**Massive blood loss protocol ‘Code Red’ at Papworth Hospital: An Audit**

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**1. Aims**

To audit when the protocol ‘Code Red’ is activated, and whether the criteria for massive blood loss is met according to hospital guidelines.

**2. Introduction**

Papworth Hospital is a centre for excellence in respect to heart and lung reparative and transplant surgery, having performed some of Europe’s and the world’s first transplants.

National guidelines describe massive blood loss as a serious clinical situation in which the patient’s life is at risk and those undergoing major open-heart and lung surgery are at an increased risk of excessive blood loss. The National Patient Safety Agency (NPSA) issued a document ‘Rapid Response Report’ highlighting the need for early recognition and immediate effective interventions to prevent hypovolemic shock and its consequences. Guidelines from the British Committee for Standards in Haematology (BCSH) and the Association of Anaesthetics of Great Britain and Ireland (AAGBI) also reiterate the need for a successful protocol, with effective communication and leadership essential to patient outcome.

In response to these national recommendations – Papworth Hospital established ‘Code Red’ based on the BCSH 2006 guidelines. The aims of management are:

1. Maintenance of blood volume to ensure tissue oxygenation
2. Control bleeding by surgical intervention and use of blood component therapy to stem the bleeding

Upon activation of ‘Code Red’, Pack A is issued rapidly and without the need for a haematologists’ consent and in the absence of blood test results. This ensures timely activation of ‘Pack A’: 4 units of RBC and Fresh Frozen Plasma (FFP) and one unit of platelets. This fulfils both aims above and acts to prevent secondary haemodilution, which can subsequently become the major issue in massive blood transfusion.

Within Papworth hospital, 2,100 cardiopulmonary bypass procedures are performed, using 6,000 packs of red cells, 1,700 platelets and 1,000 fresh frozen plasma annually. The purpose of this audit is to evaluate if ‘Code Red’ is activated appropriately. The protocol defines massive blood loss as bleeding >150ml/hr for females and >250ml/hr for male patients or the equivalent of one complete volume of blood in 24hours.

**3. Methods**

A Laboratory Information System (LIMS) search using keywords ‘Code Red’ was undertaken to establish the number of times the protocol was activated in the last 12months. To ensure completeness, all paper request forms sent to the laboratory were also checked.

To establish the amount of blood loss prior to activation of the protocol, different patient care systems were used to extract information: SaferSleep (anaesthetic in-theatre records) and CIS (ICU records). WinPath is the software that the pathology lab use to release blood products.

The amount of blood lost was calculated on the basis of cell-salvaged blood and already transfused RBC from SaferSleep, if the ‘Code Red’ was activated in the operating theatre; therefore blood loss was estimated using the amount of blood already transfused. If the ‘Code Red’ was activated elsewhere, CIS or patient notes were used to establish if the blood loss had been documented.

It is assumed that one unit of RBC is equivalent to 250-350ml.

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**4. Results**

Over the 12 month period audited, there were 18 separate activations of the ‘Code Red’ protocol on individual patients.

**Demographics and Professional Data**

Of these 18 patients, 78% were male, and 22% were female. The audited patients had an average age of approximately 57 years and 11 months at the date of ‘Code Red’ activation. The patient group also had an average BMI of 28.97, with an average weight of 88kg.

**Criteria for Massive Blood Loss**

The results show that ‘Code Red’ was activated in line with the hospitals protocol 83% of the time. The average amount of blood transfused prior to activation was 10.1L. (see Table 1). The amount of blood transfused prior to ‘Code Red’ activation was inconclusive in 6 of the 18 patients, with no documentation on any of the digital systems and no paper request forms from the laboratory.

**Fig 1: Blood transfused prior to ‘Code Red’ activation. Please note that data was unavailable for 6 patients**

**Table 1: Context of ‘Code Red’ activation, from patient records**

**Fig 2: Patient outcomes 12 hours after ‘Code Red’ activation. Please note that data was unavailable for 6 patients**

**Table 2: Massive blood loss criteria fulfilled**

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**5. Discussion**

The aim of the audit was to evaluate if ‘Code Red’ criteria for activation was met. This criteria is based on a patient experiencing massive blood loss as defined by the BCSH guidelines. The results show that for 83% of cases, the criteria was met and therefore the protocol was activated appropriately. However, it is important to appreciate that with an already small sample size of 18 patients and the subsequent unavailable data for 6 patients, the reality of ‘Code Red’ activation may not be as 83% meet the criteria.

When considering patient outcomes, it is hard to measure causation vs correlation with regards to whether or not activation of ‘Code Red’ actually improves a patients’ clinical situation. Ranucci confirms that the more cardiac surgical operations, the greater the risk of mortality. This audit does not take into account wholly the patients clinical context. For example, many patients had undergone 2 or more surgeries in the days preceding ‘Code Red’ activation, suggesting an already vulnerable state.

The ‘Code Red’ protocol is based upon BCSH guidelines from 2006 and may need to be reviewed, focusing on the ratio of protocols given and specifically administered to prevent coagulopathies. Papworth is the quaternary centre for cardiothoracic surgery. The BCSH and AAGBI guidelines are written for primary, secondary and tertiary centres. The context of massive blood loss at Papworth is so unique, is a generalised guideline applicable? The staff at Papworth have a wealth of expertise and experience when dealing with blood loss and feedback from the clinical staff about the protocol suggest that an arbitrary criteria massive blood loss does not work.

Continuing the theme of specialisation at Papworth, the criteria for massive blood loss and hence protocol activation may also need to be further investigation. The instances when ‘Code Red’ may have been activated ‘inappropriately’ as per the guidelines, the clinicians assessed the case deemed the need for rapid blood products in order to ensure patient survival. Feedback from anaesthetists agree and as a hospital, Papworth are moving towards individual clinicians discretion to activate the protocol. It is also important to appreciate the average weight of the patients. Currently, Pack A issues 4 units of FFP. However, the national body for transfusion recommend that those patients over 85kg should be issued 5 units.

**6. Conclusion**

This audit has shown that the majority of the ‘Code Red’ protocol are activated appropriately and are fulfilling the criteria for massive blood loss as per Papworth’s protocol.

**7. Acknowledgements**

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**8. References**

5. Gourley S, Too YWP. Laboratory haemostatic abnormalities in massively transfused patients given red blood cells and platelets. Anaesthesia 2004; 237 – 243