

CLINICAL STRATEGIES FOR MANAGING HAEMORRHAGE AND ANAEMIA WITHOUT BLOOD TRANSFUSION

This booklet is an attempt to bring together current thinking on 'bloodless' medicine and surgery from a wide variety of medical sources. We trust that this format will prove helpful to clinicians by providing ready access to relevant information on the management of patients who request treatment without recourse to allogeneic blood.

This material reflects current clinical and scientific knowledge and is therefore subject to change. The strategies do not indicate an exclusive course of treatment, as clinical judgement may necessitate modification, depending on the specific circumstances and patient preferences.

Printed in Britain

IBSA

IBSA House, The Ridgeway, London NW7 1RN

January 2003

<i>Table of Contents</i>	Page
General Non-blood Management Principles _____	4
General Therapeutic Principles _____	4
Minimise Haemorrhagic Blood Loss _____	5
Avoid hypertension and hypervolaemia	
Avoid severe hypotension	
Maintain extra vigilance	
Avoid delay	
Blood salvage	
Maintain normothermia	
Adequate and appropriate heparin/protamine dosing	
Haemostatic agents	
Prophylaxis of upper gastrointestinal haemorrhage	
Avoid/treat infections promptly	
Reduce Iatrogenic Blood Loss _____	7
Restrict phlebotomy	
Review adverse effects of current medications	
Maximise Oxygen Delivery _____	8
Maintain intravascular volume	
Maintain cardiovascular support	
Maintain ventilation and oxygenation	
Minimise Oxygen Consumption _____	10
Adequate and appropriate analgesia	
Sedation	
Mechanical ventilation	
Maintain/restore normothermia	
Optimise Red Blood Cell Production _____	11
Therapy for haematinic deficiencies	
Prophylactic haematinic therapy	
Recombinant erythropoietin	
Other Haematopoietic Growth Factors	
Nutritional Support	
PRE-OPERATIVE PLANNING _____	13
Pre-operative Workup/Clinical Evaluation _____	13
Medical history and physical examination	
Laboratory Assessment/Screening	
Management of bleeding risk/therapy for coexisting disease	
Correct anaemia and optimise pre-operative haemoglobin level	
Surgical/Anaesthetic Blood Conservation Techniques _____	15
References _____	16

GENERAL NON-BLOOD MANAGEMENT PRINCIPLES

1. Thoroughly plan the management of the patient so as to avoid allogeneic blood transfusion by using an appropriate combination of blood conservation strategies.
2. Anticipate potential risks of blood loss and be prepared to address them.
3. Employ a multispecialty team approach.
4. Maintain frequent, close observation for haemorrhage. Early recognition and prompt intervention to prevent/control abnormal bleeding is the cornerstone of effective care for patients who will not accept allogeneic blood.

Avoid a “watch and wait” approach to the bleeding patient.

5. Exercising clinical judgement, be prepared to modify routine practice when appropriate.
6. Consult promptly with senior specialists experienced in non-blood management if complications arise.
7. Transfer a stabilised patient, if necessary, to a centre of excellence before the patient’s condition deteriorates.
8. Discuss risks (both short- and long-term), benefits and alternatives to proposed interventions with the patient/family.
9. If managing a patient who is one of Jehovah’s Witnesses, contact the local Hospital Liaison Committee.

GENERAL THERAPEUTIC PRINCIPLES^{1,2,3,4}

1. Control or avoid haemorrhagic and iatrogenic blood loss.
2. Optimise cardiac and respiratory support by maximising oxygen delivery (volume replacement, oxygenation, vasoactive agents) and minimising oxygen consumption (analgesia, sedation, mechanical ventilation).
3. Restore/improve blood count by stimulating haematopoiesis.

1. MINIMISE HAEMORRHAGIC BLOOD LOSS⁵

A. Avoid hypertension and hypervolaemia^{6,7}

1. If active bleeding is present, consider tolerating mild hypotension (i.e., reduced systolic blood pressure in the range of 90-100 mm Hg for a normotensive patient) until haemorrhage is promptly controlled, using a combination of available blood conservation strategies.^{8,9,10} (See 7. A.M.)
2. Hypertension and hypervolaemia may inhibit spontaneous haemostasis, accentuate haemorrhage, or disrupt effective thrombus. Excess fluids may also promote haemorrhage by diluting coagulation factors and lowering blood viscosity.
3. Allow a slow, gradual return to normal blood pressure after bleeding is controlled.¹¹
4. In resuscitation from shock state avoid circulatory overload. Fluid administration simply by protocol without ongoing clinical judgement should be avoided.
5. Use vasodilators to manage hypertension with/without automated control of transient hypertension.¹²

B. Avoid severe hypotension

1. Use vasoactive drug therapy to control marked hypotension not responding to fluid therapy.
2. In severe head trauma, maintain appropriate level of cerebral perfusion pressure (i.e. 70-80 mm HgCPP).^{13,14} Resuscitation of head-injured, multiply-traumatised patients with lactated Ringer's, hypotonic, or dextrose-containing solutions may be detrimental.^{15,16}

C. Maintain extra vigilance to detect and treat ongoing bleeding and other complications.¹⁷

Note: Continuous low-level bleeding (e.g., from small vessels and capillaries) could become significant if tolerated for a prolonged period of time.

D. Avoid delay. Do not defer surgery if active bleeding cannot be controlled non-operatively^{18,19} (e.g., pharmacologic, endoscopic, angiographic).

E. Blood salvage^{20,21,22} (e.g., intra-operative or post-operative).

F. Maintain normothermia unless hypothermia is indicated.²³

Notes:

1. External active warming may be superior to passive warming.
2. Coagulation proteins may be less effective at lower temperatures, increasing the risk of blood loss.²⁴
3. Hypothermia is associated with higher infection rates.²⁵

4. Controlled hypothermia may be considered for severe anaemia or cerebral protection.^{26,27}

G. Adequate and appropriate heparin/protamine dosing^{28,29}

H. Haemostatic agents for bleeding/clotting problems^{30,31}

1. Tranexamic acid^{32,33}
2. Epsilon-aminocaproic acid³⁴
3. Desmopressin^{35,36,37} (use trial dose to assess response)³⁸
4. Aprotinin^{39,40,41}

Note: Aprotinin or desmopressin may reduce bleeding due to drug-induced platelet dysfunction (e.g., due to aspirin, NSAIDs, beta-lactam antibiotics, antithrombotics).⁴²

5. Conjugated oestrogens^{43,44}
6. Vasopressin⁴⁵
7. Appropriate drugs to control gynaecological haemorrhage (e.g., hormone manipulation)
8. Vitamin K^{46,47}

Notes:

1. Consider prophylactic parenteral administration of vitamin K.
2. Causes of vitamin K deficiency include:
 - a. Inadequate dietary intake, limited absorption or synthesis
 - b. Antibiotics
 - c. Anticoagulants (e.g., warfarin, nicoumalone)
 - d. Other drugs (e.g., salicylates)
9. Treatment for congenital or acquired haemorrhagic disorders:
 - a. Clotting factor replacement therapy
Note: Factors VIIa, VIII, IX are available as recombinant products.
 - b. Cryoprecipitate

I. Prophylaxis of upper gastrointestinal haemorrhage^{48,49}

1. Cytoprotective agents (e.g., sucralfate)⁵⁰
2. Enteral nutrition⁵¹
3. Proton pump inhibitors⁵²
4. H₂ blockers⁵³ (associated with thrombocytopenia and pancytopenia in some patients; may reduce iron solubility due to increase in gastric pH).

