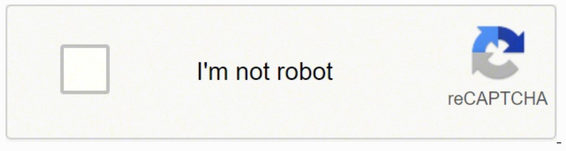

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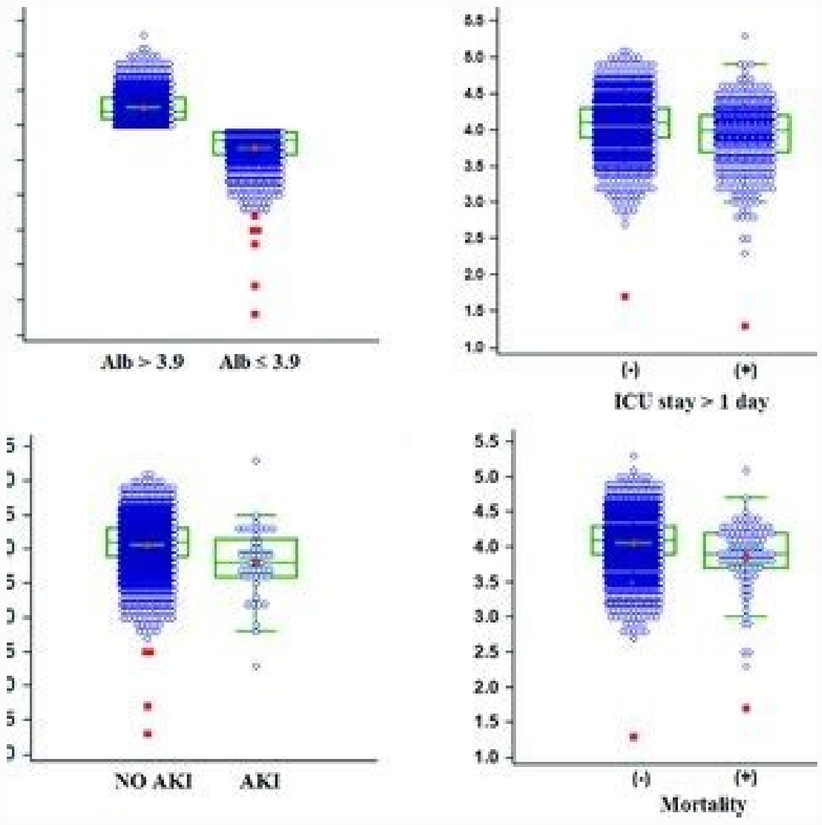

Effects of saline or albumin resuscitation on standard coagulation tests

Rinaldo Bellomo, Hiroshi Morimatsu, Jeff Presneill, Craig French, Louise Cole, David Story, Shigehiko Uchino, Toshio Naka, Simon Finfer, D James Cooper and John Myburgh, on behalf of the SAFE Study Investigators and the Australian and New Zealand Intensive Care Society Clinical Trials Group

ABSTRACT

Aims: To explore whether fluid resuscitation with normal saline or 4% albumin is associated with differential changes in routine clinical coagulation tests.

Design: Substudy from a large double-blind randomised controlled trial, the SAFE (Saline versus Albumin Fluid Evaluation) study.

Setting: Three general intensive care units.

Patients: Cohort of 687 critically ill patients.

Intervention: We randomly allocated patients to receive either 4% human albumin or normal saline for fluid resuscitation, and collected demographic and haematological data.

Methods and main results: Albumin was administered to 338 patients and saline to 349. At baseline, the two groups had similar mean activated partial thromboplastin time (APTT) of 37.2 s (albumin) v 39.1 s (saline); mean international normalised ratio (INR) of 1.38 v 1.34, and mean platelet count of 244 × 10⁹/L v 249 × 10⁹/L. After randomisation, during the first day of treatment, the APTT in the albumin group was prolonged by a mean of 2.7 s, but shortened slightly by a mean of −0.9 s in the saline group. The INR did not change in either group, while the platelet count decreased transiently in both groups. Using multivariate analysis of covariance to account for baseline coagulation status, albumin fluid resuscitation ($P = 0.01$) and a greater overall volume of resuscitation ($P = 0.03$) were independently associated with prolongation of APTT during the first day.

