The relevance of pre-operative hemostasis screening

Ton Lisman, Dept. Surgery, UMC Groningen, The Netherlands

Clinical practice

Two million non-cardiac elective surgeries in the US (2006-2012)

Preoperative hemostatic screening tests†	
INR	872,501 (43.2%)
aPTT	748,568 (37.1%)
Platelet count	1,679,926 (83.1%)
All 3 preoperative screening tests were done	728,135 (36.0%)
No preoperative screening tests	324,638 (16.1%)
Patient history variables indicative of potential bleeding tendency	
Bleeding disorder	89,942 (4.5%)
Chronic steroid use	60,252 (3.0%)
Chemotherapy	19,328 (1.0%)
Radiation therapy	11,011 (0.5%)
Disseminated cancer	39,470 (2.0%)
Renal disease	31,175 (1.5%)
Hepatic disease	10,142 (0.5%)
History indicative of potentially abnormal hemostasis‡	226,856 (11.2%)

PLoS ONE 2015;10: e0139139.

The Usefulness of Preoperative Laboratory Screening

Eric B. Kaplan, Lewis B. Sheiner, Alison J. Boeckmann, Michael F. Roizen, Stuart L. Beal, Stephen N. Cohen, C. Diana Nicoll

JAMA. ***1985;****253****(24):3576.***

Abstract

…..Several tests ordered by protocol and performed by the laboratory at the time of admission were examined in these samples, including complete blood cell count, differential cell count, prothrombin time, partial thromboplastin time, platelet count, six-factor automated multiple analysis, and glucose level.

Sixty percent of these routinely ordered tests would not have been performed if testing had only been done for recognizable indications, and only 0.22% of these revealed abnormalities that might influence perioperative management. Chart review indicated that these few abnormalities were not acted on nor did they have adverse surgical or anesthetic consequences. In the absence of specific indications, routine preoperative laboratory tests contribute little to patient care and could reasonably be eliminated.

(*JAMA* 1985;253:3576-3581)

bjh guideline

Guidelines on the assessment of bleeding risk prior to surgery or invasive procedures

British Committee for Standards in Haematology

Y. L. Chee, [1] J. C. Crawford, [2] H. G. Watson[1] and M. Greaves[3]

[1]*Department of Haematology, Aberdeen Royal Infirmary, Aberdeen,* [2]*Department of Anaesthetics, Southern General Hospital, Glasgow, and* [3]*Department of Medicine and Therapeutics, School of Medicine, University of Aberdeen, Aberdeen, UK*

Patients undergoing surgery should have a bleeding history taken. This should include detail of previous surgery and trauma, a family history, and detail of anti-thrombotic medication. Patients with a negative bleeding history do not require routine coagulation screening prior to surgery.

Br J Haematol. 2008 Mar;140(5):496-504.

The Practice Advisory for Preanesthesia Evaluation by the American Society of Anesthesiologists

"Clinical characteristics to consider for ordering selected coagulation studies include bleeding disorders, renal dysfunction, liver dysfunction, and type and invasiveness of procedure".

Anesthesiology 2012 Mar;116(3):522-538

National Institute for Health and Care Excellence

Preoperative tests (update)

Routine preoperative tests for elective surgery

Clinical guideline NG45

Methods, evidence and recommendations

April 2016

Developed by the National Guideline Centre,
hosted by the Royal College of Physicians

ASA grades

The ASA (American Society of Anesthesiologists) Physical Status Classification System is a simple scale describing fitness to undergo an anaesthetic. The ASA states that it does not endorse any elaboration of these definitions. However, anaesthetists in the UK often qualify (or interpret) these grades as relating to functional capacity – that is, comorbidity that does not (ASA 2) or that does (ASA 3) limit a person's activity.

