ANEMIA MANAGEMENT

EVALUATION

Impact of erythropoiesis-stimulating agents on morbidity and mortality in patients with heart failure: An updated, post-TREAT meta-analysis

Eur J Heart Fail. 2010 Jun 5. [Epub ahead of print]
Desai A, Lewis E, Solomon S, McMurray JJ, Pfeffer M
Cardiovascular Division, Brigham and Women's Hospital, Boston, MA

AIMS: Randomized clinical trials have suggested that treatment of anaemia with erythropoiesis-stimulating agents (ESAs) in patients with cancer or chronic kidney disease may increase cardiovascular risk. We therefore examined the effect of treating anaemia with an ESA in patients with heart failure in a meta-analysis of randomized clinical trials, including the recently reported TREAT study. METHODS AND RESULTS: We performed a systematic review and meta-analysis of all prospective, randomized, controlled studies of ESAs enrolling patients with heart failure and reporting data on mortality or non-fatal heart failure events. Of 10 trials initially identified by our search strategy, we pooled data from 9 placebo-controlled studies enrolling a total of 2039 patients, of whom 1023 (50.2%) were allocated to ESA treatment. The pooled risk ratio for ESA treatment relative to placebo was 1.03 (95% confidence interval (CI): 0.89-1.21, P = 0.68) for overall mortality and 0.95 (95% CI: 0.82-1.10, P = 0.46) for worsening heart failure. CONCLUSIONS: The use of ESAs to manage anaemia in patients with heart failure was associated with a neutral effect on both mortality and non-fatal heart failure events. Definitive assessment of the balance of risk and benefit in this population awaits the completion of a randomized clinical trial adequately powered to assess clinical outcomes.


Effects of the dose of erythropoiesis stimulating agents on cardiovascular events, quality of life, and health-related costs in hemodialysis patients: the Clinical Evaluation of the dose of erythropoietins (C.E. DOSE) trial protocol

Trials. 2010 Jun 9;11(1):70. [Epub ahead of print]

ABSTRACT BACKGROUND: Anemia is a risk factor for death, adverse cardiovascular outcomes and poor quality of life in patients with chronic kidney disease (CKD). Erythropoietin Stimulating Agents (ESA) are commonly used to increase hemoglobin levels in this population. In observational studies, higher hemoglobin levels (around 11-13 g/dL) are associated with improved survival and quality of life compared to hemoglobin levels around 9-10 g/dL. A systematic review of randomized trials found that targeting higher hemoglobin levels with ESA causes an increased risk of adverse vascular outcomes. It is possible, but has never been formally tested in a randomized trial, that ESA dose rather than targeted hemoglobin concentration itself mediates the increased risk of adverse vascular outcomes. The Clinical Evaluation of the DOSe of Erythropoietins (C.E. DOSE) trial will assess the benefits and harms of a high versus a low fixed ESA dose for the management of anemia in patients with end stage kidney disease. METHODS: This is a randomized, prospective open label blinded end-point (PROBE) trial due to enrol 2204 hemodialysis patients in Italy. Patients will be randomized 1:1 to 4000 IU/week versus 18000 IU/week of intravenous epoietin alfa or beta, or any other ESA in equivalent doses. The dose will be adjusted only if hemoglobin levels fall outside the 9.5-12.5 g/dL range. The primary outcome will be a composite of all-cause mortality, non fatal stroke, non fatal myocardial infarction and hospitalization for cardiovascular causes. Quality of life and costs will also be assessed. DISCUSSION: The C.E.DOSE study will help inform the optimal therapeutic strategy for the management of anemia of hemodialysis patients, improving clinical outcomes, quality of life and costs, by ascertaining the potential benefits and harms of different fixed ESA doses. Trial registration Clinicaltrials.gov NCT00827021.


ANEMIA MANAGEMENT

ERYTHROPOIETIC AGENTS

Cardiovascular risks of anemia correction with erythrocyte stimulating agents: Should blood viscosity be monitored for risk assessment?

Cardiovasc Drugs Ther. 2010 Jun 1. [Epub ahead of print]
Jeong SK, Cho YJ, Duy M, Rosenson RS

Department of Neurology & Research Institute of Clinical Medicine, Chonbuk National University Medical School and Hospital, Jeonju, Jeonbuk, South Korea

To date, all major clinical trials for anaemia correction using erythrocyte stimulating agents (ESAs) failed to show
improved outcomes for cardiovascular disease (CVD), stroke, and vascular thrombosis. Even moderate elevations in hemoglobin (e.g., to 13 g/dL) using erythropoietin have been associated with significantly increased risk of thrombotic cardiovascular events and heart failure. This review presents a biophysical rationale for increased risk of CVD among certain patients treated with ESAs and suggests a risk management approach based on blood viscosity. Whole blood viscosity is a key determinant of the work of the heart, and elevated blood viscosity appears to be both a strong predictor of cardiovascular disease and an important pathophysiological factor in the development of atherothrombosis. Blood donation has been shown to reduce viscosity. Reflecting these findings, studies in male blood donors and in women of premenopausal age with regular menstruation have shown reduced incidence of cardiovascular events such as myocardial infarction, angina, stroke, and the requirement for procedures such as percutaneous transluminal coronary angioplasty and coronary artery bypass graft compared with non-donors and postmenopausal women, respectively. We propose that blood viscosity monitoring should be considered as part of a cardiovascular risk assessment, whenever an increased cardiovascular risk is detected and particularly in the context of anemia correction.


ANEMIA MANAGEMENT

IRON

Short course pre-operative ferrous sulphate - is it worth while in patients with colorectal cancer?

Quinn M, Drummond RJ, Ross F, Murray J, Murphy J, Macdonald A

INTRODUCTION: Pre-operative anaemia is well recognised in patients presenting with colorectal cancer (CRC). While the benefits of long-term FeSO4 supplementation on Fe deficiency anaemia are well established, it is not known if short-course supplementation (2-3 weeks) impacts significantly on pre-operative haemoglobin (Hb) levels. This study examines the impact of short-term, oral FeSO4 supplementation on patients undergoing surgery for CRC.PATIENTS AND METHODS All patients with CRC presenting to a single surgeon were included. At diagnosis, baseline Hb and blood film were checked on all patients who then received 200 mg tds of FeSO4. Haemoglobin was rechecked pre-operatively and daily postoperatively. Patients requiring pre-operative blood transfusions were excluded from analysis.RESULTS Between 1 January 2004 and 31 December 2006, 117 patients were identified, 14 of whom were excluded. Patients received a median of 39 days' treatment with FeSO4. Fifty-eight (56.3%) patients were anaemic at presentation gaining a mean of 1.73 g/dl (P < 0.001) from short-course FeSO4 supplementation. Right-sided tumours (lower mean Hb at presentation; P = 0.008) responded more to FeSO4 when compared to left-sided tumours (P < 0.017). Increase in Hb was unrelated to pathological stage. The transfusion rate for all curative resections was 0.69 units/patient. For the historical cohort (patients undergoing curative resection between 1 January 2001 and 31 December 2003), the mean transfusion rate fell from 1.69 units/patient.CONCLUSIONS Routine short-course supplementation with iron offers improved pre-operative Hb prior to surgery in CRC, especially in right-sided lesions and those with presenting anaemia.


