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Cardiovascular and Thoracic Abstracts

Contents

An unusual complication of a pulmonary artery catheter

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60

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INTRODUCTION

We had a patient in the operation room about to under-go a double lung transplant for Idiopathic pulmonary fibrosis (IPF). The pulmonary artery catheter (PAC) was attempted to be floated through a left sided internal jugular vein Cordis sheath but was unsuccessful after multiple attempts. The PAC subsequently formed a knot and while attempting to withdraw it, it snared the newly inserted left subclavian vein triple lumen central line causing an abrupt stoppage of all the infusions running through it. Knot formation is a recognized complication associated with PAC insertion,[1] but snaring of the subclavian central line hasn't been reported before. We believe our experience with this case can be of use to others.

CASE PRESENTATION

A 58-yr-old man with history of IPF was posted for an emergency double lung transplant. In view of fairly normal pulmonary artery pressures, the patient was induced and intubated with a double-lumen endobronchial tube (DLT), maintained on propofol total intravenous anesthesia and subsequently planned to float a PAC through a left-sided internal jugular vein (IJV) Cordis sheath and also place a left sided subclavian triple lumen central line. The central line and Cordis sheath were inserted uneventfully but the PAC could not be floated following multiple attempts. The surgeons opened the chest with a clam-shell incision. Another attempt to float the catheter once the chest was opened was unsuccessful. The catheter was then attempted to be withdrawn, but during that process it was noted that all the drug infusions running through the subclavian central line stopped abruptly. On dissecting the mediastinal structures, the surgeons noticed a large hematoma in the mediastinum. A new femoral central line was inserted by the surgeons and on vascular exploration it was noted that the subclavian catheter had perforated the vein at the atrial-caval junction. The catheter was cut and the vein repaired. The double lung transplant was completed successfully with extracorporeal membrane oxygenation support and at the end of the case, fluoroscopy was used to identify the PAC knotted in the left IJV. The left side neck was explored by Vascular surgery and the PAC was noted to have snared the subclavian central line catheter. Both the PAC and central line were removed and the neck closed.

CONCLUSION

Indications for using PAC in cardiac and noncardiac surgical patients include severe left ventricular dysfunction, severe pulmonary hypertension, septic shock, cardiogenic shock, pulmonary edema, and severe toxaemia of pregnancy. Complications associated with PAC[2] are divided into the following categories: venous access, dysrythmias, complications associated with catheter residence inside the body including venous thrombosis, thrombophlebitis, pulmonary embolism, cardiac mural thrombi, valvular injury, infection, and pulmonary artery rupture. Sepsis is a complication of PAC residence. The PAC snaring the subclavian catheter is something we did not find in literature and wanted to add it to the list of vascular complications.

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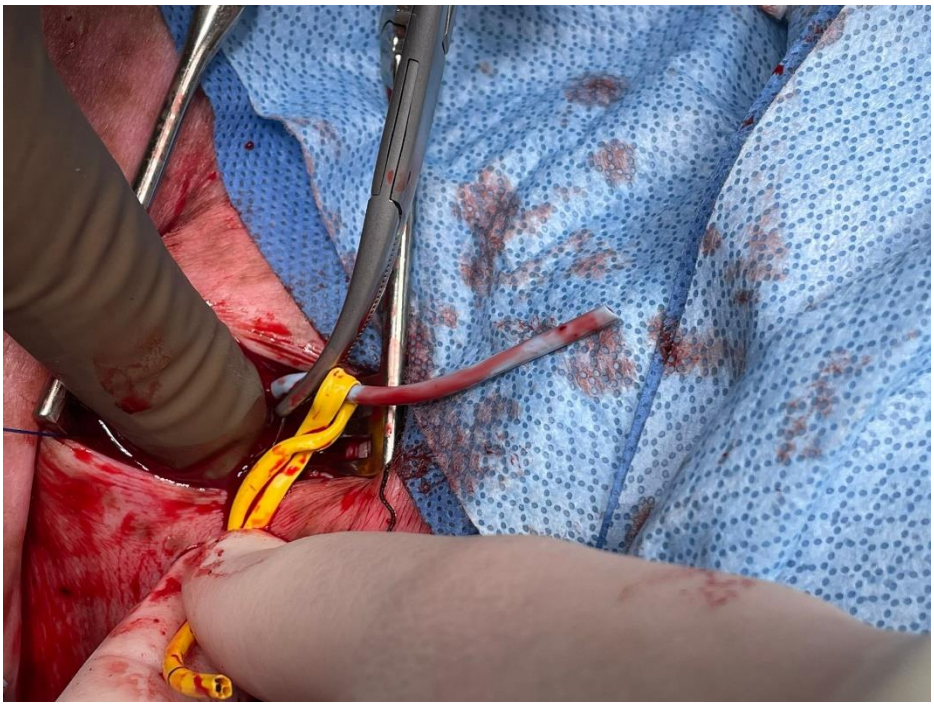
Figure



