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ORIGINAL RESEARCH

The practice of patient blood management among South African anaesthetic providers: a cross-sectional study

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Background: Patient blood management (PBM) is a patient-centred, systematic, evidence-based approach to improve patient outcomes by managing and preserving a patient's own blood while promoting patient safety and empowerment. Thus far, perioperative PBM practices of South African anaesthetic providers have not been described.

Methods: This study prospectively evaluated perioperative PBM practices in South Africa utilising an online survey. In addition, we described the extent to which practices align with the 2020 South African Society of Anaesthesiologists (SASA) and 2014 South African National Blood Service (SANBS) guidelines.

Results: The information letter was opened 573 times, and 403 surveys were more than 50% complete (response rate 70.3%). Most respondents were specialists (54.6%) or specialist trainees (25.1%). Although most providers (89.3%) often or always record preoperative haemoglobin (Hb), only 1% would defer elective surgery (other than caesarean section) if the Hb were < 13 g/dl. Appropriate preoperative anaemia treatment was rarely or never seen by 65.5% of respondents. Only 25.6% of respondents had no access to any point-of-care (POC) test. Most respondents (63.9%) use a transfusion threshold of 7 g/dl for red cell concentrates (RCC) in non-cardiac patients. Few respondents often or always use cell salvage in non-obstetric surgery, where blood loss > 500 ml is anticipated (21.2%), or in major obstetric haemorrhage (21.2%). In major haemorrhage, most respondents often or always monitor for, treat, and prevent hypothermia (97.5%), acidosis (96.0%), hypocalcaemia (90.0%), and hyperkalaemia (91.6%). Tranexamic acid (TXA) is often or always used in severe trauma (70.7%) and major obstetric haemorrhage (72.1%).

Conclusion: Rational blood usage practices among respondents were reasonably good; however, PBM practices were poor and did not align with South African guidelines. Preoperative anaemia management requires improvement, including facilities to identify and treat anaemic patients preoperatively.

Keywords: patient blood management, transfusion

Introduction

PBM is a patient-centred, systematic, evidence-based approach to improve patient outcomes by managing and preserving a patient's own blood while promoting patient safety and empowerment.[1] The World Health Organization (WHO) has acknowledged the urgent need to implement PBM globally, "PBM has the potential to significantly improve global population health and the clinical outcomes of patients and the population at large, while reducing healthcare costs by billions of US dollars."[2]

South Africa is an upper middle-income economy, where anaemia is common.[3-5] This applies to the perioperative population, where half of adult (47.8%) and paediatric (46.2%) South African surgical patients are anaemic preoperatively. The 30-day in-hospital mortality rate in adults with preoperative anaemia (4.9%) was more than double in those without anaemia (1.9%).[3,4] In these studies, anaemia was defined as < 13 g/dl in adult males, < 12 g/dl in adult females, < 12 g/dl in children 12–14 years, < 11.5 g/dl in children 5–11 years, and < 11 g/dl in those aged 6–59 months.

South Africa and other low- to middle-income countries (LMICs) are encouraged to implement PBM and establish systems to conserve blood, which is important in the context of national blood product shortages.[6,7] Despite these challenges, modelling shows South Africa to be the only country in sub-Saharan Africa with enough blood collection to meet needs.[8]

Two sets of guidelines govern perioperative PBM in South Africa: the SASA 2020 Perioperative Patient Blood Management Guidelines and the SANBS 2014 Clinical Guidelines for the Use of Blood Products in South Africa.[9,10] The 2019 Critical Care Society of South Africa Adult Patient Blood Management Guidelines align with the SASA guidelines and are not included in this study.[11] The impact of these guidelines on practice among South African anaesthetic providers has not been investigated. The primary objective was to describe the practices surrounding perioperative PBM among South African anaesthetic providers. The secondary objectives were to describe how these practices compare to the 2020 SASA perioperative PBM guidelines and the 2014 SANBS clinical guidelines for the use of blood products in South Africa.[9,10]

Methods

Ethics

Approval to conduct the study was granted by the University of the Witwatersrand Human Research Ethics Committee (M230407), the University of Pretoria Faculty of Health Sciences Research Ethics, and the Survey Committee (216/2023). Survey completion implied consent and the institutional review boards waived the requirement for written, informed consent.

Study design and setting

The study followed a prospective, cross-sectional research design. The setting was South Africa, an upper middle-income economy.[5]

Study population

The study population included all registered, independent anaesthesia providers in South Africa, both specialists and non-specialists. Surveys that were less than 50% complete were excluded.