J. Avoid/treat infections promptly

1. Prophylaxis of infection^{54,55,56}
2. Thorough assessments of wounds; avoid secondary contamination (e.g., colon or rectal)

2. REDUCE IATROGENIC BLOOD LOSS

A. Restrict phlebotomy^{57,58}

1. Perform only essential tests
2. Eliminate duplication; perform multiple tests per sample⁵⁹
3. Paediatric phlebotomy tubes⁶⁰
4. Point-of-care whole blood microsampling^{61,62,63,64}
5. Pulse oximetry
6. Transcutaneous oximetry
7. End-tidal CO₂ monitoring
8. In-line blood reservoirs; eliminate purge discard volume^{65,66}
9. In-line arterial blood gas monitors⁶⁷

B. Review adverse effects of current medications (NSAIDs, e.g., ketorolac; antibiotics, e.g., cephalosporins, penicillins) and drug reactions and interactions that may increase risk of bleeding, of iatrogenic anaemia, hypoprothrombinaemia, or may suppress erythropoiesis.

1. Consider dosage reduction, discontinuation, or substitution with alternative medication. Continue monitoring for adverse reactions.
2. Be judicious about prophylaxis of thromboembolism. Closely monitor patients treated with anticoagulants/antiplatelet drugs. The risk of haemorrhage is related to dosage, duration of therapy, and predisposing conditions.

Note: Some herbal preparations can interfere with clotting.

3. MAXIMISE OXYGEN DELIVERY

A. Maintain intravascular volume⁶⁸ (stop any bleeding—see **1. A.I.**)

1. Judicious use of non-blood fluids:
 - a. Crystalloids
 - i. Ringer's lactate
 - ii. Normal saline
 - iii. Hypertonic saline⁶⁹
 - b. Colloids
 - i. Pentastarch^{70,71}
 - ii. Hetastarch (may adversely affect coagulation—see note 3 below)
 - iii. Gelatin⁷²
 - iv. Dextran (may adversely affect coagulation—see note 3 below)
 - c. Perfluorochemicals (artificial oxygen carriers)

Notes:

1. Normovolaemic anaemia can be tolerated in haemodynamically stable patients.^{73,74,75,76,77}
2. Avoid circulatory overload, especially in profoundly anaemic patients. Closely monitor fluid balance and vital signs.
3. The clinician should judiciously choose the solution(s) for volume expansion.^{78,79,80,81,82,83} (See also **1. A.**)
4. In cases where clinical examination and non-invasive investigation may provide inadequate data, use invasive monitoring⁸⁴ (e.g., central venous line, arterial catheter, pulmonary artery catheter,) to guide the management of patients.
5. Bleeding should be considered and diagnosis sought when a patient shows evidence of hypovolaemia despite reasonable hydration. Avoid aggressive fluid replacement to normalise blood pressure. Adequate perfusion can be obtained at lower pressure. Simple measurement of vital signs is a poor indicator of blood volume loss.
6. Albumin therapy may be detrimental to the shocked patient.⁸⁵

B. Maintain cardiovascular support^{86,87}

1. Closely monitor and assess oxygen utilisation/hypoxia (e.g., clinical signs, pH and lactate, urine output), haemodynamics (e.g., cardiac output, pulmonary artery wedge pressure).
2. Maintain/improve tissue perfusion and cardiac output (fluids and inotropes).⁸⁸
3. Maintain blood pressure (fluids and vasopressors).

C. Maintain ventilation and oxygenation⁸⁹

1. Ensure appropriate and adequate ventilatory support for optimal oxygenation and CO₂ elimination⁹⁰ (e.g., CPAP, IPPV, PEEP).

Note: Nitric oxide and hypercapnia may increase risk of bleeding.

2. Use ongoing monitoring and assessment of the adequacy of ventilation and oxygenation (clinical assessment, arterial blood gas analysis and/or pulse oximetry, capnometry, oximetric pulmonary artery catheter) to allow for early and appropriate intervention.
3. Hyperbaric Oxygen Therapy (HBO)^{91,92,93,94}
 - a. Indications for HBO therapy:
 - i. Adequate oxygen transport (arterial and mixed venous blood gas analysis) cannot be achieved using conventional mechanical ventilation.
 - ii. Tissue hypoxia (e.g., mental confusion, abnormal vital signs, decreased urine output, metabolic acidosis) in the presence of adequate fluid resuscitation and perfusion.
 - b. Use ongoing monitoring to determine appropriate HBO dosage and onset of adverse effects (e.g., pulmonary and CNS function).⁹⁵
 - c. Use intermittent HBO therapy to minimise oxygen toxicity or barotrauma.^{96,97}
 - d. Provide concomitant therapy with i.v. r-HuEPO, and iron, folate, and nutrition to support haematopoiesis.

4. MINIMISE OXYGEN CONSUMPTION

A. Adequate and appropriate analgesia

B. Sedation; consider neuromuscular blockade (i.e., to prevent muscle shivering, agitation, anxiety).

1. To minimise adverse effects, use the *lowest dose and shortest duration* of analgesia and sedation necessary.⁹⁸
2. Closely monitor the degree of blockade (e.g., peripheral nerve stimulation) and adjust drug doses to determine the minimum appropriate dosage. This allows faster recovery of neuromuscular function and spontaneous ventilation. Avoid standard dosing.⁹⁹

C. Mechanical ventilation

D. Maintain/restore normothermia unless hypothermia is indicated. Actively rewarm post-operative patients. Cool febrile patients.

5. OPTIMISE RED BLOOD CELL PRODUCTION

A. Therapy for haematinic deficiencies:

1. i.v. iron^{100,101} (use test dose^{102,103})
2. Folic acid¹⁰⁴
3. Vitamin B₁₂¹⁰⁵

Notes:

1. Intravenous route of administration improves bioavailability, rapidly increases stores, avoids potential malabsorption or gastric irritation (e.g., oral iron).
2. Concomitant administration of ascorbic acid and oral iron may enhance absorption from the gastrointestinal tract.
3. Oral iron is known to interact with many commonly used drugs.