ASA 1	A normal healthy patient
ASA 2	A patient with mild systemic disease
ASA 3	A patient with severe systemic disease
ASA 4	A patient with severe systemic disease that is a constant threat to life

Test	ASA 1	ASA 2	ASA 3 or ASA 4
Minor surgery (**examples**: excising skin lesion; draining breast abscess)			
Full blood count	Not routinely	Not routinely	Not routinely
Haemostasis	Not routinely	Not routinely	Not routinely
Kidney function	Not routinely	Not routinely	Consider in people at risk of AKI[1]
ECG	Not routinely	Not routinely	Consider if no ECG results available from past 12 months
Lung function/arterial blood gas	Not routinely	Not routinely	Not routinely

Test	ASA 1	ASA 2	ASA 3 or ASA 4
Intermediate surgery (**examples**: primary repair of inguinal hernia; excising varicose veins in the leg; tonsillectomy or adenotonsillectomy; knee arthroscopy)			
Full blood count	Not routinely	Not routinely	Consider for people with cardiovascular or renal disease if any symptoms not recently investigated
Haemostasis	Not routinely	Not routinely	Consider in people with chronic liver disease • If people taking anticoagulants need modification of their treatment regimen, make an individualised plan in line with local guidance • If clotting status needs to be tested before surgery (depending on local guidance) use point-of-care testing[2]
Kidney function	Not routinely	Consider in people at risk of AKI[1]	Yes
ECG	Not routinely	Consider for people with cardiovascular, renal or diabetes comorbidities	Yes
Lung function/arterial blood gas	Not routinely	Not routinely	Consider seeking advice from a senior anaesthetist as soon as possible after assessment for people who are ASA grade 3 or 4 due to known or suspected respiratory disease
Major or complex surgery (**examples**: total abdominal hysterectomy; endoscopic resection of prostate; lumbar discectomy; thyroidectomy; total joint replacement; lung operations; colonic resection; radical neck dissection)			
Full blood count	Yes	Yes	Yes
Haemostasis	Not routinely	Not routinely	Consider in people with chronic liver disease • If people taking anticoagulants need modification of their treatment regimen, make an individualised plan in line with local guidance • If clotting status needs to be tested before surgery (depending on local guidance) use point of care testing[2]

Moderate to major surgery ASA 3 or 4

Consider in people with chronic liver disease

- If people taking anticoagulants need modification of their treatment regimen, make an individualised plan in line with local guidance
- If clotting status needs to be tested before surgery (depending on local guidance) use point-of-care testing[2]

In aggregate:

- In patients with a negative history, that are not using antithrombotic drugs, there are very little indications for preoperative hemostasis screening

- Why are hemostasis test still requested frequently?
    - Habit?
    - Defensive medicine?

Consequences of abnormalities in pre-operative tests

- Transfusion?
  - Effective in improving hemostatic status?
  - Effective in reducing perioperative bleeding?
  - Risk benefit?
  - Cost?

- Cancel surgery?

The use of fresh-frozen plasma in England: high levels of inappropriate use in adults and children

Simon J. Stanworth, John Grant-Casey, Derek Lowe, Mike Laffan, Helen New, Mike F. Murphy, and Shubha Allard

In adult patients 43% of all FFP transfusions were given in the absence of documented bleeding, as prophylaxis for abnormal coagulation tests or before procedures or surgery.

TRANSFUSION Volume 51, January 2011

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Changes in standard coagulation results after FFP administration were generally very small for adults and children…. the median reduction in INR was −0.2 (IQR, −0.7 to 0.0; n = 2543) and in PT was −1.9 seconds (IQR, −5.9 to 0.1; n = 2701) for all adults….

TRANSFUSION Volume 51, January 2011

Prophylactic plasma transfusion for surgical patients with abnormal preoperative coagulation tests: a single-institution propensity-adjusted cohort study

Qing Jia, Michael J Brown, Leanne Clifford, Gregory A Wilson, Mark J Truty, James R Stubbs, Darrell R Schroeder, Andrew C Hanson, Ognjen Gajic, Daryl J Kor

Lancet Haematol 2016; 3: e139–48

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Non-cardiac surgery, INR>1.5

Prophylactic plasma transfusion for surgical patients with abnormal preoperative coagulation tests: a single-institution propensity-adjusted cohort study

Qing Jia, Michael J Brown, Leanne Clifford, Gregory A Wilson, Mark J Truty, James R Stubbs, Darrell R Schroeder, Andrew C Hanson, Ognjen Gajic, Daryl J Kor

