

Clinical characteristics of hypertensive patients undergoing total hip or knee replacement

Paweł Łęgosz¹, Anna E. Płatek^{2,3}, Marcin Kotkowski¹, Bartosz Krzowski², Filip M. Szymanski²,
Janusz Sierdziński⁴, Paweł Malydy¹, Krzysztof J. Filipiak²

¹Department of Orthopaedics and Traumatology, Medical University of Warsaw, Warsaw, Poland

²1st Department of Cardiology, Medical University of Warsaw, Warsaw, Poland

³Department of General & Experimental Pathology with Centre for Preclinical Research and Technology (CEPT), Medical University of Warsaw, Warsaw, Poland

⁴Department of Medical Informatics and Telemedicine, Medical University of Warsaw, Warsaw, Poland

Abstract

Introduction. Orthopaedic surgeries are major procedures, often associated with perioperative risk. They are especially challenging for elderly patients afflicted with several comorbidities and cardiovascular risk factors. Currently, one of the most frequent types of orthopaedic surgeries is joint alloplasties of hip or knee. The aim of this study was to establish the clinical characteristics of hypertensive patients undergoing total hip or knee replacement and to describe the frequency of the early complication of the surgery, which is a need for blood transfusion.

Material and methods. The study enrolled 199 consecutive patients who underwent hip or knee alloplasty. From this group patients with previous diagnosis of hypertension were selected for further assessment. All patients were screened for presence of cardiovascular risk factors and cardiovascular disease, according to the current guidelines. All patients were also followed for the necessity of blood transfusion during the hospitalisation.

Results. From the screened population 135 patients had previous diagnosis of hypertension and met inclusion criteria (mean age 69.0 ± 9.3 years, 30.4% male). From those patients, 70 (48.1%) underwent knee replacement, and 65 (51.9%) had hip replacement. As for the prevalence of cardiovascular disease, 16 (11.9%) had coronary artery disease, 5 (3.7%) had a history of previous myocardial infarction and 2 (1.5%) had diagnosed heart failure. Cardiovascular risk factors were also highly prevalent in the study population, 26 (19.3%) patients had diagnosed dyslipidemia, 27 (20.0%) had diabetes and 58 (43.0%) were obese. There were no statistical differences in the prevalence of those factors between patients with hip and knee replacement. 33 (24.4%) had blood loss during the operation, which led to a need for blood transfusion (19 (29.2%) patients in hip replacement group, and 14 (20%) in knee replacement group, $p = 0.05$). We found no differences in the prevalence of cardiovascular disease and cardiovascular risk factors between patients who required and did not require blood transfusion ($p > 0.05$).

Conclusions. Hypertensive patients who undergo hip or knee replacement have high prevalence of cardiovascular risk factors and other cardiovascular disease, therefore are at high perioperative risk. No differences are seen between patients with hip and knee replacement. There is also a high frequency of blood transfusions in this group.

key words: hypertension, blood transfusion, hip replacement, orthopaedics

Arterial Hypertens. 2017, vol. 21, no. 1, pages: 29–33

DOI: 10.5603/AH.2017.0004

Address for correspondence: Janusz Sierdziński, MD, PhD
Department of Medical Informatics and Telemedicine, Medical University of Warsaw, Warsaw, Poland
1A Banacha Street, 02–097 Warsaw, Poland
E-mail: janusz.sierdzinski@wum.edu.pl

Background

Total hip and knee arthroplasties are very common nowadays, and their number is gradually increasing. It is due to the increasing life span and advanced degenerative and inflammatory arthritis. Those surgeries relieve pain and improve patients' function. They usually have good clinical outcomes, but sometimes are associated with complications i.e. blood loss requiring transfusion. [1]. Usually, large amount of blood is lost during total hip arthroplasty — it is estimated to be around 1510 mL, including hidden loss of 471 mL [2]. Hidden blood loss is understood as blood extravasation into tissues, residual blood in the joint and loss caused by haemolysis. This is the reason why patients often need blood transfusion, according to studies 2–70% of patients after hip or knee arthroplasty receive a blood transfusion [3, 4]. The aim of this study was to establish the clinical characteristics of hypertensive patients undergoing total hip or knee replacement and to describe the frequency of the early complication of the surgery, which is a need for blood transfusion.