A prospective randomized, controlled trial of intravenous versus oral iron for moderate iron deficiency anaemia of pregnancy

Khalafallah A, Dennis A, Bates J, Bates G, Robertson IK, Smith L, Ball MJ, Seaton D, Brain T, Rasko JE
Launceston General Hospital (LGH), University of Tasmania, Tasmania, Australia

Abstract: Khalafallah A, Dennis A, Bates J, Bates G, Robertson IK, Smith L, Ball MJ, Seaton D, Brain T, Rasko JE Launceston General Hospital (LGH), Australia; University of Tasmania, Australia; and Centenary Institute, University of Sydney, NSW, Australia) A prospective randomized, controlled trial of intravenous versus oral iron for moderate iron deficiency anaemia of pregnancy. J Intern Med 2010; doi: 10.1111/j.1365-2796.2010.02251.x

Background: Iron deficiency anaemia is the most common deficiency disorder in the world, affecting more than one billion people, with pregnant women at particular risk. Objectives and design. We conducted a single site, prospective, nonblinded randomized-controlled trial to compare the efficacy, safety, tolerability and compliance of standard oral daily iron versus intravenous iron Subjects. We prospectively screened 2654 pregnant women between March 2007 and January 2009 with a full blood count and iron studies, of which 461 (18%) had moderate IDA. Two hundred women matched for haemoglobin concentration and serum ferritin level were recruited. Interventions. Patients were randomized to daily oral ferrous sulphate 250 mg (elemental iron 80 mg) with or without a single intravenous iron polymaltose infusion. Results. Prior to delivery, the intravenous plus oral iron arm was superior to the oral iron only arm as measured by the increase in haemoglobin level (mean of 19.5 g/L vs. 12 g/L; P < 0.001); the increase in mean serum ferritin level (222 mug/L vs. 18 ug/L; P < 0.001); and the percentage of mothers with ferritin levels below 30 mug/L (4.5% vs. 79%; P < 0.001). A single dose of intravenous iron polymaltose was well tolerated without significant side effects. Conclusions. Our data indicate that intravenous iron polymaltose is safe and leads to improved efficacy and iron stores compared to oral iron alone in pregnancy-related IDA.


ANESTHETIC TECHNIQUES

FLUID MANAGEMENT

Intraoperative management of extreme hemodilution in a patient with a severed axillary artery

Dai J, Tu W, Yang Z, Lin R

We present a case of extreme hemodilution in which appropriately crossmatched blood was not available. A 53-year-old man was admitted to our hospital because of
Intraoperative fluid optimization using stroke volume variation in high risk surgical patients: Results of prospective randomized study

Crit Care. 2010 Jun 16;14(3):R118. [Epub ahead of print]


ABSTRACT INTRODUCTION: Stroke volume variation (SVV) is a good and easily obtainable predictor of fluid responsiveness, which can be used to guide fluid therapy in mechanically ventilated patients. During major abdominal surgery, inappropriate fluid management may result in occult organ hypoperfusion or fluid overload in patients with compromised cardiovascular reserves and thus increase postoperative morbidity. The aim of our study was to evaluate the influence of SVV guided fluid optimization on organ functions and postoperative morbidity in high risk patients undergoing major abdominal surgery. METHODS: Patients undergoing elective intraabdominal surgery were randomly assigned to a Control group (n=60) with routine intraoperative care and a Vigileo group (n=60), where fluid management was guided by SVV (Vigileo/FloTrac system). The aim was to maintain the SVV below 10% using colloid boluses of 3ml/kg. The laboratory parameters of organ hypoperfusion in perioperative period, the number of infectious and organ complications on day 30 after the operation, and the hospital and ICU length of stay and mortality were evaluated. The local ethics committee approved the study. RESULTS: The patients in the Vigileo group received more colloid (1425ml [1000-1500] vs. 1000ml [540-1250]; P=0.0028) intraoperatively and a lower number of hypotensive events were observed (2[1-2] Vigileo vs. 3.5[2-6] in Control; P=0.0001). Lactate levels at the end of surgery were lower in Vigileo (1.78+/− 0.83 mmol/l vs. 2.25 +/−1.12mmol/l; P=0.0252). Fewer Vigileo patients developed complications (18 (30%) vs. 35 (58.3%) patients; P=0.0033) and the overall number of complications was also reduced (34 vs. 77 complications in Vigileo and Control respectively; P=0.0066). A difference in hospital length of stay was found only in per protocol analysis of patients receiving optimization (9 [8-12] vs. 10 [8-19] days; P=0.0421). No difference in mortality (1 (1.7%) vs. 2 (3.3%); P=1.0) and ICU length of stay (3 [2-5] vs. 3 [0.5-5]; P=0.789) was found. CONCLUSIONS: In this study, fluid optimization guided by SVV during major abdominal surgery is associated with better intraoperative hemodynamic stability, decrease in serum lactate at the end of surgery and lower incidence of postoperative organ complications. Trial registration: Current Controlled Trials ISRCTN95085011.


BLOOD SUBSTITUTES

Setbacks in blood substitutes research and development: A biochemical perspective


Alavash AI

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Recent setbacks in using Hb-based technology to develop oxygen carriers or blood substitutes may spur new and fundamentally different approaches for the development of a new generation of hemoglobin-based oxygen carriers (HBOCs). This article briefly details some underlying mechanisms that may have been responsible for the adverse-event profile associated with HBOCs, with a focus on the contribution of the author's laboratory toward identifying some of these biochemical pathways and some ways and means to control them. It is hoped that this will aid in the development of a safe and effective second generation of HBOCs. Published by Elsevier Inc.


