



The value of preoperative haemoglobin level as an indicator of blood loss in total hip arthroplasty: results of a multicentre pilot and prospective study

Ameliyat öncesi hemoglobin düzeyinin total kalça artroplastisinde kan kaybını tahmin etmedeki değeri: Çokmerkezli, pilot, prospektif bir çalışmanın sonuçları

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Objectives: Primary total hip arthroplasty (THA) is an elective orthopaedic procedure that is associated with significant blood loss. This multicentre pilot and prospective study was carried out to determine the amount of blood loss in THA using blood haemoglobin (Hb) as an indicator to help predict blood loss for a particular patient during the preoperative assessment.

Patients and methods: The study included 723 patients (416 females, 307 males; mean age 68 years; range 69 to 79 years) who underwent primary single-sided THA at three different hospitals. All the operations were performed under normotensive general anaesthesia. Preoperatively, blood Hb value was at least 12 g/dl, without a history of any preoperative transfusions. Haemoglobin was measured at 24 and 48 hours postoperatively. The mean difference in Hb measured before surgery and at postoperative 48 hours was calculated, which was defined as the amount of blood loss.

Results: Pre- and postoperative (48 hours) blood Hb levels ranged from 12.0 g/dl to 15.3 g/dl (mean 12.8 g/dl) and from 7.8 g/dl to 11.3 g/dl (mean 8.6 g/dl), respectively. The mean difference between the pre- and postoperative blood Hb levels was 4.2 g/dl.

Conclusion: An estimated amount of blood loss (4.2 g/dl) can be used as a simple and useful guide in the preoperative assessment of patients undergoing THA. It may help the surgeon anticipate the amount of blood loss, without requiring complicated calculations and costly procedures.

Key words: Blood loss, surgical; blood transfusion; hemoglobins; hemorrhage; hip joint/surgery; hip prosthesis; intraoperative period.

Amaç: Primer total kalça replasmanı (TKR) önemli kan kaybına yol açabilen elektif bir ortopedi ameliyatıdır. Bu çokmerkezli pilot ve ileriye dönük çalışmada, hastanın ameliyat öncesi değerlendirmesinde ameliyatla ilişkili kan kaybını tahmin etmek için, kan hemoglobini (Hb) gösterge olarak, TKR'de kan kaybı miktarının belirlenmesi amaçlandı.

Hastalar ve yöntemler: Çalışmaya, üç farklı merkezde primer ve tek taraflı TKR uygulanan 723 hasta (416 kadın, 307 erkek; ort. yaş 68; dağılım 69-79) alındı. Tüm ameliyatlar normotensif genel anestezi altında yapıldı. Ameliyat öncesinde hastalarda ortalama Hb değeri en az 12 g/dl idi ve hiçbirinde transfüzyon öyküsü yoktu. Hemoglobin ölçümleri ameliyat sonrası 24 ve 48. saatlerde yapıldı. Ameliyattan önceki değer ile ameliyat sonrası 48. saatte ölçülen değerler arasındaki fark hesaplandı ve bu fark TKR sırasındaki kan kaybı olarak tanımlandı.

Bulgular: Ameliyat öncesinde ve sonrasında (48. saat) ölçülen Hb düzeylerinin dağılımı sırasıyla 12.0 gr/dl ile 15.3 gr/dl (ort. 12.8 gr/dl) ve 7.8 gr/dl ile 11.3 gr/dl (ort. 8.6 gr/dl) arasında değişiyordu. İki ölçüm arasındaki ortalama fark 4.2 gr/dl bulundu.

Sonuç: Çalışmada bulunan ortalama kan kaybı miktarı (4.2 gr/dl) TKR uygulanacak hastaların ameliyat öncesi değerlendirilmesinde basit ve yararlı bir kılavuz olabilir ve cerraha, karmaşık hesaplara ve masraflı incelemelere gerek kalmadan kan kaybı miktarının tahmininde yardımcı olabilir.

Anahtar sözcükler: Kan kaybı, cerrahi; kan nakli; hemoglobin; kanama; kalça eklemi/cerrahi; kalça protezi; intraoperatif dönem.

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Total hip arthroplasty (THA) has become one of the most frequently performed elective reconstructive procedures in orthopaedic surgery. However, blood loss remains an important problem associated with this procedure, often requiring blood transfusion.^[1-3] Besides various infections, blood transfusion has got a number of other transfusion-related adverse effects.^[4,5] Many of these adverse effects can simply be minimised or eliminated by transfusions based on genuine indications. It is, therefore, in the best interest of the patient to use blood with utmost care wherever possible, especially for elective operative procedures like THA, for which preoperative planning is possible.

The use of various blood conservation techniques in THA has been evaluated and advocated by many studies.^[1,6-13] There are numerous studies in the literature to guide towards various methods of blood transfusion. Yet, to the best of our knowledge, there is not any study that specifically aimed to quantify the actual blood loss in primary THA, thereby helping predict blood loss in the intra- and postoperative phases.