Analgesic efficacy of single shot erector spinae block in video-assisted thoracoscopic surgery: a propensity score matched retrospective cohort study

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8

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INTRODUCTION

Video-assisted thoracic surgery (VATS) is a minimally invasive surgical technique with rising popularity over the last two decades, though effective analgesia for management of VATS-associated pain remains as a challenge.[1] While thoracic epidural analgesia has traditionally been utilized, it is invasive and technically demanding.[2] Recently, interfascial plane blocks such as erector spinae plane block (ESPB) has emerged as a promising analgesic method for VATS for its ease and safety of placement.[3] Furthermore, it has been postulated to be more effective than routine systemic analgesia alone, potentially by targeting both dorsal and ventral rami of thoracic spinal nerves. Despite its potential, studies that evaluated the analgesic efficacy of ESPB in VATS yielded inconclusive results.[4,5] Therefore, our aim was to determine whether ESPB in patients undergoing VATS is associated with reduced opioid consumption in the first 12 postoperative hr through a retrospective propensity score-matched cohort study.

METHODS

This study was approved by the Western University Health Science Research Ethics Board. We conducted a single-centre retrospective study including patients who had undergone VATS procedures at a single tertiary academic centre in Canada from 2018 to 2020. Our primary outcome was the total opioid consumption in IV hydromorphone equivalents in the first 12 postoperative hr. Our secondary outcomes included the area under curve (AUC) of the numeric rating scale for pain in the first 12 postoperative hr, incidence of hypoxia during the first 12 postoperative hr, duration of postanesthetic recovery unit (PACU) stay, and the total length of hospital stay. We used binomial logistic regression to model whether patients received ESPB as a function of age, sex, body mass index, American Society of Anesthesiologists Physical Status, and surgery type to generate a propensity score for each patient for matching. Continuous postmatch variables were analyzed using Mann–Whitney *U* tests and categorical variables using

Fisher's exact tests. Outcomes were presented as difference in means and odds ratios with 95% confidence intervals (CI), and $P < 0.05$ was considered statistically significant.

RESULTS

From 1 December 2018 to 1 January 2020, 286 patients undergoing VATS at Victoria hospital in London, ON, Canada were screened. One hundred and seventy patients met the inclusion criteria and 55 patients each in the ESBP and no-block groups were matched. Compared to the no-block group, ESPB was associated with a 1.2 mg (95% CI, −2.2 to −0.2 mg; $P = 0.02$) reduction of opioid use in 12-hr opioid use in intravenous hydromorphone equivalents. Nevertheless, no associated differences were found in 12-hr pain score AUC, PACU length of stay, hospital length of stay, or incidence of hypoxia between the two groups.

DISCUSSION

In our study, for patients undergoing VATS, ESPB was associated with a modest reduction in the total opioid consumption in the first 12 postoperative hr, although we did not observe a difference in 12-hr pain score AUC, PACU length of stay, hospital length of stay, or incidence of hypoxia. As such, ESPB may offer benefits through the reduction of opioid consumption, as repeated use of opioids place patients at risk of side effects including respiratory depression, sedation, and nausea. While its analgesic efficacy may be limited, ESPB could be considered a component of multimodal analgesia in VATS.

