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Scientific Articles of Interest

Section Editor: Rick G. Smith, BS, CCP

APROTININ

Efficacy and safety of aprotinin use for reoperative valvular surgery.
Rodrigues AJ, Evora PR, Bassetto S, et al. Ann Thorac Surg. 2007;83(6):2060–5.

Pro: Aprotinin should be used in coronary artery bypass graft surgery with cardiopulmonary bypass.
Hill SE. J Cardiothorac Vasc Anesth. 2007;21(2):298–301.

Con: Aprotinin should not be used in cardiac surgery with cardiopulmonary bypass.
Augoustides JG. J Cardiothorac Vasc Anesth. 2007;21(2): 302–4.

Anti-inflammatory strategies and hemostatic agents: old drugs, new ideas.
Levy JH. Hematol Oncol Clin North Am. 2007;21(1):89–101.

Protease activated receptors: clinical relevance to hemostasis and inflammation.
Landis RC. Hematol Oncol Clin North Am. 2007;21(1): 103–13.

These two excellent reviews by Levy and Landis examine the effect of inflammatory pathways and mediators and the available pharmacologic agents to mediate this response to cardiac surgery. Impaired hemostasis is a direct response to inflammatory pathways. In Landis's treatise, the important role of thrombin and its effects on platelet function and protease-activated receptors is described. Many of the available agents are available to attenuate hemostatic abnormalities following cardiopulmonary bypass, very few are able to modulate the inflammatory response often responsible for abnormal bleeding.

Mortality associated with aprotinin during 5 years following coronary artery bypass graft surgery.
Mangano DT, Miao Y, Vuylsteke A, et al.; Investigators of The Multicenter Study of Perioperative Ischemia Research Group; Ischemia Research and Education Foundation. JAMA. 2007;297(5):471–9.

Following the landmark but controversial study suggesting the use of aprotinin may increase the risk of renal failure and stroke, Mangano and coauthors publish additional details that suggest increased mortality following the administration of aprotinin. Neither aminocaproic acid nor tranexamic acid was associated with increased mortality. Mangano's observations have led to considerable debate and have followed in the footsteps of other reports regarding drug safety. While Mangano's work may have focused the spotlight on the safety of aprotinin, it may also begin the scrutiny of the accuracy and applicability of newer retrospective, observational study methods.

BIOCOMPATIBILITY

Attenuated renal and intestinal injury after use of a mini-cardiopulmonary bypass system.
Huybregts RA, Morariu AM, Rakhorst G, et al. Ann Thorac Surg. 2007;83(5):1760–6.

The use of miniature perfusion circuits may be beneficial in reducing bleeding and transfusions, and renal and mesenteric injury. Low priming volumes and reduced surface area may attenuate the inflammatory response to cardiopulmonary bypass and improve hemostasis. While many studies describe the beneficial effects of mini-perfusion circuits, few acknowledge the role of eliminating the cardiotomy suction in many of these perfusion techniques. Air-handling safety continues to be a consideration.

Minimally invasive cardiopulmonary bypass: does it really change the outcome?
Ranucci M, Isgro G. Crit Care. 2007;11(2):R45.

Heparin-bonded circuits versus nonheparin-bonded circuits: an evaluation of their effect on clinical outcomes.
Mangoush O, Purkayastha S, Haj-Yahia S, et al. Eur J Cardiothorac Surg. 2007;31(6):1058–69.

This meta-analysis shows heparin-bonded perfusion circuits reduce the inflammatory response to cardiopulmonary bypass and lowers the incidence of transfusion requirements and re-sternotomy. Additional benefits may include lower mortality, wound infection, duration of ventilation, and intensive care unit and hospital-length of stay.

Minimally invasive closed circuit versus standard extracorporeal circulation for aortic valve replacement.
Castiglioni A, Verzini A, Pappalardo F, et al. Ann Thorac Surg. 2007 Feb;83(2):586–91.

BLOOD CONSERVATION

Perioperative blood transfusion and blood conservation in cardiac surgery: The Society of Thoracic Surgeons and The Society of Cardiovascular Anesthesiologists clinical practice guideline.
Society of Thoracic Surgeons Blood Conservation Guideline Task Force; Ferraris VA, Ferraris SP, Saha SP, et al.; Society of Cardiovascular Anesthesiologists Special Task Force on Blood Transfusion; Spiess BD, Shore-Lesserson L, Stafford-Smith M, et al. Ann Thorac Surg. 2007;83(5 Suppl):S27–86.

