Resuscitation fluid practices in Brazilian intensive care units: a secondary analysis of Fluid-TRIPS

Práticas de ressuscitação volêmica em unidades de terapia intensiva brasileiras: uma análise secundária do estudo Fluid-TRIPS

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Table 1S - Characteristics of fluid episodes in Brazil and in other countries

Variable	Brazil (n = 880)	Other countries (n = 1.836)	p value GEE
Crystalloid episode	843 (95.8)	1.365 (74.3)	< 0.0001
0.9% Sodium chloride	527 (62.5)	370 (27.1)	< 0.0001
Ringer's lactate/Ringer's acetate/Ringer's solution	270 (32.0)	537 (39.3)	0.064
Ringer's simple/Hartmann	29 (3.4)	148 (10.8)	< 0.0001
Plasmalyte	23 (2.7)	143 (10.5)	< 0.0001
Other balanced salt	0 (0.0)	140 (10.3)	< 0.0001
Other crystalloid	10 (1.2)	66 (4.8)	< 0.0001
Colloid episode	55 (6.2)	526 (28.6)	< 0.0001
Albumin	32 (58.2)	431 (81.9)	0.001
HES	18 (32.7)	33 (6.3)	< 0.0001
Gelatin	5 (9.1)	59 (11.2)	0.811
Dextran	0 (0.0)	4 (0.8)	< 0.0001

GEE - generalized estimating equation; HES - hydroxyethyl starch. Summary statistics of categorical variables are presented as percentages and p-values of the generalized estimating equation model (adjusted for patient-level clustering effect).

Table 2S - Fluid availability in intensive care units in Brazil (n = 217) and other countries (n = 209)

Fluid name	Brazil		Other countries	
	Yes	No	Yes	No
Crystalloid				
0.9% Saline	214 (98.6)	0 (0.0))	201 (96.2)	2 (1.0)
Hypertonic saline	139 (64.1)	72 (33.2)	132 (63.2)	70 (33.5)
Ringer's simple/Hartmann	146 (67.3)	67 (30.9)	50 (23.9)	152 (72.7)
Ringer's lactate	212 (97.7)	1 (0.5)	120 (57.4)	81 (38.8))
Plasmalyte A	15 (6.9)	190 (87.6)	18 (8.6)	183 (87.6)
Plasmalyte R	4 (1.8)	201 (92.6)	6 (2.9)	195 (93.3)
Plasmalyte 148 replacement	1 (0.5)	204 (94.0)	25 (12.0)	176 (84.2)
Ringer's acetate	2 (0.9)	203 (93.5)	58 (27.8)	143 (68.4)
Balanced glucose	3 (1.4)	202 (93.1)	40 (19.1)	161 (77.0)
Dextrose	211 (97.2)	2 (0.9)	162 (77.5)	40 (19.1)
Dextrose/saline	84 (38.7)	123 (56.7)	109 (52.2)	93 (44.5)
Hypertonic glucose	191 (88.0)	22 (10.1)	178 (85.2)	24 (11.5)
Colloid				
Albumin 4 - 5%	41 (18.9)	166 (76.5)	135 (64.6)	66 (31.6)
Albumin 20 - 25%	199 (91.7)	14 (6.5)	187 (89.5)	15 (7.2)
6% HES in saline	100 (46.1)	106 (48.8)	80 (38.3)	121 (57.9)
6% HES in balanced salt solution	27 (12.4)	178 (82.0)	34 (16.3)	166 (79.4)
Other starch	1 (0.5)	204 (94.0)	5 (2.4)	196 (93.8)
706 Plasma replacement	61 (28.1)	146 (67.3)	23 (11.0)	178 (85.2)
Gelatin	22 (10.1)	183 (84.3)	81 (38.8)	120 (57.4)
Haemaccel	44 (20.3)	161 (74.2)	14 (6.7)	187 (89.5)
Dextran 40 or 70	17 (7.8)	188 (86.6)	52 (24.9)	149 (71.3)

HES - hydroxyethyl starch. Results expressed as n (%).