	No therapy (n=1095)	Preoperative plasma (n=139)	p value	OR (95% CI)
Perioperative WHO grade 3 bleeding	350 (32%)	73 (53%)	<0·0001	2·35 (1·65–3·36)
Intraoperative red blood cell transfusion	268 (24%)	56 (40%)	<0·0001	2·08 (1·44–3·00)
Estimated blood loss, mL (n=564)	200 (50–500)	300 (85–930)	0·0844	NA
Reoperation	49 (4%)	16 (12%)	0·0008	2·78 (1·53–5·03)
Postoperative haemoglobin, mg/dL (n=961)*	10·1 (9·1–11·3)	10·2 (9·1–11·5)	0·44	NA
ICU admission	389 (36%)	88 (63%)	<0·0001	3·13 (2·17–4·52)
ICU length of stay, days (n=477)†	2·0 (1·1–5·1)	5·1 (1·8–8·0)	<0·0001	NA
Postoperative mechanical ventilation	251 (23%)	66 (47%)	<0·0001	3·04 (2·12–4·36)
Duration of mechanical ventilation, days (n=317)†	1·1 (0·4–5·9)	2·5 (1·2–7·0)	0·0016	NA
Hospital length of stay, days	6·0 (2·2–13·1)	12·8 (6·7–20·5)	<0·0001	6·6 (2·7–10·9)
Discharge haemoglobin, mg/dL (n=977)	9·8 (9·0–10·9)	9·8 (9·0–11·1)	0·97	NA
Death	83 (8%)	24 (17%)	0·0002	2·54 (1·55–4·17)

For binary outcomes, values are presented as numbers (%) and the odds ratio for preoperative plasma transfusion versus no therapy are given; for continuous outcomes, values are presented as median (IQR). For continuous outcomes, the estimate is the difference in mean (preoperative plasma minus no therapy) with 95% CIs calculated from 10 000 bootstrap samples. p values are from logistic regression for binary outcomes and from Wilcoxon rank sum test for continuous outcomes. OR=odds ratio. ICU=intensive care unit. NA=not applicable. *Postoperative haemoglobin was defined as the first haemoglobin obtained after completion of the surgical procedure. To qualify, the haemoglobin must have been obtained within 24 h of the surgical procedure. †ICU length of stay is summarised only for patients admitted to the ICU; duration of mechanical ventilation is summarised only for patients who received mechanical ventilation postoperatively.

Table 2: **Univariate analyses of primary and secondary outcomes by the presence or absence of preoperative plasma transfusion**

