

Differences in Perioperative Patient Autologous Blood Management for Instrumental Spinal Surgery

Wataru Shimada¹, Hiraku Kikuchi^{1*}, Sei Mihira¹, Jin Nakajima¹, Kayoko Sumino², Narihiro Okada³ and Emiko Iuchi⁴

¹Department of Orthopaedic Surgery, Sakai Sakibana Hospital, Osaka, Japan

²Department of Nursing, Sakai Sakibana Hospital, Osaka, Japan

³Department of Orthopaedic Surgery, Sumoto Itsuki Hospital, Hyogo, Japan

⁴Department of Nursing, Sumoto Itsuki Hospital, Hyogo, Japan

*Corresponding Author: Hiraku Kikuchi, Department of Orthopaedic Surgery, Sakai Sakibana Hospital, Osaka, Japan.

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Abstract

Objectives: We investigated perioperative patient autologous blood management for spinal surgery in two affiliated hospitals under different situations in Japan. Aim to comparative pilot study for preoperative autologous blood donation using erythropoietin and transfusion versus washed red cell salvage autologous blood transfusion in instrumental spinal surgery.

Methods: This study included 10 patients each at the two hospitals who underwent instrumental spinal surgery with blood loss exceeding 600 mL included hidden blood loss in or after April 2020. In perioperative patient blood management, one is the intra-operative autologous cell salvage (Group S), and the other is pre-operative autologous blood donation with erythropoietin (Group I), mainly.

Results: Washed concentrated autologous red blood cells were 146 - 264 mL via Cell saver. The Hb levels ranged from 8.0 to 14.2 g/dL in Group S and from 9.1 to 14.9 g/dL in Group I indicated on admission time. Despite the differences in types of autologous blood transfusion, such as leukocyte depletion, no serious complications of autologous blood transfusion were detected.

Conclusion: No serious complications, including infection or delayed rehabilitation, were observed at two hospitals. The measures used in the two hospitals for patient autologous blood management were effective.

Keywords: Patient Blood Management; Spinal Surgery; Intra-Operative Autologous Cell Salvage; Preoperative Autologous Blood Donation; Erythropoietin

Abbreviations

PBM: Patient Blood Management; EPO: Erythropoietin; BMI: Body Mass Index; Hb: Hemoglobin; BKP: Balloon Kyphoplasty

Introduction

Perioperative patient blood management (PBM) [1] varies among hospitals. We investigated perioperative PBM for instrumental spinal surgery in two affiliated hospitals under different situations. Patient characteristics and PBM were analyzed in 10 patients per hospital who underwent spinal surgery requiring blood transfusion at the Department of Orthopedic Surgery of Sakai Sakibana Hospital and Sumoto Itsuki Hospital in or after April 2020.

Materials and Methods

This study included 10 patients each at the two hospitals who underwent instrumental spinal surgery (multi-level laminectomy + instrumented fusion: Peter Brehm, Germany) with blood loss exceeding 600mL (included hidden blood loss) in or after April 2020. A single primary surgeon performed the surgeries in all 20 patients. The study characteristics included age, sex, disease, body mass index (BMI), hemoglobin (Hb) level on admission and post-operation, preoperative autologous blood storage volume, concomitant use of iron preparations, dose of erythropoietin (EPO: 24,000 units of EPOGIN, Chugai Pharmaceutical, Japan) [2] for blood storage, surgical procedure, operative time, intraoperative blood salvage autologous blood transfusion volume (Cell saver, Hemonetics, USA) total blood loss, allogeneic blood transfusion, and complications. Differences between the two hospitals were noted. Pre-storage leukocyte depletion was preoperatively performed for autologous blood transfusion in four out of 10 patients at Sakai Sakibana Hospital (Group S). EPO was used in one patient for whom 800 mL of blood was stored. All 10 patients received washed cell salvage autologous blood transfusions during surgery. All patients at the Sumoto Itsuki Hospital (Group I) received both iron preparations (100 mg of ferrous citrate) and EPO. Before surgery, we attempted to store 800 mL of blood but were unable to perform pre-storage leukocyte depletion. Regarding patient characteristics, no differences in age, sex, or Hb levels on admission between Groups S and I were noted (Table 1). Iron preparations were used for blood storage in four patients of Group S and in all patients of Group I. Iron preparations were administered to all patients at the same dose. In Group I, EPO was concomitantly administered to all 10 patients. However, difficulty in blood collection resulted in failure to store 800 mL of blood in three patients. No adverse reactions, such as vasovagal reactions, occurred at the time of blood storage.

