An audit of **ROTEM** guided management of bleeding in cardiac surgical patients at a major tertiary teaching hospital using a case control study.

Laetitia Deknudt MD Department of Anaesthesia, Royal Adelaide Hospital; **Sameer Thakur MBBS**, Department of Cardiothoracic Surgery, Royal Adelaide Hospital; **Thomas Painter MBChB, FANZCA** Department of Anaesthesia, Royal Adelaide Hospital; **Kate Drummond MBBS FANZCA** Department of Anaesthesia, Royal Adelaide Hospital, Senior Clinical Lecturer, The University of Adelaide.

Introduction

Bleeding complications after cardiac surgery are associated with morbidity and mortality.[1] Point of care coagulation testing (e.g. Rotational Thromboelastometry, ROTEM) is rapid and allows timely decisions for targeted intervention[2]. ROTEM based treatment algorithms have been shown to reduce the use of blood products for patients with postoperative bleeding[2].

We audited ROTEM use in cardiac surgical patients returning to theatre for excessive postoperative bleeding over a three-month period.

Aims

To identify areas for quality improvement, by comparing the management of patients who returned to theatre for bleeding and had a ROTEM performed using case-control methodology.

Methods

Following ethics approval, (HREC/18/CALHN/388) patients who returned to theatre for bleeding between 1st January 2018 and 31st March 2018 were identified for inclusion.

Control cases were matched using the Papworth bleeding risk score.3,4 Data collected were ROTEM variables (assessed by blinded investigator), temperature, blood products given, chest drain outputs, STS score5, tranexamic acid dose, pre-operative antiplatelet agent use, ACT post protamine, pre- and postoperative haemoglobin, acute kidney injury, renal replacement therapy, mortality at 30 days.

Results

All 15 patients who returned to theatre had a perioperative ROTEM performed. 93.3% (28/30) of the patients were men. 53.3% (16/30) of the cases were urgent or emergency cases.

Abnormal ROTEM was non-significantly associated with return to theatre (Odds Ratio, 6.1; 95% Confidence Interval: 0.97-37.9). There was no association between ROTEM results (abnormal/normal) and identification of a surgical source of bleeding after adjusting for the Papworth bleeding score (p=0.4025). There was a statistically significant association between low temperature on admission to ICU and return to theatre (p = 0.034).

Of the patients who returned to theatre, 47% (7/15) had an abnormal ROTEM. 57% (4/7) had a surgical source of bleeding identified. In those with a normal ROTEM, 62% (5/8) had a surgical source of bleeding identified.

Of patients who returned to theatre with abnormal ROTEM results, 43% (3/7) required platelets, 71% (5/7) required cryoprecipitate, and 14% (1/7) required protamine. No patients required FFP or TXA. All patients with an abnormal ROTEM were treated appropriately.

Those patients who returned to theatre had significantly more red blood cell transfusions (Mean: 3.4 Units; 95% CI: 5.1, 1.7, p <0.0001) and there was a higher drain output in the first 4 hours postoperatively (614ml, 95% CI: 916, 312mL, p <0.0001).

	Return to theatre	Controls
Age (mean, SD)	64.3 (11.3)	64.1 (10.8)
Male	100%	86%
Urgent/emergent	8/15 (53%)	8/15 (53%)
BMI (mean, SD)	30.18 (10.99)	30.09 (4.57)
Aortic valve disease	7/15 (47%)	4/15 (27%)

Table 1: Patient Demographics used for Papworth score

	Return to theatre	Controls	P value
STS mortality (average)	2.4%	2.3%	
Abnormal ROTEM	7/15 (47%)	2/15 (13%)	
Drain output at 4 hours in mls (mean/SEM)	783.74 (116.97)	169.92 (100.13)	P < 0.0001
RBC transfused (mean/SEM)	4.27 (0.6)	0.86 (0.6)	P < 0.0001
Temperature in ICU (mean/SEM)	35.9 (0.20)	36.5 (0.19)	P < 0.0001

Table 2: Outcomes between patients who returned to theatre versus controls

Conclusion

Of those patients who had an abnormal ROTEM, numerically more patients returned to theatre, but this did not help to predict cause of bleeding. Therefore, in addition to the appropriate treatment of abnormal ROTEM results, it is crucial to monitor drain output in the first hours postoperatively.

Achieving and maintaining normothermia at the end of the procedure is vital.

References

1. *Vivacqua A, Koch CG, Yousuf AM. Morbidity of bleeding after cardiac surgery: is it blood transfusion, reoperation for bleeding, or both? Ann Thorac Surg. 2011 Jun;91(6):1780-90.*
2. *Bolliger D, Tanaka KA. Point-of-Care Coagulation Testing in Cardiac Surgery. Semin Thromb Hemost. 2017 Jun;43(4):386-396*
3. *Vuylsteke A, Pagel C, Gerrard C, Reddy B, Nashef S, Aldam P, Utley M. The Papworth Bleeding Risk Score: a stratification scheme for identifying cardiac surgery patients at risk of excessive early postoperative bleeding. Eur J Cardiothoracic Surg. 2011;39(6):924-30*
4. *Pearce N, Analysis of matched case-control studies. BMJ 2016;352:i969*
5. *O'Brien SM, Shahian DM, Filardo G, et al. The Society of Thoracic Surgeons 2008 cardiac surgery risk models: part 2 — isolated valve surgery. Ann Thorac Surg. 2009;88(1 Suppl):S23-S42*

Acknowledgements

David Jarvis, FANZCA, Department of Anaesthesia, Royal Adelaide Hospital; **Suzanne Edwards**, Statistician, University of Adelaide; **Dr Paul Richards**, Department of Anaesthesia, special interest in coagulation, ROTEM expert, Flinders Medical Centre.

Government of South Australia
SA Health