Why a restrictive (prophylactic) transfusion strategy makes sense

Survival after CABG

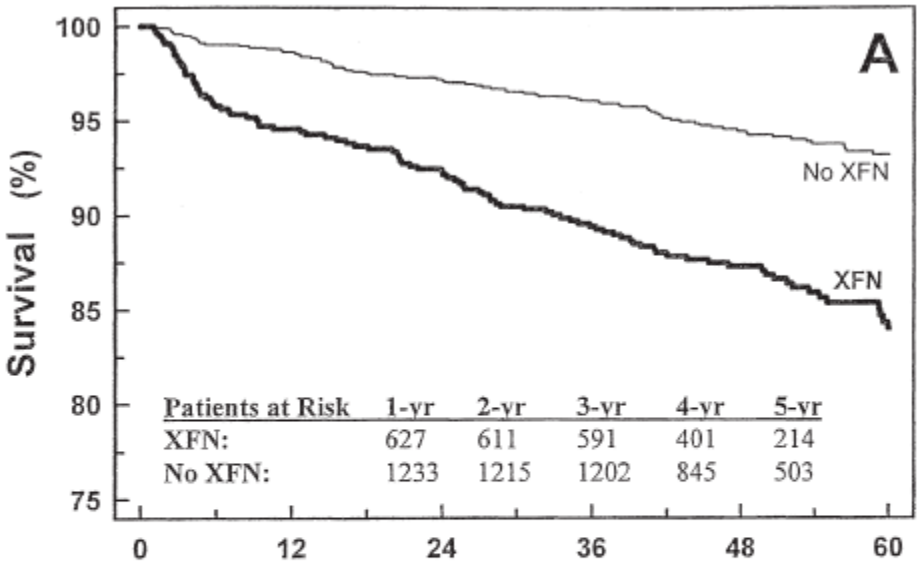


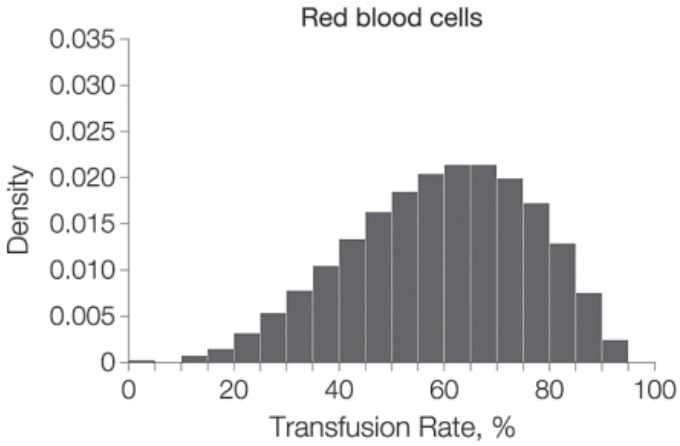
Figure 1. The Kaplan Meier mortality curves for those patients transfused perioperatively and for those not transfused. Those patients not transfused had approximately a 2.5-fold better survival than those who received one or more units of red blood cells during their hospital stay for coronary artery bypass grafting surgery. This data was after propensity analysis weighting confounding events and risks. XFN = transfusion. From reference 60, used with permission.

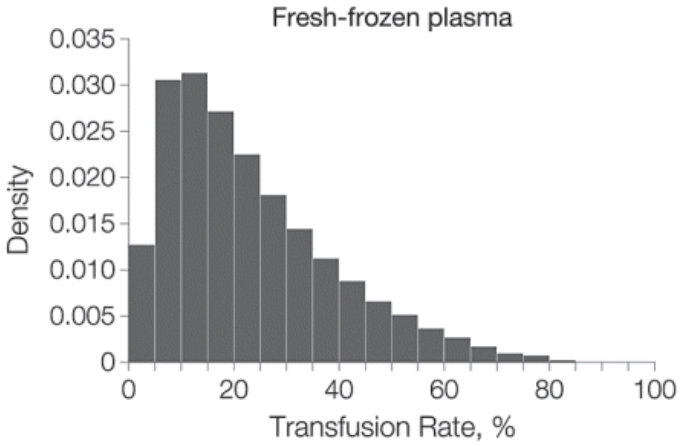
Seminars in Cardiothoracic and Vascular Anesthesia, Vol 8, No 4 (December), 2004: pp 267–281

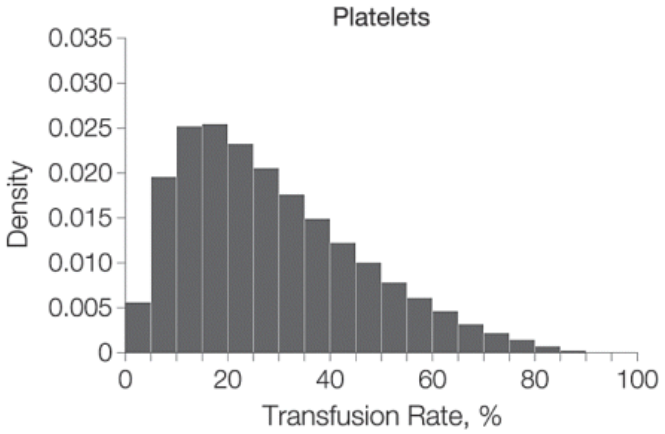
Side effects of blood product transfusion

- Hemolytic transfusion reactions
- Febrile nonhemolytic transfusionreactions
- Allergic and anaphylactic reactions
- Acute pain reactions
- Bacterial contamination
- Transfusion related acute lung injury
- Transfusion related acute graft versus host disease
- Hypotensive transfusion reactions
- Post transfusion purpura
- Circulatory overload
- Hemachromatosis
- Etc,etc

Major differences between centers in % op patients receiving transfusion during CABG