Table 3S - Comparison of the characteristics of fluid use in 518 Brazilian patients in a total of 879 episodes by trauma status

Variable	Trauma		p value
	Yes n = 50	No n = 468	
Patients received crystalloid	50 (100.0)	456 (97.4)	0.252
Patients received colloid	2 (4.0)	36 (7.7)	0.341
Total volume of resuscitation fluid received on survey day (mL)	1000.0 (500.0 – 1.500.0)	1.000.0 (500.0 – 1.500.0)	0.217
Total volume of crystalloid received on survey day (mL)	1.000.0 (500.0 – 1.500.0)	1.000.0 (500.0 – 1.500.0)	0.298
Total volume of colloid received on survey day (mL)	275.0 (162.5 - 387.5)	275.0 (100.0 - 500.0)	0.505
Total volume of fluid input on the survey day (mL)	3.117.0 (2.347.5 – 4.490.8)	3.058.0 (2.000.0 – 4.164.0)	0.572
Total volume of fluid output on the survey day (mL)	1.400.0 (800.0 – 2.000.0)	1.380.0 (730.0 – 2.326.0)	0.952
Net fluid balance on the survey day (mL)	1.438.0 (772.0 – 2.549.0)	1.300.0 (500.0 – 2.515.0)	0.459
	n = 90	n = 789	Valor de p
Crystalloid episode	88 (97.8)	754 (95.6)	0.322
Colloid episode	2 (2.2)	53 (6.7)	0.095

Summary statistics of continuous variables are presented as the median (interquartile range), with p-values based on the nonparametric test (i.e., Wilcoxon rank-sum test). Summary statistics of categorical variables are presented as percentages, with p-values based on Pearson's Chi-squared test.

Table 4S - Comparison of characteristics of fluid use in 518 Brazilian patients in a total of 879 episodes by traumatic brain injury status

Variável	TBI		p value
	Yes n = 14	No n = 504	
Patients received crystalloid	14 (100.0)	492 (97.6)	0.559
Patients received colloid	0 (0.0)	38 (7.5)	0.286
Total volume of resuscitation fluid received on survey day (mL)	500.0 (500.0 – 1.500.0)	1.000.0 (500.0 – 1.500.0)	0.760
Total volume of crystalloid received on survey day (mL)	500.0 (500.0 – 1.500.0)	1.000.0 (500.0 – 1.500.0)	0.776
Total volume of colloid received on survey day (mL)	NA	275.0 (100.0 - 500.0)	NA
Total volume of fluid input on the survey day (mL)	3.663.3 (3.020.0 – 5.070.8)	3.054.0 (2.000.0 – 4.141.0)	0.064
Total volume of fluid output on the survey day (mL)	1.700.0 (925.0 – 2.450.0)	1.376.5 (745.0 – 2.306.2)	0.390
Net fluid balance on the survey day (mL)	1.478.0 (1.060.8 – 2.963.2)	1.312.0 (500.0 – 2.488.0)	0.237
	n = 23	**n = 856**	**Valor de p**
Crystalloid episode	23 (100.0)	819 (95.7)	0.308
Colloid episode	0 (0.0)	55 (6.4)	0.209

TBI - traumatic brain injury; NA – not applicable. Summary statistics of continuous variables are presented as the median (interquartile range), with p-values based on the nonparametric test (i.e., Wilcoxon rank-sum test). Summary statistics of categorical variables are presented as percentages, with p-values based on Pearson's Chi-squared test.

Table 5S - Comparison of characteristics of fluid use in 517 Brazilian patients in a total of 877 episodes by sepsis status

Variable	Sepsis		p value
	Yes n = 205	No n = 312	
Patients received crystalloid	201 (98.0)	304 (97.4)	0.651
Patients received colloid	16 (7.8)	22 (7.1)	0.748
Total volume of resuscitation fluid received on survey day (mL)	1.000.0 (500.0 – 1.500.0)	1.000.0 (500.0 – 1.500.0)	0.153
Total volume of crystalloid received on survey day (mL)	1.000.0 (500.0 – 1.500.0)	1.000.0 (500.0 – 1.500.0)	0.186
Total volume of colloid received on survey day (mL)	275.0 (100.0 - 623.5)	365.5 (100.0 - 500.0)	0.857
Total volume of fluid input on the survey day (mL)	3.311.0 (2.340.0 – 4.359.5)	2.903.0 (1.870.0 – 3.922.2)	0.004
Total volume of fluid output on the survey day (mL)	1.245.0 (565.0 – 2.062.5)	1.500.0 (820.0 – 2.425.0)	0.006
Net fluid balance on the survey day (mL)	1.705.5 (940.0 – 2.667.5)	1.187.0 (305.0 – 2.235.0)	<0.0001
	n = 342	**n = 535**	**Valor de p**
Crystalloid episode	328 (95.9)	512 (95.7)	0.883
Colloid episode	24 (7.0)	31 (5.8)	0.466

Summary statistics of continuous variables are presented as the median (IQR), with p-values based on the nonparametric test (i.e., Wilcoxon rank-sum test). Summary statistics of categorical variables are presented as percentages, with p-values based on Pearson's chi-squared test.