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Autologous cell salvage: an *in vivo* comparison of autotransfusion devices in cardiac surgery

Submission ID

72

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INTRODUCTION

Autologous cell salvage is recommended for surgical procedures where high-volume blood loss (> 500 mL) is expected to reduce the need for allogeneic red blood cell (RBC) transfusions.[1] In cardiac surgery, it is recommended that autologous cell salvage be used for all cases, at least in 'collect only' mode to allow for processing and reinfusion if significant blood loss occurs.[1] Comparative analysis of a previous generation of autotransfusion devices demonstrated significant differences in device removal of heparin (UFH), potassium, plasma free hemoglobin (PfHb), white blood cells (WBCs), and platelets in cardiac surgery.[2] As part of a quality improvement initiative in our institution, the aim of this study was to compare the wash quality of autologous RBCs processed during cardiac surgery by four modern, commercially available autotransfusion devices: Medtronic AutoLog iQ, LivaNova Xtra, Haemonetics Cell Saver Elite+, and Fresenius Kabi CATSmart.

METHODS

This prospective observational study, conducted with Institutional Quality Improvement Review Committee approval and research ethics board waiver, focused on 130 adult patients undergoing cardiac surgery with autologous cell salvage between 9 May 2023 and 29 September 2023. Autotransfusion devices were trialed consecutively, completing data collection for each device before introducing the next. Patients were grouped according to the autotransfusion device employed, determined by the device under evaluation at that point in time. Manufacturer-recommended settings and heparinized saline (30 $U \cdot mL^{-1}$) as an anticoagulant were uniformly applied, with perfusionists choosing processing set sizes of 125 mL or 225 mL when applicable. Unwashed and washed samples were collected pre- and postprocessing, respectively, analyzing Hematocrit (Hct), WBC, platelet (PLT), heparin (UFH),

potassium (K+), and plasma free hemoglobin (PfHb) levels. Device-reported Hct measurements were recorded for comparison to laboratory measurements. Washout quality was assessed by contaminant removal ratios and reinfusion concentrations of UFH and K+.

Standard descriptive statistics (mean with SD, median with percentiles/IQR, and proportions) were employed. Normal distribution was evaluated using graphical assessments and the Shapiro–Wilk test. Statistical analysis, utilizing one-way analysis of variance or Kruskal–Wallis ranks as appropriate, considered significance threshold of < 0.05. Data analysis was conducted using R Statistical Software V 4.2.3 (3).

RESULTS

One hundred and fifteen were included in the analysis, AutoLog iQ 30 (26%), Xtra 30 (26%), Cell Saver Elite+ 29 (25%), and CATSmart 26 (23%). Mean age of the population was 61 ± 15.7 yr, 22% were female (*n* = 26), with mean BMI of 28.21 ± 5.3 $kg \cdot m^{-2}$. The distribution of the procedures was: 24% two major procedures (*n* = 28), 21% isolated coronary artery bypass graft surgery (CABG) (*n* = 24), 16% off-pump (*n* = 18), 12% ≥ 3 major procedures (*n* = 14), 9% Re-dos (*n* = 10), 7% single non-CABG (*n* = 8), 4% MICS (*n* = 5), 4% thoracic aorta (*n* = 5), and 3% others (*n* = 3). Hct of the packed red cell concentrate and RBC recovery rates differed significantly between devices. All devices removed > 99% UHF, > 95% K+, > 94% PLT, and > 8 5% PfHb, yet exhibited varying WBC elimination rates (Figure). The lowest median reinfusion concentration of UFH was 0.09 (0.03) $U \cdot mL^{-1}$ PRC by the Elite+ 125 mL and the highest was 0.62 (0.15) $U \cdot mL^{-1}$ PRC, by the Xtra 125 mL processing sets.