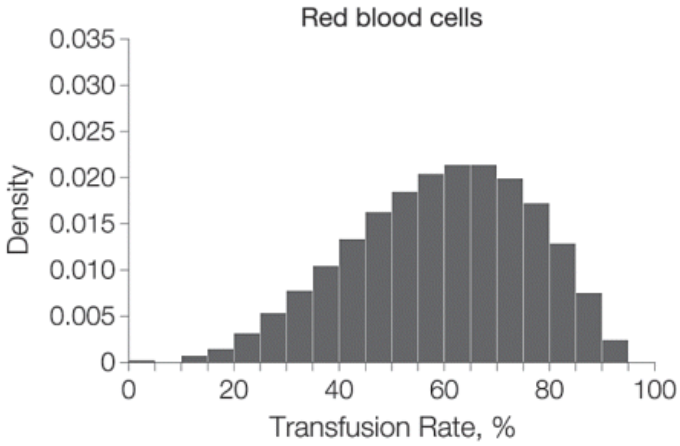


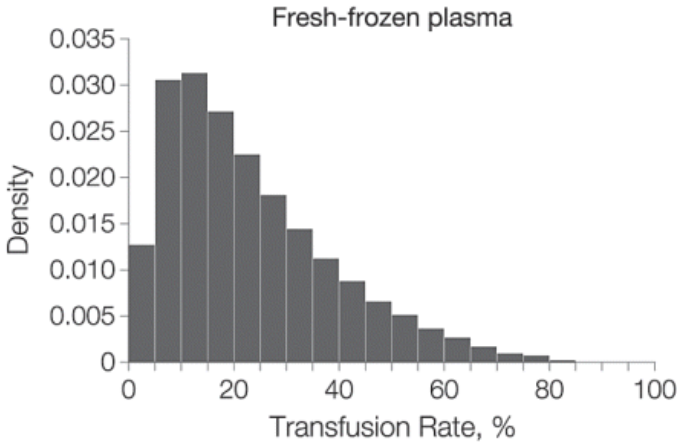


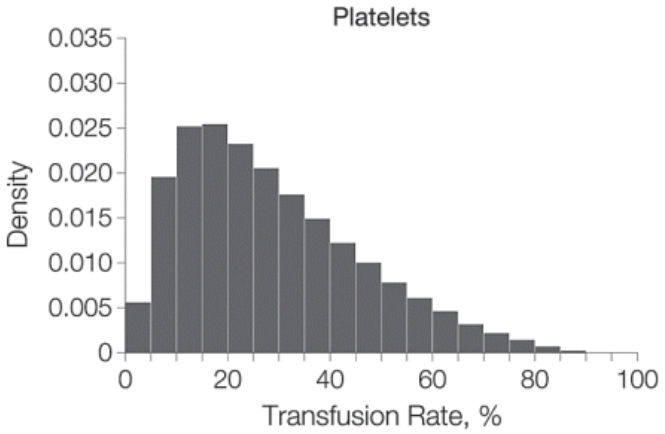


JAMA 2010: 304: 1568-1575

Major differences between centers in % op patients receiving transfusion during CABG







…..some of the variability we observed may be due to honest differences between clinicians in the perceived benefits and risks of transfusion

JAMA 2010: 304: 1568-1575

J Neurosurg 116:1097–1105, 2012

Use and utility of preoperative hemostatic screening and patient history in adult neurosurgical patients

Clinical article

Andreea Seicean, M.P.H.,[1,4] Nicholas K. Schiltz, B.S.,[1,4] Sinziana Seicean, M.D., M.P.H., Ph.D.,[2,3] Nima Alan, B.S.,[4] Duncan Neuhauser, Ph.D.,[1,4] and Robert J. Weil, M.D.[5]

[1]Department of Epidemiology and Biostatistics, [4]Case Western Reserve University School of Medicine; [2]Departments of Pulmonary and Critical Care and Sleep Medicine, University Hospitals, Case Medical Center; [3]Heart and Vascular Institute, Cleveland Clinic Foundation; and [5]Rose Ella Burkhardt Brain Tumor and Neuro-Oncology Center, and Department of Neurosurgery, Neurological Institute, Cleveland Clinic, Cleveland, Ohio

Conclusion of this study:

- Patient history is as predictive as laboratory testing for hemostasis-related outcomes with higher sensitivity

- Testing limited to neurosurgical patients in the USA with a positive history would save ~80.000.000 USD annually

Potential savings for all surgical procedures:

- 1.150.000.000 USD (PT, APTT, plt)

PLoS ONE 2015;10: e0139139.

So:

- If we test, and treat abnormal tests by blood products
  - We may not improve test results
  - Paradoxically increase bleeding risk
  - May do harm

Should we test patients with liver disease?