Conclusions: Administration of albumin or of larger fluid volumes is associated with a prolongation of APTT. In ICU patients, the choice and amount of resuscitation fluid may affect a routinely used coagulation test.

Crit Care Resusc 2009; 11: 250–256

Fluid resuscitation is common in critically ill patients.[1,2] However, there is uncertainty about which fluid should be preferentially administered. To examine the effects of choice of fluid resuscitation on clinical outcome, the SAFE (Saline versus Albumin Fluid Evaluation) study randomly allocated 6997 critically ill patients to receive either 4% albumin or normal saline.[3,4] No specific information was collected as part of this study to investigate the effect of choice of fluid resuscitation on routine measures of blood coagulation, such as international normalised ratio (INR), activated partial thromboplastin time (APTT) or platelet count. However, it has been suggested that fluid resuscitation may cause dilutional coagulopathy,[5-13] and that the effect may be greater with albumin than with saline.[3] Accordingly, in three of the trial hospitals, we conducted a pre-planned substudy of the coagulation results from SAFE study patients, to assess the differential effects of albumin and saline on routinely measured tests of coagulation. We hypothesised that patients resuscitated with albumin have higher INR, prolonged APTT, and lower platelet counts than patients resuscitated with saline.

Methods

This study was designed to extend knowledge derived from the 2004 SAFE study.[3] The SAFE study was a prospective, double-blind, randomised controlled trial in which 6997 patients requiring fluid resuscitation were randomly allocated to receive either saline or albumin for all fluid resuscitation in the ICU for up to 28 days.[3] As part of the original SAFE study, three of the 16 SAFE study hospitals collected additional coagulation data for the current analysis, with the approval of the ethics committee of each hospital and informed consent from patients or their next-of-kin. Data on coagulation variables were collected prospectively until the earlier of ICU discharge or the 5th study day. They included results of three daily tests performed as part of standard patient care — platelet count, APTT and INR. Baseline pre-randomisation values were taken as the coagulation results temporally closest to, but preceding, the time of randomisation in the SAFE study by not more than 6 hours.

Measurements of coagulation

APTT, INR and platelet counts were measured in the central laboratories of all three hospitals as part of standard care. APTT was measured at Hospital A using a Platelin LS reagent from BioMerieux, containing purified phospholipids

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自己アルブミン製剤としての濾過濃縮腹水の有効性

槍澤　大樹[1]　小林　良輔[1]　磯合　綾子[2]　小野寺博和[1]　松野　義弘[2]
加藤　道夫[3]　菅野　仁[1]

難治性腹水に対して，自己腹水中のアルブミンを回収し，経静脈性に投与する方法は，腹水濾過濃縮再静注法（Cell-free and Concentrated Ascites Reinfusion Therapy：CART）として既に 30 年近くの臨床実績があるが，今回我々は CART を施行した 147 例について前方視的に調査を行った．特に腹水中のアルブミンに着目して，アルブミン製剤としての濾過濃縮腹水の有用性と問題点について考察した．回収されたアルブミン量は滲出性腹水で 66.5g，漏出性腹水で 31.1g であり，濾過濃縮された腹水製剤の投与により，漏出性では血清総蛋白 0.5g/dl，アルブミン 0.3g/dl，滲出性では血清総蛋白 1.1g/dl，アルブミン 0.7g/dl と有意な上昇を示した．肝硬変による難治性腹水（胸水）症に伴う低アルブミン血症に対して，高張アルブミン製剤の投与が推奨されているが，我が国のアルブミンの国内自給率は 50% 前後と低く，自己腹水中アルブミンの有効な利用法として，CART はアルブミン製剤の使用量削減に貢献すると考えられた．

