

## Blood loss, cell salvage, tranexamic acid and transfusion: an audit of major surgery at a tertiary hospital

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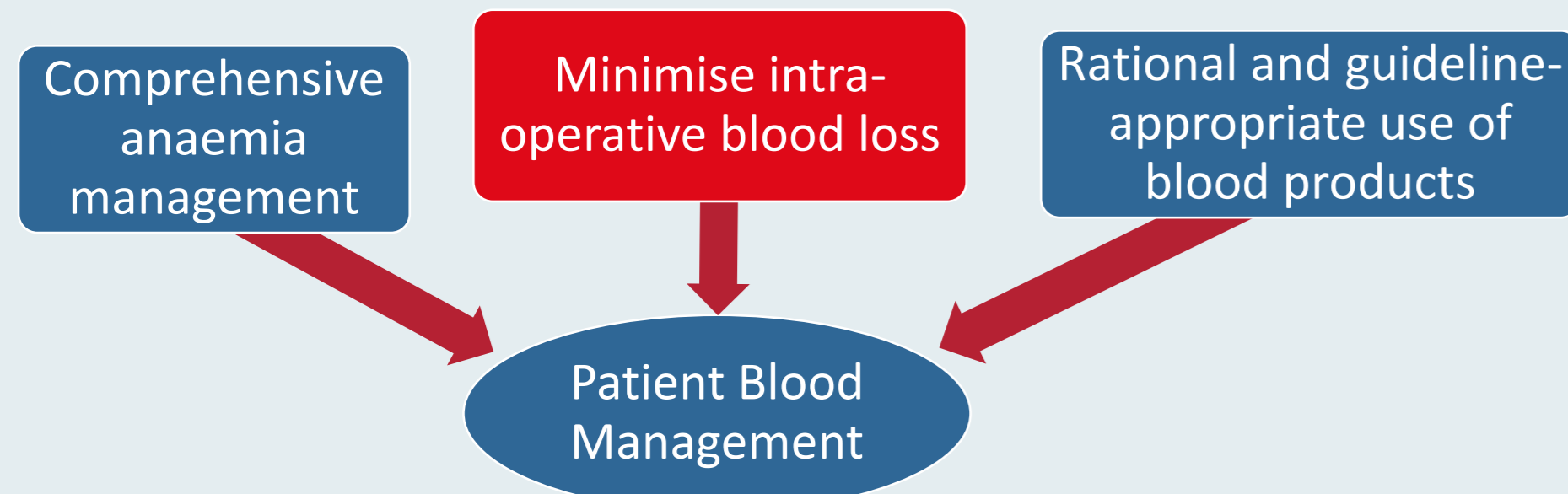
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### Introduction

Peri-operative blood transfusion is an independent risk factor for morbidity and mortality across a range of major surgery<sup>1</sup>. Patient blood management (PBM) is a multimodal approach that seeks to promote the appropriate provision and use of blood, its components and derivatives, and strategies to reduce or avoid the need for blood transfusion<sup>2</sup>. A key pillar of PBM is to minimise intra-operative bleeding.



The NICE guideline for Blood Transfusion (2015) recommends offering tranexamic acid to adults expected to have moderate blood loss (greater than 500mls) and consideration of intra-operative cell salvage with tranexamic acid for patients who are expected to lose a very high volume of blood<sup>3</sup>. NICE recommends cell salvage should not routinely be used without tranexamic acid.

### Methods

We conducted a retrospective snapshot audit. A list of all cases performed during April 2019 was extracted from the Surginet electronic record. A total of 1709 surgeries were listed.