Material and methods

The study was designed to be an observational cohort study in order to establish the association between clinical characteristics and periprocedural risk in consecutive Polish patients undergoing total hip or knee replacement surgery in a tertiary University Hospital. The study was conducted with respect to the Declaration of Helsinki and an approval form the Ethics Committee by the Medical University of Warsaw was obtained before the beginning of the study. Written, informed consent was obtained from every study participant prior to the study enrolment.

The study enrolled 199 consecutive patients who underwent hip or knee alloplasty. All patients were qualified for the surgery procedure following current orthopedic criteria. The study population consisted of patients in whom the operation was successfully performed, and in whom the medical records allowed valid assessment of blood pressure values and current medical treatment.

From this group patients with previous diagnosis of hypertension were selected for further assessment procedure. Diagnosis of arterial hypertension was made when office blood pressure was equal or exceeded the values of 140 for systolic blood pressure (SBP) and/or 90 for diastolic blood pressure (DBP). The number of required measurements, measure techniques and settings were in accordance with the current guidelines for arterial hypertension diagnosis and management of

the ESC and European Society of Hypertension. The diagnosis was also made taking prescription hypotensive agents or where there were eligible medical records available on previous diagnosis of arterial hypertension.

All patients were screened for presence of cardiovascular risk factors and cardiovascular disease, according to the current guidelines. Data on demographics, lifestyle, comorbidity and cardiovascular risk factors were obtained. Demographic variables analyzed included age and sex. Comorbidities assessed in the study included presence of heart failure, diabetes mellitus, stroke or TIA episodes, myocardial infarction episodes, peripheral artery disease, dyslipidemia, coronary artery disease, important valvular defect, asthma, chronic obstructive pulmonary disease, CABG, PCI, cardiac pacemaker implanted. All patients were also screened for other classical and non-classical cardiovascular risk factors including diabetes mellitus, dyslipidemia, or history of cardiovascular disease. Diagnosis of all factors was made based on eligible medical records, taking prescription drugs applicable for the respective disease (i.e. hypoglycemic agents for diabetes), or as a de novo diagnosis according to the current diagnostic criteria.

All patients were also followed for the necessity of blood transfusion during the hospitalisation. Blood transfusions were performed according to the current guidelines in patients whose clinical status required this kind of treatment.

Statistical analysis was performed using the SAS software version 21 (SAS Institute, Inc., Cary, NC, USA). Continuous data are presented as mean \pm standard deviation (SD) and were compared using the Mann-Whitney test or Student's t-test. Categorical variables were compared using either the χ^2 or Fisher's exact tests. A p value of less than 0.05 was considered statistically significant, whereas the confidence intervals (CI) were 95%.

Results

From the screened population 135 (67.8%) patients had previous diagnosis of hypertension. The mean age of the study population was calculated to be 69.0 ± 9.3 years, and 30.4% of the study group were male. From those patients, 70 (48.1%) underwent knee replacement, and 65 (51.9%) had hip replacement. As for the prevalence of cardiovascular disease, 16 (11.9%) had coronary artery disease, 5 (3.7%) had a history of previous myocardial infarction and 2 (1.5%) had diagnosed heart failure. Cardiovascular risk factors were also highly prevalent in the study

population, 26 (19.3%) patients had diagnosed dyslipidemia, 27 (20.0%) had diabetes and 58 (43.0%) were obese. Table I presents detailed characteristics of patients included into the study.

There were no statistical differences in the prevalence of those factors between patients with hip and knee replacement. Detailed characteristics are presented in the Table II.