キーワード：腹水，胸水，腹水濾過濃縮再静注法，アルブミン

イントロダクション

肝硬変や悪性腫瘍などによる難治性腹水に対してはループ利尿剤や抗アルドステロン剤などが使用されるが，利尿剤抵抗性の腹水では治療に難渋することも多い[1]．大量に貯留した腹水を廃液することにより，アルブミンをはじめとした多くのタンパク質が失われ，さらなる腹水貯留を招くことから，厚生労働省による『血液製剤の使用指針（改訂版）』では高張アルブミン製剤の使用が考慮されている[2]．1l の腹水あたり 8～10g のアルブミン投与が大量（4l 以上）の腹水廃液に伴う腎障害，低ナトリウム血症，循環不全等の予防に有効であり，予後の改善にも繋がることが示された[3]．

腹水濾過濃縮再静注法（Cell-free and Concentrated Ascites Reinfusion Therapy：CART）は，腹水症（又は胸水症）患者の腹水（又は胸水）を採取し，濾過濃縮後に再静注する治療法であり，1977 年に旭化成メディカル社で開発され，1981 年の保険収載以来 30 年以上広く実施されている．今日では「肝硬変診療ガイドライン（日本消化器病学会編）」，「慢性肝炎の治療ガイド（日本肝臓学会編）」，厚生労働省の「重篤副作用疾患別対応マニュアル：卵巣過剰刺激症候群（OHSS）」などに CART が推奨されるに至っている．

従来，CART による治療効果は腹水中のアルブミンによる血中膠質浸透圧の維持によるものと考えられてきたが[2]，現在では濾過濃縮腹水中のアルブミンが血管壁の内腔側の血管内皮糖衣（Endothelial glycocalyx）の層と血管内皮細胞表面（endothelial surface layer）を形成することで血管外に水が漏出することを防ぐ効果があることがわかってきている[3]．

我々の施設では濾過濃縮腹水を「自己腹水アルブミン製剤」として捉え，輸血部門による一括管理体制を構築し，電子カルテによるオーダーシステム，バーコードシステムによる製剤管理と取り違え防止，エンドトキシンや遺離ヘモグロビンの供給前検査などを行ない，安全性と品質管理の徹底を図っている[4]．

CART の安全性と有効性については肝硬変症に伴う難治性腹水に対して評価・報告が行われてきた．最近我々は，近年適応症例が著明な増加を示しているがん性腹水患者を多数含む CART 症例の安全性と有効性を評価するための市販後調査を実施した．22 施設による 147 例，356 回の CART について検討し，その結果を報告した[5]．採取された腹水の平均量は 3.7l であり，平均濃縮比は 9.2 であった．再静注されたタンパク質の平均量は 67.8g（回収率 72.0%）であった．CART 後の末国

1）東京女子医科大学輸血・細胞プロセシング科
2）旭化成メディカル株式会社血液浄化事業部
3）加藤道夫肝臓内科クリニック
〔受付日：2018 年 1 月 29 日，受理日：2018 年 5 月 13 日〕

JEHOVAH'S WITNESSES
MEDICAL ALTERNATIVES TO BLOOD

1. NOT ACCEPTABLE

- ✓ *Whole Blood*
- ✓ *Packed Red Blood Cells*
- ✓ *Plasma*
- ✓ *White Blood Cells*
- ✓ *Platelets*
- ✓ *Autotransfusion of predeposited blood*
- ✓ *Any technique that involves blood storage*

2. ACCEPTABLE ALTERNATIVES

Blood-Oxygen Monitoring Devices:
- ✓ Transcutaneous Pulse Oximeter
- ✓ Pediatric ultra-microsampling equipment
- ✓ Multiple tests per blood draw [batching]

Hematopoietic Agents:
- ✓ Iron Dextran (Ferrlecit, Infed, Verofer *(IV-form)*)
- ✓ Folic Acid
- ✓ Vitamin B-12
- ✓ Vitamin C
- ✓ Granulocyte-Colony Stimulating Factor (*Neupogen*)
- ✓ Granulocyte Macrophage Colony Stimulating Factor
- ✓ Interleukin-II (*Neumega*)
- ✓ Antibolic Androgenic Hormones
- ✓ Recombinant Stem-Cell Factor (*Stemgen*)

Hemostatic Agents to Promote Clotting:
- ✓ Topical: Avitene, Gelfoam, Oxycel, Surgicel
- ✓ Injectable: Desmopressin (*DDAVP*), e-aminocaproic acid (*Amicar*), Tranexamic acid (*Cyklokapron*), Vasopressin (*Pitressin*), conjugated estrogens, Aprotinin (*Trasylol*), Vincristine (*Oncovin*), Vitamin K (*Phytonadione*)