Data management

Anaesthetic providers were emailed a link to the information leaflet and survey, shared through university departments, private hospitals, and national medical and anaesthetic organisations. Study data were collected and managed using REDCap (Research Electronic Data Capture) tools hosted by the University of the Witwatersrand.[12,13] The data capture period was from 5 June to 13 October 2023.

The survey was based on the work of Baron et al.,[14] and adapted for content to the 2020 SASA and 2014 SANBS guidelines.[9,10] A survey of 30 questions was produced. The questions were categorised into four groups: demographics, background of practice, preoperative practice, and intraoperative practice. A panel of national experts, selected for involvement in PBM guideline development and research experience, reviewed the questions for face and content validity. Participants were instructed to complete the questions concerning their clinical practice.

Data analysis

Data was analysed using Stata® 18, with assistance from a biostatistician, and expressed as frequency and analysed according to the number of responses given for each question. The survey consisted of single and multiple-answer questions. A five-point Likert scale (never, rarely, sometimes, often, and always) was used to quantify the frequency of practice. In reporting this data, we adhered to the EQUATOR (enhancing the quality and transparency of health research) guidelines and the STROBE (strengthening the reporting of observational studies in epidemiology) checklist.

Sample size estimation

The sample population is the 1 750 anaesthetic providers in South Africa, determined by the World Federation of Societies of Anaesthesiologists Workforce Survey of 2024.[15] The sample population included all providers of anaesthesia: specialists, registrars, medical officers, general practitioners, and community service medical officers. A literature review found no studies describing perioperative PBM among South African anaesthetic providers from which to extract the effect size.

The Stata® 18 statistical program was used to calculate a sample size of 783, assuming a conservative proportion of 50% and a ± 5% margin of error at a 95% confidence interval. However, based on the logistics and resources available, 403 responses were included, resulting in a ± 6.9% margin of error at 80% power and a 95% confidence interval with a proportion of 50%. This was considered sufficient to describe practices surrounding perioperative PBM among South African anaesthetic providers. There is no central database of anaesthetic providers in South Africa. This made it difficult to contact the study population directly. Therefore, non-anaesthetic organisations sent an email to their members, allowing them to self-select.

Results

The information leaflet was opened 573 times, and the survey was started 484 times. A total of 81 surveys, representing 16.7% of responses, were less than 50% complete and excluded as per protocol. The remaining 403 (83.3%) survey responses were analysed, giving a ± 6.9% margin of error. The total response rate was 70.3%. Given the methodology, the authors cannot determine the number of members of the sample population contacted.

Table I: Demographic data

	Frequency (*n*)	(%)
Training status		
Community service medical officer (non-specialist PGY 3)	5	1.2
Medical officer (non-specialist PGY ≥ 4)	105	26.1
Registrar (specialist trainee)	101	25.1
Specialist (registered specialist)	192	47.6
Years of experience at current training status		
< 5	220	54.6
5–9	85	21.1
10–14	38	9.4
15–19	20	5.0
≥ 20	40	9.9
Place of work (multiple-answer question)		
Public hospital, district (generalist service)	35	8.7
Public hospital, secondary (specialist service)	67	16.6
Public hospital, tertiary (subspecialist service)	118	29.3
Public hospital, university-affiliated (academic)	170	42.2
Private hospital (independent sector)	126	31.3

PGY – post-graduate year

Study participants' demographic and profession-related data

Table I shows the characteristic data of the population surveyed. The sample mainly consisted of specialists (47.6%) and specialist trainees (25.1%). Most had spent less than 10 years at their current status (75.7%), with a majority having spent less than five years (54.6%). Nearly a third of respondents (31.3%) worked in private hospitals, and 42.2% worked in a university-affiliated hospital. Only 8.7% of respondents worked in smaller district hospitals.

Awareness of both the SASA (75.2%) and SANBS (74.9%) guidelines was high. However, only 15.1% had read the SASA guidelines in full, and only 13.4% had read the SANBS guidelines in full. Both guidelines were mainly engaged with in part or as a summary. Most anaesthetic providers (93.8%) believe their management of severe perioperative bleeding could be improved. Only 30.5% of participants were certain that their institution had a written massive transfusion protocol, guideline, or algorithm concerning the management of severe perioperative bleeding. This deviates from the SASA guidelines recommending that policies be defined in an institutional major haemorrhage protocol.[9] The SANBS guidelines do not make a recommendation.