	Group S (n = 10)	Group I (n = 10)
Age/Gender	48 - 84/Men 6, Female 4	62 - 85/Men 6, Female 4
Hb on admission	11.7 - 14.9	8.5 - 15.2
(Average mg/dL)	13.4 ± 1.2	12.5 ± 1.9
Iron preparations	4	10
Combined use EPO	0	10
Preoperative donation	400 mL:3, 800 mL:1	400 mL:3, 800 mL:7

Table 1: Backgrounds for preoperative patients each at the two hospitals who underwent instrumental spinal surgery.

Results and Discussion

No differences in surgical procedures, operative time, or total blood loss between the two hospitals were observed. Regarding autologous blood transfusion, four patients in Group S received 146 - 264 mL of washed packed red blood cell transfusion and pre-storage autologous blood transfusion via Cell saver. In contrast, all patients in Group I received autologous blood transfusion without leukocyte depletion. Immediately after surgery, the Hb levels ranged from 8.0 to 14.2 g/dL with a mean of 10.7 g/dL in Group S and from 9.1 to 14.9 g/dL with a mean of 12.1 g/dL in Group I. Despite the differences in types of blood transfusion, such as leukocyte depletion, no serious complications of autologous blood transfusions were detected. No allogeneic blood transfusion was required in either group. No perioperative complications were noted, and postoperative rehabilitation was performed without delay (Table 2). Factors considered for PBM include improvement of anemia before surgery, preoperative blood storage (simple blood storage; 400 mL, blood storage with EPO; 800 mL), hemodiluted autologous blood transfusion immediately before surgery (requiring the cooperation of an anesthesiologist), intraoperative blood salvage autologous blood transfusion (easy to salvage blood in spinal surgery), achievement of intraoperative hemostasis, and postoperative blood salvage autologous blood transfusion (low postoperative blood loss in spinal surgery, but hidden blood loss was considered). In Group S, transfusion of both pre-storage leukocyte-depleted autologous blood and blood salvaged with Cell saver contributed to a shortened duration of hospital stays. In Group I, a certain preoperative period was required for preoperative blood storage, including

administration of iron preparations and EPO. Since preoperatively stored blood is banked blood containing platelets and leukocytes, in principle, it is recommended to remove leukocytes at the time of blood storage, as performed by the Japanese Red Cross Society [3]).

	Group S (n = 10)	Group I (n = 10)
Operation time (min.)	73-151	96-156
Total blood loss (g.)	610-1,290	620-1,465
Average loss (g.)	877±208	949±267
Both data: not included hidden blood loss		
Autologous transfusion (mL)	Cell saver 146-264	400-800
Donated (mL)	400-800	
Allogenic transfusion (mL)	None	None
Sever complications	None	None

Table 2: Clinical results for patients each at the two hospitals who underwent instrumental spinal surgery.

However, this process is not covered by the national health insurance system and incurs a huge cost burden in hospitals. This resulted in differences between the two hospitals.

A typical case

An 81-year-old man (height, 159 cm; weight, 55.5 kg; and BMI, 21.9) with bilateral leg paralysis is presented here. The patient experienced difficulty in walking due to lumbar spinal canal stenosis and compression fracture, He was therefore referred for surgery. On admission, his Hb level was 12.8 g/dL. Before surgery, 400 mL of leukocyte-depleted autologous blood was stored. Laminectomy of L3 to S1, balloon kyphoplasty (BKP: Teijin, Japan) of L4, and instrumented fusion from L3 to L5 were performed for 151 min (Figure 1). Intraoperative blood loss was 1,066 g (not include hidden blood loss). With Cell saver, 151 mL of blood was recovered and supplied in the operating room. After surgery, 400 mL of pre-storage leukocyte-depleted autologous blood was returned.