From these, cases were extracted where blood loss "may be expected to exceed 500ml". Surgeries included were from a range of specialties:

- Vascular: elective and emergent open repair of abdominal aortic aneurysm
- Hepatobiliary surgery: liver transplant, hepatic resections and pancreaticoduodenectomy, pancreatic transplant
- Urology: major open surgery such as nephrectomy and cystectomy,
- Head and neck surgery: head and neck cancer surgery
- Orthopaedic surgery: revision hip replacement and sarcoma resection.
- Endoscopy: emergency endoscopy for upper-GI bleeds

Data extracted from patient notes and e-record including baseline patient characteristics, ASA grade, date of surgery, surgery performed, pre and post-operative haemoglobin, documented blood loss during surgery, anaesthetic technique, post-op destination, date of discharge, complications as inpatient, 30day mortality, utilisation of cell salvage and tranexamic acid, and perioperative blood transfusion. This was defined as administration of RBC intra-operatively or within 48hrs of surgery

### Limitations

Intra-operative blood loss is difficult to predict and depends on numerous factors. Some procedures have consistently high blood loss (e.g. emergency repair of AAA), for other procedures the blood loss is more difficult to predict and may be minimal (e.g. major head and neck surgery, nephrectomy). This snapshot audit aimed to incorporate patients across a broad range of specialties, though the methodology of case selection was not pre-determined and therefore subject to observer bias. However 59% of cases identified did have at least moderate blood loss, which makes it a fair sample against which to examine the implementation of the NICE guidelines.

The absolute numbers for any specialty were small, and differences between groups were trends rather than statistically significant. Cell salvage was associated with higher mean blood loss (2040 vs 709ml), LOS (32 vs 10 days) and rates of transfusion (3/7 42.8% vs 9/50 18%), however this data is skewed by the case mix it was utilized in: two elective open AAA, two emergency AAA, a liver transplant, a pancreatic transplant, and a revision hip replacement.

### Results

#### Blood loss

Eight patients did not have their intra-operative blood loss documented. Of the remaining cases the mean blood loss was 840ml (5-6200ml) with median blood loss 500ml (IQ range 75-1150ml) Twenty-nine patients (59%) had intra-operative blood loss >500ml, this was associated with:

- increased chance of receiving peri-operative blood transfusion (8/29 patients 27.5% vs 2/22 9%)
- increased length of stay (mean LOS 16.4 vs 7.8 days, median LOS 9 vs 4.5 days.)

#### Tranexamic acid utilisation

- A total of nine patients (15%) received tranexamic acid.
- There were no significant differences in mean operative blood loss (785ml vs 849ml), transfusion requirement (22 vs 21%) or mean LOS (15.7 vs 12.9 days) between patients who did and did not receive tranexamic acid.

#### Cell salvage utilization

- 7/57 (12%) patients received blood from cell salvage. (2 cases unknown or incomplete documentation)
- The mean volume of blood received from cell salvage was 675ml, (240-1608ml)
- 4 patients who received cell salvage avoided peri-operative transfusion despite mean blood loss >2000ml

#### Perioperative RBC Transfusion

- 12 patients received a transfusion RBC within 48hrs (6 were cancer surgery):
- Only 2 patients who received transfusion received tranexamic acid
- Only 3 patients who received transfusion received cell salvage
- Patients who had a pre-op Hb <130 (30 vs 12%) or blood loss >500ml (27.5 vs 9%) were more likely to receive a transfusion.
- Patients who received transfusion had greater mean (22 vs 11.2 days) and median (19.5 vs 6 days) LOS.