BLOOD UTILIZATION

Creation, implementation, and maturation of a massive transfusion protocol for the exsanguinating trauma patient

J Trauma. 2010 Jun;68(6):1498-505

Nunez TC, Young PP, Holcomb JB, Cotton BA

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The majority of trauma patients (>90%) do not require any blood product transfusion and their mortality is <1%. However, 3% to 5% of civilian trauma patients will receive a massive transfusion (MT), defined as >10 units of packed red blood cells (PRBC) in 24 hours. In addition, more than 25% of these patients will arrive to emergency departments with evidence of trauma-associated coagulopathy. With this combination of massive blood loss and coagulopathy, it has become increasingly more common to transfuse early the trauma patients and with a combination of PRBC, plasma, and platelets. Given the inherent uncertainties common early in the care of patients with severe injuries, the efficient administration of massive amounts of PRBC and clotting factors tends to work best in a predefined, protocol driven system. Our purpose here is to (1) define the problem of massive hemorrhage and coagulopathy in the trauma patient, (2) identify which group of patients this type of protocol should be applied, (3) describe the extensive coordination required to implement this multispecialty MT protocol, (4) explain in detail how the MT was developed and implemented, and (5) emphasize the need for a robust performance improvement or quality improvement process to monitor the implementation of such a protocol and to help identify problems and deliver feedback in a "real-time" fashion. The successful implementation of such a complex process can only be accomplished in a multispecialty setting. Input and representation from departments of Trauma, Critical Care, Anesthesiology, Transfusion Medicine, and
Emergency Medicine are necessary to successfully formulate (and implement) such a protocol. Once a protocol has been agreed upon, education of the entire nursing and physician staff is equally essential to the success of this effort. Once implemented, this process may lead to improved clinical outcomes and decreased overall blood utilization with extremely small wastage of vital blood products.


The epidemiology of red cell transfusion
Vox Sang, 2010 Jun 23. [Epub ahead of print]
Barr PJ, Donnelly M, Morris K, Parker M, Cardwell C, Bailie KE
Centre for Excellence in Public Health, Queens University Belfast, Belfast, UK

Background and Objectives Understanding of the clinical usage of red cells is limited despite its importance in transfusion practice improvement and planning for blood supply requirements. Previous studies have described red cell use based upon ICD and hospital discharge codes; however, such approaches are open to misclassification. This study addresses this limitation by undertaking an epidemiological analysis of red cell use using case note review. Materials and Methods Patient, disease and contextual factors were extracted from the medical records of a randomly selected sample of hospital patients in Northern Ireland who received a red cell transfusion during 2005 (n = 1474). Results Transfused patients received a total of 3804 units (median of two units per transfusion episode). Most transfusions occurred in a medical setting (71%). Patients undergoing treatment for gastrointestinal conditions were responsible for the majority of the demand (29% of transfusion episodes; 34% of red cell units). The presence of bleeding and abnormal tests of coagulation were associated with receiving larger transfusions (>3 units), while patients undergoing orthopaedic surgery and those with a haemoglobin level over 7 g/dl had the lowest risk of receiving >3 units in any one transfusion episode. Conclusion The majority of red cells are now prescribed in a medical setting. With an ageing population and increasing therapeutic interventions, the demand for blood is likely to increase despite efforts to reduce usage by eliminating inappropriate transfusions through education and behaviour change. The post-transfusion target (and therefore the number of units to transfuse) for any given clinical situation as well as guidance on a ‘safe’ transfusion threshold should be considered in future guidelines.


COST EFFECTIVENES

Treating anemia in heart failure patients: A review of erythropoiesis-stimulating agents
Expert Opin Biol Ther, 2010 Jun 17. [Epub ahead of print]
Geisler BP
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Importance of the field: Prevalence of chronic heart failure (CHF) is increasing, and despite improvements in the past decade the prognosis in terms of mortality and health-related quality of life remains poor. Anemia is often found concomitantly in CHF patients. Areas covered in this review: Erythropoiesis-stimulating agents (ESAs) are a new treatment option for these anemic CHF patients, promising to decrease mortality and hospitalizations, and increase health-related quality of life. What the reader will gain: CHF epidemiology is briefly discussed. Currently available clinical efficacy and safety data are critically appraised. Health care utilization by CHF patients, particularly hospitalizations, are reviewed in order predict cost-effectiveness of ESAs. Take home messages: The efficacy for the most pertinent endpoints has not been proven by a pivotal trial or a meta-analysis free of bias, and there might be increased cardiovascular events and cancer incidence rates above a currently unknown target value or with multiple doses. However, subgroups should be identified in which ESAs might prove to be more efficacious and as safe as usual care and either cost-saving or cost-effective. Nevertheless, depending on the subgroup, the budget effect for payors might be dramatic due to the large number of CHF patients.


CRITICAL CARE / ICU

Transfusion practice in the intensive care unit: a 10-year analysis
Transfusion, 2010 Jun 10. [Epub ahead of print]
From the Division of Pulmonary and Critical Care Medicine, the Department of Epidemiology and Preventive Medicine, and the Department of Pathology, University of Maryland School of Medicine; and the Division of Pulmonary and Critical Care Medicine, The Johns Hopkins School of Medicine, Baltimore, MD

BACKGROUND: Clinical guidelines recommend a restrictive transfusion strategy in nonhemorrhaging critically ill patients. STUDY DESIGN AND METHODS: We conducted a retrospective observational study of 3533 single-admission patients, without evidence of acute coronary syndromes, hemorrhage, or hemoglobinopathy admitted to the intensive care unit (MICU) of a large, academic medical center. RESULTS: MICU admission hemoglobin (Hb) level did not change significantly over the study period. The proportion of transfused patients decreased from 31.0% in 1997 to 1998 to 18.0% in 2006 to 2007 (p < 0.001). Among patients receiving transfusion, the mean pretransfusion Hb level decreased over time from 7.9 +/- 1.3 to 7.3 +/- 1.3 g/dL (p < 0.001). These changes in practice were not accounted for by differences in patient characteristics. The mean nadir Hb level in nontransfused patients decreased from 11.2 +/- 2.2 g/dL in 1997 to 1999 to 10.4 +/- 2.3 g/dL in 2006 to 2007 (p < 0.001). The mean number of units per patient transfused decreased during this time from 4.3 +/- 4.7 to 3.0 +/- 3.8 units (p < 0.001). The proportion of transfused patients who were transfused at a Hb level of less than 7.0 g/dL increased by an estimated absolute increment of 3.2% (95% CI, 2.1%-4.3%) per interval (p < 0.001), and the proportion of single-unit transfusions during the first transfusion episode increased by 1.4% per interval (95% CI, 0.2 to 2.6%; p = 0.03) from 40.2% in 1997 to 1998 to 53.1% in 2006 to 2007. CONCLUSIONS:
Between 1997 and 2007, important and sustained changes have occurred in our MICU physician transfusion practices, with overall reductions in the proportion of patients transfused, mean pretransfusion Hb level, and nadir Hb level in patients who were not transfused. 