Table I. Baseline characteristics of the study population

Parameter	Value (% or mean \pm SD)
Age (years)	69.0 \pm 9.3
Male sex	41 (30.4%)
Coronary artery disease	16 (11.9%)
Prior myocardial infarction	5 (3.7%)
Heart failure	2 (1.5%)
Atrial fibrillation	8 (5.9%)
Dyslipidemia	26 (19.3%)
Prior stroke or TIA	3 (2.2%)
Diabetes mellitus	27 (20.0%)

Data are presented as number (%) or mean \pm SD. SD — standard deviation, TIA — transient ischaemic attack

When we compared patients with and without blood transfusion, we saw that 33 (24.4%) had blood loss during the operation, which led to a need for blood transfusion (19 (29.2%) patients in hip replacement group, and 14 (20%) in knee replacement group, $p = 0.05$). We found no differences in the prevalence of cardiovascular disease and cardiovascular risk factors between patients who required and did not require blood transfusion ($p > 0.05$). Detailed characteristic is presented in the Table III.

Discussion

The present study showed that hypertensive patients undergoing hip or knee alloplasty are at elevated risk of early complication of the joint surgery that is the need for blood transfusion. Studies show different transfusion rates in knee and hip arthroplasty patients (4,8–63,8% vs 4,3–86,8%). It shows that transfusion rate depends on surgeon's decision and preferences [5]. Another reason requiring blood transfusion may be preoperative anaemia, which is especially crucial in surgical patients [6]. It has been

Table II. Differences between patients undergoing hip and knee replacement

Parameter	Patients with hip replacement (n = 65)	Patients with knee replacement (n = 70)	p value
Age (years)	67.9 \pm 10.8	70.1 \pm 7.7	0.45
Male sex	28 (43.1%)	13 (18.6%)	0.03
Coronary artery disease	6 (9.2%)	10 (14.3%)	0.43
Prior myocardial infarction	4 (6.2%)	1 (1.4%)	0.20
Heart failure	2 (3.1%)	0 (0.0%)	0.23
Atrial fibrillation	5 (7.7%)	5 (4.3%)	0.48
Dyslipidemia	11 (16.9%)	15 (21.4%)	0.52
Prior stroke or TIA	1 (1.5%)	2 (2.9%)	1.00
Diabetes mellitus	11 (16.9%)	16 (22.9%)	0.52

Table III. Differences between patients who did and did not need blood transfusion

Parameter	Patients with blood transfusion (n = 102)	Patients without blood transfusion (n = 33)	p value
Age (years)	68.9 \pm 9.7	69.5 \pm 8.2	0.72
Male sex	30 (29.4%)	11 (33.3%)	0.67
Coronary artery disease	15 (14.7%)	1 (3.0%)	0.12
Prior myocardial infarction	4 (3.9%)	1 (3.0%)	1.00
Heart failure	2 (2.0%)	0 (0.0%)	1.00
Atrial fibrillation	6 (5.9%)	2 (6.1%)	1.00
Dyslipidemia	19 (18.6%)	7 (21.2%)	0.80
Prior stroke or TIA	2 (2.0%)	1 (3.0%)	0.57
Diabetes mellitus	18 (17.6%)	9 (27.2%)	0.32

proven that preoperative anaemia leads, for example, to increased perioperative adverse outcomes and periprosthetic joint infections [7]. Evaluation of haemoglobin level should be provided 3–4 weeks before surgery, which allows to correct anaemia and prevent serious adverse outcomes. Few of the reasons may be nutrient deficiency, chronic renal insufficiency, chronic inflammatory disease or even gastrointestinal malignancy. Also intraoperative blood loss can be limited. Patient's bleeding tendency needs to be estimated. We ought to look for von Willebrand disease or ask whether patient is treated with anti-platelet therapy. What is more, adequate positioning of the patient and maintenance of patient's body during surgery results in minimizing blood loss. Patients' body temperature kept at normal level results in losing 20–25% less blood and improves wound healing [8], which makes blood transfusion unnecessary. Another factor that limits blood loss is tranexamic acid. Meta-analysis showed that patients treated with tranexamic acid were less likely to require blood transfusion than patients from placebo group (11 randomized controlled trials; pooled odds ratio [OR] 0.16, 95% CI 0.09–0.26) [9]. Additionally, people who received tranexamic acid had lower transfusion rate in comparison to control group (17% vs. 35%, $p < 0,001$) [10]. Patient with DVT or myocardial infarction in history requires extra care while treating with tranexamic acid. Blood loss depends also on postoperative actions. Meta-analysis shows that both mild- and high-flexion of the limb after knee surgery reduces total blood loss and reduces transfusion requirements [11]. Post-operative transfusion is more often given to older people, woman, people with smaller BMI and lower estimated blood volume. Additionally, those patients present a higher prevalence of CAD [12]. Older patients are more likely to benefit from blood transfusion due to worst toleration of lower haemoglobin and haematocrit [13]. For younger patients it would be advisable to avoid blood transfusion. They can be protected from long-term risks. One of the reasons why allogenic blood transfusion should be avoided is a significantly increased surgical-site infection rate after hip or knee surgery [14]. Allergic reactions may be another argument for abstaining from transfusion. It can be caused by blood components — plasma components, cytokines. Allergic reactions are common source of morbidity [15]. Incorrect blood transfusion may lead to circulation overload resulting in pulmonary oedema. It is especially dangerous for people with left ventricular dysfunction, renal dysfunction or acute myocardial infarction [16].