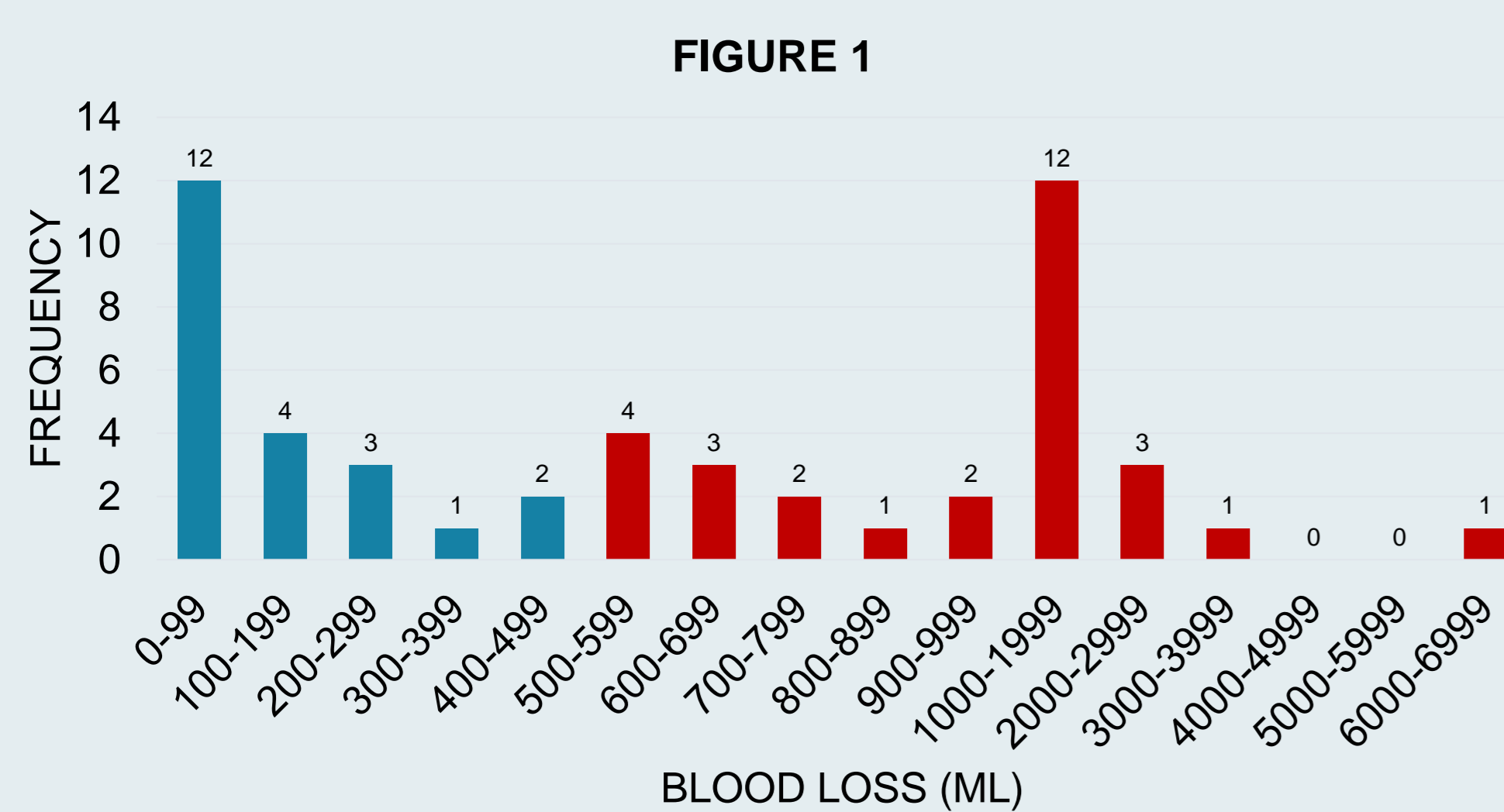


FIGURE 1 (above): Documented blood loss in ml (excludes 8 cases where blood loss was not documented)