B. Prophylactic haematinic therapy to maximise stores and optimise the response to erythropoietin.¹⁰⁶

C. Recombinant erythropoietin (r-HuEPO) therapy^{107,108,109,110}

1. Subcutaneous injection or intravenous administration^{111,112}
2. Factors that may delay or attenuate the response to r-HuEPO include:^{113,114}
 - a. Iron deficiency^{115,116,117}
 - b. Chronic infection, inflammation, or malignant process
 - c. Occult blood loss
 - d. Bone marrow disease
 - e. Vitamin deficiencies (folate, B₁₂)
 - f. Poor subcutaneous absorption of r-HuEPO
 - g. Haemolysis
 - h. Aluminium intoxication (e.g., medications, dialysate fluid)
 - i. Hyperparathyroidism

Notes:

1. Endogenous EPO production is proportional to the degree of anaemia. For severe anaemia, r-HuEPO should be used for the rapid restoration of red cell mass.
2. A high endogenous EPO level does not preclude response to r-HuEPO.¹¹⁸
3. The rate of response to r-HuEPO is dose dependent and varies among patients. Therapy may need to be individualised. Monitor and escalate the dosage or change the route of administration to improve the response.^{119,120,121,122}

4. Consider pre-treatment investigation to identify and correct, if possible, any factor that could mediate erythropoietin resistance. If this fails, use a higher dose.¹²³
5. Hyperoxic ventilation (a high PaO₂) or critical illness may blunt endogenous EPO production in response to acute anaemia.
6. r-HuEPO administration up to 2,000 U/kg/day in divided doses has been reported to be well tolerated.¹²⁴
7. Monitor for hypertension, which may induce bleeding, and consider initiation or increases in antihypertensive therapy.
8. r-HuEPO may produce a moderate dose-dependent rise in the platelet count, within the normal range, during treatment.^{125,126}

D. Other Haematopoietic Growth Factors (e.g., G-CSF, GM-CSF, IL-11)

E. Nutritional Support¹²⁷ (oral/parenteral)

PRE-OPERATIVE PLANNING

6. PRE-OPERATIVE WORKUP/CLINICAL EVALUATION

Thorough assessment of the patient is essential to develop a comprehensive patient care plan. Consider the risk factors and employ an optimal combination of the available alternative strategies.¹²⁸

A. Medical history and physical examination^{129,130}

1. History of anaemia
2. Congenital/acquired bleeding disorders¹³¹ (suspected by reviewing obstetric history, circumcision, frequent nose bleeds, easy bruising without trauma, tonsillectomy, dental extraction, menorrhagia, prolonged bleeding after minor skin lesion, previous surgery, pregnancy, etc.).
 - a. Personal history
 - b. Family history
3. End-organ disease/injury (esp. renal or hepatic)
4. Previous surgery (blood loss may be increased with repeat surgery)
5. Identify medications that may adversely affect haemostasis¹³² (e.g., aspirin, NSAIDs, anticoagulants, platelet aggregation inhibitors, antibiotics, dietary supplements). Also ensure that additional prescription and non-prescription drugs containing aspirin or NSAIDs are not inadvertently taken by patients.^{133,134}
6. Physical examination (e.g., purpuric lesions, petechiae, ecchymosis, hepatomegaly, splenomegaly)

B. Laboratory Assessment/Screening^{135,136,137}

1. Establish baseline parameters:
 - a. Complete blood count (including red blood cell and platelet counts)
 - b. Serum ferritin
 - c. Serum folate
 - d. Serum vitamin B₁₂
 - e. PT, PTT, template bleeding time (as indicated)
2. Additional investigation as indicated by the history of the patient and the degree of haemostatic challenge:
 - a. Coagulation tests
 - i. Platelet function, adhesion, aggregation tests
 - ii. Fibrinogen concentration

- iii. Fibrin degradation products (FDP)
 - iv. Specific coagulation factor assays
 - v. Assay for ristocetin cofactor activity (von Willebrand disease, Bernard-Soulier syndrome)
- b. Liver function
 - c. Renal function (creatinine)
 - d. Point-of-care coagulation monitoring (e.g., thrombelastogram, Sonoclot)¹³⁸

Note: Minimise iatrogenic blood loss. (See **2. A.**)

C. Management of bleeding risk/therapy for coexisting disease^{139,140}

1. Consider discontinuing medications associated with increased post-operative bleeding complications (from 3 to 14 days pre-operatively) and temporary substitution with alternate therapy (e.g., NSAIDs with short half-lives, heparin):¹⁴¹
 - a. Aspirin (at least 7 days before surgery)
 - b. NSAIDs (10 days or more for NSAIDs with long half-lives)
 - c. Anticoagulants, platelet inhibitors (e.g., warfarin, ticlopidine)
 - d. Antibiotics (e.g., ticarcillin)
2. Treat congenital/induced haemorrhagic disorders¹⁴² (See **1. H.**)
3. Consider pre-operative prophylactic optimisation of tissue perfusion by augmentation of cardiac output^{143,144} (patients with coexisting pathology and poor cardiac function).

D. Correct anaemia and optimise pre-operative haemoglobin level

(See **5. A.-C.**)

Note: Consider pre-operative use of r-HuEPO in surgical patients where there is risk of significant blood loss, even in the absence of anaemia.^{145,146,147,148}

7. SURGICAL/ANAESTHETIC BLOOD CONSERVATION TECHNIQUES^{149,150,151,152,153}

- A.** Surgical procedure(s) to specifically avoid and prevent blood loss^{154,155}
 - 1. Minimally invasive techniques (endoscopic/laparoscopic surgery)
 - 2. Enlarged surgical team/minimal time¹⁵⁶
 - 3. Surgical positioning to minimise bleeding^{157,158}
 - 4. Staged surgery for complex procedures¹⁵⁹
- B.** Arterial embolisation^{160,161,162} (including pre-operative)^{163,164}
- C.** Meticulous haemostasis^{165,166,167}
- D.** Mechanical occlusion of bleeding vessel¹⁶⁸
- E.** Electrocautery
- F.** Ultrasonic scalpel¹⁶⁹
- G.** Argon beam coagulator^{170,171}
- H.** Tissue adhesives^{172,173}
- I.** Intra-operative blood salvage^{174,175}
- J.** Haemodilution^{176,177}
- K.** Platelet-rich plasma sequestration^{178,179}
- L.** Induced hypothermia
- M.** Hypotensive anaesthesia¹⁸⁰

Note: Regardless of the choice of anaesthesia (regional, narcotic, etc.) the anaesthetic technique must be well-planned and executed so as to minimise blood loss (e.g., positioning, ventilation, deliberate hypotension). Avoid increases in arterial or venous pressure.¹⁸¹