Preoperative assessment and treatment of anaemia

Figure 1 displays data about the preoperative assessment and treatment of anaemia. Recording of preoperative Hb was common, in keeping with SASA guidelines.[9] The SASA guidelines recommend that patients with anaemia (Hb < 13 g/dl) should be investigated and treated before elective surgery.[9] They further recommend that elective surgery, other than caesarean section, should be delayed if required.

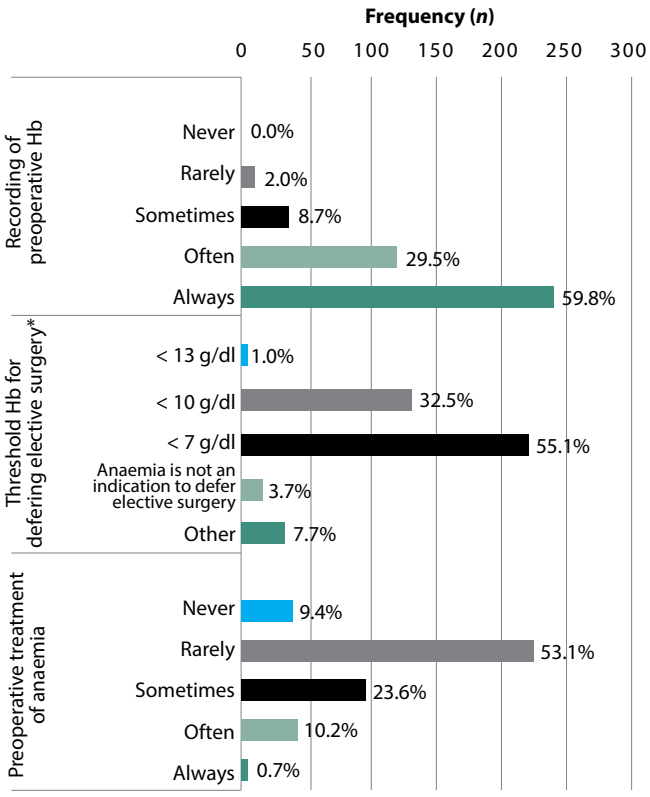

Figure 1: Preoperative assessment and treatment of anaemia among South African anaesthetic providers
* Other than caesarean section.
Hb – haemoglobin

SANBS does not make a recommendation on delaying elective surgery but recommends that anaemia be investigated and a definitive diagnosis made.[10] Despite this, only 1% of anaesthetic providers would delay elective surgery other than caesarean section if Hb was < 13 g/dl. The most common practice was only to delay surgery if Hb was < 7 g/dl (55.1%).

Regarding the treatment of perioperative anaemia, 65.5% of respondents rarely or never saw patients with a Hb < 13 g/dl receiving appropriate treatment, such as iron therapy, in the perioperative period. This is despite the SASA and SANBS recommendations.[9,10]

Intraoperative assessment and treatment of coagulopathy

Figure 2 displays data about the perioperative assessment and treatment of coagulopathy. A quarter of respondents (25.6%) had no access to any validated POC modalities used in PBM. The most commonly available POC device is the TEG® (58.1%). Conventional laboratory-based testing of clotting, including activated partial thromboplastin time, prothrombin time, and international normalised ratio, was used sometimes (30.3%) and often or always (27.8%) in managing acute, ongoing bleeding.

SASA recommends that conventional laboratory tests have little relevance to acute bleeding.[9] In addition, there is a conflict with the SANBS recommendation that POC or laboratory testing should guide management, representing the change in the literature between the guideline publications.[10] Many respondents (42.0%) never or rarely used POC testing in acute, ongoing bleeding; however, 36.9% often or always used POC testing. Using POC testing in acute, ongoing bleeding is recommended by both SASA and SANBS.[9,10]

Freeze-dried plasma (FDP) is commonly viewed by respondents (89.3%) as an acceptable substitute for fresh frozen plasma (FFP). This is in keeping with the SASA recommendation.[9] SANBS did not make a recommendation. The SANBS guidelines recommend a dose of 10–15 ml/kg for FFP and make no recommendation for FDP.[10] The SASA guidelines recommend 15–20 ml/kg for both FDP and FFP.[9] A 10–15 ml/kg dose was used by 54.7% of respondents for FDP and 55.2% for FFP. Only 14.2% answered 15–20 ml/kg for FDP and 14.4% for FFP. The SASA recommendation does not appear to be broadly adopted.