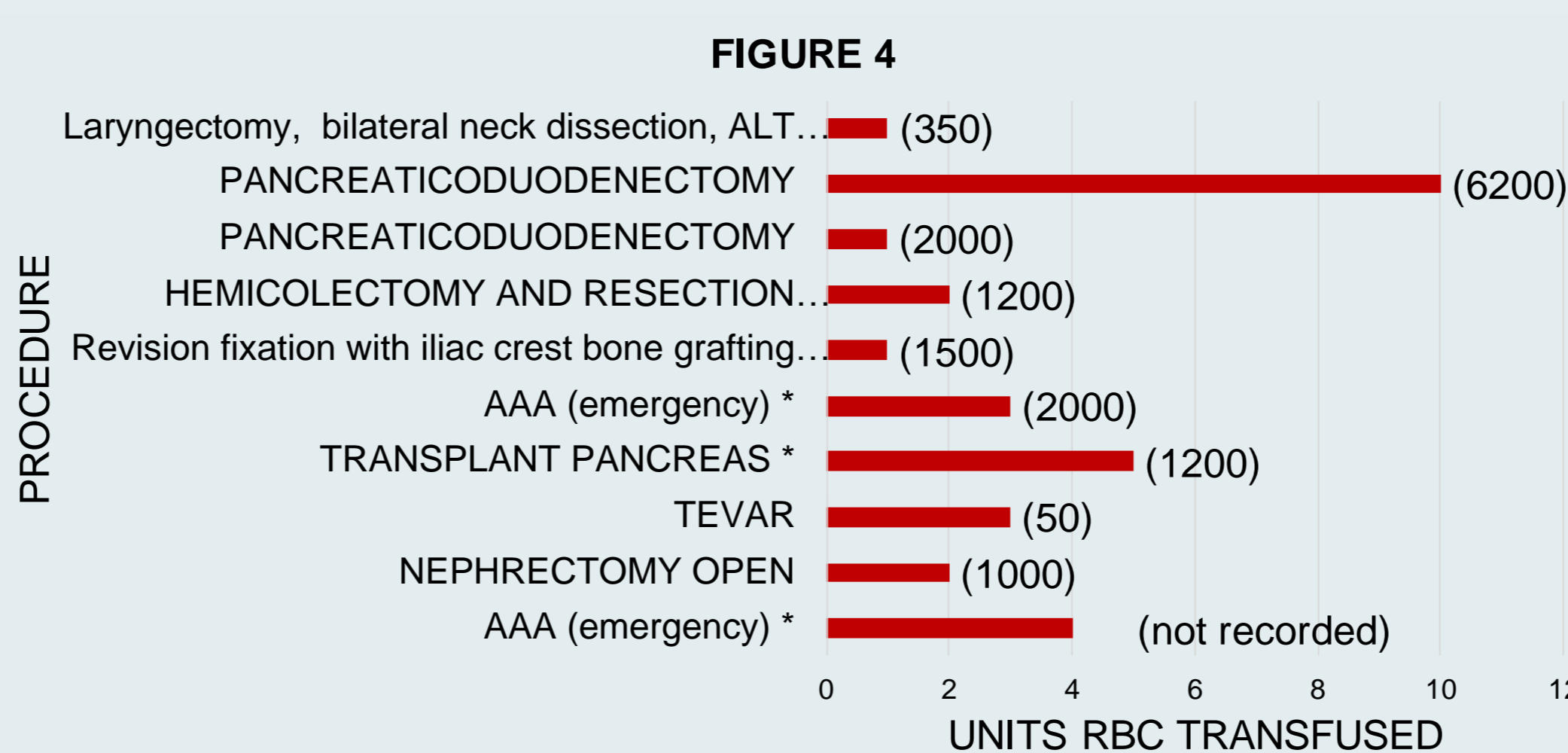


FIGURE 4 (above): Transfusion requirements of patients receiving peri-operative RBC transfusion. Documented blood loss shown in brackets. Cases where cell salvage utilized denoted with \*