Operative & Anesthetic Techniques for Surgery:
- ✓ Hypotensive Anesthesia
- ✓ Induced Hypothermia
- ✓ Mechanical occlusion of bleeding vessel

Oxygen Therapy:
- ✓ Hyperbaric Oxygen
- ✓ Perfluorocarbon Solutions

Recombinant Antihemophilic Factors:
- ✓ Recombinant Factor VIIa (*NovoSeven*)®
- ✓ Recombinant Factor VIII (*ReFacto*)
- ✓ Recombinant Factor IX (*BeneFIX*)

Surgical Devices & Techniques:
- ✓ Electrocautery
- ✓ Laser Surgery
- ✓ Argon Beam Coagulator
- ✓ Gamma Knife Radiosurgery
- ✓ Microwave Coagulating Scalpel
- ✓ Endoscope
- ✓ Arterial Embolization
- ✓ Ultrasonic Scalpels
- ✓ Cryosurgery
- ✓ Minimally Invasive Surgery

Volume Expanders:
- ✓ Crystalloids: Ringers' Lactate, Normal and Hypertonic Saline
- ✓ Colloids: Dextran, Gelatin, Hetastarch, (*Hespan, Hextend, Pentastarch*)

Important note: All product names listed here are for identification purposes only. This sheet does not constitute an endorsement or prohibition.

3. PERSONAL DECISION

Medical Products & Therapy:
- ✓ Albumin
- ✓ Cryoprecipitate (contains small amt. of plasma)
- ✓ EPO- Erythropoietin (contains small amt. of albumin)
- ✓ Hemoglobin-based blood substitutes
- ✓ Hemophiliac preparations (non-synthetic)
- ✓ Immune Globulins
- ✓ Interferon (natural & synthetic buffered with albumin)
- ✓ Organ transplants and donations
- ✓ Plasma Protein Fraction (*Plasmanate*)
- ✓ Tissue adhesives
- ✓ Wound healing factors (platelet deriv

Medical Test:
- ✓ Red & white blood cell tagging

Recombinant Antihemophilic Factors:
- ✓ Recombinant Factor VIII (*Kogenate* - small amt. of albumin)

Surgical Procedures *(non-blood primed & no storage):*
- ✓ Dialysis & heart-lung equipment
- ✓ Hemodilution
- ✓ Intraoperative & postoperative blood salvage (*cell saver*)
- ✓ Therapeutic Ap[illegible]resis

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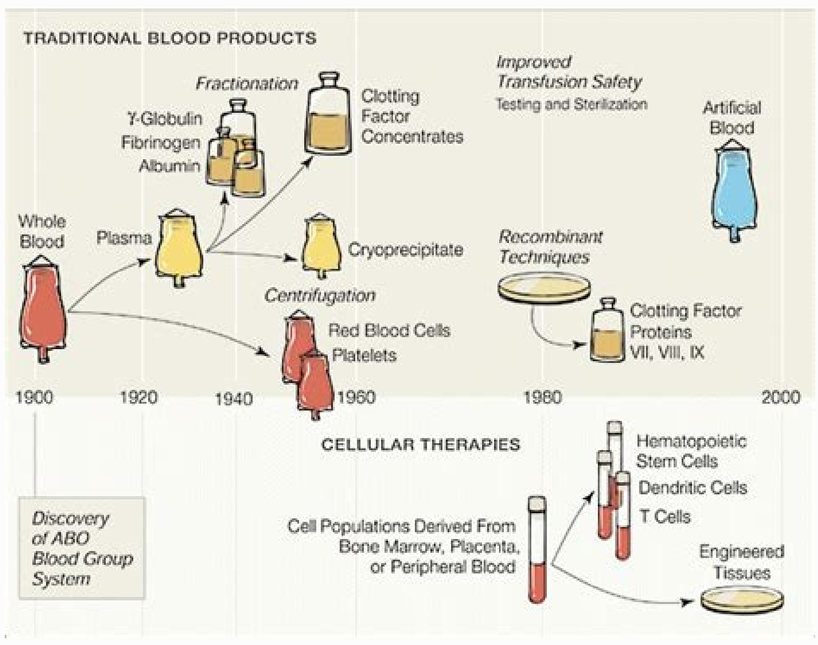

Albumin transfusion side effects. Albumin transfusion dog. Albumin transfusion icd 9. Albumin transfusion reaction. Albumin transfusion in nephrotic syndrome. Albumin transfusion time. Albumin transfusion dog cost. Albumin transfusion in neonates.

