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CRYSTALLOIDS/COLLOIDS RATIO FOR FLUID RESUSCITATION DURING ANESTHESIA

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Abstract

Crystalloids and colloids are first options for fluid resuscitation. Crystalloids expand extracellular volume, while colloids (synthetic and natural) exert a high oncotic pressure and expand volume by oncotic pressure. Many clinical studies advocate the use of crystalloids versus colloids. Greater fluid volumes are required to meet the same targets with crystalloids than with colloids, but there is a heterogenity among studies. Crystalloids' effect may lead to extracellular fluid accumulation, increased gastrointestinal wall edema, pulmonary edema, especially in patients with cardiac or renal dysfunctions. While low dose colloids preserve hematocrit and coagulation, there is a risk of abnormal hemostasis if high doses of colloids are administered. This study presents researches results regarding crystalloids/colloids ratio for fluid resuscitation during anesthesia.

Key words: *Crystalloids, colloids, anesthesia.*

INTRODUCTION

Crystalloids are solutions of electrolytes that can pass freely outside of the vascular space while colloidal macromolecular solutions are kept inside the vascular space for a longer period of time. Fluids are used during anesthesia for maintaining the homeostasis, loss covering or fluid resuscitation. There is no evidence from randomized controlled trials that resuscitation with colloids reduces the risk of death, compared to resuscitation with crystalloids, since the use of hydroxyethyl starch might increase mortality (Perel P. et al. 2013). Since colloids are not associated with an improvement in survival rate (Annane D. et al. 2013), this study aims to present the results after the use of colloids and crystalloids for a group of anesthetized patients.

MATERIALS AND METHODS

This study compares the results of fluid administration (crystalloids and colloids) during anesthesia for 123 cases (dogs), from the small animal clinic of the Faculty of Veterinary Medicine Bucharest (June 2015-December 2016). Patients with sepsis, renal dysfunction, severe liver disease or coagulopathy were not included in this study. The average rate for fluid therapy during anesthesia for all cases, without any loss of fluids was 3-5 ml/kg/hour of normal saline solution (0.90% NaCl, 308 mOsm/L) (Costea R, 2015). Fluid resuscitation protocol was necessary in 9 anesthesia cases, complicated with hypovolemic shock. During hypovolemic shock a fluid therapy protocol was administered, consisting of a bolus of isotonic crystalloid (20-30 ml/kg, given in 20 minutes) followed by a bolus of colloids (hydroxyethyl starch- Voluven, 6% HES 130 / 0.4.- 5 ml /kg, in 5-10 minutes).
The algorithm was repeated at 10-20 minutes, until the patient was stabilized, within the limits of maximum doses (maximum 80 ml/kg for NaCl 0.9% and 10-20 ml/kg for HES).

RESULTS AND DISCUSSIONS

Fluid therapy was given continuously during anesthesia, at 3-5 ml/kg/hour (NaCl 0.9%) for all cases. Fluid therapy protocol for hypovolemic shock consisted in a bolus of crystalloids followed by a colloid bolus, respecting doses and dosing interval until the patient is stable (Bansch P, 2015). A bolus of NaCl 0.9%, 20-30 ml/kg was followed by a bolus of 5 ml/kg HES. This protocol was necessary for a number of 19 cases during

anesthesia (15.4% of total cases). In 13/19 cases the protocol was continued with a second administration of crystalloid/ colloid bolus. Five of this cases needed a total of 3 administrations (Table 1). For each case a crystalloid/colloid ratio was calculated and then a group ratio was obtained (Table 2). The protocol was repeated for each case until clinical status was stabilized, taking into consideration the following:

- normal heart rate (60-100 bpm)
- normal perfusion (CRT = 1,5 seconds)
- powerful and constant pulse
- mean arterial blood pressure (>60 mm Hg)
- urinary output (1-2 ml/kg/hour)
- HTC > 25%

Table 1-clinical data

No. of cases	NaCl 0.9% ml/kg/h mean values	HES 5 ml/kg	Mean time until clinical stabilization
6	18.9 ml	5 ml	18.9 minutes
8	37.2 ml	7.8 ml	48.8 minutes
5	57.1 ml	19.2 ml	87 minutes
104	4.7 ml	-	-

Table 2-clinical data

No. of protocols administrated		Total ml		NaCl 0.9%/ HES
		NaCl 0.9%	HES	
6 cases	1	1268	450	2.81
8 cases	2	3776	1397	2.7
5 cases	3	4032.5	1420	2.83
19		9076.5	3267	**2.77**

Fluid volumes required to meet the same clinical targets for resuscitation with crystalloids (37.73 ml/kg mean total amount for 19 cases) exceeded colloids (10.66 ml/kg mean total amount for 19 cases), with an estimated ratio of 2.77 (2.73–2.83).

CONCLUSIONS

Greater fluid volumes are required to meet the same targets with crystalloids than with colloids with an estimated ratio of 2.77 (2.73–2.83). Colloids were not used frequently compared to crystalloids. Only for 19 cases (15.4% OF total cases) a colloid/ crystalloid protocol was necessary for fluid resuscitation. When a colloid/ crystalloid protocol was established, clinical status was assessed as normal after a mean time of 49.41 minutes. Further studies are needed to establish a correlation between the crystalloids/colloids ratio and the mean time of patient clinical stabilization.

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