Moderate to major surgery ASA 3 or 4

Consider in people with chronic liver disease

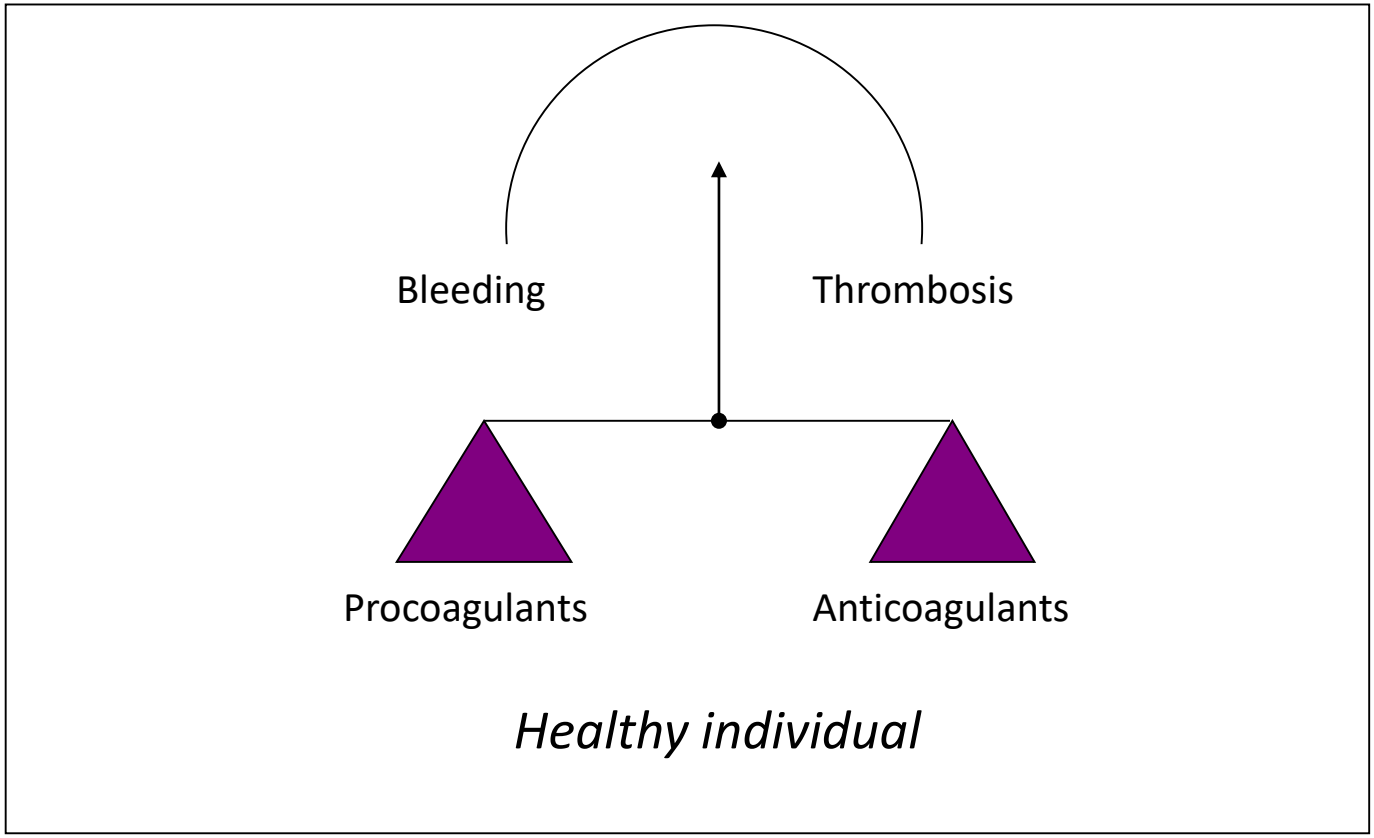
- If people taking anticoagulants need modification of their treatment regimen, make an individualised plan in line with local guidance
- If clotting status needs to be tested before surgery (depending on local guidance) use point-of-care testing[2]

