Our Sincere Appreciation to the Working Group

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- Mr. Rick Trifunov, Director Plasma Products and Services, Canadian Blood Services
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- Dr. Morris Blajchman, Professor Emeritus Division of Hematology and Thromboembolism, Department of Medicine, McMaster University, Medical Director Canadian Blood Services, Hamilton Centre, Editor Transfusion Medicine Reviews
- Dr. Nadine Shehata, Assistant Professor, Division of Hematology, University of Toronto (Mount Sinai Hospital), Associate Medical Director Canadian Blood Services
- Dr. Doron Shmorgun, Assistant Professor, Division of Reproductive Medicine, Department of Obstetrics and Gynecology, University of Ottawa
- Dr. Carl Laskin, Co-Medical Director, LifeQuest Centre for Reproductive Medicine, Toronto ON

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Ontario Albumin Administration Recommendations

These albumin administration recommendations are offered as a possible treatment choice for some of the more common uses listed in this document. For many of these indications, albumin is not the sole treatment option. It is often used in conjunction with other substances, and in some situations, other treatment options may be considered before administering albumin. Although albumin is a relatively safe human blood product, it should be prescribed with caution. The reasons are two-fold: it is derived from human plasma and therefore carries some of the inherent risks associated with blood products and it is more costly when compared to crystalloids.

Albumin preparations are available in 5% and 25% preparations. The 5% solution has the same oncotic pressure as plasma and its uses are quite different than the hyperoncotic 25% solution. Therefore, this document is divided into 25% albumin indications and conditions treated with 5% albumin. These two solutions are very different in their scopes of use and are not interchangeable.

**Note:** There is a complete reference list at the end of this document. The reference content was abbreviated within the recommendation table in order to maintain a concise, user friendly format.

**Disclaimer:** The Ontario Albumin Administration Recommendations are not intended to replace sound clinical judgment concerning a patient’s unique situation. No formal monitoring of albumin use in Ontario is being implemented at this time. Furthermore, although the advice and information contained in this document is believed to be true and accurate at the time of going to press, neither the authors nor the publishers can accept any legal responsibility for any errors or omissions that may have occurred.
# 25% Albumin Administration Indications

## A. Liver Disease

<table>
<thead>
<tr>
<th>Indication</th>
<th>Details</th>
<th>Suggested Dose</th>
<th>References/Other Information</th>
</tr>
</thead>
</table>
| Hepatorenal syndrome type 1 (acute onset) | Eligible for liver transplant in conjunction with vasoactive drugs. Consider terlipressin | Day 1: 1g/kg Days 2-14: 100 – 200 mL/day | 1. Sanyal AJ et al. Gastroent 2008;134:1360-1368. “Terlipressin is an effective treatment to improve renal function in HRS type 1”  
4. Gluud LL et al. Cochr DB of Sys Rev 2006;4: CD005162. Cautions that although sample size is small, terlipressin may reduce mortality and improve renal function  
5. Sagi SV et al. JGH 2010;25:880-885. “Terlipressin is effective in reversing HRS type 1” |
| Spontaneous bacterial peritonitis | All patients, in conjunction with antibiotics                            | Day 1: 1.5g/kg Day 3: 1g/kg       | 6. Nazar A et al. J Hepatol 2009; 50:586 “The administration of albumin prevents renal failure, improves survival in patients with cirrhosis and spontaneous bacterial peritonitis”  
7. Sort P et al. NEJM 1999; 341(6):403-409 “In patients with cirrhosis and spontaneous bacterial peritonitis, treatment with intravenous albumin in addition to an antibiotic reduces the incidence of renal impairment and death in comparison with treatment with an antibiotic alone”  
8. Sigal SH et al. Gut 2007; 56(4): 597–599 Patients with a bilirubin greater than 68.4 umol/L and/or a creatinine greater than 88.4 umol/L, albumin may be of benefit |
## 25% ALBUMIN ADMINISTRATION INDICATIONS