References

1. Spence RK, Cernaianu AC, Carson J, et al. Transfusion and surgery. *Curr Probl Surg* 1993;XXX(12):1103-80.
2. Mann MC, Votto J, Kambe J, et al. Management of the severely anemic patient who refuses transfusion: lessons learned during the care of a Jehovah's Witness. *Ann Intern Med* 1992;117(12):1042-8.
3. Boyd ME. The obstetrician and gynaecologist and the Jehovah's Witness. *J Soc Obstet Gynaecol Can* 1992;14(6):7-9.
4. Koenig HM, Levine EA, Resnick DJ, et al. Use of recombinant human erythropoietin in a Jehovah's Witness. *J Clin Anesth* 1993;5(3):244-7.
5. White GC 2nd, Marder VJ, Colman RW, et al. Approach to the bleeding patient. In: Colman RW, Hirsh J, Marder VJ, et al. *Hemostasis and Thrombosis: Basic Principles and Clinical Practice*. 3rd ed. Philadelphia: Lippincott; 1994. p. 1134-47.
6. Estioko MR, Litwak RS, Rand JH. Reoperation, emergency and urgent open cardiac surgery in Jehovah's Witnesses. *Chest* 1992;102(1):50-3.
7. Elefteriades JA, Geha AS, Cohen LS. *House officer guide to ICU care: fundamentals of management of the heart and lungs*. 2nd ed. New York: Raven Press; 1994. p. 175-83.
8. Bickell WH, Shaftan GW, Mattox KL. Intravenous fluid administration and uncontrolled hemorrhage. *J Trauma* 1989;29(3):409.
9. Hemstad J. Blood conservation techniques in anesthesia. In: Spiess BD, Counts RB, Gould SA, editors. *Perioperative Transfusion Medicine*. Baltimore: Williams & Wilkins; 1998. p. 309-23.
10. Shoemaker WC, Peitzman AB, Bellamy R, et al. Resuscitation from severe hemorrhage. *Crit Care Med* 1996;24(2 Suppl):S12-S23.
11. Klowden AJ, Salem MR, Fahmy NR, et al. Deliberate hypotension. In: Salem MR, editor. *Blood Conservation in the Surgical Patient*. Baltimore: Williams & Wilkins; 1996. p. 189-251.
12. Cosgrove DM III, Petre JH, Waller JL, et al. Automated control of postoperative hypertension: a prospective, randomized multicenter study. *Ann Thorac Surg* 1989;47:678-83.
13. Rosner MJ, Rosner SD, Johnson AH. Cerebral perfusion pressure: management protocol and clinical results. *J Neurosurg* 1995;83(6):949-62.
14. Hamilton SM, Breakey P. Fluid resuscitation of the trauma patient: how much is enough? *Can J Surg* 1996;39(1):11-16.
15. Zornow MH, Prough DS. Fluid management in patients with traumatic brain injury. *New Horiz* 1995;3(3):488-98.
16. Simma B, Burger R, Falk M, et al. A prospective, randomized, and controlled study of fluid management in children with severe head injury: lactated Ringer's solution versus hypertonic saline. *Crit Care Med* 1998;26(7):1265-70.
17. Drife J. Management of primary postpartum haemorrhage. *Br J Obstet Gynaecol* 1997;104(3):275-7.
18. Baker CE, Kelly GD, Perkins GD. Perioperative care of a Jehovah's Witness with a leaking abdominal aortic aneurysm. *Br J Anaesth* 1998;81(2):256-9.
19. Atabek U, Spence RK, Pello M, et al. Pancreaticoduodenectomy without homologous blood transfusion in an anemic Jehovah's Witness. *Arch Surg* 1992;127:349-51.
20. Øvrum E, Åm Hølen E, Tangen G. Consistent non-pharmacologic blood conservation in primary and reoperative coronary artery bypass grafting. *Eur J Cardiothorac Surg* 1995;9(1):30-5.
21. Schmidt H, Følsgaard S, Mortensen PE, et al. Impact of autotransfusion after coronary artery bypass grafting on oxygen transport. *Acta Anaesthesiol Scand* 1997;41(8):995-1001.

22. Han CD, Shin DE. Postoperative blood salvage and reinfusion after total joint arthroplasty. *J Arthroplasty* 1997;12(5):511-6.
23. Bush HL Jr, Hydo LJ, Fischer E, Fantini GA, Silane MF, Barie PS. Hypothermia during elective abdominal aortic aneurysm repair: the high price of avoidable morbidity. *J Vasc Surg* 1995;21(3):392-402.
24. Schmied H, Kurz A, Sessler DI, et al. Mild hypothermia increases blood loss and transfusion requirements during total hip arthroplasty. *Lancet* 1996;347(8997):289-92.
25. Kurz A, Sessler DI, Lenhardt R. Perioperative normothermia to reduce the incidence of surgical wound infection and shorten hospitalization. *N Engl J Med* 1996;334:1209-15.
26. Marion DW, Penrod LE, Kelsey SF, et al. Treatment of traumatic brain injury with moderate hypothermia. *N Engl J Med* 1997;336(8):540-6.
27. Akingbola OA, Custer JR, Bunchman TE, et al. Management of severe anemia without transfusion in a pediatric Jehovah's Witness patient. *Crit Care Med* 1994;22(3):524-8.
28. Jobses DR, Aitken GL, Shaffer GW. Increased accuracy and precision of heparin and protamine dosing reduces blood loss and transfusion in patients undergoing primary cardiac operations. *J Thorac Cardiovasc Surg* 1995;110(1):36-45.
29. Despotis GJ, Joist JH, Hogue CW Jr., et al. The impact of heparin concentration and activated clotting time monitoring on blood conservation. A prospective, randomized evaluation in patients undergoing cardiac operation. *J Thorac Cardiovasc Surg* 1995;110(1):46-54.
30. Spence RK, Cernaianu AC. Pharmacological agents as adjuncts to bloodless vascular surgery. *Semin Vasc Surg* 1994;7(2):114-20.
31. Royston D. Blood-sparing drugs: aprotinin, tranexamic acid, and epsilon-aminocaproic acid. *Int Anesthesiol Clin* 1995 Winter;33(1):155-79.
32. Karski JM, Teasdale SJ, Norman P, et al. Prevention of bleeding after cardiopulmonary bypass with high-dose tranexamic acid. *J Thorac Cardiovasc Surg* 1995;110(3):835-42.
33. Henry DA, O'Connell DL. Effects of fibrinolytic inhibitors on mortality from upper gastrointestinal haemorrhage. *BMJ* 1989;298:1142-6.
34. Chen RH, Frazier OH, Cooley DA. Antifibrinolytic therapy in cardiac surgery. *Tex Heart Inst J* 1995;22(3):211-15.
35. Kobrinsky NL, Tulloch H. Treatment of refractory thrombocytopenic bleeding with 1-desamino-8-d-arginine vasopressin (desmopressin). *J Pediatr* 1988;112(6):993-6.
36. Cattaneo M. Review of clinical experience of desmopressin with congenital and acquired bleeding disorders. *Eur J Anaesthesiol* 1997;14(Suppl 14):10-18.
37. Aledort LM. New approaches to management of bleeding disorders. *Hosp Prac* 1989;24(2):207-11, 214, 219-21, 225-6.
38. Flordal PA. Use of desmopressin to prevent bleeding in surgery. *Eur J Surg* 1998;164(1):5-11.
39. Çiçek S, Demirkiliç U, Kuralay E, et al. Postoperative aprotinin: effect on blood loss and transfusion requirements in cardiac operations. *Ann Thorac Surg* 1996;61(5):1372-6.
40. Taylor KM. Aprotinin therapy and blood conservation: extending the indications. *Br J Surg* 1992;79(12):1258-9.
41. Murkin JM, Shannon NA, Bourne RB, et al. Aprotinin decreases blood loss in patients undergoing revision or bilateral total hip arthroplasty. *Anesth Analg* 1995;80(2):343-8.
42. Douglas JT, Shaw J. High-dose desmopressin in bleeding disorders. *Eur J Anaesthesiol* 1997 Mar;14(Suppl 14):v-vi.
43. van Cutsem E, Rutgeerts P, Vantrappen G. Treatment of bleeding gastrointestinal vascular malformations with oestrogen-progesterone. *Lancet* 1990;335(8695):953-5.
44. Frenette L, Cox J, McArdle P, et al. Conjugated estrogen reduces transfusion and coagulation factor requirements in orthotopic liver transplantation. *Anesth Analg* 1998;86(6):1183-6.