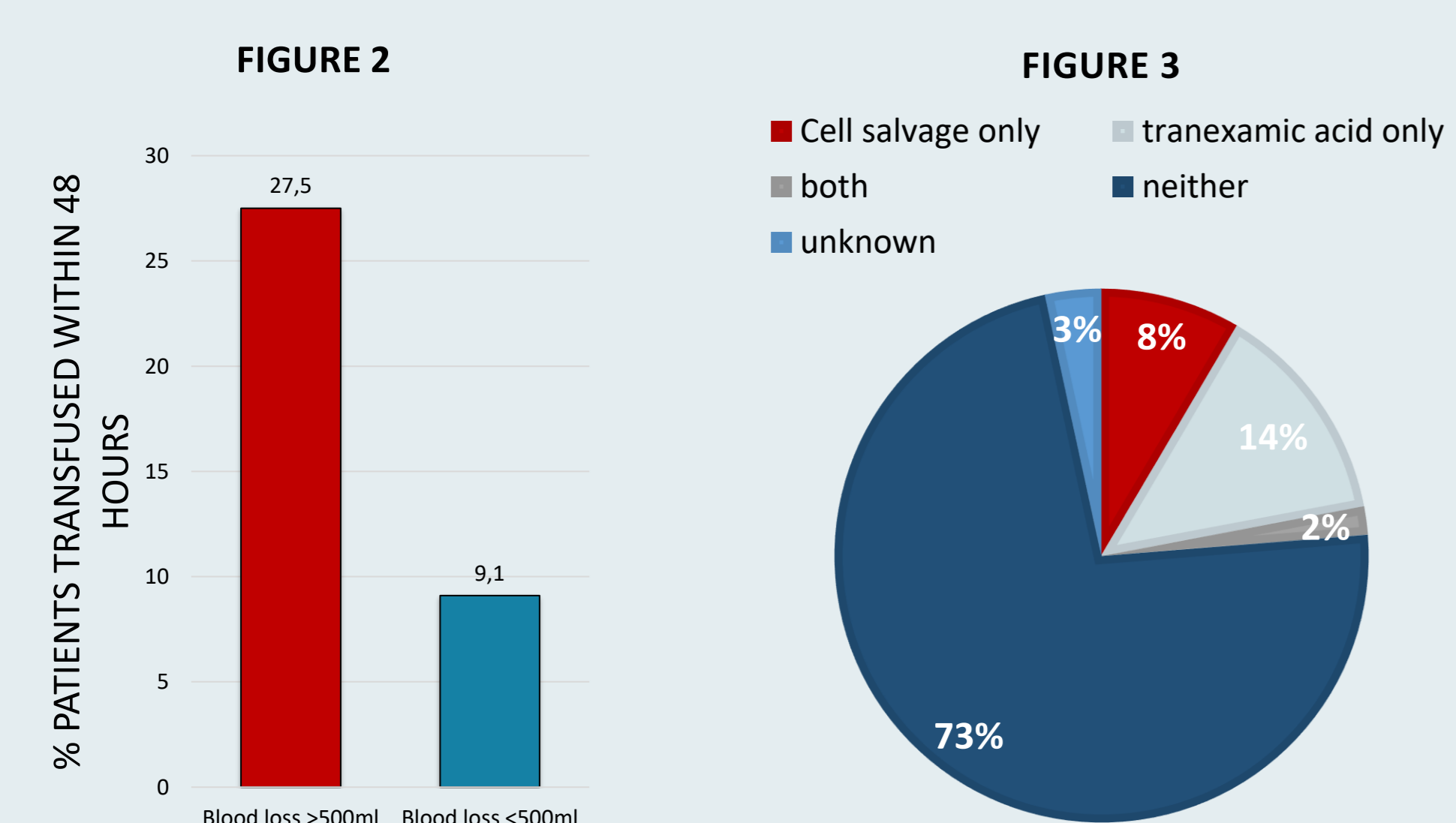


FIGURE 2: Blood loss and risk of peri-operative RBC transfusion. (excludes 8 cases where blood loss was not documented)