Background: A minority of patients having cardiac procedures (15% to 20%) consume more than 80% of the blood products transfused at operation. Blood must be viewed as a scarce resource that carries risks and benefits. A careful review of available evidence can provide guidelines to allocate this valuable resource and improve patient outcomes. **Methods:** We reviewed all available published evidence related to blood conservation during cardiac operations, including randomized controlled trials, published observational information, and case reports. Conventional methods identified the level of evidence available for each of the blood conservation interventions. After considering the level of evidence, recommendations were made regarding each intervention using the American Heart Association/American College of Cardiology classification scheme. **Results:** Review of published reports identified a high-risk profile associated with increased postoperative blood transfusion. Six variables stand out as important indicators of risk: (1) advanced age, (2) low preoperative red blood cell volume (preoperative anemia or small body size), (3) preoperative antiplatelet or antithrombotic drugs, (4) reoperative or complex procedures, (5) emergency operations, and (6) noncardiac patient comorbidities. Careful review revealed preoperative and perioperative interventions that are likely to reduce bleeding and postoperative blood transfusion. Preoperative interventions that are likely to reduce blood transfusion include identification of high-risk patients who should receive all available preoperative and perioperative blood conservation interventions and limitation of antithrombotic drugs. Perioperative blood conservation interventions include use of antifibrinolytic drugs, selective use of off-pump coronary artery bypass graft surgery, routine use of a cell-saving device, and implementation of appropriate transfusion indications. An important intervention is application of a multimodality blood conservation program that is institution based, accepted by all health care providers, and that involves well thought out transfusion algorithms to guide transfusion decisions. **Conclusions:** Based on available evidence, institution-specific protocols should screen for high-risk patients, as blood conservation interventions are likely to be most productive for this high-risk subset. Available evidence-based blood conservation techniques include (1) drugs that increase preoperative blood volume (eg, erythropoietin) or decrease postoperative bleeding (eg, antifibrinolytics), (2) devices that conserve blood (eg, intraoperative blood salvage and blood sparing interventions), (3) interventions that protect the patient's own blood from the stress of operation (eg, autologous predonation and normovolemic hemodilution), (4) consensus, institution-specific blood transfusion algorithms supplemented with point-of-care testing, and most importantly, (5) a multimodality approach to blood conservation combining all of the above.

Retransfusion of pericardial blood does not trigger systemic coagulation during cardiopulmonary bypass.
van den Goor JM, Nieuwland R, Rutten PM, et al. Eur J Cardiothorac Surg. 2007;31(6):1029–36.

CARDIOPULMONARY SUPPORT

Elective high-risk percutaneous coronary interventions supported by extracorporeal life support.
Vainer J, van Ommen V, Maessen J, et al. Am J Cardiol. 2007;15;99(6):771–3.

Prolonged transcutaneous cardiopulmonary support for postcardiotomy cardiogenic shock.
Saeed D, Kizner L, Arusoglu L, ASAIO J. 2007;53(3): e1–3.

CEREBRAL PROTECTION

Monitoring brain oxygen saturation during coronary bypass surgery: a randomized, prospective study.
Murkin JM, Adams SJ, Novick RJ, et al. Anesth Analg. 2007;104(1):51–8.

The use of intraoperative cerebral regional oxygen saturation (rSO2) monitoring and treatment intervention protocols not only prevents profound cerebral desaturation but also significantly fewer incidences of major organ dysfunction. Overall hospital stay was subsequently reduced.

Cerebral oxygen desaturation after cardiopulmonary bypass in a patient with raynaud's phenomenon detected by near-infrared cerebral oximetry.
Aron JH, Fink GW, Swartz MF, Ford B, Hauser MC, O'Leary CE, Puskas F. Anesth Analg. 2007;104(5):1034–6.

Integrity of the cerebral blood-flow response to hyperoxia after cardiopulmonary bypass.
Floyd TF, Ratcliffe SJ, Detre JA, J Cardiothorac Vasc Anesth. 2007;21(2):212–7.

Neuroprotective effect of mild hypothermia in patients undergoing coronary artery surgery with cardiopulmonary bypass: five-year follow-up of a randomized trial.
Nathan HJ, Rodriguez R, Wozny D, Dupuis JY, Rubens FD, Bryson GL, Wells G. J Thorac Cardiovasc Surg. 2007;133(5):1206–11.

PERFUSION TECHNIQUE

The "sandblasting" effect of aortic cannula on arch atheroma during cardiopulmonary bypass.
Swaminathan M, Grocott HP, Mackensen GB, et al. Anesth Analg. 2007;104(6):1350–1.

Selecting a vasopressor drug for vasoplegic shock after adult cardiac surgery: a systematic literature review.
Egi M, Bellomo R, Langenberg C, et al. Ann Thorac Surg. 2007;83(2):715–23.

Minimized cardiopulmonary bypass combined with a smart suction device: the future of cardiopulmonary bypass?
Stalder M, Gygax E, Immer FF, et al. Heart Surg Forum. 2007;10(3):E235–8.

Reliability of temperatures measured at standard monitoring sites as an index of brain temperature during deep hypothermic cardiopulmonary bypass conducted for thoracic aortic reconstruction.
Akata T, Setoguchi H, Shirozu K, Yoshino J. J Thorac Cardiovasc Surg. 2007 Jun;133(6):1559–65.