45. Achauer BM, Hernandez J, Parker A. Burn excision with intraoperative vasopressin. *J Burn Care Rehabil* 1989;10(4):375-8.
46. Alperin JB. Coagulopathy caused by vitamin K deficiency in critically ill, hospitalized patients. *JAMA* 1987;258(14):1916-9.
47. Alparin JB. Transfusion medicine issues in the practice of anesthesiology. *Transfus Med Rev* 1995;IX(4):339.
48. MacLean LD. Prophylactic treatment of stress ulcers: first do no harm. *Can J Surg* 1988;31(2):76-7.
49. Konicek FJ. Surgical hemostasis and blood conservation. Gastroenterology. In: Salem MR, editor. *Blood Conservation in the Surgical Patient*. Baltimore: Williams & Wilkins; 1996. p. 406-10.
50. Tryba M. Sucralfate versus antacids or H₂-antagonists for stress ulcer prophylaxis: a meta-analysis on efficacy and pneumonia rate. *Crit Care Med* 1991;19(7):942-9.
51. Heyland DK, Cook DJ, Guyatt GH. Enteral nutrition in the critically ill patient: a critical review of the evidence. *Intensive Care Med* 1993;19(8):435-42.
52. Lasky MR, Metzler MH, Phillips JO. A prospective study of omeprazole suspension to prevent clinically significant gastrointestinal bleeding from stress ulcers in mechanically ventilated trauma patients. *J Trauma* 1998;44(3):527-33.
53. Cook D, Guyatt G, Marshall J, et al. Canadian Critical Care Trials Group. A comparison of sucralfate and ranitidine for the prevention of upper gastrointestinal bleeding in patients requiring mechanical ventilation. *N Engl J Med* 1998 Mar; 338(12):791-7.
54. D'Amico R, Pifferi S, Leonetti C, et al. Effectiveness of antibiotic prophylaxis in critically ill adult patients: systematic review of randomised controlled trials. *BMJ* 1998;316:1275-85.
55. Nichols RL, Smith JW. Risk of infection, infecting flora and treatment considerations in penetrating abdominal trauma. *Surg Gynecol Obstet* 1993;177 Suppl:50-4.
56. Griswold JA, Muakkassa FF, Betcher E, Poole GV. Injury severity dictates individualized antibiotic therapy in penetrating abdominal trauma. *Am Surg* 1993;59(1):34-9.
57. Smoller BR, Kruskall MS, Horowitz GL. Reducing adult phlebotomy blood loss with the use of pediatric-sized blood collection tubes. *Am J Clin Pathol* 1989;91(6):701-3.
58. Corwin HL, Parsonnet KC, Gettinger A. RBC transfusion in the ICU. Is there a reason? *Chest* 1995;108(3):767-71.
59. Civetta JM, Hudson-Civetta JA. Maintaining quality of care while reducing charges in the ICU. Ten ways. *Ann Surg* 1985;202(4):524-32.
60. Vernon S, Pfeifer GM. Are you ready for bloodless surgery? *Am J Nurs* 1997;97(9):40-6.
61. Mock T, Morrison D, Yatscoff R. Evaluation of the i-STAT system: a portable chemistry analyzer for the measurement of sodium, potassium, chloride, urea, glucose, and hematocrit. *Clin Biochem* 1995;28(2):187-92.
62. Englehardt T, Ball DR. Coagulation assessment at the bedside. *Anaesth* 1997;52(8):810-11.
63. Kendall J, Reeves B, Clancy M. Point of care testing: randomized controlled trial of clinical outcome. *BMJ* 1998;316:1052-7.
64. Lardi AM, Hirst C, Mortimer AJ, et al. Evaluation of the HemoCue® for measuring intra-operative haemoglobin concentrations: a comparison with the Coulter Max-M®. *Anaesth* 1998;53(4):349-52.
65. Peruzzi WT, Parker MA, Lichtenthal PR, et al. A clinical evaluation of a blood conservation device in medical intensive care unit patients. *Crit Care Med* 1993;21(4):501-6.
66. Silver MJ, Jubran H, Stein S, et al. Evaluation of a new blood-conserving arterial line system for patients in intensive care units. *Crit Care Med* 1993;21(4):507-11.
67. Franklin ML, Peruzzi WT, Moen SG, et al. Evaluation of an on-demand, ex vivo bedside blood gas monitor on pulmonary artery blood gas determinations. *Anesth Analg* 1996;83(3):500-4.