Intraoperative transfusion practice

Figure 3 displays data on perioperative transfusion and cell salvage practices. Most respondents (63.9%) use a transfusion threshold of 7 g/dl for RCC in non-cardiac patients. This aligns with the recommendations of both the SASA and SANBS guidelines.[9,10] Despite this recommendation, 34.1% of respon-

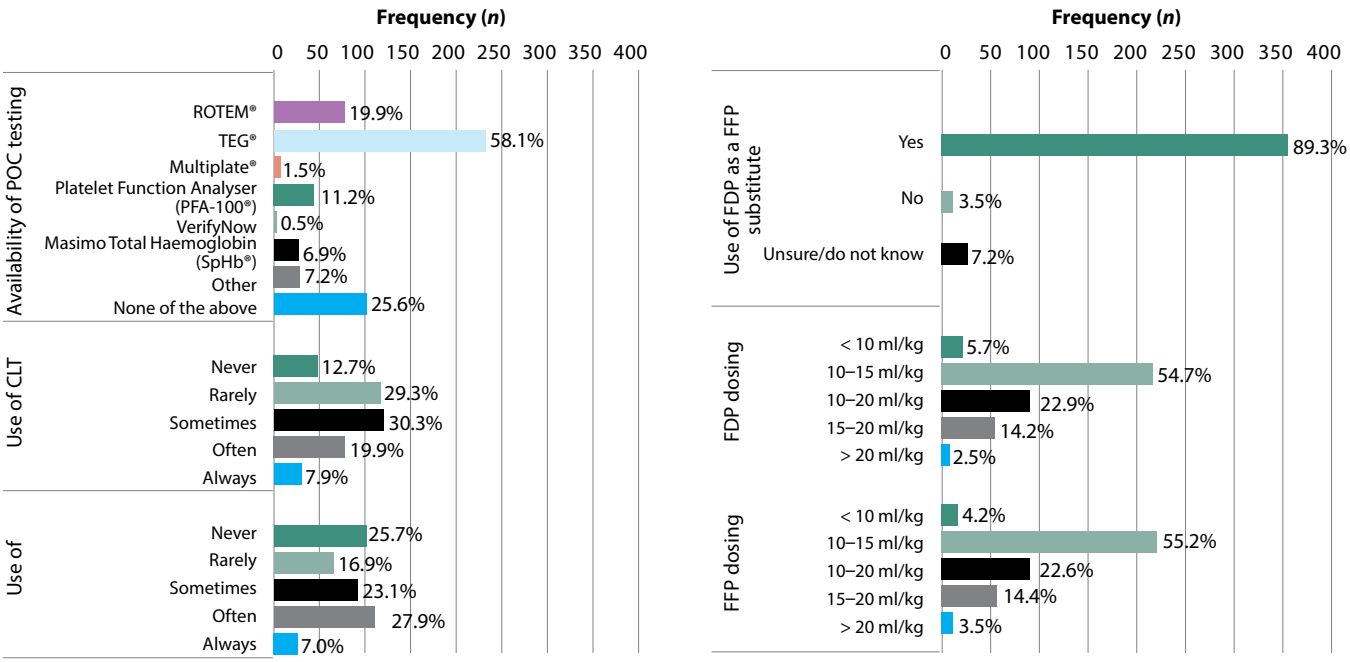

Figure 2: Perioperative assessment and treatment of coagulopathy in ongoing bleeding among South African anaesthetic providers
* Multiple answers permissible.
CLT – conventional laboratory-based testing, FDP – freeze-dried plasma, FFP – fresh frozen plasma, POC – point-of-care

dents use a value greater than 7 g/dl as the transfusion threshold for RCC.

Respondents commonly used a higher transfusion threshold in acute coronary syndrome (79.2%), ischaemic heart disease (88.3%), and after cardiac surgery (61.5%). This is consistent with the SASA recommendation that a clinician may consider a threshold of 8 g/dl and the SANBS recommendation of targeting a post-transfusion value of 8–10 g/dl.[9,10] SANBS does not comment on cardiac surgery.

While the SANBS guideline does not make a recommendation on the use of group O emergency RCC, SASA suggests that it should only be used when haemorrhage is life-threatening.[9] Group O emergency RCC is used by 94.8% of respondents in this situation. However, group O emergency blood is given by 23.3% of respondents while waiting for blood from the blood bank when the turnaround time is normal for their institution, and 39.0% if the turnaround time is prolonged.