. . There is no strong evidence to support the use of albumin in the following: Cardiac surgery; Volume resuscitation for hypovolemia; Cerebral ischemia / hypovolemic brain injury; Hypoalbuminemia; Hypotension during dialysis therapy. Published, 1995. McConachie I, McIntyre L, Cook DR, Callum J, Murto K, Dickie S, Arellano R, Trifunov R. Schierhout G, Roberts I. Human Albumin Administration in Critically Ill Patients: Systematic Review of Randomised Controlled Trials. It is a highly soluble molecule that is negatively charged overall but is capable of binding to both cations and anions. Annane D, Siami S, Jaber S, Martin C, Elatrous S, Descorps Declère A, Preiser JC, Outin H, Troché G, Charpentier C, Trouillet JL, Kimmoun A, Forceville X, Darmon M, Lesur O, Reignier J, Abroug F, Berger P, Clec'h C, Cousson J, Thibault L, Chevret S, for the CRISTAL Investigators. JAMA 2013; 310: 1809-17. N Engl J Med 2014; 370: 1412-21. . Efficacy and safety of albumin Albumin purified from human plasma has been used as a therapeutic agent since the 1940s, despite ongoing controversy regarding its efficacy and safety compared with other colloids and crystalloids. Dart AB, Mutter TC, Ruth CA, Taback SP. Alternatives to albumin Alternatives to albumin therapy include other colloid solutions and crystalloids. . A multinational RCT in 2013, the Colloids Versus Crystalloids for the Resuscitation of the Critically Ill (CRISTAL) trial, found no significant difference in 28 day mortality of ICU patients with hypovolemia who were treated with colloids (including albumin) versus crystalloids (relative risk, RR, 0.96; 95% confidence interval, CI, 0.88–1.04).4 In the Albumin Italian Outcome Sepsis (ALBIOS) study, the addition of albumin to crystalloid therapy in severe sepsis/septic shock did not alter 28 day mortality in 1,818 patients (RR 1.0; 95% CI 0.85-1.05).5 A 2013 Cochrane systematic review showed again that albumin had no benefit or harm compared to crystalloids for fluid resuscitation in critically ill (trauma, burns and postoperative) patients; the pooled RR for death with albumin was 1.01 (95% CI 0.93–1.10).6 This review did find, however, that one type of colloid, hydroxyethyl starch (HES), may contribute to an increased risk of death (RR 1.10; 95% CI 1.02–1.19). Colloids differ from crystalloids in that they have an increased ability to hold water in the intravascular compartment. Monitoring of patients for circulatory overload and hyperhydration is recommended with 25% albumin infusions. Caironi P, Tognoni G, Masson S, Fumagalli R, Pesenti A, Romero M, Fanizza C, Caspani L, Faenza S, Grasselli G, Iapichino G, Antonelli M, Parrini V, Fiore G, Latini R, Gattinoni L, Investigators AS. Hepatology 2012; 55: 1172-81. . University Hospital Consortium. Several hormones can increase the body's ability to synthesize albumin, but malnutrition, stress, medications and aging may all decrease production. In Canada, albumin is supplied as a human-derived plasma protein product that is a sterile, latex-free solution with a physiologic pH and a sodium concentration of 130–160 mmol per litre. . Generally, plasma volume-expanding therapeutic agents used clinically can be classified into three broad categories: crystalloid colloid (e.g. albumin) hypertonic solutions (as alternatives to 25% albumin). Albumin is compatible with standard electrolyte and carbohydrate IV solutions such as normal saline, Ringer's lactate, PlasmaLyte and D5W, but should not be co-infused with solutions containing alcohol or protein hydrolysates. Storage and transportation See Table 1 for storage temperatures for the various albumin preparations available through Canadian Blood Services. If there is normal membrane permeability, colloids do not enter interstitial or intracellular compartments and may preferentially increase plasma volume. Albumin must not be diluted with hypotonic solutions such as sterile water for injection, as it may lead to severe hemolysis. Two Canadian (British Columbia and Ontario) recommendations are published on the respective provincial websites.14, 15 These recommendations differ slightly but agree that albumin would generally be indicated in the following situations: 25% albumin preparations: Patients with liver disease and bacterial peritonitis; Large volume (>5 litre) paracentesis in cirrhotic patients; Hepatorenal syndrome type 1. N Engl J Med 1999; 341: 403-9. Stabilizers are present but preservatives are not commonly included. 