EFFECT OF FLUID THERAPY ON BLOOD COAGULATION IN PATIENTS UNDERGOING ELECTIVE ORTHOPAEDIC SURGERY

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INTRODUCTION

Perioperative fluids infusion may affect blood coagulation increasing a risk of perioperative bleeding. This effect results from perioperative blood dilution, transient decrease in plasma factor VII and von Willebrand concentrations or impaired platelet reactivity [1]. These disorders are strongly dependent on kind of fluid and infused volume. Previous study showed a higher decrease in coagulation competence in patients receiving hydroxyethyl starches than in patients treated with crystalloids [2].

The aim of this study was to analyse the effect of fluid infusion on popular coagulation variables in patients undergoing orthopaedic surgery.

METHODS

- Adult patients undergoing elective knee arthroplasty under spinal anaesthesia.
- Excluded patients: complicated perioperative period, massive fluid resuscitation following perioperative bleeding.
- Studied variables: active partial thromboplastin time (APTT), prothrombin time and international normalized ratio (INR).
- Time points: A – a day before surgery (baseline), B – 3 hours after surgery and C – 24 hours after surgery.
- Patients division (four equal groups):
 - R – Ringer solution, P – Plasmalyte®,
 - S – Sterofundin® ISO G – Gelatin®.
- All fluids were administered at the dose 10 – 15 mL/kg body weight.

RESULTS

80 patients (33 female and 47 male) aged 34 – 84 (mean 63 ± 12) were studied.
Mean BMI : 28.21 ± 4.41,
Mean body weight: group R – 82.83 ± 14.28 kg, group P – 88.25 ± 20.67 kg,
group S – 86.05 ± 16.3 kg, group G – 78.75 ± 21.76 kg.
Mean duration of surgery: 66 ± 22 min.

Table 1. Changes in coagulation variables in patients undergoing elective knee arthroplasty (median [quartile 1 and 3]). Time points: A - a day before surgery (baseline), B – 3 hours after surgery completion, 24 hours after surgery completion. * p < 0.05, ** p < 0.01, *** p < 0.001 – comparison with baseline (Wilcoxon test).

	APTT		
	A	B	C
Group R	29.5 [27.8; 31.3]	28.4* [26.2; 31.6]	30.3 [27.8; 33.4]
Group P	27 [26.2; 30.7]	26.6* [24; 29.6]	29.3 [26.2; 31.8]
Group S	27.6 [25.8; 27.7]	26.8 [25.5; 28]	27.2 [26.1; 31.8]
Group G	27.5 [26.3; 28.6]	28.9* [27.1; 30.7]	28.7** [27.3; 31.6]
	PT		
	A	B	C
Group R	11.2 [10.9; 11.7]	12.2*** [11.8; 12.6]	12.8*** [12.2; 13.3]
Group P	10.9 [10.7; 11.5]	12.1*** [11.5; 12.6]	12.3*** [12.1; 13]
Group S	11.5 [10.9; 12]	12.4*** [11.9; 12.9]	13.4*** [13; 13.9]
Group G	11.2 [10.9; 11.8]	12.7*** [12.3; 13.2]	13.4*** [12.5; 14]
	INR		
	A	B	C
Group R	1.03 [0.98; 1.05]	1.1** [1.06; 1.13]	1.15*** [1.1; 1.2]
Group P	0.99 [0.96; 1.04]	1.09*** [1.02; 1.12]	1.11*** [1.07; 1.18]
Group S	1.04 [0.98; 1.07]	1.1*** [1.06; 1.16]	1.19*** [1.15; 1.24]
Group G	1 [0.97; 1.1]	1.14*** [1.09; 1.17]	1.21*** [1.14; 1.25]

Figure 1 Differences in active partial thromboplastin time between patients receiving Ringer solution, Plasmalyte®, Sterofundin® ISO and Gelatin®. * p < 0.05, ** p < 0.01, *** p < 0.001 – Mann-Whitney test.

Figure 2 Differences in prothrombin time between patients receiving Ringer solution, Plasmalyte®, Sterofundin® ISO and Gelatin®. * p < 0.05, ** p < 0.01, *** p < 0.001 – Mann-Whitney test.

Figure 3 Differences in international normalized ratio between patients receiving Ringer solution, Plasmalyte®, Sterofundin® ISO and Gelatin®. * p < 0.05, ** p < 0.01, *** p < 0.001 – Mann-Whitney test.

CONCLUSIONS

Crystalloids infusion prolongs coagulation times. Disorders in coagulation associate with both crystalloids and gelatine infusion.

1. Kozek-Langenecker SA. Fluids and coagulation. Curr Opin Crit Care 2015, 21: 285–91, doi. 10.1097/MCC.0000000000000219
2. Rasmussen KC, Secher NH, Pedersen T. Effect of perioperative crystalloid or colloid fluid therapy on hemorrhage, coagulation competence, and outcome. A systematic review and stratified meta-analysis. Medicine 2016; 95: 31 (e4498).