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Is central venous pressure still relevant in the contemporary era of liver resection?



Eva See Wah Cheng, MD,^a Julie Hallet, MD, MSc(c),^{b,c}
 Sherif S. Hanna, MD, MSc,^{b,c} Calvin H.L. Law, MD, MPH,^{b,c}
 Natalie G. Coburn, MD, MPH,^{b,c} Jordan Tarshis, MD,^d Yulia Lin, MD,^{e,f}
 and Paul J. Karanicolas, MD, PhD^{b,c,*}

^a Faculty of Medicine, University of Toronto, Toronto, Ontario, Canada

^b Division of General Surgery, Department of Surgery, Sunnybrook Health Sciences Centre - Odette Cancer Centre, Toronto, Ontario, Canada

^c Department of Surgery, University of Toronto, Toronto, Ontario, Canada

^d Department of Anesthesiology, Sunnybrook Health Sciences Centre, Toronto, Ontario, Canada

^e Department of Clinical Pathology, Sunnybrook Health Sciences Centre, Toronto, Ontario, Canada

^f Department of Laboratory Medicine and Pathobiology, University of Toronto, Toronto, Ontario, Canada

ARTICLE INFO

Article history:

Received 9 June 2015

Received in revised form

29 July 2015

Accepted 6 August 2015

Available online 13 August 2015

Keywords:

Liver resection

Blood transfusion

Central venous pressure

Anemia

ABSTRACT

Background: Perioperative red blood cell transfusion (RBCT) remains common after liver resection and carries risk of increased morbidity and worse oncologic outcomes. We sought to assess the factors associated with perioperative RBCT after hepatectomy with a focus on intraoperative hemodynamics.

Methods: We performed a retrospective review of our prospective hepatectomy database, supplemented by a review of anesthetic records of all patients undergoing hepatectomy with hemodynamic monitoring (arterial and central venous pressures [CVP]) from 2003–2012. Primary outcome was perioperative RBCT (during and within 30 d after surgery). After descriptive and univariate comparisons, multivariate analysis was conducted to identify factors associated with RBCT.

Results: Of 851 hepatectomies, 530 had complete hemodynamic data and 30.2% (161 of 530) received RBCT. Among transfused patients, female gender ($P = 0.01$), preoperative anemia ($P < 0.001$), and major liver resection ($P = 0.02$) were more common. Mean estimated blood loss was 1.1 L higher (2.0 versus 0.9 L; $P < 0.001$) and operating time was 1.1 h longer (5.8 versus 4.7 h; $P < 0.001$) in transfused patients. Trends in intraoperative CVP differed significantly based on transfusion status ($P = 0.007$). Independent factors associated with RBCT included female gender (odds ratio [OR], 2.27; $P = 0.01$), preoperative anemia (OR, 2.38; $P = 0.03$), longer operative time (OR, 1.19 per hour; $P = 0.03$), and higher intraoperative CVP at 1 h during surgery (OR, 1.10 per mm Hg; $P = 0.005$).

Conclusions: Likelihood of RBCT is independently associated with female gender, preoperative anemia, longer operative time, and higher intraoperative CVP. Focus on management

Part of this study has been accepted for poster presentation at the 2014 Canadian Surgery Forum of the Canadian Association of General Surgeons, in Vancouver, British Columbia, Canada.

* Corresponding author. Department of Surgery, Sunnybrook Health Sciences Centre - Odette Cancer Centre, 2075 Bayview Avenue, Toronto, Ontario, Canada. Tel.: +1 416-480-4774; fax: +1 416-480-6002.

E-mail address: paul.karanicolas@sunnybrook.ca (P.J. Karanicolas).

0022-4804/\$ – see front matter © 2016 Elsevier Inc. All rights reserved.

<http://dx.doi.org/10.1016/j.jss.2015.08.005>

of preoperative anemia, operative efficiency, and low intraoperative CVP is needed to minimize the need for RBCTs.