68. Stehling L, Zauder HL. How low can we go? Is there a way to know? *Transfusion* 1990;30(1):1-3.
69. Cross JS, Gruber DP, Burchard KW, et al. Hypertonic saline fluid therapy following surgery: a prospective study. *J Trauma* 1989;29(6):817-26.
70. Waxman K, Holness R, Tominaga G, et al. Hemodynamic and oxygen transport effects of pentastarch in burn resuscitation. *Ann Surg* 1989;209(3):341-5.
71. Strauss RG, Stansfield C, Henriksen R, et al. Pentastarch may cause fewer effects on coagulation than hetastarch. *Transfusion* 1988;28(3):257-60.
72. Edwards J, Nightingale P, Wilkins RG, et al. Hemodynamic and oxygen transport response to modified fluid gelatin in critically ill patients. *Crit Care Med* 1989;17(10):996-8.
73. Baigorri F, Russell JA. Oxygen delivery in critical illness. *Crit Care Clin* 1996 Oct;12(4):971-94.
74. Weiskopf RB, Viele MK, Feiner J, et al. Human cardiovascular and metabolic response to acute, severe isovolemic anemia. *JAMA* 1998;279(3):217-21.
75. Hébert PC, Wells G, Blajchman MA, for the Transfusion requirements in Critical Care Investigators and the Canadian Critical Care Trials Group. A multicenter, randomized, controlled clinical trial of transfusion requirements in critical care. *N Engl J Med* 1999;340(6):409-417.
76. Tuman KJ. Tissue oxygen delivery: the physiology of anemia. *Anesthesiol Clin North Am* 1990 Sep;8(3):451-69.
77. Phillips P. Trial suggests change in transfusion strategy. *JAMA* 1998;279(20):1596-7.
78. Strauss RG. Volume replacement and coagulation: a comparative review. *J Cardiothorac Anesth* 1988;2(6 Suppl 1):24-32.
79. Anonymous. The management of postpartum haemorrhage. Collier J, editor. *Drug Ther Bull* 1992;30(23):89-92.
80. Warren BB, Durieux ME. Hydroxyethyl starch: safe or not? *Anesth Analg* 1997;84(1):206-12.
81. Treib J, Haass A, Pindur G, et al. All medium starches are not the same: influence of the degree of hydroxyethyl substitution of hydroxyethyl starch on plasma volume, hemorrheologic conditions, and coagulation. *Transfusion* 1996;36(5):450-5.
82. Evans PA, Glenn JR, Heptinstall S, et al. Effects of gelatin-based resuscitation fluids on platelet aggregation. *Br J Anaesth* 1998;81(2):198-202.
83. Flordal PA, Ljungstrom KG, Svensson J. Desmopressin reverses effects of dextran on von Willebrand factor. *Thromb Haemost* 1989;61:541.
84. Brimacombe J, Skippen P, Talbutt P. Acute anaemia to a haemoglobin of 14 g/l with survival. *Anaesth Intens Care* 1991;19(4):581-3.
85. Lucas CE. Update on trauma care in Canada. 4. Resuscitation through the three phases of hemorrhagic shock after trauma. *Can J Surg* 1990;33(6):451-6.
86. Howell PJ, Bamber PA. Severe acute anaemia in a Jehovah's Witness. *Anaesth* 1987;42(1):44-8.
87. Kraus P, Lipman J. Erythropoietin in a patient following multiple trauma. *Anaesth* 1992;47(11):962-4.
88. Kikura M, Levy JH. New cardiac drugs. *Int Anesthesiol Clin* 1995 Winter;33(1):21-37.
89. Third European Consensus Conference in Intensive Care Medicine. Tissue hypoxia: How to detect, how to correct, how to prevent. Société de réanimation de langue française. The American Thoracic Society. European Society of Intensive Care Medicine. *Am J Respir Crit Care Med* 1996;154(5):1573-8.
90. Levy B, Bollaert PE, Bauer P, et al. Therapeutic optimization including inhaled nitric oxide in adult respiratory distress syndrome in a polyvalent intensive care unit. *J Trauma* 1995;38(3):370-4.

91. Fischer B, Jain KK, Braun E, et al. Effect of hyperbaric oxygenation on disorders of the blood: hypovolemia and acute anemia due to blood loss. *Handbook of Hyperbaric Oxygen Therapy* Berlin: Springer-Verlag; 1988. p. 181-3.
92. Grim PS, Gottlieb LJ, Boddie A, et al. Hyperbaric oxygen therapy. *JAMA* 1990;263(16):2216-20.
93. Tibbles PM, Edelsberg JS. Hyperbaric oxygen therapy. *N Engl J Med* 1996;334(25):1642-8.
94. Watt J. Alternative management procedures should be used. *BMJ* 1994;308:1424.
95. Lodato RF. Oxygen toxicity. *Crit Care Clin* 1990 Jul;6(3):749-65.
96. Hart GB, Lennon PA, Strauss MB. Hyperbaric oxygen in exceptional acute blood-loss anemia. *J Hyperbaric Med* 1987;2(4):205-10.
97. Hendricks PL, Hall DA, Hunter WL Jr., et al. Extension of pulmonary O₂ tolerance in man at 2 ATA by intermittent O₂ exposure. *J Appl Physiol* 1977;42(4):593-9.
98. Weil JV, McCullough RE, Kline JS, et al. Diminished ventilatory response to hypoxia and hypercapnia after morphine in normal man. *N Engl J Med* 1975;292:1103-6.
99. Rudis MI, Sikora CA, Angus E, et al. A prospective, randomized, controlled evaluation of peripheral nerve stimulation versus standard clinical dosing of neuromuscular blocking agents in critically ill patients. *Crit Care Med* 1997;25(4):575-83.
100. Swain RA, Kaplan B, Montgomery E. Iron deficiency anemia. When is parenteral therapy warranted? *Postgrad Med* 1996;100(5):181-92.
101. Burns DL, Mascioli EA, Bistran BR. Parenteral iron dextran therapy: a review. *Nutrition* 1995;11(2):163-8.
102. Auerbach M, Witt D, Toler W, et al. Clinical use of total dose intravenous infusion of iron dextran. *J Lab Clin Med* 1988;111(5):566-70.
103. Monaghan MS, Glasco G, St. John G, et al. Safe administration of iron dextran to a patient who reacted to the test dose. *South Med J* 1994;87:1010-12.
104. Pronai W, Riegler-Keil M, Silberbauer K, et al. Folic acid supplementation improves erythropoietin response. *Nephron* 1995;71(4):395-400.
105. Green R. Screening for vitamin B₁₂ deficiency: caveat emptor. *Ann Intern Med* 1996;124(5):509-11.
106. Rutherford CJ, Schneider TJ, Dempsey H, et al. Efficacy of different dosing regimens for recombinant human erythropoietin in a simulated perisurgical setting: the importance of iron availability in optimizing response. *Am J Med* 1994;96(2):139-45.
107. Goodnough LT, Monk TG, Andriole GL. Erythropoietin therapy. *N Engl J Med* 1997;336(13):933-8.
108. Cazzola M, Mercuriali F, Brugnara C. Use of recombinant human erythropoietin outside the setting of uremia. *Blood* 1997;89(12):4248-67.
109. Koestner JA, Nelson LD, Morris JA Jr., et al. Use of recombinant human erythropoietin (r-HuEPO) in a Jehovah's Witness refusing transfusion of blood products. *J Trauma* 1990;30(11):1406-8.
110. Atabek U, Alvarez R, Pello MJ, et al. Erythropoietin accelerates hematocrit recovery in post-surgical anemia. *Am Surgeon* 1995;61(1):74-7.
111. DeMeester SR, Marsh EE, Gerkin TM, et al. Immediate use of recombinant erythropoietin in a Jehovah's Witness following major blunt trauma. *Contemp Surg* 1994;45(4):228-32.
112. Law EJ, Still JM, Gattis CS. The use of erythropoietin in two burned patients who are Jehovah's Witnesses. *Burns* 1991;17(1):75-7.
113. Becker BN, Koury MJ. Resistance to erythropoietin in dialysis patients: factors that decrease erythropoietin responsiveness. *Dial Transplant* 1993;22(11):686-92, 707.
114. Strachan J, Fleming L, Dick J, et al. Poor response to erythropoietin. *BMJ* 1995;311:633.
115. Schaefer RM, Schaefer L. Iron monitoring and supplementation: how do we achieve the best results? *Neph Dial Transplant* 1998;13(Suppl 2):9-12.