FIGURE 3: Utilisation of tranexamic acid and cell salvage in major surgery

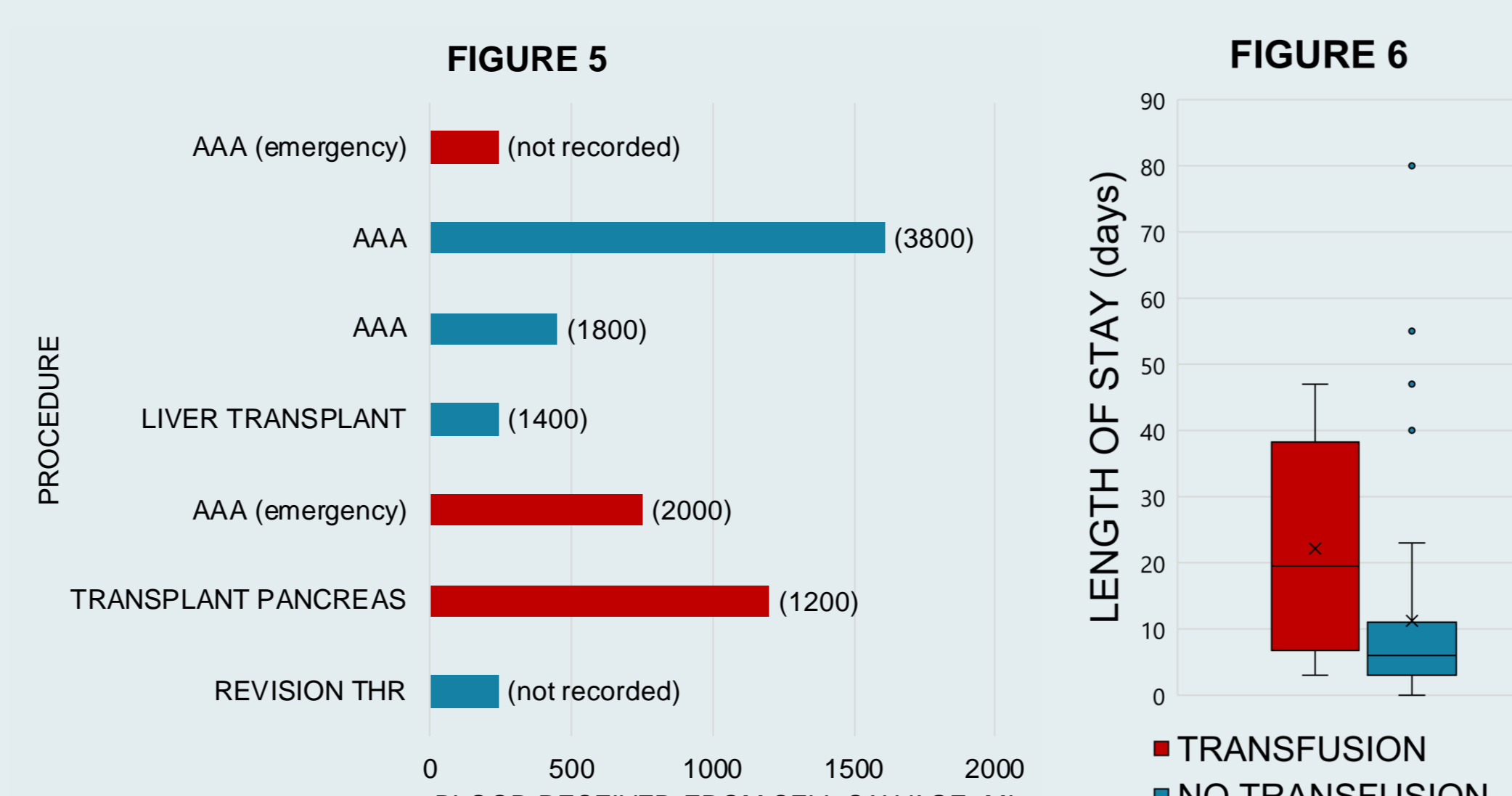


FIGURE 5: Blood received from cell salvage in ml. Documented blood loss shown in brackets. Cases receiving subsequent transfusion highlighted in red