> During deep hypothermia, accurate cerebral temperature is necessary to determine the length and safety of circulatory arrest. Using jugular bulb temperature as the reference, the authors studied the accuracy of five other standard temperatures used during cardiac surgery. Pulmonary artery temperature closely matched jugular bulb temperature except during and immediately after cardioplegia administration.

The release of systemic inflammatory mediators is independent of cardiopulmonary bypass temperature.
Rasmussen BS, Sollid J, Knudsen L, et al. J Cardiothorac Vasc Anesth. 2007;21(2):191–6.

Differential effects on the mesenteric microcirculatory response to vasopressin and phenylephrine after cardiopulmonary bypass.
Khan TA, Bianchi C, Ruel M, et al. J Thorac Cardiovasc Surg. 2007;133(3):682–8.

The effect of mannitol on oxygenation and creatine kinase MB release in patients undergoing multivessel off-pump coronary artery bypass surgery.
Shim JK, Choi SH, Oh YJ, et al. J Thorac Cardiovasc Surg. 2007 Mar;133(3):704–9.

Comparing oxygen transfer performance between three membrane oxygenators: effect of temperature changes during cardiopulmonary bypass.
Jegger D, Tevaearai HT, Mallabiabarrena I, et al. Artif Organs. 2007;31(4):290–300.

Bivalirudin during cardiopulmonary bypass in patients with previous or acute heparin-induced thrombocytopenia and heparin antibodies: results of the CHOOSE-ON trial.
Koster A, Dyke CM, Aldea G, et al. Ann Thorac Surg. 2007 Feb;83(2):572–7.

> Fifty patients with heparin-induced thrombocytopenia were prospectively enrolled in this multi-center trial to determine the safety of bivalirudin for anticoagulation during cardiopulmonary bypass.

Effect of combined anticoagulation using heparin and bivalirudin on the hemostatic and inflammatory responses to cardiopulmonary bypass in the rat.
Welsby IJ, Jones WL, Arepally G, et al. Anesthesiology. 2007;106(2):295–301.

A novel device for reducing hemolysis provoked by cardiotomy suction during open heart cardiopulmonary bypass surgery: a randomized prospective study.
Jegger D, Horisberger J, Jachertz M, et al. Artif Organs. 2007;31(1):23–30.

The effect of sodium nitroprusside infusion on renal function during reperfusion period in patients undergoing coronary artery bypass grafting: a prospective randomized clinical trial.
Kaya K, Oguz M, Akar AR, et al. Eur J Cardiothorac Surg. 2007;31(2):290–7.

Alternative anticoagulation management strategies for the patient with heparin-induced thrombocytopenia undergoing cardiac surgery.
Murphy GS, Marymont JH. J Cardiothorac Vasc Anesth. 2007 Feb;21(1):113–26.

Epsilon-aminocaproic acid inhibition of fibrinolysis in vitro: should the 'therapeutic' concentration be reconsidered?
Nielsen VG, Cankovic L, Steenwyk BL. Blood Coagul Fibrinolysis. 2007;18(1):35–9.

PEDIATRIC PERFUSION

Washing of irradiated red blood cells prevents hyperkalaemia during cardiopulmonary bypass in neonates and infants undergoing surgery for complex congenital heart disease.
Swindell CG, Barker TA, McGuirk SP, et al. Eur J Cardiothorac Surg. 2007;31(4):659–64.

Extravasation of albumin after cardiopulmonary bypass in newborns.
Tassani P, Schad H, Schreiber C, et al. J Cardiothorac Vasc Anesth. 2007;21(2):174–8.

Increased calcium supplementation is associated with morbidity and mortality in the infant postoperative cardiac patient.
Dyke PC 2nd, Yates AR, Cua CL, et al. Pediatr Crit Care Med. 2007;8(3):254–7.

VENTRICULAR ASSIST

Clinical outcomes are similar in pulsatile and nonpulsatile left ventricular assist device recipients.
Feller ED, Sorensen EN, Haddad M, et al. Ann Thorac Surg. 2007;83(3):1082–8.

> A retrospective comparison of pulsatile and non-pulsatile ventricular assist devices show little difference in patient outcomes—suggesting an expanded role in non-pulsatile devices for destination therapy in congestive heart failure.

Vascular pulsatility in patients with a pulsatile- or continuous-flow ventricular assist device.
Travis AR, Giridharan GA, Pantalos GM, et al. J Thorac Cardiovasc Surg. 2007;133(2):517–24.

Elective transfer from cardiopulmonary bypass to centrifugal blood pump support in very high-risk cardiac surgery.
Westaby S, Balacumaraswami L, Evans BJ, et al. J Thorac Cardiovasc Surg. 2007 Feb;133(2):577–8.