**HEMATOLOGY**

Female donors and transfusion-related acute lung injury

**Transfusion**. 2010 May 28. [Epub ahead of print]


From the Department of Clinical Epidemiology, Leiden University Medical Center, Leiden, The Netherlands; the Department of Research and Training, Sanquin Blood Bank South West Region, The Netherlands; the Dept of Immunohematology and Immunology of Transfusion Medicine, Institute of Haematology and Transfusion Medicine, Warsaw, Poland; the Division of Pulmonary and Critical Care Medicine, Mayo Clinic, Rochester, Minnesota; the Department of Immuno-haematology, Banc de Sang i Teixits, Barcelona, Spain; the Bonfils Blood Center, Denver, Colorado; the Departments of Pediatrics and Surgery, School of Medicine, University of Colorado at Denver, Aurora, Colorado; the Finnish Red Cross Blood Service, Helsinki, Finland; the Department of Haematology, Freeman Hospital, Newcastle upon Tyne, United Kingdom; and the Einthoven Laboratory for Experimental Vascular Medicine, Leiden University Medical Center, Leiden, The Netherlands

**BACKGROUND:** Although quantitative evidence is lacking, it is generally believed that the majority of cases of transfusion-related acute lung injury (TRALI) are caused by female blood donors. We aimed to examine the relation between female donors and the occurrence of TRALI.

**STUDY DESIGN AND METHODS:** We performed an international, multicenter case-referent study. TRALI patients who were diagnosed clinically, independent of serology or donor sex, and had received transfusions either only from male donors or only from female donors (unisex cases) were selected. The observed sex distribution among the donors of these TRALI patients was compared to the expected sex distribution, based on the relevant donor populations.

**RESULTS:** Eighty-three clinical TRALI cases were included; 67 cases received only red blood cells (RBCs), 13 only plasma-rich products, and three both. Among RBC recipients the relative risk (RR) of TRALI after a transfusion from a female donor was 1.9-191). The p value for the difference between RBCs and plasma was 0.023. CONCLUSION: Our data support the notion that plasma from female donors is associated with an increased risk of TRALI, while RBCs from female donors are not.


**GUIDELINES**

Guidelines on the use of therapeutic apheresis in clinical practice--evidence-based approach from the Apheresis Applications Committee of the American Society for Apheresis

**J Clin Apher.** 2010;25(3):83-177


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The American Society for Apheresis (ASFA) Apheresis Applications Committee is charged with a review and categorization of indications for therapeutic apheresis. Beginning with the 2007 ASFA Special Issue (fourth edition), the subcommittee has incorporated systematic review and evidence-based approach in the grading and categorization of indications. This Fifth ASFA Special Issue has further improved the process of using evidence-based medicine in the recommendations by refining the category definitions and by adding a grade of recommendation based on widely accepted GRADE system. The concept of a fact sheet was introduced in the Fourth edition and is only slightly modified in this current edition. The fact sheet succinctly summarizes the evidence for the use of therapeutic apheresis. The article consists of 59 fact sheets devoted to each disease entity currently categorized by the ASFA as category I through III. Category IV indications are also listed. Copyright 2010 American Society for Apheresis. 


**HEMOSTATIC MANAGEMENT**

**DRUGS**

Efficiency of preoperative tranexamic Acid in coronary bypass surgery: an analysis correlated with preoperative clopidogrel use

**Heart Surg Forum.** 2010 Jun 1;13(3):E149-54

Senay S, Toraman F, Karabulut H, Alhan C.

Department of Cardiovascular Surgery, Acibadem University School of Medicine, Istanbul, Turkey

**OBJECTIVE:** This study evaluates the efficiency of prophylactic tranexamic acid in coronary bypass surgery with respect to preoperative clopidogrel use.

**METHODS:** We analyzed data for 3754 consecutive patients who underwent isolated coronary bypass surgery with cardiopulmonary bypass between January 1999 and August 2008. The patients were placed into 4 groups according to the perioperative use of clopidogrel and tranexamic acid. Group 1 included patients administered neither of these medications (n = 3160, 84.2%); group 2 included patients who received tranexamic acid only (n = 444, 11.8%); group 3 included patients who received clopidogrel only (n = 113, 3.0%); and group 4 included patients who received both medications (n = 37, 1.0%).

**RESULTS:** In patients who received tranexamic acid, we noted significant decreases in postoperative drainage (615 +/- 336 mL versus 458 +/- 289 mL, group 1 versus group 2 [P = .0001]; 740 +/- 399 mL versus 570 +/- 408 mL, group
Literature Abstracts

Tranexamic acid reduces allogenic transfusion in revision hip arthroplasty


Noordin S, Waters TS, Garbuz DS, Duncan CP, Masri BA.

Department of Orthopaedics, University of British Columbia, Vancouver, BC, V5Z 4E3, Canada

BACKGROUND: Revision THA is associated with high blood loss and a high probability of blood transfusion in the perioperative period. In November 2003, government legislation established the Blood Utilization Program at our center to reduce the rate and risks associated with allogenic transfusion. QUESTIONS/PURPOSES: The purposes of this study were to (1) determine whether the allogenic transfusion rate in patients undergoing revision THA decreased in those who were reviewed preoperatively by the Blood Utilization Program versus those who were not; (2) determine whether tranexamic acid reduced the rate of transfusion; and (3) identify potential perioperative clinical parameters that are associated with an increased risk of blood transfusion.

METHODS: We included all 159 patients who underwent revision THA from January 2006 to October 2008 having either a socket and/or femoral stem revision except those having only a liner exchange. One hundred and one patients attended the Blood Utilization Program preoperatively and 58 patients did not (ie, they required urgent/emergency surgery). RESULTS: The Blood Utilization Program referral made no difference in transfusion rate or transfusion amount; however, the transfusion rates and amount were decreased by 8% and one unit, respectively. In patients referred to the Blood Utilization Program, the intraoperative use of tranexamic acid (an antifibrinolytic) was associated with reduced transfusions, regardless of dosage; preoperative erythropoietin tended to reduce transfusions while preoperative oral iron supplements did not.

CONCLUSIONS: To further increase the relevance of the blood utilization program, the guidelines for patients undergoing revision hip arthroplasty need to be redefined.

LEVEL OF EVIDENCE: Level III, therapeutic study. See the guidelines online for a complete description of level of evidence.


HEMOSTATIC MANAGEMENT

SURGICAL

Tranexamic acid reduces allogenic transfusion in revision hip arthroplasty


Noordin S, Waters TS, Garbuz DS, Duncan CP, Masri BA.

Department of Orthopaedics, University of British Columbia, Vancouver, BC, V5Z 4E3, Canada

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CONCLUSIONS: To further increase the relevance of the blood utilization program, the guidelines for patients undergoing revision hip arthroplasty need to be redefined.

LEVEL OF EVIDENCE: Level III, therapeutic study. See the guidelines online for a complete description of level of evidence.