<table>
<thead>
<tr>
<th>Indication</th>
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</table>
10. Lata J et al. Hepato-Gastroenterology 2007; 54:1930-1933. “…terlipressin...was as effective as IV albumin in preventing hemodynamic changes in patients with tense ascites treated by paracentesis. The treatment was well tolerated”  
12. Alves de Mattos A. Annals of Hepat 2011;10:S15-S20. Albumin is the treatment of choice for tense or refractory ascites when large volume paracentesis are performed  
10. Lata J et al. Hepato-Gastroenterology 2007; 54:1930-1933. “…terlipressin...was as effective as IV albumin in preventing hemodynamic changes in patients with tense ascites treated by paracentesis. The treatment was well tolerated”  
12. Alves de Mattos A. Annals of Hepat 2011;10:S15-S20. Albumin is the treatment of choice for tense or refractory ascites when large volume paracentesis are performed  
| Post liver transplant                                | Abide by hepatorenal and paracentesis guidelines                        | See above guidelines | See above references and information                                                                                                                                                                                                                                                   |
## 25% Albumin Administration Indications

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</table>
| Hypotension during dialysis             | These are some other options: saline infusions, adjust antihypertensives, caffeine midodrine, extend dialysis duration | 100 mL each episode of dialysis                    | 14. Knoll GA et al.  J Am Soc Nephrol 2004; 15:487-492. Saline just as effective as albumin  
| Nephrotic syndrome                      | NOT routinely used                                                      | NOT routinely used                                  | No albumin treatment indications found                                                       |
| Cardiopulmonary bypass                  | NOT routinely used                                                      | NOT routinely used                                  | 25% albumin preparations are not routinely used for bypass. See 5% albumin section            |
| Ovarian hyperstimulation syndrome (OHS)-prevention | NOT routinely used Consider cabergoline                                 | NOT routinely used                                  | 16. Youssef MAFM et al. Cochr BD of Systematic Reviews 2011; 2:CD001302. Little evidence of albumin preventing OHS although starch products decrease the severe OHS occurrences  
17. Jee BC et al. Gynecol Obstet Invest 2010;70:47-54. Albumin does not prevent OHS and may decrease pregnancy rate  

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**B. Renal Disease**

**C. Cardiac**

**D. Maternal/Obstetrical**
### 25% Albumin Administration Indications

#### D. Maternal/Obstetrical (continued)

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#### E. Pulmonary

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#### F. Pediatric

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<th>Suggested Dose</th>
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</thead>
<tbody>
<tr>
<td>Chronic PICU patients with hypoalbuminemia and edema</td>
<td>May be considered</td>
<td>3-4 mL/kg, once or twice a day</td>
<td>No good published data, but it is common practice throughout Canada with anecdotal positive outcomes</td>
</tr>
</tbody>
</table>
5% Albumin

### F. Intensive Care Patients

<table>
<thead>
<tr>
<th>Indication</th>
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</table>
| Burns/thermal injuries      | Use only for burns with greater than 50% BSA (body surface area) when unresponsive to crystalloid. After 24 hrs: Maintain albumin conc. of 2.5 +/- 0.5g/100 mL or a total serum protein level of 5.2g/100mL | All infusion days: 0.3-0.5 mL/kg/BSA, usually 50-100 mL/hour or 1-2 mL/min | 25. Cooper A et al. Transfusion 2006; 46:80-89 “Treatment with 5% albumin from Day 0 to Day 14 does not decrease the burden of MODS in adult burn patients”. Ringers’ lactate is equally effective  
27. Faraklas I et al. J Burn Care & Research 2011;32:91-97. Albumin patients have longer hospital stays and took longer to resuscitate. However this patient group had larger and more severe injuries. Recommends further studies.  
# 5% Albumin Administration Indications