As we showed previously, patients undergoing hip and knee replacement are at elevated risk of cardiovascular disease, therefore they should be properly managed and their risk should be carefully stratified [17].

In conclusion, every patient requires preoperative, intraoperative and postoperative care to limit blood loss and need for blood transfusion. Blood transfusion in patients treated with hip or knee replacement is a process that has a risk of multiple associated complications, but on the other hand it can be lifesaving procedure. Careful treatment and risk stratification scheduled in order to minimise blood loss during the procedure can be helpful in reducing consequences and improving patients' prognosis.

References

1. Jones C, Beaupre L, Johnston D, et al. Total Joint Arthroplasties: Current Concepts of Patient Outcomes after Surgery. *Rheum Dis Clin North Am.* 2007; 33(1): 71–86, doi: [10.1016/j.rdc.2006.12.008](https://doi.org/10.1016/j.rdc.2006.12.008).
2. Sehat KR, Evans RL, Newman JH. Hidden blood loss following hip and knee arthroplasty. Correct management of blood loss should take hidden loss into account. *J Bone Joint Surg Br.* 2004; 86(4): 561–565, indexed in Pubmed: [15174554](https://pubmed.ncbi.nlm.nih.gov/15174554/).
3. Helm AT, Karski MT, Parsons SJ, et al. A strategy for reducing blood-transfusion requirements in elective orthopaedic surgery. Audit of an algorithm for arthroplasty of the lower limb. *J Bone Joint Surg Br.* 2003; 85(4): 484–489, indexed in Pubmed: [12793549](https://pubmed.ncbi.nlm.nih.gov/12793549/).
4. Ralley FE, Berta D, Binns V, et al. One intraoperative dose of tranexamic Acid for patients having primary hip or knee arthroplasty. *Clin Orthop Relat Res.* 2010; 468(7): 1905–1911, doi: [10.1007/s11999-009-1217-8](https://doi.org/10.1007/s11999-009-1217-8), indexed in Pubmed: [20063079](https://pubmed.ncbi.nlm.nih.gov/20063079/).
5. Chen AF, Klatt BA, Yazer MH, et al. Blood utilization after primary total joint arthroplasty in a large hospital network. *HSS J.* 2013; 9(2): 123–128, doi: [10.1007/s11420-013-9327-y](https://doi.org/10.1007/s11420-013-9327-y), indexed in Pubmed: [24009534](https://pubmed.ncbi.nlm.nih.gov/24009534/).
6. Beattie WS, Karkouti K, Wijeyesundera DN, et al. Risk associated with preoperative anemia in noncardiac surgery: a single-center cohort study. *Anesthesiology.* 2009; 110(3): 574–581, doi: [10.1097/ALN.0b013e31819878d3](https://doi.org/10.1097/ALN.0b013e31819878d3), indexed in Pubmed: [19212255](https://pubmed.ncbi.nlm.nih.gov/19212255/).
7. Pulido L, Ghanem E, Joshi A, et al. Periprosthetic joint infection: the incidence, timing, and predisposing factors. *Clin Orthop Relat Res.* 2008; 466(7): 1710–1715, doi: [10.1007/s11999-008-0209-4](https://doi.org/10.1007/s11999-008-0209-4), indexed in Pubmed: [18421542](https://pubmed.ncbi.nlm.nih.gov/18421542/).
8. Schmied H, Kurz A, Sessler DI, et al. Mild hypothermia increases blood loss and transfusion requirements during total hip arthroplasty. *Lancet.* 1996; 347(8997): 289–292, indexed in Pubmed: [8569362](https://pubmed.ncbi.nlm.nih.gov/8569362/).
9. Lee JH, Han SB. Patient Blood Management in Hip Replacement Arthroplasty. *Hip Pelvis.* 2015; 27(4): 201–208, doi: [10.5371/hp.2015.27.4.201](https://doi.org/10.5371/hp.2015.27.4.201), indexed in Pubmed: [27536627](https://pubmed.ncbi.nlm.nih.gov/27536627/).
10. Chang CH, Chang Y, Chen DW, et al. Topical tranexamic acid reduces blood loss and transfusion rates associated with primary total hip arthroplasty. *Clin Orthop Relat Res.* 2014; 472(5): 1552–1557, doi: [10.1007/s11999-013-3446-0](https://doi.org/10.1007/s11999-013-3446-0), indexed in Pubmed: [24385043](https://pubmed.ncbi.nlm.nih.gov/24385043/).
11. Wu Y, Yang T, Zeng Yi, et al. Effect of different postoperative limb positions on blood loss and range of motion in total knee arthroplasty: An updated meta-analysis of randomized controlled trials. *Int J Surg.* 2017; 37: 15–23, doi: [10.1016/j.ijsu.2016.11.135](https://doi.org/10.1016/j.ijsu.2016.11.135), indexed in Pubmed: [27913236](https://pubmed.ncbi.nlm.nih.gov/27913236/).
12. Vuille-Lessard E, Boudreault D, Girard F, et al. Red blood cell transfusion practice in elective orthopedic surgery: a multicenter cohort study. *Transfusion.* 2010; 50(10): 2117–2124, doi: [10.1111/j.1537-2995.2010.02697.x](https://doi.org/10.1111/j.1537-2995.2010.02697.x), indexed in Pubmed: [20492612](https://pubmed.ncbi.nlm.nih.gov/20492612/).