HEMOSTATIC MANAGEMENT

TOPICAL APPLICATIONS

New local hemostatic treatment for postpartum hemorrhage caused by placenta previa at cesarean section


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Abstract Cesarean section in women with placenta previa is associated with the risk of heavy bleeding. We describe a new method where local hemostasis is obtained by applying a hemostatic fleece directly onto the lower uterine segment. During a 2-year period women undergoing cesarean section due to placenta previa were treated with this hemostatic fleece if they had ongoing bleeding during the surgical procedure despite routine treatment. Data were obtained retrospectively from the hospital records. Fifteen patients were treated by 15 different surgeons. No patients required reoperation. Three patients required blood transfusion due to anemia. No patients were readmitted to the hospital due to endometritis. We conclude that the application of a hemostatic fleece directly onto the bleeding surfaces in patients with postcesarean bleeding due to placenta previa is technically unproblematic. The results suggest that this procedure should be considered in case of bleeding after delivery in women with placenta previa.


IMMUNOMODULATION / STORAGE LESION

Storage age of transfused platelets and outcomes after cardiac surgery

Transfusion. 2010 Jun 21. [Epub ahead of print]


Department of Anesthesiology, Duke University Medical Center.

From the Department of Anesthesiology, the Department of Pathology, Perioperative Services, and Department of Thoracic Surgery, Duke University Medical Center, and the Duke Clinical Research Institute, Durham, NC

BACKGROUND: The relationship between duration of platelet (PLT) storage, currently limited to 5 days, and surgical outcomes has not been established. We tested the hypothesis that PLT storage age was associated with adverse outcomes. STUDY DESIGN AND METHODS: A retrospective cohort of aortocoronary bypass (CABG) surgery patients from January 1996 to January 2005 receiving one or more PLT transfusions was selected for study. The composite primary (“short-term”) outcome was 30-day mortality or prolonged hospital stay. Secondary
outcomes included complications and survival to annual follow-up. Multivariable logistic regression models and Cox proportional hazards regression analysis evaluated the association between PLT storage age and outcomes, expressed as an odds ratio (OR) or hazard ratio with 95% confidence intervals (CIs), respectively. RESULTS: PLT transfusion was administered to 3272 of 10,275 CABG patients and 2578 received units of known storage age, which ranged between 2 and 5 days (median, 4 days; 25th percentile, 3 days; 75th percentile, 5 days). The mortality rate for the 1637 patients receiving a single plateletpheresis transfusion was 3.8%, while 21.6% experienced a prolonged hospital stay or death. After adjusting for the number of PLT and red blood cell (RBC) units transfused, RBC storage age, and preoperative mortality risk, there was no association between PLT storage age and short-term outcome (OR, 1.01; 95% CI, 0.90-1.14), survival (hazard ratio [HR], 1.04; 95% CI, 0.96-1.13), or postoperative infections. CONCLUSIONS: PLT storage age was not associated with adverse short-term outcomes, decreased long-term survival, or infections after cardiac surgery.


Hypertensive disorders

HELLP syndrome: About 17 cases and literature review

Tunis Med. 2010 Jul;88(7):497-500
Boudhraa K, Jellouli MA, Gara MF

Background: HELLP syndrome is defined as an association of hemolytic anemia, raised liver enzymes and thrombocytopenia. It is a severe manifestation of pre-eclampsia. Aim: We tried to specify the epidemic factors and the best management of HELLP syndrome Methods: A retrospective study held during 6 years in the department of gynaecology and obstetrics in La Marsa hospital and according to a literature review. Results: The dominating symptoms included low abdominal pain and vomiting. The syndrome was discovered after 30.5 weeks of amenorrhea on average. Infant extraction was by cesarean section in 11 cases. Maternal morbidity was mainly marked by eclampsia and haemostatic disturbances while neonatal morbidity was attributable to the included prematurity. Conclusion: The main management consists essentially in a medical reanimation, in addition to a rapid foetal extraction.


Diagnosis and treatment of iron-deficiency anaemia during pregnancy and postpartum

Arch Gynecol Obstet. 2010 Jun 25. [Epub ahead of print]
Breymann C, Honegger C, Holzgreve W, Surbek D.
University Women's Hospital, Inselspital Effingerstr. 102, 3010, Bern, Switzerland

INTRODUCTION: Iron-deficiency anaemia during pregnancy and postpartum occurs frequently and may lead to severe maternal and foetal complications. New treatment regimens include intravenous iron administration in particular clinical situations. The aim of the study was to determine optimal diagnostic and therapeutic approaches to iron-deficiency anaemia during pregnancy and postpartum. METHODS: The evidence from data available from published studies and recommendations regarding diagnosis and treatment were reviewed. As conclusions, recommendations are given by an expert panel.

RESULTS: During pregnancy, oral iron therapy is given as first-line treatment. In cases with lack of efficacy, unwarranted side effects or very low haemoglobin values, intravenous iron treatment with iron carboxymaltose is a preferable alternative, although data regarding safety are limited. In the postpartum period, haemoglobin values less than 95 g/L are treated ideally by intravenous carboxymaltose, leading to more rapid haemoglobin recovery. CONCLUSION: New intravenous iron preparations such as iron carboxymaltose have an excellent efficacy, side effect profile and advantages as compared to oral iron preparations for particular clinical indications.


Effects of tranexamic acid on death, vascular occlusive events, and blood transfusion in trauma patients with significant haemorrhage (CRASH-2): a randomised, placebo-controlled trial

Lancet. 2010 Jun 14. [Epub ahead of print]
CRASH-2 trial collaborators.

BACKGROUND: Tranexamic acid can reduce bleeding in patients undergoing elective surgery. We assessed the effects of early administration of a short course of tranexamic acid on death, vascular occlusive events, and the receipt of blood transfusion in trauma patients.

METHODS: This randomised controlled trial was undertaken in 274 hospitals in 40 countries. 20,211 adult trauma patients with, or at risk of, significant bleeding were randomly assigned within 8 h of injury to either tranexamic acid (loading dose 1 g over 10 min then infusion of 1 g over 8 h) or matching placebo. Randomisation was balanced by centre, with an allocation sequence based on a block size of eight, generated with a computer random number generator. Both participants and study staff (site investigators and trial coordinating centre staff) were masked to treatment allocation. The primary outcome was death in hospital within 4 weeks of injury, and was described with the following categories: bleeding, vascular occlusion (myocardial infarction, stroke and pulmonary embolism), multiorgan failure, head injury, and other. All analyses were by intention to treat. This study is registered as ISRCTN86750102, Clinicaltrials.govNCT00375258, and South African Clinical Trial RegisterDOH-27-0607-1919.