Hemostatic alterations in liver disease

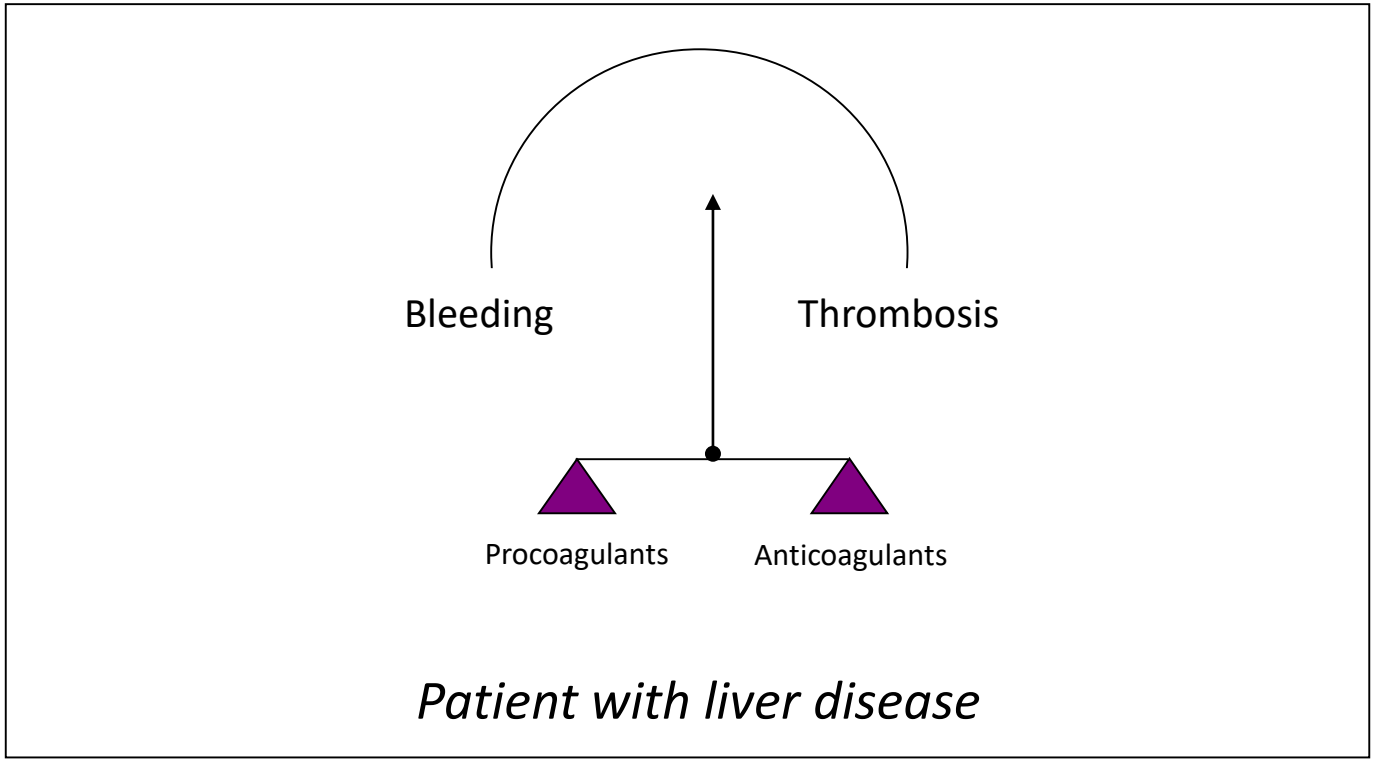
- Low platelet count
- Prolonged PT, APTT

Bleeding?

Hemostatic balance



Liver disease: Hemostatic rebalance



Coagulation Defects Do Not Predict Blood Product Requirements During Liver Transplantation

Luc Massicotte,[1,5] Danielle Beaulieu,[1] Lynda Thibeault,[2] Jean-Denis Roy,[1] Denis Marleau,[3] Réal Lapointe,[4] and André Roy[4]

Background. In our experience, correction of coagulation defects with plasma transfusion does not decrease the need for intraoperative red blood cell (RBC) transfusions during liver transplantation. On the contrary, it leads to a hypervolemic state that result in increased blood loss. A previous study has shown that plasma transfusion has been associated with a decreased 1-year survival rate. The aim of this prospective study was to evaluate whether anesthesiologists could reduce RBC transfusion requirements during liver transplantation by eliminating plasma transfusion.