20guidelines_final_20120821.pdf. The disadvantages of crystalloids are primarily seen in situations requiring large volumes for clinical resuscitation, which may lead to peripheral and pulmonary edema, and a potential for hyperchloremia in patients with renal dysfunction. Therefore, 25% albumin is the product of choice if the patient has an oncotic deficit, whereas 5% albumin is used for therapeutic plasmapheresis or conditions associated with volume deficit alone. Transfusion Medicine Advisory Group (TMAG). Albumin is typically available in two concentrations: 5% and 25%. Five percent albumin is isosmotic with plasma but 25% albumin is hyperoncotic and is roughly equivalent to a plasma volume four- to five-fold higher than the infused volume. It has a molecular weight of approximately 67 kilodaltons with a low serum viscosity. Sort P, Navasa M, Arroyo V, Aldeguer X, Planas R, Ruiz-del-Arbol L, Castells L, Vargas V, Soriano G, Guevara M, Gines P, Rodes J. Voluven and Volulyte (Hydroxyethyl Starch (Hes))- Increased Mortality and Severe Renal Injury - Notice to Hospitals. Infusions of Albumin Increase Free Fraction of Naproxen in Healthy Volunteers: A Randomized Crossover Study. Cochrane Database Syst Rev 2013; 2: CD000567. Guidelines for Use of Albumin_ Adapted from the Original Published Guidelines Developed by the University Hospital Consortium and Published in Archives of Internal Medicine, Vol 155, Feb 27, 1995. Hydroxyethyl Starch (Hes) Versus Other Fluid Therapies: Effects on Kidney Function. Fluid Resuscitation with Colloid or Crystalloid Solutions in Critically Ill Patients: A Systematic Review of Randomised Trials. If you have questions about the Clinical Guide to Transfusion or suggestions for improvement, please contact us through the Feedback form. Acta Anaesthesiol Scand 2010; 54: 430-4. Hepatology 2002; 36: 941-8. Colloids Versus Crystalloids for Fluid Resuscitation in Critically Ill Patients. . Since the SAFE trial found that albumin was neither helpful nor harmful, clinicians on both sides of the albumin argument have used this study to support their point of view. The reading of one chapter is equivalent to two credits. Effects of Fluid Resuscitation with Colloids Vs Crystalloids on Mortality in Critically Ill Patients Presenting with Hypovolemic Shock: The Cristal Randomized Trial. Industrial Stabilizers Caprylate and N-Acetyltryptophanate Reduce the Efficacy of Albumin in Liver Patients. Guidelines for Albumin Use for Adults in British Columbia. . . Although other colloids such as HES products are cheaper than albumin, they may be associated with increased side effects.16 In 2013, a Health Canada advisory was issued advising clinicians that increased mortality, renal injury and liver failure have been associated with the use of HES solutions and that HES solutions are now contraindicated in patients with sepsis, severe liver disease or renal impairment with oliguria and anuria, not related to hypovolemia.17 Continuing professional development credits Fellows and health-care professionals who participate in the Canadian Royal College's Maintenance of Certification (MOC) Program can claim the reading of the Clinical Guide to Transfusion as a continuing professional development (CPD) activity under Section 2: Self-learning credit. Contraindications Albumin is contraindicated in: Patients who would not tolerate a rapid increase in circulating blood volume. Stange J, Stiffel M, Goetze A, Strube S, Gruenert J, Klammt S, Mitzner S, Koball S, Liebe S, Reisinger E. Hepatology 2015; 62: 567-74. Indications In 1995, the University Hospital Consortium in the United States developed the first consensus statement on indications for albumin use.13 Many jurisdictions still use these