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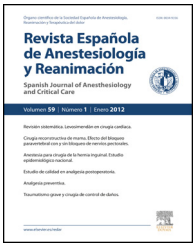

ORIGINAL ARTICLE

Characteristics and quality of intra-operative cell salvage in paediatric scoliosis surgery☆

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KEYWORDS
Bloodless medical and surgical procedures;
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Scoliosis;
Orthopedic surgery

Abstract
Objective: To determine the hematological and microbiological characteristics of blood recovered by using a cell saver with a rigid centrifuge bowl (100 ml) in pediatric scoliosis surgery and to determine whether it conforms to the standard expected in adult patients.
Material and methods: A cross-sectional, descriptive cohort study was performed on 24 consecutive red blood cell (RBC) units recovered from the surgical field and processed by a Haemolite® 2+ (Haemonetics Corp., Braintree, MA, USA) cell saver. Data were collected regarding age, weight, surgical approach (anterior or posterior), processed shed volume and volume of autologous RBC recovered, full blood count, and blood culture obtained from the RBC concentrate, and incidence of fever after reinfusion.
Results: The processed shed volume was very low (939 ± 569 ml) with high variability (coefficient of variation = 0.6), unlike the recovered volume 129 ± 50 ml (coefficient of variation = 0.38). A statistically significant correlation between the processed shed volume and recovered RBC concentrate haematocrit was found (Pearson, $r = 0.659$, $p = 0.001$). Hematological parameters in the recovered concentrate were: Hb $11 \pm 5.3\ g\,dl^{-1}$; haematocrit: $32.1 \pm 15.4\%$ (lower than expected); white cells $5.34 \pm 4.22 \times 103\ \mu l^{-1}$; platelets $37.88 \pm 23.5 \times 103\ \mu l^{-1}$ (mean ± SD). Blood culture was positive in the RBC concentrate recovered in 13 cases (54.2%) in which Staphylococcus coagulase (−) was isolated.
Conclusions: Cell salvage machines with rigid centrifuge bowls (including pediatric small volume) do not obtain the expected haematocrit if low volumes are processed, and therefore they are not the best choice in pediatric surgery.

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PALABRAS CLAVE
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Escoliosis;
Cirugía ortopédica

Características y calidad de la sangre autóloga recuperada del campo quirúrgico durante cirugía de escoliosis en pediatría

Resumen
Objetivos: Determinar las características hematológicas y microbiológicas de la sangre recuperada mediante el uso de un recuperador celular con campana centrifugadora pediátrica rígida (100 ml) en cirugía de escoliosis en pediatría y comprobar si se ajusta al estándar esperado en el paciente adulto.
Material y método: Estudio de cohorte transversal, descriptivo, sobre 24 unidades consecutivas de sangre recuperada del campo quirúrgico procesadas mediante un recuperador de sangre modelo Haemolite® 2+ (Haemonetics Corp., Braintree, MA, EE. UU.). Se recogieron los datos referentes a edad, peso, abordaje (anterior o posterior) de la cirugía de escoliosis, volumen procesado y volumen de concentrado de hematíes (CH) autógeno recuperado, hemograma y hemocultivo del concentrado obtenido y la incidencia de fiebre tras la reinfusión.
Resultados: El volumen procesado fue muy escaso (939 ± 569 ml) con gran variabilidad (coeficiente de variación = 0,6), a diferencia del volumen recuperado 129 ± 50 ml (coeficiente de variación = 0,38). Se estableció correlación estadísticamente significativa entre el volumen procesado y el hematocrito del CH recuperado (Pearson, r = 0,659; p = 0,001) que fue menor del esperado. Los parámetros hematológicos más relevantes de los concentrados recuperados fueron: Hb 11 ± 5,3 g dl^{-1}; HTO: 32,1 ± 15,4%; leucocitos 5,34 ± 4,22 × 10^3 μl^{-1}; plaquetas 37,88 ± 23,5 × 10^3 μl^{-1} (media ± DE). El hemocultivo del CH recuperado fue positivo en 13 casos (54,2%) en los que se aisló Staphylococcus coagulasa (−).
Conclusiones: Los recuperadores celulares con campana centrifugadora de volumen fijo (incluso pediátrica) no obtienen la concentración esperada si se procesan bajos volúmenes, por lo que no son la mejor opción en el niño.

Introduction

Intraoperative cell salvage is recommended in adult patients undergoing orthopedic or other types of surgery in which intraoperative blood loss of more than 1500 ml is expected, and the equivalent of 1.5–2 units of packed red blood cells (PRBC) can be recovered. Postoperative salvage through wound drainage is indicated when postoperative blood loss of between 500 and 1000 ml is expected, and at least the equivalent of 1 unit of PRBC can be recovered.[1]

In pediatric patients, however, this technique is less effective due to their limited blood volume. Therefore, in purely quantitative terms, less blood will be lost, but this blood loss will have a significant effect on the child. Salvaging this small volume in children is far more difficult than in adults, because it is mostly collected in bandages. In low-weight patients, the amount of blood aspirated might be insufficient for processing, even when using a pediatric cell salvage circuit. For this reason, the use of intraoperative cell salvage in pediatric surgery is still hotly debated[2,3] and very little research has been conducted into the efficacy of the technique, the quality of the blood obtained, and the most suitable type of blood recovery system in this context.

The aim of this study is to determine the hematological and microbiological characteristics of blood salvaged during scoliosis surgery in our department using a HaemoLite® 2+ (Haemonetics Corp., Braintree, MA, USA) system, and to compare it against the standard specified by the manufacturer and expected in adult patients. This enabled us to determine which type of cell saver is most appropriate in pediatric surgery.

Materials and methods

Transversal descriptive cohort study, approved by our hospital's Independent Ethics Committee. We obtained informed, signed consent from the guardians of study patients under 12 years; patients over that age signed a specially adapted informed consent form. Following this, 24 units of intraoperative blood collected consecutively from 24 pediatric scoliosis patients were processed in a Haemolite® 2+ cell saver (Haemonetics Corp., Braintree, MA, USA). Blood was aspirated intraoperatively at a negative pressure of less than150 mmHg and immediately combined with heparinized saline solution (SS) (30 U ml^{-1}) at a blood/serum ratio of approximately 7:1 and stored in the cell saver reservoir until the end of surgery. After surgery, the blood was centrifuged in a pediatric bowl (100 ml) at a speed of 8000 rpm, and washed with 500 ml of SS to obtain the salvaged, processed PRBC. The process was conducted under sterile conditions.

All patients were treated by the same team of surgeons and anesthetists, and received antibiotic prophylaxis with cefazolin (35 mg kg^{-1}) following anesthesia induction.

Patients' details, including age, weight, approach used (anterior or posterior), volume of intraoperative blood