<table>
<thead>
<tr>
<th>Indication</th>
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<tbody>
<tr>
<td>Cardiac bypass, circuit priming</td>
<td>Possibly, depending on circuits used. Also institution/patient population specific NOTE: some reports indicate the use of 20-25% albumin for this purpose. However, it is diluted with non-colloid solutions to approximately 5%</td>
<td>Pediatric: weight dependent Adult: 1200 – 2000 mL</td>
<td>29. Wilkes MM et al. Ann Thorac Surg 2001;721:527-534 “Postoperative blood loss is significantly lower in cardiopulmonary bypass patients exposed to albumin than HES” 30. Riegger LQ et al. Crit Care Med 2002;30: 2649-2654. 5% albumin prime may reduce wait gain by attenuating the decrease in COP and serum albumin levels in young children after CPB. Transfusion rate may increase. Further study required. 31. Tomi T et al. Anesth Analg 2006; 102:998-1006 “The greatest impairment in hemostasis was seen after hydroxyethyl starch administration, whereas albumin appeared to have the least effect on hemostatic variables” 32. Ernest D et al. Crit Care Med 2001; 29:2299-2302 “In post-op cardiac surgical patients, infusion of 5% albumin is approx. 5X as efficient as a PV expander” but is comparable to saline with effects on changes in ISFV and oxygen delivery 33. Kuitunen A et al. Sc J of Surg 2007; 96:72-78 Albumin group of patients had better pulmonary capillary wedge pressure and hemostasis</td>
</tr>
<tr>
<td>Indication</td>
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<tr>
<td>Volume resuscitation: Brain injury</td>
<td>Evidence suggests patient harm-death</td>
<td>Evidence suggests patient harm</td>
<td></td>
</tr>
<tr>
<td>Mild acute lung injury and ARDS</td>
<td>NOT routinely used</td>
<td>NOT routinely used</td>
<td>24. Martin GS et al. See ‘Hypoalbuminemia’</td>
</tr>
<tr>
<td>Sepsis</td>
<td>Possible benefit including pediatric patients</td>
<td>Patient dependent</td>
<td>40. Finfer S et al (SAFE study investigators). Intensive Care Med 2011; 37:86-96. Albumin compared to saline did not impair renal or other organ function and may decrease risk of death 34. Delaney AP et al. See ‘Volume Resuscitation’</td>
</tr>
</tbody>
</table>
### 5% Albumin Administration Indications

#### G. Other Indications

<table>
<thead>
<tr>
<th>Indication</th>
<th>Details</th>
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</tr>
</thead>
</table>
| Plasma exchange, neurology     | 5% albumin ONLY                                                       | Between 1 – 1.5 plasma volume exchanges, every other day. Length of treatment patient dependent (5 – 15 exchanges) | 41. Llufriu S et al.  Neurology 2009;73:949-953. Demonstrates clinical improvement in 63% of the patients at 6 months  
44. Lehmann HC et al.  Arch Neurol 2006;63:930-935. Discusses 3 – 5 exchanges of a 1 to 1.5 plasma volume exchange; some patients require additional exchanges |
### 5% Albumin Administration Indications

#### G. Other Indications-continued

<table>
<thead>
<tr>
<th>Indication</th>
<th>Details</th>
<th>Suggested Dose</th>
<th>References/Other Information</th>
</tr>
</thead>
</table>
| Hypoalbuminemia | NOT routinely used | NOT routinely used | 45. Yuan XY et al. Amer J of Surgery 2008;196:751-755. No benefits were observed when compared to the saline arm  
47. Finfer S et al (SAFE Study Investigators). BMJ 2006;333:1044. “The outcomes of resuscitation with albumin and saline are similar irrespective of patients’ baseline serum albumin concentration” |
References for Ontario Albumin Administration Recommendations

1. Sanyal AJ et al.  A Randomized, Prospective, Double-Blind, Placebo-Controlled Trail of Terlipressin for Type 1 Hepatorenal Syndrome. Gastroent 2008;134:1360-1368.  “Terlipressin is an effective treatment to improve renal function in HRS type 1”


7. Sort P et al.  Effect of Intravenous Albumin on Renal Impairment and Mortality in Patients with Cirrhosis and Spontaneous Bacterial Peritonitis. NEJM 1999; 341(6):403-409  “In patients with cirrhosis and spontaneous bacterial peritonitis, treatment with intravenous albumin in addition to an antibiotic reduces the incidence of renal impairment and death in comparison with treatment with an antibiotic alone”

8. Sigal SH et al.  Restricted use of albumin for spontaneous bacterial peritonitis.  Gut 2007; 56(4): 597–599  Patients with a bilirubin greater than 68.4 umol/L and/or a creatinine greater than 88.4 umol/L, albumin may be of benefit