indications, but based on recent systematic reviews including those discussed above, some newer guidelines limit the use of this product to volume replacement in hypovolemic shock. Patients with a history of an allergic reaction to albumin. N Engl J Med 2004; 350: 2247-56. Many research publications and systematic reviews have attempted to resolve this controversy. Liver Transpl 2011; 17: 705-9. BC Provincial Blood Coordinating Office, BC Ministry of Health, 2007. . Bernardi M, Caraceni P, Navickis RJ, Wilkes MM. Subgroup analyses of the SAFE trial did not demonstrate benefit in the infusion of albumin in hypoalbuminemic patients. The product should not be administered if it is expired or if: the solution has been frozen or otherwise stored under inappropriate conditions; the solution is turbid or contains particulate material (e.g. glass or cork); or the solution vials are damaged. There are some concerns for certain patient populations regarding the osmolality, sodium content, pH and the product stabilizers (caprylate, N-acetyltryptophanate and aluminum).11, 12 Product description Human albumin is prepared from donated plasma using a process called fractionation. Reine PA, Kongsgaard UE, Andersen A, Thogersen AK, Olsen H. Effect of Intravenous Albumin on Renal Impairment and Mortality in Patients with Cirrhosis and Spontaneous Bacterial Peritonitis. . Serum albumin is the most abundant protein in the plasma. Viral inactivation processes occur during the fractionation process. Once opened, the vial of albumin should be discarded if not infused within four hours. BMJ 1998; 316: 961-4. Serum albumin is synthesized in the liver at a rate of approximately 16 g per day in a healthy adult. However, the infusion rates for 5% albumin solutions should not exceed 5 ml per minute whereas the rate for 25% albumin, because of its hyperosmotic nature, should not exceed 1-2 ml per minute. Albumin Infusion in Patients Undergoing Large-Volume Paracentesis: A Meta-Analysis of Randomized Trials. Suggested albumin doses are indicated in Table 2. Table 2: Suggested doses for indicated uses of 25% albumin.8 Indication Dose Large volume paracentesis > 5 litres in cirrhotic patients 6-8 g of albumin per litre of fluid removed Spontaneous bacterial peritonitis (non-malignant) Day 1: 1.5 g/kg Day 3: 1 g/kg Hepatorenal syndrome type 1 (acute onset)* *administered with vasoactive agents (e.g. terlipressin) Day 1: 1 g/kg Days 2–14: 100–200 ml/day Infusion is through a standard vented intravenous (IV) set. Acknowledgements The authors, Gwen Clarke and Matthew Yan, acknowledge Susan Nahirniak, MD, FRCPC, as the author of a previous version of this chapter. Finfer S, Bellomo R, Boyce N, French J, Myburgh J, Norton R. Cochrane Database Syst Rev 2010: CD007594. Ontario Albumin Administration Recommendations. Cavallin M, Kamath PS, Merli M, Fasolato S, Toniutto P, Salerno F, Bernardi M, Romanelli RG, Colletta C, Salinas F, Di Giacomo A, Ridola L, Fornasiere E, Caraceni P, Morando F, Piano S, Gatta A, Angeli P. See Table 1 for a list of albumin preparations available through Canadian Blood Services. Generally, one gram of albumin attracts 18 ml of water by its oncotic activity; thus, an infusion of 25 g of albumin expands the plasma volume by 450 ml. A Comparison of Albumin and Saline for Fluid Resuscitation in the Intensive Care Unit. This pressure is important for maintaining appropriate levels of water in the circulatory system. In patients with liver dysfunction, a meta-analysis has shown a benefit for albumin following large-volume paracentesis; albumin treatment reduced postparacentesis circulatory dysfunction (odds ratio, OR, 0.39; 95% CI 0.27–0.55), hyponatremia (OR 0.58; 95% CI 0.39–0.87) and mortality (OR 0.64; 95% CI 0.41–0.98) relative to treatment with other colloids.7 Smaller prospective studies have also suggested the potential benefit of albumin in cirrhotic patients with spontaneous bacterial peritonitis,8 as well as in patients with hepatorenal syndrome in conjunction with terlipressin.9,10 Side effects specific to albumin include a very rare risk of