13. American Society of Anesthesiologists Task Force on Perioperative Blood Transfusion and Adjuvant Therapies. Practice guidelines for perioperative blood transfusion and adjuvant therapies: an updated report by the American Society of Anesthesiologists Task Force on Perioperative Blood Transfusion and Adjuvant Therapies. *Anesthesiology*. 2006; 105(1): 198–208, indexed in Pubmed: [16810012](#).
14. Kim JL, Park JH, Han SB, et al. Allogeneic Blood Transfusion Is a Significant Risk Factor for Surgical-Site Infection Following Total Hip and Knee Arthroplasty: A Meta-Analysis. *J Arthroplasty*. 2017; 32(1): 320–325, doi: [10.1016/j.arth.2016.08.026](#), indexed in Pubmed: [27682006](#).
15. Lieberman L, Maskens C, Cserti-Gazdewich C, et al. A retrospective review of patient factors, transfusion practices, and outcomes in patients with transfusion-associated circulatory overload. *Transfus Med Rev*. 2013; 27(4): 206–212, doi: [10.1016/j.tmr.2013.07.002](#), indexed in Pubmed: [24075097](#).
16. Alam A, Lin Y, Lima A, et al. The prevention of transfusion-associated circulatory overload. *Transfus Med Rev*. 2013; 27(2): 105–112, doi: [10.1016/j.tmr.2013.02.001](#), indexed in Pubmed: [23465703](#).
17. Łęgosz P, Korkowski M, Platek AE, et al. Assessment of cardiovascular risk in patients undergoing total joint arthroplasty: the CRASH-JOINT study. *Kardiol Pol*. 2016 [Epub ahead of print], doi: [10.5603/KP.2016.0162](#), indexed in Pubmed: [27878804](#).