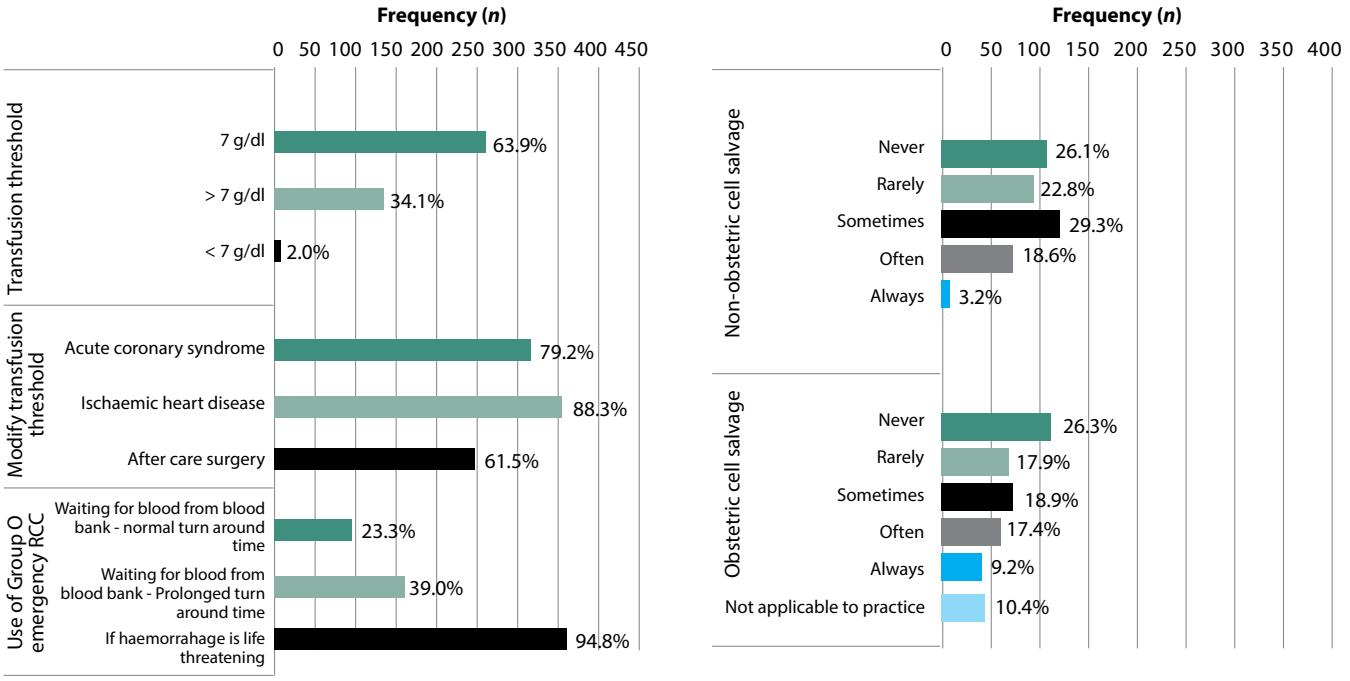

Figure 3: Perioperative transfusion and cell salvage practices among South African anaesthetic providers
* Multiple answers permissible.
RCC – red cell concentrates

