and statistical processing of data

All authors have read and approved the final version of the manuscript of the article. All authors agree to bear responsibility for all aspects of the study to ensure proper consideration and resolution of all possible issues related to the correctness and reliability of any part of the work.

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REFERENCES

1. Rodeghiero F., Stasi R., Gernsheimer T., Michel M., Provan D., Arnold D.M. et al. Standardization of terminology, definitions and outcome criteria in immune thrombocytopenic purpura of adults and children: report from an international working group. *Blood*. 2009;113(11):2386-2393. doi: 10.1182/blood-2008-07-162503.
2. Provan D., Stasi R., Newland A.C., Blanchette V.S., Bolton-Maggs P., Bussel J.B. et al. International consensus report on the investigation and management of primary immune thrombocytopenia. *Blood*. 2009;115(2): 168-186. doi: 10.1182/blood-2009-06-225565.
3. Weinstein R.S. Clinical practice: glucocorticoid-induced bone disease. *N Engl J Med*. 2011;365(1):62-70. doi: 10.1056/NEJMcp1012926.
4. Chang C.C., Chang H.C., Wu C.H., Chang C.Y., Liao C.C., Chen T.L. Adverse postoperative outcomes in surgical patients with immune thrombocytopenia. *British J Surg*. 2013;100(5):684-692. doi: 10.1002/bjs.9065.
5. Nezu M., Oh H., Cho R., Sato H., Ikegami T., Yokota A. et al. [The combination therapy with vinca-alkaloid slow infusion and cholchicine was effective to refractory idiopathic thrombocytopenic purpura. The patient could receive femoral head replacement in safety]. *Rinsho Ketsueki*. 1996;37(2):158-160. (In Japanese).

6. Kim Y.S., Chung .JW., Sung B.Y., Woo Y.K., Kwon S.Y. Total hip replacement arthroplasty in patient with idiopathic thrombocytopenic purpura: clinical experience of perioperative management. *J Korean Hip Soc.* 2008;20(1):15-18. doi.org/10.5371/jkhs.2008.20.1.15.
7. Singhal R., Gudimetla V., Stewart A., Luscombe K.L., Charalambous C.P. Perioperative care of a patient with refractory idiopathic thrombocytopenic purpura undergoing total knee arthroplasty. *Knee Surg Relat Res.* 2012;24(4):245-248. doi: 10.5792/ksrr.2012.24.4.245.
8. Kojouri K., Vesely S.K., Terrell D.R., George J.N. Splenectomy for adult patients with idiopathic thrombocytopenic purpura: a systematic review to assess long-term platelet count responses, prediction of response, and surgical complications. *Blood.* 2014;104(9):2623-2634. doi: 10.1182/blood-2004-03-1168.
9. Royston P. Approximating the Shapiro-Wilk W-test for non-normality. *Statistics and Computing.* 1992;2:3:117-119.
10. Wang Y., Zhang Y., Wang Y., Han H., Zhao J., Wang J. Chronic thrombocytopenia and in-hospital outcomes after primary total hip and knee arthroplasty. *J Arthroplasty.* 2022;37(1):19-25.e4. doi: 10.1016/j.arth.2021.08.032.
11. Chang C.C., Chang H.C., Wu C.H., Chang C.Y., Liao C.C., Chen T.L. Adverse postoperative outcomes in surgical patients with immune thrombocytopenia. *Br J Surg.* 2013;100(5):684-692; discussion 693. doi: 10.1002/bjs.9065.
12. Monreal M., Lafoz E., Llamazares J,. Roncales J., Roca J. Granero X. Preoperative platelet count and postoperative blood loss in patients undergoing hip surgery: an inverse correlation. *Haemostasis*. 1996;26(3):164-169. doi: 10.1159/000217202.
13. Zorenko V.Yu., Polyanskaya T.Yu., Karpov E.E., Sadykova N.V., Sampiev M.S., Mishin G.V. et al. Endoprosthesis replacement of elbow and shoulder joints in the terminal stage of arthropathy in patients with hemophilia. *Gematologiya i transfuziologiya* [Russian journal of Hematology and Transfusiology]. 2020; 65(S1):146
14. Malpani R., Haynes M.S., Clark M.G., Galivanche A.R., Bovonratwet P., Grauer J.N. Abnormally high, as well as low, preoperative platelet counts correlate with adverse outcomes and readmissions after elective total knee arthroplasty. *J Arthroplasty.* 2019;34(8):1670-1676. doi: 10.1016/j.arth.2019.04.012.

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