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1. Introduction

Recent advances in perioperative care and surgical technique for liver resection have significantly improved outcomes, with mortality rates now ranging from 0%–5% [1]. Intraoperative blood loss remains a concern during liver resection, leading to use of perioperative red blood cell transfusions (RBCTs) in 17%–40% of cases [2–5]. Beyond risks of transfusion-related reactions and infection transmission, RBCTs are associated with worse outcomes including infection, morbidity, mortality, and even cancer recurrence [6–11]. The National Summit on Overuse of the American Medical Association and the Choosing Wisely Campaign identified RBCT as an overused treatment to be targeted in efforts to improve patient outcomes [12,13]. Optimization of RBCT use is important from both patient outcome and resource utilization perspectives [14,15].

Better understanding of the factors associated with RBCT for hepatectomy in the contemporary era may focus efforts to decrease the use of transfusions. Major changes in perioperative management of liver resections have occurred and transformed care for these patients, including focus on limiting blood loss [16]. In this effort, low central venous pressure (CVP) anesthesia has emerged as a potentially effective strategy to decrease blood loss at the time of parenchymal transection [2,3,17].

We sought to assess preoperative and intraoperative factors associated with perioperative RBCT for liver resection, with a focus on modifiable intraoperative hemodynamic parameters, including CVP. In particular, we hypothesized that intraoperative CVP was independently associated with the need for perioperative RBCT.

2. Methods

We performed a retrospective review of our prospective hepatectomy database, with a mandated detailed review of anesthetic records. This study was approved by the Sunnybrook Health Sciences Centre Research Ethics Board.

2.1. Selection of participants

Patients undergoing elective liver resection for benign or malignant disease from 2003–2012 at a single academic institution specialized in hepatopancreatobiliary surgery (Sunnybrook Health Sciences Centre–Odette Cancer Centre) were identified using the Odette Cancer Centre liver database. We included all adult patients (≥ 18 -years-old) undergoing liver resection regardless of the indication or extent of resection. We excluded patients who did not have central venous catheters for measurement of CVP.

2.2. Outcomes and data collection

The primary outcome was perioperative RBCT, defined as transfusion of one or more units of allogeneic red blood cells during surgery or within 30 d after surgery. As part of the standard of care, patients underwent outpatient follow-up 4 wk after surgery, at which point any morbidities occurring after discharge from hospital, including transfusion, were assessed. Assessors not involved in the treatment process collected data using a standardized form. Data collection included baseline demographic and clinical characteristics, as well as intraoperative hemodynamic and technical characteristics. Preoperative anemia was defined as hemoglobin level (Hb) < 130 g/L within 30 d of surgery [18]. Major liver resection was defined as resection of three or more segments. Intraoperative complications were captured based on the operative report dictated by the attending surgeon, including major bleeding, injury to surrounding structures, pneumothorax, hypotension, and cardiac events.

2.3. Technical considerations

All liver resections at our institution were performed aiming for low central CVP [2]. CVP was monitored for most patients intraoperatively using a central venous catheter. The use of central venous catheters was left to the discretion of the anesthesiologist, based on individual assessment of extent of surgery and patient-level factors such as comorbidities. Intermittent portal flow occlusion was used selectively based on extent of resection and intraoperative bleeding. Parenchymal transection was performed according to the preferred technique of each surgeon.

Patients were monitored for at least 24 h in a surgical intensive care unit after surgery. According to the institutional guidelines during the study period, RBCTs were administered for a Hb < 70 g/L or 70–100 g/L in cases of symptoms in the nonbleeding patient and to maintain Hb between 70 and 100 g/L in the bleeding patient.

2.4. Statistical analysis

SPSS 21.0 (IBM Corp, Armonk, NY) was used for all statistical analysis. Two groups were considered as follows: (1) patients receiving perioperative RBCT (transfused) and (2) patients not receiving RBCT (nontransfused). Categorical data were reported as absolute number (n) and proportion (%), and continuous data were reported as median with interquartile range or mean with standard error. Comparison analysis was conducted using the Student t -test, Fisher exact test, or Pearson chi-square test, as appropriate. Multivariate analyses were conducted to identify preoperative and intraoperative factors associated with the need for RBCT. Variables identified

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