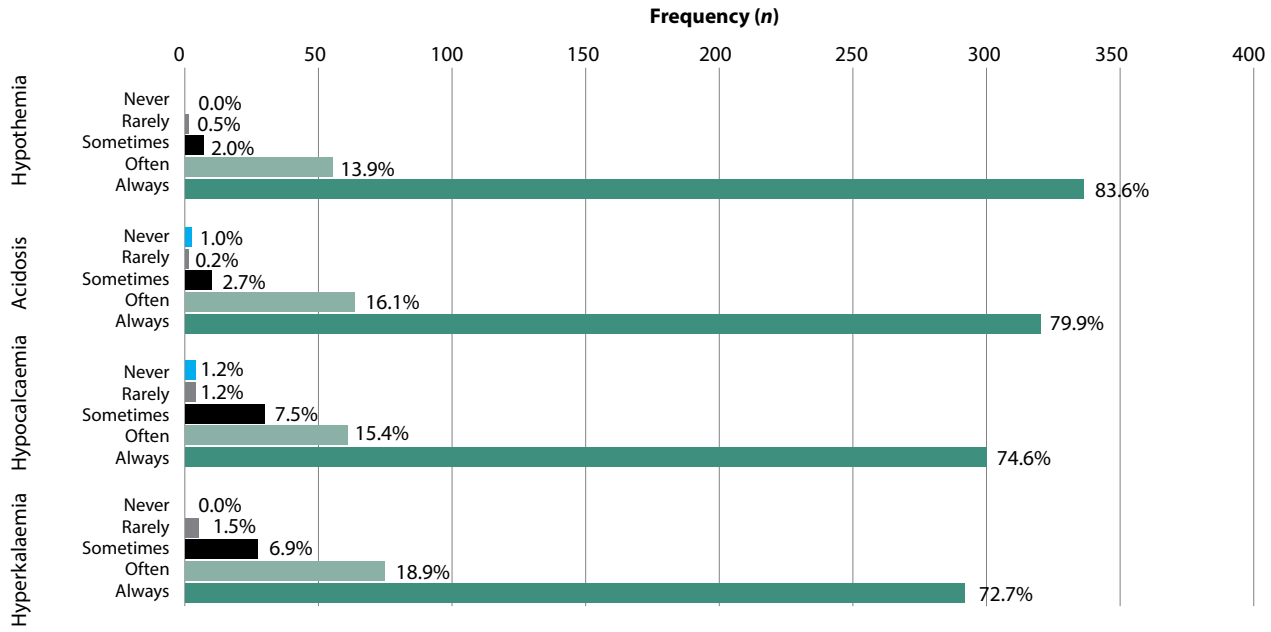

Figure 4: Monitoring, treatment, and prevention of hypothermia, acidosis, hypocalcaemia, and hyperkalaemia in major haemorrhage among South African anaesthetic providers

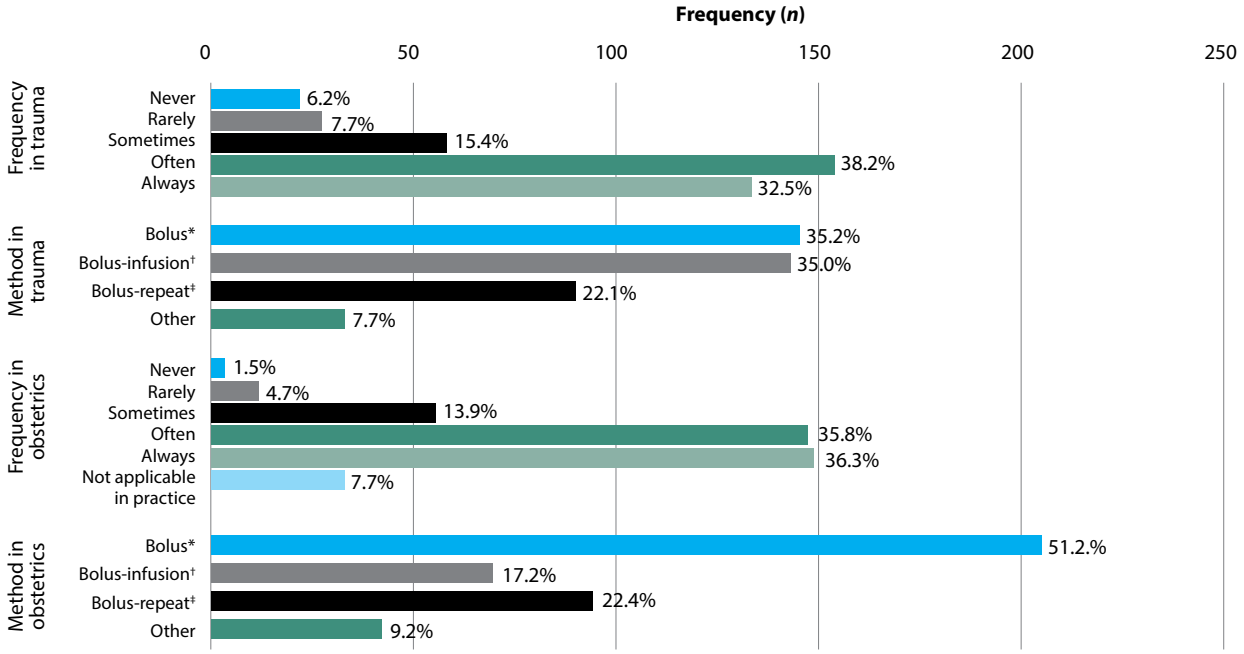

Figure 5: Use of tranexamic acid among South African anaesthetic providers in severe trauma (within three hours of injury) and in obstetric major haemorrhage
* 1 g tranexamic acid intravenously stat.
† 1 g tranexamic acid intravenously stat, followed by 1 g infused over eight hours.
‡ 1 g tranexamic acid intravenously stat, followed by 1 g after 30 minutes if bleeding persists or recurs within 24 hours.