anaphylaxis. The most common crystalloids in clinical use are normal saline, PlasmaLyte and Ringer's lactate. Serum albumin is responsible for about 80% of the total plasma oncotic pressure (also known as colloid osmotic pressure). Terlipressin Therapy with and without Albumin for Patients with Hepatorenal Syndrome: Results of a Prospective, Nonrandomized Study. The advantages of crystalloid therapy over most colloid solutions include decreased expense, increased urine output and a simpler chemical structure that is easily metabolized and excreted. References Cochrane Injuries Group Albumin Reviewers. Serum albumin is lost at a rate of 12 g per 500 ml of blood lost; thus, in the setting of a four-unit hemorrhage, the albumin lost will be entirely replaced by normal synthesis in three days. The shelf life ranges from two to five years depending on the manufacturing process. Terlipressin Plus Albumin Versus Midodrine and Octreotide Plus Albumin in the Treatment of Hepatorenal Syndrome: A Randomized Trial. Ontario Regional Blood Coordinating Network, 2012. . There have been no reports of human immunodeficiency virus (HIV), hepatitis or other viral transmission at the time of writing, but a theoretical risk of variant Creutzfeldt-Jakob disease (vCJD) transmission exists. Health Canada, Government of Canada, 2013. South Australian Neonatal Medication Guidelines - Albumin Human Albumin 40g/L (Albumex® 4%) 200g/L (Albumex® 20%) Download This chapter describes when and how to use the plasma protein product albumin and introduces therapeutic alternatives to albumin. 5% albumin preparations: Therapeutic plasma exchange; Thermal injury involving >50% total body surface area, if unresponsive to crystalloid. Two meta-analyses in the late 1990s indicated that albumin use for the treatment of hypovolemia, burns, or hypoalbuminemia was associated with an increase in mortality.1,2 However, the studies examined were small and involved heterogeneous patient populations. Table 1: Albumin preparations available through Canadian Blood Services* Product name Vial sizes Supplier Storage Stabilizers and buffers pH and sodium (Na) Plasbumin® / Albumin 5% 50 ml, 250 ml Grifols 2 to 30°C Sodium caprylate, acetyltryptophan, sodium carbonate Na content = 145 mEq/L Plasbumin® / Albumin 25% 100 ml Alburex® 5% 250 ml, 500 ml CSL Behring 2 to 30°C Sodium caprylate, acetyltryptophan, sodium carbonate pH range = 6.4–7.4 Na content = 3.2 mg/ml Alburex® 25% 50 ml, 100 ml *For ongoing updates, please refer to the complete table of plasma protein products at blood.ca. Albumin Replacement in Patients with Severe Sepsis or Septic Shock. Normal albumin solutions are clear, slightly viscous fluids that range in colour from almost colorless to pale yellow, amber or green. . Dose and administration The volume and rate of infusion should be determined by the clinical situation. Ortega R, Gines P, Uriz J, Cardenas A, Calahorra B, De Las Heras D, Guevara M, Bataller R, Jimenez W, Arroyo V, Rodes J. Perel P, Roberts I, Ker K. BMJ 1998; 317: 235-40. In 2004, a large randomized controlled trial (RCT) in 6,997 Australian intensive care unit (ICU) patients undergoing fluid resuscitation, the Saline versus Albumin Fluid Evaluation (SAFE) trial, showed no difference in mortality between 4% albumin and saline.3 There were also no significant differences between albumin and saline when days in ICU, days in hospital, days on a ventilator, or multi-organ failure were assessed. An expiry date is stated on each package and the expiration date of each unit should be checked prior to administration. In addition to albumin, colloids currently available in Canada for therapeutic use include: Dextrans (D40, D70) Gelatins (haemaccel) Hydroxyethyl starches (HESs) (Volulyte®, Voluven® and Hextend) Potential disadvantages with colloid therapy include: cost, with colloids significantly more expensive than crystalloids; decreased recipient hemoglobin concentration following infusion; dilution of plasma proteins including coagulation factors; and circulatory overload.

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