116. Hörl WH, Cavill I, Macdougall IC, et al. How to diagnose and correct iron deficiency during r-huEPO therapy—a consensus report. *Nephrol Dial Transplant* 1996;11:246-50.
117. Major A, Mathez-Loic F, Rohling R, et al. The effect of intravenous iron on the reticulocyte response to recombinant human erythropoietin. *Br J Haematol* 1997;98(2):292-4.
118. Boshkov LK, Tredget EE, Janowska-Wieczorek A. Recombinant human erythropoietin for a Jehovah's Witness with anemia of thermal injury. *Am J Hem* 1991;37(1):53-4.
119. Kaufman JS, Reda DJ, Fye CL, et al. Subcutaneous compared with intravenous epoetin in patients receiving hemodialysis. *N Engl J Med* 1998;339(9):578-83.
120. Schreiber S, Howaldt S, Schnoor M, et al. Recombinant erythropoietin for the treatment of anemia in inflammatory bowel disease. *N Engl J Med* 1996;334(10):619-23.
121. Faris PM, Ritter MA, Abels RI, et al. The effects of recombinant human erythropoietin on perioperative transfusion requirements in patients having a major orthopaedic operation. *J Bone Joint Surg* 1996;78A(1):62-72.
122. Busuttill D, Copplestone A. Management of blood loss in Jehovah's Witnesses. *BMJ* 1995;311:1115-6.
123. Danielson B. R-HuEPO hyporesponsiveness—who and why? *Nephrol Dial Transplant* 1995;10 (Suppl 2):69-73.
124. Niemeyer CM, Baumgarten E, Holldack J, et al. Treatment trial with recombinant human erythropoietin in children with congenital hypoplastic anemia. *Contrib Nephrol* 1991;88:276-80.
125. Epoetin alfa erythropoiesis regulating hormone product monograph. *Compendium of Pharmaceuticals and Specialties*. 32nd ed. Ottawa: Canadian Pharmaceutical Association; 1997. p. 540-4.
126. Porter JC, Leahey A, Polise K, et al. Recombinant human erythropoietin reduces the need for erythrocyte and platelet transfusions in pediatric patients with sarcoma: a randomized double-blind, placebo-controlled trial. *J Pediatr* 1996;129(5):656-60.
127. Dudrick SJ, O'Donnell JJ, Raleigh DP, et al. Rapid restoration of red blood cell mass in severely anemic surgical patients who refuse transfusion. *Arch Surg* 1985;120:721-7.
128. Helm RE, Rosengart TK, Gomez M, et al. Comprehensive multimodality blood conservation: 100 consecutive CABG operations without transfusion. *Ann Thorac Surg* 1998;65(1):125-36.
129. McIntyre AJ. Blood transfusion and haemostatic management in the perioperative period. *Can J Anaesth* 1992;39(5 Pt 2):R101-R107.
130. Colon-Otero G, Cockerill KJ, Bowie EJ. How to diagnose bleeding disorders. *Postgrad Med* 1991;90(3):145-50.
131. Hampton KK, Preston FE. ABC of clinical hematology. Bleeding disorders, thrombosis, and anticoagulation. *BMJ* 1997;314:1026-9.
132. Spiess BD. Coagulation function in the operating room. *Anesthesiol Clin North Am* 1990 Sep;8(3):481-99.
133. Brigden M, Smith RE. Acetylsalicylic-acid-containing drugs and nonsteroidal anti-inflammatory drugs available in Canada. *Can Med Assoc J* 1997;156(7):1025-8.
134. Hylek EM, Heiman H, Skates SJ, et al. Acetaminophen and other risk factors for excessive warfarin anticoagulation. *JAMA* 1998;279(9):657-62.
135. Malhotra N, Roizen MF. Laboratory testing. *Prob Anesth* 1991 Dec;5(4):575-90.
136. Feldman MD, McCrae KR. Clinical coagulation laboratory evaluation of hemostasis in the perioperative period. In: Lake CL, Moore RA, editors. *Blood: Hemostasis, Transfusion, and Alternatives in the Perioperative Period*. New York: Raven Press; 1995. p. 153-78.
137. Bowie EJW, Owen CA Jr. Clinical and laboratory diagnosis of hemorrhagic disorders. In: Ratnoff OD, Forbes CD, editors. *Disorders of Hemostasis*. 3rd ed. Philadelphia: Saunders; 1996. p. 53-78.