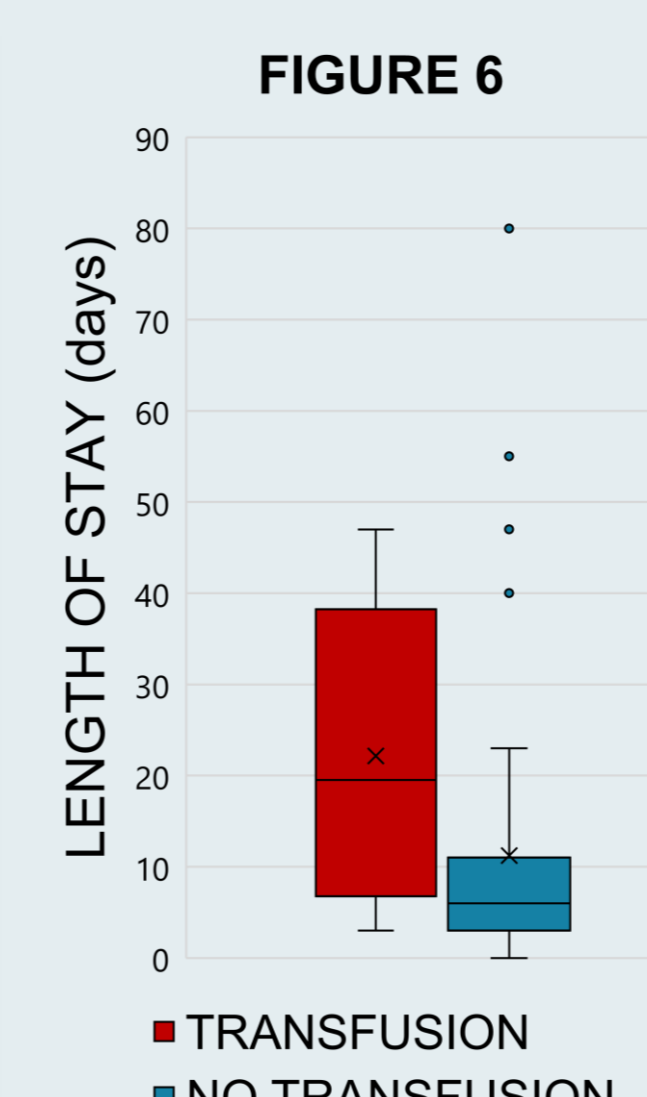


FIGURE 6: Transfusion and length of stay

### Conclusions

Our audit shows there is potential for greater utilisation of both tranexamic acid and cell salvage in major surgery undertaken at Freeman Hospital. Barriers to the implementation of both do exist, in particular concerns over thrombotic complications following utilisation of tranexamic acid (particularly in vascular and HPB patients) and use of cell salvage in cancer surgery across all specialties.

Incorporation of discussion of expected blood loss into the WHO checklist would facilitate routine consideration of utility of tranexamic acid and/or cell salvage outside of the specialties in which they are routinely used. Consideration should be given to greater utilisation of tranexamic acid in major surgery outside of orthopaedics. Cell salvage should be considered in major surgery where blood loss expected >500ml, e.g. revision hip, in addition to areas it is already utilised (AAA, liver transplant).

In the context of cancer surgery cell salvage may offer some benefits compared to allogeneic blood transfusion, which has been shown to be associated with detrimental effects on cancer recurrence and survival<sup>4-8</sup>. The potential reduction in red cell transfusion requirement must be balanced against the chance of re-introducing cancer cells into the circulation. A leucocyte depletion filter may be used to reduce the number of malignant cells re-entering the circulation<sup>9</sup>. Evidence on the relative risks of transfusion vs cell salvage in this area is scarce and so specific consent should be sought.

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