



Cell Saver for Adult Spinal Deformity Surgery Reduces Cost

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Abstract

Study Design: Retrospective cohort.

Objectives: To determine if the use of cell saver reduces overall blood costs in adult spinal deformity (ASD) surgery.

Summary of Background Data: Recent studies have questioned the clinical value of cell saver during spine procedures.

Methods: ASD patients enrolled in a prospective, multicenter surgical database who had complete preoperative and surgical data were identified. Patients were stratified into (1) cell saver available during surgery, but no intraoperative autologous infusion (No Infusion group), or (2) cell saver available and received autologous infusion (Infusion group).

Results: There were 427 patients in the Infusion group and 153 in the No infusion group. Patients in both groups had similar demographics. Mean autologous infusion volume was 698 mL. The Infusion group had a higher percentage of EBL relative to the estimated blood volume (42.2%) than the No Infusion group (19.6%, $p < .000$). Allogeneic transfusion was more common in the Infusion group (255/427, 60%) than the No Infusion group (67/153, 44%, $p = .001$). The number of allogeneic blood units transfused was also higher in the Infusion group (2.4) than the No Infusion group (1.7, $p = .009$).

Total blood costs ranged from \$396 to \$2,146 in the No Infusion group and from \$1,262 to \$5,088 in the Infusion group. If the cost of cell saver blood was transformed into costs of allogeneic blood, total blood costs for the Infusion group would range from \$840 to \$5,418. Thus, cell saver use yielded a mean cost savings ranging from \$330 to \$422 (allogeneic blood averted). Linear regression showed that after an EBL of 614 mL, cell saver becomes cost-efficient.

Conclusion: Compared to transfusing allogeneic blood, cell saver autologous infusion did not reduce the proportion or the volume of allogeneic transfusion for patients undergoing surgery for adult spinal deformity. The use of cell saver becomes cost-efficient above an EBL of 614 mL, producing a cost savings of \$330 to \$422.

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Introduction

Intraoperative blood salvage autotransfusion systems are commonly utilized during spine surgery to reduce the need for perioperative allogeneic blood transfusion [1,2]. If significant blood loss occurs and the patient requires a transfusion, the salvaged blood can be reinfused, potentially eliminating or reducing the need for allogeneic blood transfusions [3]. The use of autologous rather than allogeneic blood has several theoretic advantages, including reduced infection rates and avoidance of transfusion reactions [4].

The utility of cell saver has been well established in cardiac and nonspine orthopedic surgeries [5-7]. However, studies on the utility of cell saver in spine surgery are more limited and have varying results regarding its ability to reduce the utilization of intra- or postoperative allogeneic blood transfusion [3,8-12]. Even fewer studies have investigated the ability of cell saver to decrease costs associated with allogeneic blood transfusion [3,9,10]. Despite the lack of evidence for effectiveness in reducing allogeneic blood transfusion or decreasing costs, cell saver is frequently used during adult spinal deformity (ASD) surgery.

The goal of the study is to evaluate the cost-efficiency, if any, of cell saver in the setting of adult spinal deformity surgery using a prospective, multicenter surgical database. The specific objectives of the study are (1) to quantify intra- and postoperative total blood costs in ASD surgery; (2) to determine if the use of cell saver reduces cost in ASD surgery; and (3) to evaluate patient and surgical factors that can predict a threshold when cell saver becomes cost-efficient.

Materials and Methods

Data sources

Adult spinal deformity patients undergoing ≥ 5 -level fusion enrolled in a prospective, multicenter surgical database that had complete preoperative and surgical data were identified. Patients were enrolled from 2008 to 2014 involving 20 surgeons from 11 institutions. The University of Louisville Institutional Review Board approved the study protocol prior to the initiation of the study. Of the total cohort of 614 surgical cases enrolled in the database, 580 (94%) patients had documented cell saver information. Cell saver was set up for all posterior-only procedures, for both anterior and posterior procedures (combined) when performed the same day, and for the

posterior portion of delayed (not the same day) staged, anterior-posterior procedures. Cases were also excluded if more than 10% of the data needed to perform the analysis was missing. Missing data was treated as missing data and not imputed.

Patients were stratified into one of two groups based on their cell saver status: (1) cell saver available during surgery, but no intraoperative autologous infusion (No Infusion group), or (2) cell saver available and received autologous infusion (Infusion group). Estimated blood loss, levels fused, volume(s) transfused perioperatively and postoperatively prior to discharge, preoperative comorbidities, length of stay, and all related complications were also recorded. Data for estimated blood loss were taken from the operative record.

Cost analysis

In the current study, cell-saver effectiveness was measured in terms of allogeneic transfusions averted. We adopted a patient perspective in which all costs were relevant to the analysis. The costs of setting up the blood salvage machine, infusing salvaged autologous blood, and transfusing allogeneic blood were obtained from billing representatives at nine institutions.

Statistical analysis

All statistical analyses were conducted using IBM SPSS Statistics Version 20 (Somes, New York), with the significance level set at $p < .01$. Independent Student *t* tests were used to determine any significant differences in continuous variables between groups. Fisher's exact test was utilized to compare categorical variables between the groups. Regression modeling was used to determine at what EBL autologous infusion can be expected to occur and to identify any patient or surgical factors that predict cell saver use.

Results

Allogeneic blood transfusion rates (effectiveness)

Of 580 cases that had documented cell saver use, 427 (74%) had an intraoperative autologous infusion (Infusion group) and 153 (26%) had none (No Infusion group). Patients in both groups were similar in age, sex distribution, body mass index, smoking status, and ASA grade. The number of levels fused, number of interbody fusions, and number and type of osteotomies were also similar between the two groups. Mean volume of autologous infusion was

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