FINDINGS: 10,096 patients were allocated to tranexamic acid and 10,115 to placebo, of whom 10,060 and 10,067, respectively, were analysed. All-cause mortality was significantly reduced with tranexamic acid (1463 [14.5%] tranexamic acid group vs 1613 [16.0%] placebo group; relative risk 0.91, 95% CI 0.85-0.97; p=0.0035). The risk of death due to bleeding was significantly reduced (489 [4.9%] vs 574 [5.7%]; relative risk 0.85, 95% CI 0.76-0.96; p=0.0077). INTERPRETATION: Tranexamic acid safely reduced the risk of death in bleeding trauma patients in this study. On the basis of these results, tranexamic acid should be considered for use in bleeding trauma patients.

FUNDING: UK NIHR Health Technology Assessment programme, Pfizer, BUPA Foundation, and J P Moulton

**Transfusion**, 2010 May 28. [Epub ahead of print]

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**BACKGROUND:** Previous surveys have reported variation in transfusion practice or policies in specific pediatric populations. Our objective was to determine the current transfusion policies in US and Canadian children's hospitals for both neonatal and pediatric general populations. **STUDY DESIGN AND METHODS:** US and Canadian blood bank (BB) personnel at children's hospitals that provide blood products between the dates of October 2008 and January 2009 were surveyed. **RESULTS:** Of the 90 US and Canadian children's hospitals identified, 51 (56.7%) blood bankers or their designees responded. There were 42 of 51 (82.4%) respondents from the United States and 9 of 51 (17.6%) from Canada. There was wide variation in beliefs regarding the effect of red blood cell (RBC) storage age on outcomes with 66.6% of respondents interested in a prospective randomized trial in critically ill children. There was also wide variation in policies restricting the storage age of RBCs according to patient age and clinical condition. In the United States 28 of 33 (84.8%) respondents provided universal leukoreduction of RBCs whereas it is 9 of 9 (100%) in Canada. Variation of policies existed for RBC irradiation and washing. The majority of respondents indicated that RBC transfusions were audited if the pretransfusion hemoglobin level was more than 8 to 10 mg/dL. Fresh whole blood is available at 6 of 40 (15%) responding children's hospitals. **CONCLUSIONS:** There is a wide variation in BB policies regarding RBC transfusions at children's hospitals in the United States and Canada. Prospective randomized controlled trials are needed to allow for evidence-based standards of care regarding RBC transfusions.


**Evaluation of anemia in children**


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Anemia is defined as a hemoglobin level of less than the 5th percentile for age. Causes vary by age. Most children with anemia are asymptomatic, and the condition is detected on screening laboratory evaluation. Screening is recommended only for high-risk children. Anemia is classified as microcytic, normocytic, or macrocytic, based on the mean corpuscular volume. Mild microcytic anemia may be treated presumptively with oral iron therapy in children six to 36 months of age who have risk factors for iron deficiency anemia. If the anemia is severe or is unresponsive to iron therapy, the patient should be evaluated for gastrointestinal blood loss. Other tests used in the evaluation of microcytic anemia include serum iron studies, lead levels, and hemoglobin electrophoresis. Normocytic anemia may be caused by chronic disease, hemolysis, or bone marrow disorders. Workup of normocytic anemia is based on bone marrow function as determined by the reticulocyte count. If the reticulocyte count is elevated, the patient should be evaluated for blood loss or hemolysis. A low reticulocyte count suggests aplasia or a bone marrow disorder. Common tests used in the evaluation of macrocytic anemias include vitamin B12 and folate levels, and thyroid function testing. A peripheral smear can provide additional information in patients with anemia of any morphology.


**Interventions for preventing blood loss during the treatment of cervical intraepithelial neoplasia**


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**BACKGROUND:** Cervical intraepithelial neoplasia (CIN) is the most common pre-malignant lesion. Surgical treatments for CIN are commonly associated with blood loss. **OBJECTIVES:** To assess the effectiveness and safety of interventions for preventing blood loss during the treatment of CIN. **SEARCH STRATEGY:** We searched the Cochrane Gynaecological Cancer Group Trials Register, MEDLINE, EMBASE and CENTRAL up to April 2009. We also searched registers of clinical trials, abstracts of scientific meetings and reference lists of included studies. **SELECTION CRITERIA:** Randomised controlled trials (RCTs) of vasopressin, tranexamic acid, haemostatic sutures, Amino-Cerv or Monsel's solution in women undergoing surgery for CIN. **DATA COLLECTION AND ANALYSIS:** Two reviewers independently abstracted data and assessed risk of bias. Risk ratios comparing adverse events in women who received one of the interventions were pooled in a random-effects meta-analyses or included in single trial analyses. **MAIN RESULTS:** Twelve RCTs (N = 1602, of whom 1512 were assessed) were included. Vasopressin significantly reduced perioperative bleeding (mean difference (MD) = -100.80, 95% confidence interval (CI) -129.48 to -72.12) and was associated with a decreased risk of bleeding that required haemostatic sutures or further vasopressin, compared to placebo (risk ratio (RR) = 0.39, 95% CI 0.27 to 0.56). Tranexamic acid significantly reduced risk of secondary haemorrhage (RR = 0.23, 95% CI 0.11 to 0.50), but not primary haemorrhage (RR = 1.24, 95% CI 0.04 to 38.23) after knife and laser cone biopsy, compared with
placebo. There was also a statistically significant reduction in postoperative blood loss compared with placebo (MD = 55.60, 95% CI -94.91 to -16.29). Packing with Monsel's solution resulted in less perioperative blood loss (MD = -22.00, 95% CI -23.09 to -20.91) and decreased the risk of dysmenorrhoea (RR = 0.37, 95% CI 0.16 to 0.84), unsatisfactory colposcopy (RR = 0.43, 95% CI 0.30 to 0.63) and cervical stenosis (RR = 0.35, 95% CI 0.25 to 0.49) compared to routine suturing, but was not statistically different to sutures for risk of primary and secondary haemorrhages. Aminocerv antibiotic gel failed to make a difference on secondary haemorrhage but was associated with significantly less vaginal discharge at 2 weeks compared with routine care (RR = 0.27, 95% CI 0.09 to 0.86). There was no significant difference in blood loss between women who received ball electrode diathermy and those who received Monsel's paste (MD = 4.82, 95% CI -3.45 to 13.09). AUTHORS’ CONCLUSIONS: Bleeding associated with surgery of the cervix appears to be reduced by vasopressin, used in combination with local anaesthetic. Tranexamic acid appears to be beneficial after knife and laser cone biopsy. There are insufficient data to assess the effects on primary haemorrhage. There is some evidence that haemostatic suturing has an adverse effect on blood loss, cervical stenosis and satisfactory colposcopy.