DISCUSSION

This study highlighted the variations in PRC concentrate hematocrit among autotransfusion devices. The observed differences in RBC mass recovery rates between bowl sizes for Xtra and Elite+ devices could have implications for the efficiency and performance of these systems when a high rate of blood loss is anticipated. Ineffective WBC removal by autotransfusion devices warrants consideration for additional postprocessing filtration methods. Limitations include nonrandomization and potential measurement variability, impacting baseline characteristics and study scope. Further investigations are warranted to address the clinical relevance of these variations in autologous blood transfusion.

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Figure Results by device

A. Complete Blood Count by Device

	Bowl Size	n	Pre-Hct %	Post-Hct %	Pre-Plt (x10^9/L)	Post-Plt (x10^9/L)	Pre-WBC (x10^9/L)	Post-WBC (x10^9/L)
AutoLog iQ	135 ml	30	14 (7)	63 (3)	50.5 (34.5)	8.5 (10.5)	3.05 (1.65)	10.35 (5.3)
Xtra	125 ml	15	11 (4.5)	63 (2.5)	36 (26)	7 (12.5)	2.2 (1.65)	6.60 (5.75)
Xtra	225 ml	15	16 (4.5)	62 (2.5)	60 (30)	17 (27)	4.4 (2.10)	12 (3.75)
Elite+	125 ml	15	13 (10.5)	62 (5)	55 (31)	15 (40.5)	3.4 (2.85)	13.6 (13.9)
Elite+	225 ml	14	19 (1.75)	56 (4.5)	66 (24.25)	12.5 (14)	4.4 (3.27)	12.35 (8.33)
CATSmart	N/A	26	15.5 (5.75)	71 (8)	49.5 (39.5)	6 (11.25)	3.5 (3.15)	10.05 (8.7)

** Values presented as Median (IQR)*

B. Plasma Concentrations by Device

	Bowl Size	n	Pre-UFH (U/ml)	Post-UFH (U/ml)	Pre-K+ (mmol/L)	Post-K+ (mmol/L)	Pre-PfHb (mg/L)	Post-PfHb (mg/L)
AutoLog iQ	135 ml	30	17 (5.82)	0.57 (0.32)	4.7 (1.93)	2.1 (0.95)	1905 (2269)	2373 (1464)
Xtra	125 ml	15	16.2 (2.3)	1.70 (0.42)	4.2 (2.05)	1.7 (0.70)	1530 (1615)	2884 (1207)
Xtra	225 ml	15	15 (2.9)	0.92 (0.42)	5.4 (2.6)	1.9 (1.05)	2668 (1080)	2800 (1218)
Elite+	125 ml	15	17.6 (3.30)	0.24 (0.08)	4.8 (1.75)	2.4 (0.95)	2060 (865)	3395 (2113)
Elite+	225 ml	14	15.4 (4.10)	0.55 (0.25)	5.5 (1.30)	1.9 (0.75)	3180 (2433)	2500 (903)
CATSmart	N/A	26	15.2 (2.35)	1.06 (1.06)	4.75 (1.83)	2.7 (1.02)	2391 (2573)	2991 (3172)

**Values presented as Median (IQR)*

C. RBC Recovery and Washout quality by Device

	AutoLog iQ 135 ml	Xtra 125 ml	Xtra 225 ml	Elite+ 125 ml	Elite+ 225 ml	CATSmart N/A	*p-value*
RBC_{Rec}	86 [74;91]	95 [91;99]	87 [83;90]	87 [78;94]	94 [92;97]	65 [56;74]	<0.001
RBC_{RecR}	19 [17;20]	12 [11;13]	19 [17;21]	8 [8;10]	24 [22;25]	14 [12;16]	0.021
WBC_{RR}	42 [34;58]	50 [44;62]	35 [29;48]	27 [21;35]	26 [19;33]	59 [42;68]	< 0.001
PLT_{RR}	97 [94;98]	97 [95;98]	95 [86;96]	95 [86;97]	94 [89;96]	98 [97;99]	< 0.001
$PfHb_{RR}$	92 [87;95]	89 [83;91]	89 [85;91]	85 [72;88]	88 [87;91]	93 [88;94]	< 0.001
$K+_{RR}$	96 [95;98]	97 [95;98]	96 [94;97]	94 [94;98]	95 [93;95]	97 [96;98]	0.004
UFH_{RR}	100 [100;100]	99 [99;99]	99 [99;99]	100 [100;100]	99 [99;100]	100 [99;100]	< 0.001