Methods. Two hundred consecutive liver transplantations were prospectively studied over a 3-year period. Patients were divided into two groups: low starting international normalized ratio (INR) value <1.5 and high INR ≥ 1.5. Low central venous pressure was maintained in all patients before the anhepatic phase. Coagulation parameters were not corrected preoperatively or intraoperatively in the absence of uncontrollable bleeding. Phlebotomy and auto transfusion of blood salvaged were used following our protocol. Independent variables were analyzed in both univariate and multivariate fashion to find a link with RBC transfusions or decreased survival rate.

Results. The mean number of intraoperative RBC units transfused was 0.3 ± 0.8. Plasma, platelet, albumin, and cryoprecipitate were not transfused. In 81.5% of the patients, no blood product was used during their transplantation. The average final hemoglobin (Hb) value was 91.2 ± 15.0 g/L. There were no differences in transfusional rate, final Hb, or bleeding between two groups (low or high INR values). The overall 1-year survival rate was 85.6%. Logistic regression showed that avoidance of plasma transfusion, phlebotomy, and starting Hb value were significantly linked to liver transplantation without RBC transfusion. The need for intraoperative RBC transfusion and Pugh's score were linked to the decreased 1-year survival rate.

Conclusion. The avoidance of plasma transfusion was associated with a decrease in RBC transfusions during liver transplantation. There was no link between coagulation defects and bleeding or RBC or plasma transfusions. Previous reports indicating that it is neither useful nor necessary to correct coagulation defects with plasma transfusion before liver transplantation seem further corroborated by this study. We believe that this work also supports the practice of lowering central venous pressure with phlebotomy to reduce blood loss, during liver dissection, without any deleterious effect.

Keywords: Coagulation defects, Liver transplantation, Transfusion, Survival.

(*Transplantation* 2008;85: 956–962)

Transfusion Rate for 500 Consecutive Liver Transplantations: Experience of One Liver Transplantation Center

Luc Massicotte,[1,6] André Y. Denault,[1] Danielle Beaulieu,[1] Lynda Thibeault,[2] Zoltan Hevesi,[3] Anna Nozza,[4] Réal Lapointe,[5] and André Roy[5]

Background. Orthotopic liver transplantation (OLT) has been associated with major blood loss and the need for blood product transfusions. During the last decade, improved surgical and anesthetic management has reduced intraoperative blood loss and blood product transfusions. A first report from our group published in 2005 described a mean intraoperative transfusion rate of 0.3 red blood cell (RBC) unit per patient for 61 consecutive OLTs. Of these patients, 80.3% did not receive any blood product. The interventions leading to those results were a combination of fluid restriction, phlebotomy, liberal use of vasopressor medications, and avoidance of preemptive transfusions of fresh frozen plasma. This is a follow-up observational study, covering 500 consecutive OLTs.

Methods. Five hundred consecutive OLTs were studied. The transfusion rate of the first 61 OLTs was compared with the last 439 OLTs. Furthermore, multivariate logistic regression was used to determine the main predictors of intraoperative blood transfusion.

Results. A mean (SD) of 0.5 (1.3) RBC unit was transfused per patient for the 500 OLTs, and 79.6% of them did not receive any blood product. There was no intergroup difference except for the final hemoglobin (Hb) value, which was higher for the last 439 OLTs compared with the previously reported smaller study (94 [20] vs. 87 [20] g/L). Two variables, starting Hb value and phlebotomy, correlated with OLT without transfusion.

Conclusions. In our center, a low intraoperative transfusion rate could be maintained throughout 500 consecutive OLTs. Bleeding did not correlate with the severity of recipient's disease. The starting Hb value showed the strongest correlation with OLT without RBC transfusion.

Keywords: Liver transplantation, Transfusion, Phlebotomy, Antifibrinolytic, Cell saver, MELD score.

Preoperative hemostasis testing may have limited use in patients with liver disease, and an abnormal platelet count, prothrombin time, activated partial thromboplastin time, and fibrinogen level should not trigger prophylactic transfusion of blood product components.

Lisman & Porte, Anesthesiology, in press

Conclusions

- In patients with a negative history, that are not using antithrombotic drugs, there are very little indications for preoperative hemostasis screening

- Preoperative screens are commonly requested, despite guidelines advising against unselected screening

- Preoperative hemostasis screens contribute significantly to health care costs