On a multicentre pilot and prospective basis, this study was carried out to determine the amount of blood loss in THA using blood haemoglobin (Hb) as an indicator to predict blood loss for a particular patient during the preoperative assessment.

PATIENTS AND METHODS

The study included 723 patients (416 females, 307 males; mean age 68 years; range 69 to 79 years) from three different hospitals, who were operated on by 18 surgeons between February 2000 and August 2003. All the patients underwent primary THA with appropriate indications of surgery for osteoarthritis of the hip.

Exclusion criteria included the presence of any blood disorder, a past history of transfusion, the use of anticoagulation medications, and ischaemic heart disease. Patients with rheumatoid arthritis, psoriatic arthritis, and Paget's disease were also excluded. All the operations were performed under normotensive general anaesthesia. All the patients had cemented Charnley prosthesis with the use of a modified Hardinge approach. Neither the surgeon nor the patient was aware of the inclusion/exclusion criteria and the first author, who collected and evaluated the data, was not involved in any of the operations.

All the patients were assessed preoperatively and appropriate blood investigations were made. Preoperatively, all met the criterion of having at least 12 g/dl of Hb and none of them received any preoperative transfusions or donated any blood for autologous transfusion. Nor did they receive transfusions of blood or other blood products during or following surgery. Haemoglobin count was repeated at 24 and 48 hours postoperatively. The latter was considered to be sufficiently reflecting the postoperative blood Hb level, because the former count might be confounded by intraoperative haemoconcentration or dilution with intravenous fluids over the first 24 hours postoperatively. Thus, the mean difference in blood Hb measured pre- and postoperatively was calculated.

All the patients were administered enoxaparin 40 mg for the prophylaxis of deep vein thrombosis from the night of surgery. All received the same fluid regimen during the immediate postoperative period. Rehabilitation protocol included immediate full weight-bearing ambulation on the first postoperative day.

RESULTS

The three hospitals that participated in the study perform an average of 300 primary THA operations each year. Over a three and a half year period, a total of 723 patients met the the inclusion criteria. Of these, 392 patients and 331 patients underwent right and left primary THA operations, respectively. None of the patients had bilateral THA.

Preoperative blood Hb levels ranged between 12.0 g/dl and 15.3 g/dl (mean 12.8 g/dl). The postoperative range measured at 48 hours was between 7.8 g/dl and 11.3 g/dl (mean 8.6 g/dl). The mean difference between the pre- and postoperative blood Hb was 4.2 g/dl, which delineated the estimated blood loss in primary THA within the first 48 hours from the beginning of the operation.

DISCUSSION

One potential problem in the perioperative period for THA is the blood loss and its associated complications including difficulties in postoperative rehabilitation and prolonged length of hospital stay.^[4-6,14] Even if a detailed preoperative assessment of patients is made, this still remains a challenge due to the fact that the surgeon may not be prepared for the amount of blood loss in a particular patient.

Haemoglobin is a strong indicator for blood loss that could easily be estimated anytime of the day.^[3,15] In our study, we made as many variables as possible similar by our inclusion and exclusion criteria and determined that the amount of blood loss associated with THA would be about 4.2 g/dl, showing the mean difference between measurements preoperatively and at 48 hours postoperatively. This predicted blood loss would enable the surgeon to be better prepared for intraoperative and postoperative blood-related problems in the best interest of the patient.

It has been established that hypotensive anaesthetic techniques can effectively reduce blood loss and transfusion requirements in THA.^[16,17] However, special expertise and monitoring are required to ensure safety in using these techniques.^[16,17] All the patients in our study were operated on under normotensive general anaesthesia which is perhaps the most commonly used anaesthetic technique in hospitals.^[18] Yet, if the decrease in Hb is likely to exceed the predicted amount, then the surgeon may find opportunity to liaise with the anaesthetist regarding conversion to hypotensive anaesthesia to minimise blood loss during the intraoperative period.

Quite a few studies have attempted to predict blood transfusion after total hip or knee arthroplasties.^[3,15,19] However, all these studies are based on blood transfusions given intraoperatively to the patients, which most often do not reflect the actual blood loss and need of the patient. It is our opinion that, intraoperative blood transfusions should rely on the preoperative estimation of Hb, which was found to range from 7.8 g/dl to 11.3 g/dl (mean 8.6 g/dl) postoperatively.

In our study, of four variables that have been proved to be strongly related to blood loss in hip/knee arthroplasties, namely Hb, body weight, type of arthroplasty, and primary *vs* revision surgery,^[3,15] the last two were excluded at the beginning during patient selection. On the other hand, Hb has been reported to be a far more reliable predictor than the body weight.^[3,15,19] Even though the preoperative Hb values of the patients in this study were 12 g/dl or above, our results may still be helpful for perioperative management of patients with a Hb value of less than 12 g/dl.

In conclusion, an estimated amount of blood loss (4.2 g/dl) can be used as a simple and useful guide in the preoperative assessment of patients undergoing THA. It may help the surgeon anticipate the amount of possible intraoperative blood loss, without requiring complicated calculations and costly procedures.

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