The effectiveness of prestorage leukocyte-reduced red blood cell transfusion on perioperative inflammatory response with a miniaturized biocompatible bypass system


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OBJECTIVE: Since 2007, the Japanese Red Cross Blood Center has provided prestorage leukocyte-reduced red blood cell concentrates in which the leukocytes were reduced soon after collection. We have established a miniaturized bypass system (140 mL) to reduce the perioperative inflammatory responses. This study was designed to reveal the effectiveness of leukocyte-reduced red blood cell concentrate transfusion on perioperative inflammatory responses in pediatric cardiac surgery.

METHODS: Between May 2006 and June 2008, 50 consecutive patients weighing less than 5 kg who underwent a surgical procedure with red blood cell concentrate transfusion using a miniaturized bypass system were reviewed retrospectively. Twenty-five patients before 2007 received stored red blood cell concentrate in which leukocytes were reduced with a filter just before transfusion (group A). After 2007, 25 patients received the prestorage leukocyte-reduced red blood cell concentrate transfusion (group B). The postoperative peak C-reactive protein level, peak white blood cell count, peak neutrophil count, percentage body weight gain, inotrope score, plasma lactate concentration, postoperative mechanical ventilation time, and length of intensive care unit stay were compared as the perioperative inflammatory response and morbidity for both groups. RESULTS: There were no significant differences in peak white blood cell count, peak neutrophil count, percentage body weight gain, and inotrope score between the groups. The peak C-reactive protein level in group A was significantly greater than that in group B (6.7 +/- 4.7 vs 4.2 +/- 3.6 mg/dL, P < .05). The lactate concentration at 12 and 24 hours after surgical intervention in group A was significantly greater than that in group B (3.1 +/- 2.5 vs 1.9 +/- 1.1 mmol/L [P < .05] and 2.2 +/- 0.2 vs 1.4 +/- 0.2 mmol/L [P < .05], respectively). The postoperative mechanical ventilation time and intensive care unit stay in group A were significantly greater than those in group B (5.9 +/- 7.4 vs 2.1 +/- 2.0 days [P < .05] and 9.8 +/- 7.9 vs 5.0 +/- 2.1 days [P < .05], respectively). Multivariate analyses showed that the leukocyte-reduced red blood cell concentrate transfusion reduced the peak C-reactive protein level (in milligrams per deciliter; coefficient, -2.95; 95% confidence interval [CI], -4.66 to -0.93; P = .003), postoperative mechanical ventilation time (in days; coefficient, -3.41; 95% CI, -6.07 to -0.74; P = .013), and intensive care unit stay (in days; coefficient, -4.51; 95% CI, -7.37 to -1.64; P = .003). CONCLUSIONS: Our study revealed that in neonates and small infants, compared with transfusions with stored red blood cell concentrate, transfusion of leukocyte-reduced red blood cell concentrates was associated with reduced perioperative inflammatory responses and improved clinical outcomes. Copyright 2010 The American Association for Thoracic Surgery. Published by Mosby, Inc. All rights reserved. http://www.ncbi.nlm.nih.gov/pubmed/20038472

TRANSFUSION PRACTICE

Blood product transfusion in the critical care setting

Curr Opin Crit Care. 2010 Jun 10. [Epub ahead of print]

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PURPOSE OF REVIEW: The past two decades have witnessed an extensive re-evaluation of transfusion therapy in the intensive care unit (ICU). The purpose of this review is to present the current state of knowledge regarding blood transfusion in the critically ill and to identify gaps in our current understanding for future research. RECENT FINDINGS: Accumulating evidence suggests a lack of efficacy with red blood cell (RBC), plasma, and platelet transfusion in the majority of critically ill patients. Evidence has also increasingly exposed previously under-recognized transfusion risks. The result is a growing number of recommendations for more restrictive RBC, plasma, and platelet transfusion strategies. An important exception to a more conservative transfusion practice occurs in patients with major trauma and life-threatening bleeding. Delaying RBCs, plasma and platelet component therapies in this population can promote the lethal triad of coagulopathy, acidosis, and hypothermia with a resultant increase in bleeding, greater transfusion requirements, and higher mortality.

SUMMARY: Although we have made substantial progress...
in understanding the role of blood transfusion in the ICU, multiple important knowledge gaps persist. Future studies are needed to better define and characterize the impact of RBC storage, male-only plasma and platelet donor procurement procedures, and transfusion strategies in those requiring massive transfusion and with acute local or global tissue ischemia.


**Risk analysis of blood transfusion requirements in emergency and elective spinal surgery**

*Burr J, 2010 Jun 27. [Epub ahead of print]*

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Spinal surgery has long been considered to have an elevated risk of perioperative blood loss with significant associated blood transfusion requirements. However, a great variability exists in the blood loss and transfusion requirements of differing patients and differing procedures in the area of spinal surgery. We performed a retrospective study of all patients undergoing spinal surgery who required a transfusion >1 U of red blood cells (RBC) at the National Spinal Injuries Unit (NSIU) at the Mater Misericordiae University Hospital over a 10-year period. The purpose of this study was to identify risk factors associated with significant perioperative transfusion allowing the early recognition of patients at greatest risk, and to improve existing transfusion practices allowing safer, more appropriate blood product allocation. 1,596 surgical procedures were performed at the NSIU over a 10-year period. 25.9% (414/1,596) of these cases required a blood transfusion (n = 414). Surgical groups with a significant risk of requiring a transfusion >2 U RBC included deformity surgery (RR = 3.351, 95% CI 1.123-10.006, p = 0.03), tumor surgery (RR = 3.298, 95% CI 1.078-10.089, p = 0.036), and trauma surgery (RR = 2.444, 95% CI 1.183-5.050, p = 0.036). Multivariable logistic regression analysis identified multilevel surgery (>3 levels) as a significant risk of requiring a transfusion >2 U RBC (RR = 4.682, 95% CI 2.654-8.261, p < 0.0001). Several risk factors in the spinal surgery patient were identified as corresponding to significant transfusion requirements. A greater awareness of the risk factors associated with transfusion is required in order to optimize patient management.


**Traditional transfusion practices are changing**

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ABSTRACT: Schochl and co-authors have described a 5-year retrospective study that outlines a novel, important and controversial transfusion concept in seriously injured trauma patients. Traditionally, clinicians have been taught to use a serial approach, resuscitating hypovolemic trauma patients with a form of crystalloid or colloid, followed by red blood cells (RBCs), then fresh frozen plasma (FFP), and lastly platelets. The data supporting this widely accepted approach are remarkably weak. Conversely, Schochl and colleagues, in an innovative, retrospective study, describe the use of fibrinogen concentrate, plasma complex concentrate, RBCs, FFP, and platelets driven by a thromboelastometry-based algorithm. Finally, it appears that transfusion therapy is becoming driven by physiology.