Additional intraoperative procedures

The use of cell salvage varies, both in major obstetric haemorrhage and non-obstetric surgery, where blood loss > 500 ml is anticipated. The SASA guidelines recommend cell salvage in these circumstances.[9] In this sample, 21.2% often or always use cell salvage in non-obstetric surgery, and 26.6% answered the same for obstetric surgery. Though SANBS describes cell salvage as a technique, no recommendation is made on its use.[10]

Figure 4 details resuscitative practices surrounding perioperative major haemorrhage. Both the SASA and SANBS guidelines suggest that one should monitor for, prevent, and treat hypothermia, acidosis, hypocalcaemia and hyperkalaemia.[9,10]

Figure 5 shows data on the perioperative use of TXA. Both SANBS and SASA recommend that TXA be given to critically ill patients with severe trauma as a bolus followed by an infusion.[9,10] The SASA guidelines recommended 1 g stat, then 1 g over eight hours. The SANBS guidelines recommend a loading dose of 10 mg/kg, followed by the same dose over six hours.

In trauma, the most frequent dosing strategy was bolus only (35.2%), followed by bolus-infusion (35.0%). A significant portion of the study population (22.1%) used a bolus-repeat strategy. In major obstetric haemorrhage, SASA suggests a bolus-repeat strategy.[9] SANBS does not suggest a dosing strategy for TXA in obstetric major haemorrhage; much of the relevant literature was published after 2014. In obstetric major haemorrhage, only 22.4% used the guideline-suggested bolus-repeat strategy, 51.2% gave a bolus only, and 17.2% followed a bolus-infusion strategy.

Discussion

In 2015, Baron et al.[14] investigated how PBM practices in Europe compared to the recommendation of the European Society of Anaesthesia guidelines, which have been updated.[16,17] Their study showed major deficits in using the recommended PBM practices among European anaesthetists. Data from LMICs surrounding PBM practices are scarce. A 2017 International Society of Blood Transfusion (ISBT) survey describes the global presence of PBM interventions on the institutional level and compares high-income countries (HICs) to LMICs.[18] According to the ISBT, providers had access to transfusion guidelines more often in HICs (90.3%) than in LMICs (72.8%).

The 30.5% rate of institutional protocol presence for managing severe perioperative bleeding in South Africa compares unfavourably with Europe's 52% rate in 2015.[14] The ISBT survey showed major haemorrhage protocols to be more common in HICs (73.4%) than in LMICs (41.4%).[18] South Africa remains at the stage of individual PBM initiatives.[19] Currently, there are no large-scale or state-mandated programmes, leaving institutions or individuals without reference to standards or protocols.

The "Saving Blood, Saving Lives" project, which aims to encourage rational blood product utilisation without increasing cost or requiring additional staff, has shown the effectiveness of PBM interventions in South Africa.[20] The strategy consisted of a paper-based blood transfusion accountability form, a 12-minute educational presentation, and the revitalisation of the hospital transfusion committee. The programme reduced RCC, platelet, and FDP use by 40% and saved R46 million over five years.

In Europe, 24% of respondents were assessed for anaemia four to eight weeks before surgery.[14] Only 38% were routinely investigated for a cause if anaemia was detected. In South Africa, most anaesthetic providers recorded a preoperative Hb; however, very few practitioners deferred elective surgery for the workup and treatment of anaemia. This may be explained by the fact that appropriate treatment of preoperative anaemia was rarely seen or due to financial and workload constraints, including short-term surgery scheduling.

According to the ISBT survey, preoperative outpatient screening was commonly available in LMICs (62.9%) and HICs (63.7%).[18] Anaesthetists were most commonly responsible for outpatient screening. The SASA recommendation that pre-assessment clinics be established may improve South African performance. The issue remains important, as preoperative anaemia is associated with poor outcomes and death, both in South Africa and internationally.[4,21,22]

A quarter of physicians in our survey reported having no access to POC testing, a rate lower than in Europe in 2015 (41%). Despite this, POC testing usage is poor in South Africa. In comparison, Europeans with access to POC testing use it 75% of the time. This indicates an opportunity to improve the targeted use of blood products in South Africa by improving the uptake of POC testing. However, given that many practitioners in our sample are from academic or private hospitals, the availability of POC testing may be overestimated.