10. Lata J et al. The efficacy of Terlipressin in Comparison with Albumin in the Prevention of Circulatory Changes after the Paracentesis of Tense Ascites: a Randomized Multicentric Study. Hepato-Gastroenterology 2007; 54:1930-1933. “...terlipressin...was as effective as IV albumin in preventing hemodynamic changes in patients with tense ascites treated by paracentesis. The treatment was well tolerated”


17. Jee BC et al. Administration of IV albumin around the time of oocyte retrieval reduces pregnancy rate without preventing OHS: a systematic review and meta-analysis. Gynecol Obstet Invest 2010;70:47-54. Albumin does not prevent OHS and may decrease pregnancy rate
24. Martin GS et al. A randomized, controlled trial of furosemide with or without albumin in hypoproteinemic patients with acute lung injury. CCM 2005; 33:1681-1687. Albumin significantly improves oxygenation with greater net negative fluid balance and better maintenance of hemodynamic stability. However the authors do recommend additional randomized clinical trials
25. Cooper A et al. Five percent albumin for adult burn shock resuscitation: lack of effect on daily multiple organ dysfunction score. Transfusion 2006; 46:80-89. “Treatment with 5% albumin from Day 0 to Day 14 does not decrease the burden of MODS in adult burn patients”. Ringers’ lactate is equally effective
27. Faraklas I et al. Colloid Normalizes Resuscitation Ration in Pediatric Burns. J Burn Care & Research 2011; 32:91-97. Albumin patients have longer hospital stays and took longer to resuscitate. However this patient group had larger and more severe injuries. Recommends further studies.

30. Riegger LQ et al. Albumin versus crystalloid prim solution for cardiopulmonary bypass in young children. Crit Care Med 2002;30: 2649-2654. 5% albumin prime may reduce wait gain by attenuating the decrease in COP and serum albumin levels in young children after CPB. Transfusion rate may increase. Further study required.

31. Tomi T et al. Gelatin and Hydroxethyl Starch, but Not Albumin, Impair Hemostasis After Cardiac Surgery. Anesth Analg 2006; 102:998-1006 “The greatest impairment in hemostasis was seen after hydroxyethyl starch administration, whereas albumin appeared to have the least effect on hemostatic variables”

32. Ernest D et al. Distribution of normal saline and 5% albumin infusions in cardiac surgical patients. Crit Care Med 2001; 29:2299-2302 “In postoperative cardiac surgical patients, infusion of 5% albumin is approx. 5X as efficient as a PV expander but has comparable effects on changes in ISFV and oxygen delivery relative to normal saline”

33. Kuitunen A et al. A comparison of the hemodynamic effects of 4% succinylated gelatin, 6% hydroxyethyl starch and 4% human albumin after cardiac surgery. Sc J of Surg 2007; 96:72-78. Albumin group of patients had better pulmonary capillary wedge pressure and hemostasis

34. Delaney AP et al. The role of albumin as a resuscitation fluid for patients with sepsis: A systematic review and meta-analysis. Crit Care Med 2011; 39:386-391. Recommend albumin until further trials conducted although albumin patients had a lower mortality rate


40. Finfer S et al (SAFE study investigators). Impact of albumin compared to saline on organ function and mortality of patients with severe sepsis. Intensive Care Med 2011; 37:86-96. Albumin compared to saline did not impair renal or other organ function and may decrease risk of death.
45. Yuan XY et al. Is albumin administration beneficial in early stage of postoperative hypoalbuminemia following gastrointestinal surgery?: a prospective randomized controlled trial. Amer J of Surgery 2008;196:751-755. No benefits were observed when compared to the saline arm.
47. Finfer S et al (SAFE study investigators). Effect of baseline serum albumin concentration on outcome of resuscitation with albumin or saline in patients in intensive care units: analysis of data from the saline versus albumin fluid evaluation (SAFE) study. BMJ 2006;333:1044. “The outcomes of resuscitation with albumin and saline are similar irrespective of patients’ baseline serum albumin concentration.”