Table 6S - Comparison of characteristics of fluid use in 517 Brazilian patients in a total of 877 episodes by acute respiratory distress syndrome status

Variable	ARDS		p value
	Yes n = 32	No n = 485	
Patients received crystalloid	31 (96.9)	474 (97.7)	0.755
Patients received colloid	1 (3.1)	37 (7.6)	0.344
Total volume of resuscitation fluid received on survey day (mL)	1000.0 (500.0 - 1500.0)	1000.0 (500.0 - 1500.0)	0.261
Total volume of crystalloid received on survey day (mL)	1000.0 (500.0 - 1500.0)	1000.0 (500.0 - 1500.0)	0.129
Total volume of colloid received on survey day (mL)	150.0 (150.0 - 150.0)	300.0 (100.0 - 500.0)	NA
Total volume of fluid input on the survey day (mL)	3981.0 (2865.5 - 4988.5)	3016.0 (2000.0 - 4041.0)	0.003
Total volume of fluid output on the survey day (mL)	1000.0 (490.0 - 1925.0)	1400.0 (780.0 - 2350.0)	0.093
Net fluid balance on the survey day (mL)	2420.0 (1631.2 - 3758.6)	1285.0 (480.0 - 2464.0)	0.0001
	n = 57	**n = 820**	**Valor de p**
Crystalloid episode	54 (94.7)	786 (95.9)	0.685
Colloid episode	3 (5.3)	52 (6.3)	0.745

ARDS - acute respiratory distress syndrome; NA - not applicable. Summary statistics of continuous variables are presented as the median (interquartile range), with p-values based on the nonparametric test (i.e., Wilcoxon rank-sum test). Summary statistics of categorical variables are presented as percentages, with p-values based on Pearson's chi-squared test.

Table 7S - Univariate analysis of factors associated with the administration of crystalloids or colloids