A systematic review could not recommend or discourage using FDP in major haemorrhage.[23] The shelf-stable nature of FDP may have driven the SASA recommendation of equivalence with FFP.

In Europe, 56% of physicians used a transfusion threshold of 7–9 g/dl, similar to the South African sample, which used a threshold of > 7 g/dl in 63.9%.[14] Group O emergency RCC transfusion is safe but represents a limited resource in South Africa.[7,24] Consequently, it should be used only when haemorrhage is acutely life-threatening and not to address delays in receiving blood from the blood bank.

Europe reported a 28% rate of cell salvage use. This is comparable with the South African rate of use in both obstetric and non-obstetric major haemorrhage. The ISBT data show that intra- and postoperative cell salvage was more commonly available in HICs (55.6%) than in LMICs (38.6%).[18] Cell salvage is an integral part of a blood conservation strategy.[25] Improving access to and use of cell salvage in the South African context could improve the capacity to respond to major haemorrhage without further burdening the blood bank services.

In Europe, 89% of respondents aimed to avoid hypothermia and acidosis; the treatment of hypocalcaemia and hyperkalaemia was not measured.[14] South Africans performed well in these areas. The importance of treating acidosis, hypothermia, hypocalcaemia, and associated coagulopathy in bleeding is established. This represents a strength in South African perioperative PBM.

TXA was routinely utilised by 54% of respondents in Europe.[14] South Africa compares favourably in the usage of TXA in both severe trauma and obstetric major haemorrhage. This contrasts with the IBST finding, which shows that the intraoperative availability of TXA was higher in HICs than in LMICs.[18] Poor adherence to SASA guideline dosing should be put into context. The use of TXA in postpartum haemorrhage and bleeding trauma patients has been established.[26,27] However, a single 1 g or 2 g TXA bolus was found to be equivalent to a bolus-infusion technique in traumatic major haemorrhage.[28] A prehospital secondary analysis of patients with moderate to severe head injury and intracranial haemorrhage showed that a 2 g bolus of TXA within two hours of injury may be associated with lower 28-day mortality and disability at six months compared to other

strategies.[29] It may be practical for future guidelines to recognise this.

Study strengths

This is the first study describing the perioperative PBM practices of anaesthetic providers in South Africa. It was broadly distributed throughout the country and offers important context for implementing perioperative PBM, both in South Africa and other LMICs.

Study limitations

This study is at risk of response bias. The population surveyed may not represent anaesthetic providers in South Africa as a whole, as convenience sampling was used. Survey responses may also not directly translate into clinical practice. The sample included only anaesthetic providers and is not generalisable to other groups. The sample may not accurately reflect the population, with many respondents from academic hospitals and private practice. This may especially affect access to POC testing and cell salvage. The work patterns or mix of anaesthetic providers was not investigated, which may influence the degree to which certain subpopulations and situations are viewed in the survey. The availability of cell salvage was not investigated and may have affected practices surrounding its use. We were unable to describe the reasons for practice variation. Further work is required in this direction.

Conclusions

South African anaesthetic providers believe their management of severe perioperative bleeding could be improved. This may be achieved through further implementation of PBM, including establishing clinics for managing perioperative PBM. Overall, PBM practices were not in keeping with local guidelines. The most glaring deficiency is in the observed management of preoperative anaemia. A particular weakness is the rate of appropriate preoperative anaemia treatment.

Further research is needed. Areas of interest include the effects of large-scale institutional PBM projects and perioperative medicine clinics on PBM in South Africa. Additionally, the acceptance of clinical substitution of FDP for FFP lends itself to a comparative study. Finally, further research into alternative dosing strategies for TXA in obstetric major haemorrhage may allow for simplified dosing, in line with recent trauma literature.

Acknowledgements

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Conflict of interest

C Eddey declares that this project was submitted in partial fulfilment of requirements for the Master of Medicine (Anaesthesia) at the University of the Witwatersrand. D Baron declares that he has received lecture honoraria, travel expenses, and research support from CSL Vifor and Pharmacosmos. The other authors have no declarations.

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Ethical approval

Approval to conduct the study was granted by the University of the Witwatersrand Human Research Ethics Committee (M230407), the University of Pretoria Faculty of Health Sciences Research Ethics, and the Survey Committee (216/2023). Survey completion implied consent and the institutional review boards waived the requirement for written, informed consent.

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