138. Dorman BH, Spinale FG, Bailey MK, et al. Identification of patients at risk for excessive blood loss during coronary artery bypass surgery: thromboelastograph versus coagulation screen. *Anesth Analg* 1993;76:694-700.
139. Czinn EA, Chediak JR. Coagulation and hemostasis. In: Salem MR, editor. *Blood Conservation in the Surgical Patient*. Baltimore: Williams & Wilkins; 1996. p. 45-78.
140. Kitchens CS. Surgery and hemostasis: the influence of one on the other. In: Ratnoff OD, Forbes CD, editors. *Disorders of Hemostasis*. 3rd ed. Philadelphia: Saunders; 1996. p. 356-82.
141. Medication management before surgery. *Compendium of Pharmaceuticals and Specialties*. 32nd ed. Ottawa: Canadian Pharmaceutical Association; 1997. p. L38-L41.
142. Spence RK. Management of surgical patients with special problems. In: Petz LD, Swisher SN, Kleinman S, et al, editors. *Clinical Practice of Transfusion Medicine*. 3rd ed. New York: Churchill Livingstone; 1996. p. 595-606.
143. Boyd O, Bennett ED. Enhancement of perioperative tissue perfusion as a therapeutic strategy for major surgery. *New Horiz* 1996;4(4):453-65.
144. Shoemaker WC, Appel PL, Kram HB. Hemodynamic and oxygen transport responses in survivors and nonsurvivors of high-risk surgery. *Crit Care Med* 1993;21(7):977-90.
145. Dubois RW, Lim D, Hébert P, et al. The development of indications for the preoperative use of recombinant erythropoietin. *Can J Surg* 1998;41(5):351-65.
146. Shimpo H, Mizumoto T, Onoda K, et al. Erythropoietin in pediatric cardiac surgery. Clinical efficacy and effective dose. *Chest* 1997;111(6):1565-70.
147. Rothstein P, Roye D, Verdisco L, et al. Preoperative use of erythropoietin in an adolescent Jehovah's Witness. *Anesthesiol* 1990;73(3):568-70.
148. Canadian Orthopedic Perioperative Erythropoietin Study Group. Effectiveness of perioperative recombinant human erythropoietin in elective hip replacement. *Lancet* 1993;341:1227-32.
149. Salem MR, editor. *Blood Conservation in the Surgical Patient*. Baltimore: Williams & Wilkins; 1996.
150. Spence RK. Blood saving strategies in surgical patients. In: Petz LD, Swisher SN, Kleinman S, et al, editors. *Clinical Practice of Transfusion Medicine*. 3rd ed. New York: Churchill Livingstone; 1996. p. 521-37.
151. Kreiger KH, Isom OW, editors. *Blood Conservation in Cardiac Surgery*. New York: Springer-Verlag; 1998.
152. Tawes RL Jr, editor. *Autotransfusion: Therapeutic Principles and Trends*. Detroit: Appleton; 1997.
153. de Andrade JR. Prudent strategies for red blood cell conservation in orthopedic surgery. *Am J Med* 1996;101(Suppl 2A):16S-21S.
154. Cooley DA. Conservation of blood during cardiovascular surgery. *Am J Surg* 1995;170(6A Suppl):53S-59S.
155. Nelson CL, Fontenot J. Ten strategies to reduce blood loss in orthopedic surgery. *Am J Surg* 1995;170(6A Suppl):64S-68S.
156. Brodsky JW, Dickson JH, Erwin WD, et al. Hypotensive anesthesia for scoliosis surgery in Jehovah's Witnesses. *Spine* 1991;16(3):304-6.
157. Milani JC. Blood preservation in spine surgery: an overview. *Spine: State Art Rev* 1991;5(1):17-27.
158. Murphy JM. Anesthetic considerations in lumbar spinal surgery. *Spine: State Art Rev* 1991;5(1):29-33.
159. Bragg LE, Thompson JS. Management strategies in the Jehovah's Witness patient. *Contemp Surg* 1990; 36:45-9.

160. Hansen ME, Kadir S. Elective and emergency embolotherapy in children and adolescents. Efficacy and safety. *Radiologe* 1990;30(7):331-6.
161. Appleton DS, Sibley GN, Doyle PT. Internal iliac artery embolisation for the control of severe bladder and prostate haemorrhage. *Br J Urol* 1988;61(1):45-7.
162. Sclafani SJA, Shaftan GW, Scalea TM, et al. Nonoperative salvage of computed tomography-diagnosed splenic injuries: utilization of angiography for triage and embolization for hemostasis. *J Trauma Injury Infect Crit Care* 1995;39(5):818-27.
163. Broaddus WC, Grady MS, Delashaw JB Jr, et al. Preoperative superselective arteriolar embolization: a new approach to enhance resectability of spinal tumors. *Neurosurgery* 1990;27(5): 755-9.
164. Mitty HA, Sterling KM, Alvarez M, et al. Obstetric hemorrhage: prophylactic and emergency arterial catheterization and embolotherapy. *Radiology* 1993 Jul;188(1):183-7.
165. Viñuela F, Canalis RF, Hartz RS, et al. Surgical hemostasis and blood conservation. In: Salem MR, editor. *Blood Conservation in the Surgical Patient*. Baltimore: Williams & Wilkins; 1996. p. 386-424.
166. Seu P, Neelankata G, Csete M, et al. Liver transplantation for fulminant hepatic failure in a Jehovah's Witness. *Clin Transplant* 1996;10(5):404-7.
167. Spence RK, Carson J, Poses R, et al. Elective surgery without transfusion: influence of preoperative hemoglobin level and blood loss on mortality. *Am J Surg* 1990;159(3):320-4.
168. Ishiwata Y, Inomori S, Fujitsu K, et al. A new intracranial silastic encircling clip for hemostasis. *J Neurosurg* 1990;73(4):638-9.
169. Rees M, Plant G, Wells J, et al. One hundred and fifty hepatic resections: evolution of technique towards bloodless surgery. *Br J Surg* 1996;83(11):1526-9.
170. Ward PH, Castro DJ, Ward S. A significant new contribution to radical head and neck surgery. The argon beam coagulator as an effective means of limiting blood loss. *Arch Otolaryngol Head Neck Surg* 1989;115(8):921-3.
171. Dunham CM, Cornwell EE, Militello P. The role of the argon beam coagulator in splenic salvage. *Surg Gynecol Obstet* 1991;173(3):179-82.
172. Kram HB, Ragu CN, Stafford FJ, et al. Fibrin glue achieves hemostasis in patients with coagulation disorders. *Arch Surg* 1989;124:385-87.
173. Radosevich M, Goubran HA, Burnouf T. Fibrin sealant: scientific rationale, production methods, properties, and current clinical use. *Vox Sang* 1997;72(3):133-43.
174. Stehling L. Autologous transfusion. *Int Anesthesiol Clin* 1990 Fall;28(4):190-6.
175. Spain DA, Miller FB, Bergamini TM, et al. Quality assessment of intraoperative blood salvage and autotransfusion. *Am Surg* 1997;63(12):1059-64.
176. Grubbs PE Jr., Marini CP, Fleischer A. Acute hemodilution in an anemic Jehovah's Witness during extensive abdominal wall resection and reconstruction. *Ann Plast Surg* 1989;22(5):448-52.
177. Kafer ER, Collins ML. Acute intraoperative hemodilution and perioperative blood salvage. *Anesthesiol Clin North Am* 1990 Sep;8(3):543-67.
178. Stehling L, Zauder HL, Vertrees R. Alternatives to allogeneic transfusion. In: Petz LD, Swisher SN, Kleinman S, et al, editors. *Clinical Practice of Transfusion Medicine*. 3rd ed. New York: Churchill Livingstone; 1996. p. 539-61.
179. Erath MH, Oliver WC Jr, Santrach PJ. Intraoperative techniques to conserve autologous blood: red-cell salvage, platelet-rich plasma, and acute normovolemic hemodilution. In: Spiess BD, Counts RB, Gould SA, editors. *Perioperative Transfusion Medicine*. Baltimore: Williams & Wilkins; 1998. p. 325-50.
180. Petrozza PH. Induced hypotension. *Int Anesthesiol Clin* 1990 Fall;28(4):223-9.
181. Salem MR, Manley S. Blood conservation techniques. In: Salem MR, editor. *Blood Conservation in the Surgical Patient*. Baltimore: Williams & Wilkins; 1996. p. 92-106.

Notes



HOSPITAL INFORMATION SERVICES (BRITAIN)

for Jehovah's Witnesses

IBSA House, The Ridgeway

London NW7 1RN

Tel: 020 8906 2211 (24-hour)

Fax: 020 8349 4545

e-mail: his@wtbts.org.uk