Variable	OR (95%CI) for receiving crystalloid	p value	OR (95%CI) for receiving colloid	p value
Age (per 1-year increase)	1.0 (1.0 - 1.0)	0.709	1.0 (1.0 - 1.0)	0.817
Sex, male	0.9 (0.4 – 2.1)	0.813	0.8 (0.4 – 1.6)	0.541
Number of days in the ICU at survey date	1.0 (1.0 - 1.0)	0.204	1.0 (1.0 - 1.0)	0.740
Number of days in the ICU at survey date > 0	0.4 (0.1 - 1.3)	0.120	1.4 (0.6 - 3.3)	0.486
Admission characteristics*				
Operating room after elective surgery	1.0	0.268	1.0	0.085
Emergency room	1.1 (0.3 - 3.4)		0.5 (0.2 - 1.5)	
Hospital floor	3.9 (0.5 - 31.9)		0.2 (0.04 - 0.8)	
Transferred from other ICU or hospital	3.2 (0.4 - 26.7)		0.6 (0.1 - 2.8)	
Operating room after emergency surgery	0.7 (0.2 - 2.4)		0.9 (0.3 - 2.5)	
Hospital floor after previous ICU stay	0.4 (0.1 - 1.5)		1.8 (0.7 - 4.8)	
Surgical admission diagnosis	0.7 (0.3 - 1.7)	0.423	1.6 (0.8 - 3.2)	0.194
Trauma at hospital admission	1.7 (0.4 - 7.4)	0.455	0.3 (0.1 - 1.4)	0.133
Sepsis in 24 hours prior to survey date	1.2 (0.5 - 2.8)	0.745	1.2 (0.6 - 2.4)	0.612
ARDS in 24 hours prior to survey date	1.0 (0.1 - 7.8)	0.987	0.6 (0.1 - 4.3)	0.585
APACHE II chronic health points criteria (any)	1.0 (0.4 - 2.4)	0.924	1.2 (0.6 - 2.6)	0.631
Indication for fluid in each fluid resuscitation				
Impaired perfusion/low cardiac output	1.0	0.479	1.0	0.714
Abnormal vital signs	1.3 (0.5 - 3.7)		0.6 (0.2 - 1.5)	
Ongoing bleeding/other fluid losses	0.5 (0.2 - 1.8)		1.1 (0.4 - 3.2)	
Unit protocol/other	0.4 (0.1 - 2.6)		1.3 (0.2 - 7.5)	
Fluid prescriber*				
Specialist	1.0	0.026	1.0	0.140
Senior resident/fellow	3.8 (0.7 - 19.5)		0.4 (0.1 - 1.4)	
Resident	0.2 (0.1 - 0.9)		2.4 (0.7 - 8.6)	
Cardiac failure (cardiac SOFA ≥ 3)	0.8 (0.4 - 1.3)	0.336	0.9 (0.5 - 1.8)	0.829
Respiratory failure (respiratory SOFA ≥ 3)	0.8 (0.3 - 2.1)	0.711	1.6 (0.8 - 3.5)	0.200
Renal replacement therapy	1.4 (0.3 - 6.5)	0.659	1.6 (0.6 - 4.3)	0.300
Mechanical ventilation	1.0 (0.4 - 2.9)	0.946	1.2 (0.7 - 2.2)	0.563
Metabolic acidosis*	0.4 (0.1 - 1.6)	0.007	1.5 (0.6 - 3.4)	0.031
Metabolic acidosis. Missing	0.2 (0.0 - 0.5)		2.4 (1.2 - 4.8)	
Lactate ≥ 2mmol/L*	1.7 (0.2 - 11.9)	0.058	0.7 (0.3 - 2.1)	0.240
Lactate (mmol/L). Missing	0.4 (0.1 - 1.5)		1.4 (0.6 - 3.1)	
Heart rate, b/minute	1.0 (1.0 - 1.0)	0.679	1.0 (1.0 - 1.0)	0.322
Heart rate (per 10 b/minute increase)	1.0 (0.9 - 1.2)	0.842	1.1 (1.0 - 1.2)	0.168
Mean arterial pressure*	1.0 (1.0 - 1.0)	0.060	1.0 (1.0 - 1.0)	0.083
Mean arterial pressure (per 10mmHg decrease)*	1.2 (1.0 - 1.4)	0.059	0.9 (0.7 - 1.0)	0.041
Creatinine ≥ 170 (μmol/L)	0.8 (0.2 - 2.5)	0.672	1.2 (0.5 - 3.0)	0.747
Bilirubin ≥ 2.0 (μmol/L) categories†	0.0 (0.0 - Inf)	< 0.0001	0.0 (0.0 - 0.0)	< 0.0001
Albumin ≥ 27g/L*	4.8 (0.1 - 401.0)	0.427	0.2 (0.02 - 1.7)	0.006
Albumin, missing	2.0 (0.6 - 6.6)		0.3 (0.1 - 0.6)	
Urine output ≥ 0.5mL/kg/hour	0.4 (0.1 - 1.2)	0.261	1.0 (0.5 - 2.1)	0.859
Urine output, missing	0.5 (0.1 - 2.3)		1.2 (0.5 - 3.0)	
Fluid output ≥ 1mL/kg/hour	1.5 (0.7 - 2.9)	0.323	0.9 (0.4 - 1.9)	0.829
Fluid output missing	1.7 (0.6 - 4.6)		0.8 (0.4 - 1.7)	

RC - razão de chance; IC95% - intervalo de confiança de 95%; UTI - unidade de terapia intensiva; SDRA – síndrome do desconforto respiratório agudo; APACHE - *Acute Physiology and Chronic Health Evaluation*; SOFA - *Sequential Organ Failure Assessment*. Variáveis categóricas com 20% de valores faltantes foram analisadas como dados faltantes apenas como grupos separados. Os resultados foram gerados de modelos de equações de estimativas generalizadas com as identidades dos pacientes atribuídas como agrupamentos. As quantidades de dados disponíveis para "traumatismo craniencefálico", "categoria de trauma na admissão ao hospital", "baixa pressão de enchimento" e "bilirrubina" foram muito pequenas. Assim, essas variáveis foram excluídas da análise multivariada independentemente dos baixos valores de p nos modelos de equações de estimativas generalizadas. "APACHE II pontos", "indicação para fluidos em cada episódio", e "prescritor dos fluidos" precisaram ser reagrupados na análise univariada em razão do pequeno tamanho da amostra em algumas subcategorias. *Variáveis com valores de p nas equações de estimativas generalizadas < 0,1 foram salientadas e elegíveis para inclusão na análise multivariada, † embora com p < 0,1, em razão da distribuição extremamente desigual das categorias de bilirrubina entre os grupos de episódios com cristaloides e coloides Sim/Não, os resultados (razão de chance e intervalo de confiança de 95%) são altamente não confiáveis. Assim, a variável de categoria de bilirrubina NÃO foi incluída na análise multivariada.