RBC = Red Blood Cell; Rec = Recovery; RecR = Recovery Rate; Hct = Hematocrit; RR = Removal Rate

** Values are presented as Median[25%;75%]*

Incidence of spinal hematoma in cardiac surgery after spinal anesthetic: a systematic review

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13

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INTRODUCTION

Spinal anesthesia in cardiac surgery is a technique with many potential benefits including improved postoperative analgesia, hemodynamic stability from denervation of the surgical site, positive myocardial oxygen balance due to hypodynamic circulation and decrease of the stress response.[1–3] One reason for hesitancy of further investigating this technique is the risk of spinal hematoma. Incidence of spinal hematoma in cardiac surgery after spinal anesthesia was projected as 1:3600 by Ho *et al*. in the year 2000.[4] This study was a retrospective review with limited data. This information is utilized by the American Society of Regional Anesthesia (ASRA) to formulate the guidelines which are utilized by anesthetists to have risk benefit discussions with patients regarding spinal anesthesia.[5] The objective of this study was to collect an up-to-date data set to project the incidence of spinal hematoma in patients undergoing cardiac surgery who receive spinals as part of their anesthetic plan, and full dose heparinization afterwards.

METHODS

A retrospective systematic literature review looking at all cases of spinal anesthesia in cardiac surgery. We formulated a search strategy with our librarian and searched MEDLINE, Embase and Cochrane Central Register of Controlled Trials (CENTRAL) through the Ovid platform to identify studies, case reports or case series looking at patients who have received spinal anesthesia during cardiac surgery and any spinal hematoma case reports. This review is conducted according to guidelines enumerated in the Methodological Expectations of Cochrane Intervention Reviews (MECIR) and reported according to the Preferred Reporting Items for Systematic Reviews and Meta-Analysis (PRISMA). With the help of international collaborators, two reviewers were utilized, and a third reviewer was used for dispute resolution. We assessed the number of cardiac surgeries conducted with spinal anesthesia and how many spinal hematomas have been documented, compared to how many cardiac surgeries were conducted with spinal anesthesia without spinal hematoma. This information was used to extrapolate the risk of spinal hematoma in cardiac surgery using both the Hanley and Lippman–Hand probability method to estimate the maximum risk, which was previously used by Ho *et al*., and weighted proportion. We reviewed American Society of Anesthesiologists (ASA) closed claims the claims in the Canadian Medical Protective Association.

RESULTS

We reviewed 416 full text articles, of which 286 were excluded. The remaining 130 studies were included. We found 23,782 spinal anesthetics conducted in cardiac surgery patients with zero spinal hematomas identified. This is 13,782 more cases than the previous incidence prediction. Maximum risk was determined to be 1 in 7,927 using the Hanley *et al*. approximation. This cuts the risk estimate nearly in half of what was previously predicted. We also reviewed the ASA closed claims which looked at 97 cases of spinal hematoma after spinal anesthesia. None of these cases were from cardiac surgery. There were zero cases of spinal hematoma after spinal anesthesia in cardiac surgery from the Canadian Medical Protective Association.

DISCUSSION

We found more than double the number of spinal's have been conducted in cardiac surgery since the initial risk evaluation conducted by Ho *et al*., with no reported incidence of spinal hematoma. This provides practitioners and patients with more confidence to include spinal anesthesia in their cardiac anesthetic plans and further study this technique. This risk is similar to other groups of patients, particularly vascular patients where spinal is used routinely. To address limitations with our study design, we approached closed claims bodies to further delineate the safety profile of spinal anesthesia in cardiac surgery.

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Figure Incidence of spinal hematoma in cardiac surgery after spinal anesthesia