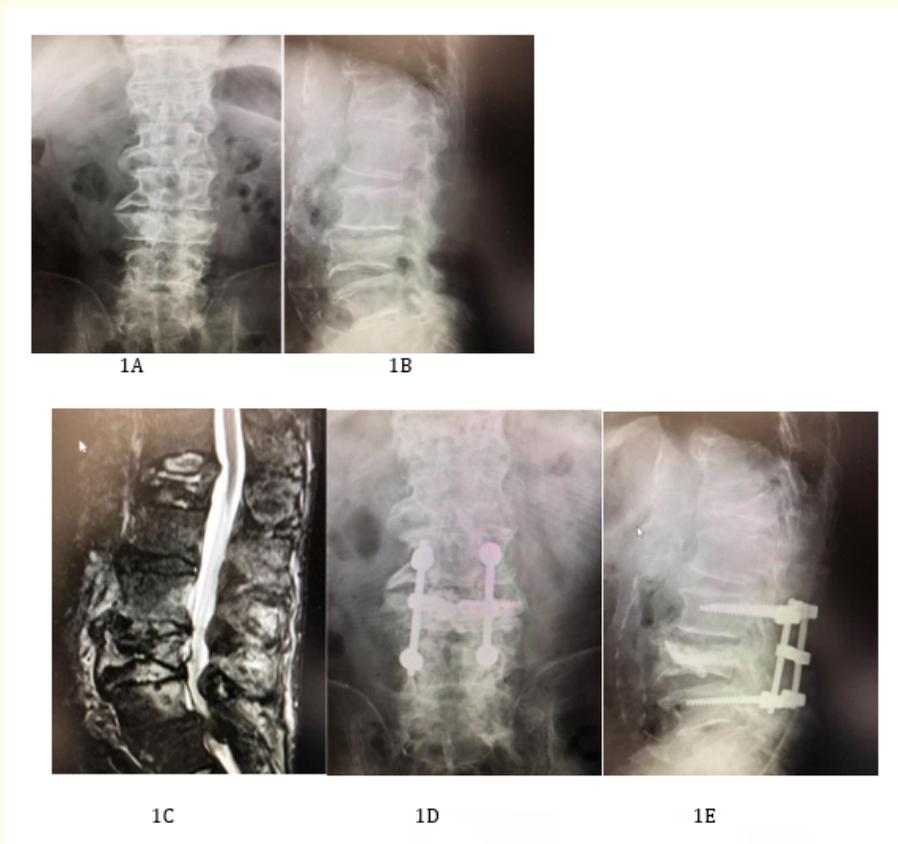


Figure 1: An 81-year-old man was received for laminectomy of L3 to S1, balloon kyphoplasty of L4, and instrumented fusion from L3 to L5. 1A: Preoperative XP AP view. 1B: Preoperative XP lateral view. 1C: MRI view. 1D: Postoperative XP AP view. 1E: Postoperative XP lateral view.

Although the lowest perioperative Hb level was 8.0 g/dL, the patient underwent postoperative recovery rehabilitation and was discharged from the hospital without complications. In patients with spinal canal stenosis complicated by compression fracture, BKP is useful for ensuring stability, shortening the operative time and reducing the blood loss.

Conclusion

For patients undergoing surgery with blood loss exceeding 600 mL included hidden blood loss for instrumental spinal canal stenosis, PBM was performed with intraoperative blood salvage with Cell saver (in combination with blood storage in four patients) and preoperative blood storage with iron preparations using EPO. No serious complications, including infection or delayed rehabilitation, were observed at any hospital. The measures used in the two hospitals for PBM were effective. When the amount of donated blood decreases because of an aging society, it is important to increase awareness, motivation, and safety and to reduce complications of allogeneic blood transfusion by performing safer autologous blood transfusions in the perioperative period.

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Conflict of Interest

No potential conflict to this was reported.

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