**TRANSFUSION RISKS / HAZARDS**

**Transfusion therapy and acute lung injury**


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Transfusion-related acute lung injury (TRALI) remains the deadliest complication of transfusion. Consensus definitions of TRALI have been developed but remain controversial. Recent evidence supports a strong relationship between blood transfusion and the development of acute lung injury in the critically ill and trauma population. Plasma and platelet transfusions have been the most commonly implicated blood products. The ‘two hit’ model may best explain the immune and nonimmune pathogenesis of TRALI. Current treatment remains largely supportive; effective measures for decreasing the incidence of TRALI include the use of predominantly male plasma and apheresis platelets. Greater understanding of the blood component and patient risk factors for TRALI will hopefully lead to novel treatment and preventive strategies for reducing the risk of this life-threatening syndrome.


**The platelet storage lesion**

*Clin Lab Med., 2010 Jun;30(2):475-87*

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The gradual loss of quality in stored platelets as measured collectively with various metabolic, functional, and morphologic in vitro assays is known as the platelet storage lesion. With the advent of pathogen reduction technologies and improved testing that can greatly reduce the risk for bacterial contamination, the platelet storage lesion is emerging as the main challenge to increasing the shelf life of platelet concentrates. This article discusses the contribution of platelet production methods to the storage lesion, long-established and newly developed methods used to determine platelet quality, and the significance for clinical transfusion outcome. Highlighted are the novel technologies applied to platelet storage including platelet additive solutions and pathogen inactivation. Copyright (c) 2010 Elsevier Inc. All rights reserved.

**Literature Abstracts**

**Stored red-blood-cells inhibit platelet function under physiologic flow**

*Vox Sang.*, 2010 Jun 7. [Epub ahead of print]

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Background and Objectives The DiaMed Impact R tests platelet function under close to physiological flow conditions. The machine is designed to use whole blood but by adding back compatible red cells, it can be used to study stored platelet concentrates. To date, red cells \( \leq 14 \) days old have been used. In this study, the effect on the assay of using red cells stored for up to 60 days was examined. Material and Methods This study looked at buffy coat-derived platelet concentrates on day 2 of storage along with various stored red-blood-cells (RBC). To determine whether the age of the RBC is a factor in supporting adhesion and aggregation, platelets were assayed with either RBC stored between 2 and 60 days or with separated 'young' and 'old' red cell populations obtained using a centrifugation method and confirmed by percoll gradient analysis. Results A statistically significant difference was observed between red-blood-cells stored for \( \leq 20 \) days compared with those which have been stored for 21-60 days in respect of their ability to support platelet adhesion (SC) and aggregation (AS) (\( P < 0.01 \)). Separating red cells by centrifugation into top (young population) and bottom (old population) showed that the effect of storage was much greater than was any difference between young and old at the individual time-points e.g. 'young' red cells from stored units were poorer at supporting platelet adhesion and aggregation than 'young' red cells from fresh units. Conclusion Results suggest that the red cells should be stored for less than 21 days when using this assay. This assay may also allow assessment of red cell functionality.


**Reforming health care will require a new delivery paradigm in transfusion medicine**

*Transfusion*, 2010 May 28. [Epub ahead of print]

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**Current uses of transfusion administration sets: A cause for concern?**

*Transfus Med.*, 2010 Jun 9. [Epub ahead of print]

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There is potential for inappropriate use of transfusion administration sets when used in combination with modern infusion pumps with consequences for patient safety. The aims of our study were to (i) establish if the design and testing of transfusion sets specified in International Standard ISO 1135-4 are adequate for their current applications, (ii) identify if infusion pumps currently supplied in the UK for blood component administration are suitable for this purpose and (iii) determine the additional control measures needed to be applied by manufacturers and users to ensure patient safety. Keyword literature search was carried out to review and correlate important transfusion parameters with resultant adverse effects. Units for occlusion pressure, flow rate and haemolysis were standardised for ease of comparison. A sample of transfusion set instructions for use was reviewed. Principal suppliers of infusion pumps to the UK market were surveyed to identify those sold for blood transfusion, their recommended operating parameters and compatible transfusion sets. Previous work showed clinically unacceptable haemolysis at pressures above 40 kPa. Modern infusion pumps operate under negative pressures of up to 210 kPa. ISO 1135-4 design and test requirements do not match this performance and in particular omit testing under negative pressure. Transfusion sets surveyed did not indicate flow or pressure restrictions or specify the blood components with which they had been validated. ISO 1135-4 requires updating and has been initiated. Meanwhile, recommendations are made for transfusion set manufacturers concerning pressure limitations and restrictions on blood component type and for users concerning purchase, configuration and validation of infusion pumps and disposables.


**The future of blood management**


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An evolving understanding of the consequences of allogeneic blood transfusion and escalating costs of providing allogeneic blood have resulted in an interest in blood management. Understanding the consequences of allogeneic transfusion includes a recognition of the immunosuppressive effects of allogeneic transfusion, a growing awareness of transfusion-related acute lung injury, and a rediscovery of transfusion-associated circulatory overload. More recently, interest has focused on the effect of stored blood on patient outcome. Although this discussion is not all-inclusive, it is intended to show that many techniques can be applied to decrease the exposure to allogeneic blood. Copyright (c) 2010 Elsevier Inc. All rights reserved.


**MISCELLANEOUS**

**INFUSION PUMP PRESSURE LIMITATIONS**

There is potential for inappropriate use of transfusion administration sets when used in combination with modern infusion pumps with consequences for patient safety. The aims of our study were to (i) establish if the design and testing of transfusion sets specified in International Standard ISO 1135-4 are adequate for their current applications, (ii) identify if infusion pumps currently supplied in the UK for blood component administration are suitable for this purpose and (iii) determine the additional control measures needed to be applied by manufacturers and users to ensure patient safety. Keyword literature search was carried out to review and correlate important transfusion parameters with resultant adverse effects. Units for occlusion pressure, flow rate and haemolysis were standardised for ease of comparison. A sample of transfusion set instructions for use was reviewed. Principal suppliers of infusion pumps to the UK market were surveyed to identify those sold for blood transfusion, their recommended operating parameters and compatible transfusion sets. Previous work showed clinically unacceptable haemolysis at pressures above 40 kPa. Modern infusion pumps operate under negative pressures of up to 210 kPa. ISO 1135-4 design and test requirements do not match this performance and in particular omit testing under negative pressure. Transfusion sets surveyed did not indicate flow or pressure restrictions or specify the blood components with which they had been validated. ISO 1135-4 requires updating and has been initiated. Meanwhile, recommendations are made for transfusion set manufacturers concerning pressure limitations and restrictions on blood component type and for users concerning purchase, configuration and validation of infusion pumps and disposables.


**INFUSION PUMP PRESSURE LIMITATIONS**

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