The Knee xxx (2018) xxx–xxx

Contents lists available at ScienceDirect

The Knee

Severe and morbid obesity and transfusional risk in total knee arthroplasty: An observational study

Montserrat Tió [a,*], Misericordia Basora [a], Jose Rios [a,b,c], Gerard Sánchez-Etayo [d], Raquel Bergé [a], Sergi Sastre [e], Fátima Salazar [a], Luis Lozano [e]

[a] Department of Anesthesiology, Hospital Clinic, Barcelona, Spain
[b] Medical Statistics Core Facility, Institut d'Investigacions Biomèdiques August Pi i Sunyer (IDIBAPS) and Hospital Clinic, Barcelona, Spain
[c] Biostatistics Unit, Faculty of Medicine, Universitat Autònoma de Barcelona, Spain
[d] Anesthesiology, Hospital Clinic, Barcelona, Spain
[e] Knee Unit, Trauma and Orthopaedics Department, Hospital Clinic, Barcelona, Spain

ARTICLE INFO

Article history:
Received 5 November 2017
Received in revised form 29 May 2018
Accepted 2 July 2018
Available online xxxx

Keywords:
Obesity
Arthroplasty
Knee
Blood transfusion
Blood loss
Body mass index

ABSTRACT

Background: Severe and morbid obesity (Class II -III) represents a challenge for successful knee surgery. There isn't consensus on what influence body mass index has on blood loss and on red blood cell (RBC) transfusion during total knee arthroplasty (TKA). The objective was to determine blood loss and transfusion needs in severe and morbid obese patients undertaking TKA.
Methods: We recorded retrospectively all patients undergoing TKA. Obesity was assessed according to WHO guidelines. Perioperative haemoglobin and treatments for its optimisation were recorded. Blood losses were estimated from specific formulae for lost red-cell mass and percentage of lost blood volume.
Results: 922 patients were included: 35.90% were obese Class I and 18.76% obese Class II - III. Estimated blood volume was 4390 ± 470 ml, 4736 ± 423 ml and 5030 ± 464 ml among non-obese, obese Class I and obese Class II-III, respectively ($P < 0.001$). The global estimated blood volume (EBV) lost was 1502 ± 680 ml without differences between the three groups. However, the percentage of lost blood volume was lower in obese Class II -III (29.65%) than in non-obese (33.55%) and obese Class I (30.97%) ($P < 0.005$). Transfusion rates were 12.7%, 12.1% and 6.4% for non-obese, obese Class I and Class II -III, respectively ($P = 0.062$). A negative transfusion risk was predicted for Class II -III patients.
Conclusions: Severely and morbidly obese patients did not show greater blood loss nor higher RBC transfusion needs after primary TKA than non-obese and obese Class I patients. This could be because obese Class II -III patients had higher EBV but similar RBC losses.

1. Introduction

Total knee arthroplasty (TKA) is a very common surgery because of the great functional improvement seen in patients affected by knee osteoarthritis [1], improving pain, functional capacity and life quality, even with high body mass index (BMI) [2, 3]. The World Health Organization (WHO) 2014 estimates were of approx. 600 million obese adults, i.e. about 13% of the world's adult

* Corresponding author.
E-mail address: mtio@clinic.ub.es. (M. Tió).

https://doi.org/10.1016/j.knee.2018.07.005
0968-0160/

population, being defined as BMI ≥30 kg/m^2. Between 1980 and 2014, the worldwide prevalence of obesity more than doubled. Prevalence of obesity in Spain is currently at 21.6% [4, 5].

Many studies highlight the greater surgical difficulty of TKA in obese patients [6, 7], more perioperative complications [8–11], greater blood loss [12] and functional results after intervention that are worse than those of the population at large [13]. There are still points of dissent in TKA surgery in severely and morbidly (Class II–III) obese patients.

In our centre, patients with severe and morbid obesity are operated on by a surgical team with experience in this type of patient. We have demonstrated in another study with the same study population that severely and morbidly obese patients (i.e. BMI ≥35 kg/m^2) undergoing TKA surgery do not require longer operative time or hospital stay than non-obese or obese Class I patients [14].

The influence of BMI on blood loss and transfusion rate after TKA remains controversial as there are cases that show results in favour of an influence [15, 16] and cases against [17–20]. Recently, Frisch et al. [18] described that patients with high BMI (i.e. >30 kg/m^2) had lower rates of blood transfusion and lost a significantly smaller percentage of estimated blood volume following total hip arthroplasty and TKA than patients with lower BMIs. However, in this study all the patients with BMI >30 kg/m^2 had been categorised as obese regardless of degree of obesity (Class I, II or III).

