Orthopaedics & Traumatology: Surgery & Research 102 (2016) 67–70

Available online at ScienceDirect www.sciencedirect.com

Elsevier Masson France EM|consulte www.em-consulte.com/en

Original article

Hidden blood loss in anterior lumbar interbody fusion (ALIF) surgery

H. Ju [a,b,*], R.A. Hart [b,1]

[a] Department of Orthopedics, Guangzhou First Municipal People's Hospital, Guangzhou, Guangdong, China
[b] Department of Orthopedics and Rehabilitation, Oregon Health and Science University, 3181 SW Sam Jackson Park Road, Portland, OR 97201, United States

ARTICLE INFO

Article history:
Received 27 November 2014
Accepted 14 October 2015

Keywords:
Estimated blood loss
Hidden blood loss
Spine surgery
Lumbar spine
Complications

ABSTRACT

Background: A retrospective study was performed to determine the factors affecting the total perioperative blood loss during anterior lumbar interbody fusion (ALIF). Measurements of intraoperative blood loss underestimate the true blood loss during surgery. Our research project was to examine the hidden blood loss in lumbar spine surgery. Hidden blood loss in elective knee and hip replacement surgeries range between 100% and 30%. Hidden blood loss was about 40% in posterior spine surgery.
Methods: The factors analyzed included gender, body mass index (BMI), duration of surgery, type of surgery, aspiration, and number of fusion levels. Estimated blood loss (EBL) was obtained from the clinical records of patients as the blood collected from suctioning and the cumulative weight of the saturated sponges. Actual blood loss (ABL) was calculated from the estimated blood volume and hemoglobin level of patients. Hidden blood loss was calculated as the difference between ABL and EBL.
Results: Seventy-eight consecutive patients who underwent ALIF were reviewed. The average values (mean ± SD) for EBL and ABL were 700.1 ± 562.3 mL and 1150.6 ± 770.0 mL, respectively ($P = 0.001$, Student's t-test). The hidden blood loss averaged 39.2% of the ABL. According to linear regression analysis, surgical duration, type of surgery, and the inclusion of the L4/5 level were independent factors contributing to the ABL ($P < 0.05$), whereas BMI and gender did not correlate with ABL or EBL.
Conclusions: ALIF is associated with substantial perioperative hidden blood loss. Length of surgery, type of surgery, and the inclusion of L4/5 in the procedure are significant risk factors for increased blood loss.
Level of evidence: Level IV: retrospective or historical series.
© 2015 Elsevier Masson SAS. All rights reserved.

1. Introduction

Measurements of blood loss during orthopedic procedures consistently underestimate the true blood loss during surgery [1]. This so-called "hidden blood loss" can be an important contributor to postoperative outcomes [2,3], such as medical complications and increased hospitalization time [4]. The concept of hidden blood loss has received increased attention in recent years [2,3,5–7]. Evaluations in elective knee and hip replacement surgeries revealed that hidden blood loss comprised 100% and 30%, respectively, of the observed intraoperative blood loss [8]. In a prospective analysis of 114 patients, Smorgick et al. reported substantial hidden blood loss in connection with posterior spine surgery [9]. However, few published studies have examined the issue of hidden blood loss in anterior lumbar spine surgery.

Anterior lumbar interbody fusion (ALIF) is a widely available spine fusion technique [10], in which the abdominal muscles are retracted to the side and a bone graft is implanted in the space of the intervertebral disc, which compresses the bone. In our clinical experience, we have noted that ALIF is associated with relatively little perioperative blood loss. There are several possible reasons for this observation. For example, ALIF requires a pass through the rectus abdominis that, like the peritoneum, is easily retracted. As a result, injury to blood vessels of the soft tissues is minimized. Furthermore, little blood is lost during disc exposure, and no drainage is typically placed after ALIF.

Because published studies examining perioperative blood loss during ALIF are scarce, we performed a retrospective review to determine whether there is hidden blood loss during ALIF and to identify the factor(s) causing the actual blood loss (ABL) during this procedure.

2. Patients and methods

2.1. Patients

The study protocol was approved by the hospital and the local institutional ethics review board. The electronic medical data of

* Corresponding author. Department of Orthopedics, Guangzhou First Municipal People's Hospital, Guangzhou 510180, Guangdong, China. Tel.: +86 159 1848 3436.
E-mail addresses: bin7810@126.com (H. Ju), hartro@ohsu.edu (R.A. Hart).
[1] Tel.: +1 503 494 6406; fax: +1 503 494 5050.

http://dx.doi.org/10.1016/j.otsr.2015.10.003
1877-0568/© 2015 Elsevier Masson SAS. All rights reserved.

80 patients who had undergone the ALIF procedure at the Oregon Health and Science University Hospital Orthopedic Center from November 2008 to July 2010 were retrospectively reviewed. Two patients were excluded because ALIF surgery was stopped due to vessel injury and exposure of the surgical approach to the disc. Recorded data included the preoperative weight, height, and calculated body mass index (BMI); pre- and postoperative full blood counts (FBCs), including hematocrit (Hct); visible blood loss, including blood stored in suction bottles and weighed swabs, as measured by the anesthesiologist; and postoperative drainage and volume of blood reinfused, as measured in the charts.

The aim of this study was to determine the proportion of the ABL that was hidden. Therefore, to optimize the accuracy, the two ALIF patients who had very high blood losses requiring large volumes of fluid resuscitation due to tumors were excluded from the analysis.