The transfusion-predictive factors in knee arthroplasty are widely known and include protective factors such as preoperative haemoglobin (Hb) level >13 g/dl [21–29], the administration of tranexamic acid (TA) [22, 30, 31], shorter surgical times [23, 29] and a good physical condition as assessed by the American Society of Anesthesiologists (ASA) score (I–II) [21]. BMI is not well known as a predictive or protective factor for perioperative blood transfusion in TKA [12, 23].

The main objective of our study was to determine blood loss and transfusion needs in severely and morbidly obese (Class II–III) patients undertaking TKA. An ancillary objective was to find out whether severe and morbid obesity could be used as predictive factors of transfusion needs in TKA.

2. Materials and methods

The study was a single centre retrospective observational study. All patients had been admitted and operated on in a tertiary hospital within the period from September 2009 to December 2011. The patients included in the study had osteoarthritis and, in several cases, rheumatoid arthritis. Patients who had undergone revision arthroplasty were excluded. The patients followed the clinical guidelines for TKA. Patients were admitted the day before the intervention and followed a plan of physiotherapy and nursing care that was completed by the sixth day after surgery. At this point they were discharged from the hospital, except in cases with complications. The study was approved by an ethical committee with the registration number HCB/2014/8145. All clinical data were treated following confidentiality rules.

Before surgery, patients were evaluated in the anaesthesiology clinic and submitted to an optimisation Hb protocol when preoperative Hb levels were below 130 g/l. The protocol consisted of oral or intravenous iron and one or two doses of 40,000 IU of recombinant human erythropoietin (rHuEPO) when indicated and where there was no previous thromboembolic disease.

All patients followed the same surgical protocol. Ultrasound analgesic blockage of the femoral nerve was carried out using a stimulating catheter with 20 ml of 0.2% ropivacaine and blockage of the sciatic nerve was carried out by a single injection of 20 ml of 0.25% levobupivacaine for controlling postoperative pain, by using an elastomeric pump with ropivacaine during the first 48 h. Spinal anaesthesia was induced at the L4–5 or L3–4 intervertebral space using 10 mg of 0.5% bupivacaine plus 100 μg of fentanyl. Midazolam (one to two milligrammes) was also administered for intraoperative sedation. General anaesthesia was used only under exceptional circumstances and based on medical necessity.

In order to reduce surgical blood loss, intraoperative TA (Amchafibrin®, Laboratory Fides-Rottapharm, Almassera, València, Spain) was administered, at a dose of 10 mg/kg immediately before inflating the tourniquet and immediately after releasing it. TA was diluted in 100 ml of 0.9% saline solution and infused over 10 min [32]. The maximum total dose infused in obese patients was 2000 mg. Patients with a history of, or evolving, arterial or venous thromboembolic disease or known thrombophilia were excluded from TA and instead the postoperative cell salvage device ConstaVac (Stryker®, Kalamazoo, MI, USA) was used after surgery. The collection time for reinfusion was limited to six hours. When at least 300 ml of blood had been collected within six hours, reinfusion was carried out with a standard blood transfusion set fitted with a 40-μm microaggregate filter.

The procedures were carried out by the knee surgery team and all of them followed an identical surgical protocol. During the operation of obese patients with BMI >35 kg/m^2, a unit surgeon was present during all procedures (L.L.), who specialises in the intervention of obese Class II–III patients, and slotted-base leg positioners supported the limb in different degrees of flexion during the operation.

The models used were from various commercial providers. They were all modular posterior-stabilised (PS) implants. The approach was internal parapatellar, with eversion of the patella. Prosthetic models with a cemented femoral component were used for all patients, while cementing of the tibia component was dependent on the prosthetic model used and the patient's age. Systematic prosthesis fitting of the patella was not carried out. After cementing of components, the tourniquet was released from the member and careful haemostasis was performed before wound closure. Prior to wound closure, two Redon vacuum drainages were placed and a compressive bandage was applied. Drainages were taken away after 48 h.

We stratified patients according to the WHO's BMI classification system into four groups: non-obese (BMI < 30 kg/m^2), obese Class I (BMI 30–34.9 kg/m^2), obese Class II (BMI 35–39.9 kg/m^2) and obese Class III (≥40 kg/m^2) [33]. The groups obese Class II

Please cite this article as: Tió M, et al, Severe and morbid obesity and transfusional risk in total knee arthroplasty: An observational study, Knee (2018), https://doi.org/10.1016/j.knee.2018.07.005