2.2. Management of blood loss

A strict blood transfusion trigger of 100 g/L was used to standardize transfusion therapy and to minimize the potential effects of anemia on postoperative outcome. Blood was transfused during and after the operations as indicated. Thirty-one patients (39.74%) required transfusions. Prophylaxis against deep vein thrombosis was provided by foot pumps and compression stockings rather than anticoagulant agents. Within 2 to 3 days after the operation, the patients were hemodynamically stable, and the fluid shifts had largely completed.

2.3. Calculation of the hidden blood loss

The intraoperative estimated blood loss (EBL) was determined from data on the clinical charts as the blood collected from suctioning and the weight of the saturated sponges. The estimated blood volume (EBV) was determined according to the gender, weight (w in kg), and height (h in m) of patients, according to the following formulae [1,11]:

$$\mathrm{EBV(L)} = h^3 \times 0.356 + w \times 0.033 + 0.183(\mathrm{female})$$

$$\mathrm{EBV(L)} = h \times 0.367 + w \times 0.032 + 0.604(\mathrm{male})$$

Hgb loss in the perioperative period was calculated by assuming that the blood volume would be the same on admission and on the third postoperative day, and that all transfused units of packed red blood cells (PRBCs) contained the same number of cells. The following formula was used:

$$\mathrm{Hgb_{loss}(g)} = \mathrm{EBV} \times (\mathrm{Hgb_{adm}} - \mathrm{Hgb_{fin}}) + \mathrm{Hgb_{trans}}$$

where $\mathrm{Hgb_{loss}}$ is the actual Hgb lost, $\mathrm{Hgb_{adm}}$ is the Hgb level of the patient at admission, $\mathrm{Hgb_{fin}}$ is the final Hgb level, and $\mathrm{Hgb_{trans}}$ is the weight of the transfused PRBCs (2 unit of PRBCs = 52 g Hgb). Finally, the ABL and hidden blood loss were calculated as follows:

$$\mathrm{ABL(mL)} = (\mathrm{Hgb_{loss}}/\mathrm{Hgb_{adm}}) \times 1000$$

$$\mathrm{Hiddenbloodloss(mL)} = \mathrm{ABL(mL)} - \mathrm{EBL(mL)}$$

2.4. Statistical analysis

Independent samples Student's t-test were used to test for significant differences between males and females. The difference between the EBL and ABL was measured by Spearman relative analysis and independent samples t-test. Multivariate linear regression analysis and ANOVA were performed to identify independent factors associated with total blood loss, such as surgical level, type of surgery (stand-alone ALIF and second-stage ALIF after posterior correction and fusion), body mass index (BMI), and operative time. ANOVA tests were performed to identify independent factors associated with total blood loss and the number of surgical levels. The level of statistical significance was set at $P < 0.05$. All data analyses were performed with the SPSS 17.0 software package.

3. Results

A total of 78 patients (32 males; age range 32–78 years) were retrospectively reviewed. The patient demographic and clinical data (including blood loss results) are summarized in Tables 1–3. Student's t-test revealed a significant difference between the mean EBL and ABL for the patients ($t = 4.208$, $P < 0.0001$). The hidden blood loss averaged 39.2% of the ABL.

Male patients showed higher postoperative Hgb and blood volume results as compared to female patients ($P1 = 0.01$; $P2 < 0.0001$ by t-test; Table 4), and the BMI differed between male and female patients ($P = 0.41$). No differences were observed in the volume of blood loss or the blood cells lost between males and females ($P1 = 0.78$; $P2 = 0.94$). The number of surgical levels did not have a significant influence on the EBL or ABL ($P1 = 0.48$; $P2 = 0.86$). The

Table 1
Patient demographic and clinical information.

Parameter (unit)	Mean ± SD
Age (y)	58.9 ± 11.7
Male:female	32:46
Surgery duration (min)	241.0 ± 86.3
Height (cm)	1.7 ± 0.1
Weight (kg)	81.6 ± 20.4
BMI (kg/m^2)	27.7 ± 7.6
Estimated blood loss (mL)	700.1 ± 562.3
Actual blood loss (mL)	1150.6 ± 770.0

Table 2
Number and involved fusion levels.

Segment number	Number	Proportion (%)
1	16	20.5
2	28	35.9
3	17	21.8
4	16	20.5
5	1	1.3
Total	78	100

Table 3
Number and distribution of spinal segments.

Spinal fusion segments	Number
L1-L4	5
L2-S1	16
L3-S1	7
L4-L5	4
L4-S1	28
L5-S1	10
Other level	8

Table 4
Comparison of clinical results between males and females.

Parameter (unit)	Male	Female	t	P
Preoperative Hgb (g/L)	118.5 ± 27.2	112.4 ± 17.6	1.20	0.23
Postoperative Hgb (g/L)	101.8 ± 18.9	91.5 ± 17.2	2.51	0.01
Blood volume (L)	5.5 ± 0.7	4.2 ± 0.8	7.93	0.00
Lost blood cell (g)	137.4 ± 88.1	135.6 ± 104.6	−0.08	0.94
Volume of blood loss (mL)	1121.3 ± 710.3	1171.1 ± 816.0	−0.28	0.78
BMI	29.9 ± 6.1	27.4 ± 4.8	2.07	0.41

Data are mean ± SD; Hgb: hemoglobin.

Download English Version:

https://daneshyari.com/en/article/4080946

Download Persian Version:

https://daneshyari.com/article/4080946

Daneshyari.com