Publikace, které OPRAVDU ovlivnily moji praxi:

Péče o vnitřní prostředí

František Duška

AKUTNĚ.CZ

Potenciální střet zájmů

- Radiometer, Copenhagen: Sponzoring pro 4UE Summer School of Acid Base
- Koeditor www.acidbase.org
- Spolupořadatel International Fluid Academy Day-mini Prague 2023 (bez finanční spoluúčasti)

Albumin

1998 Conflicting results of metaanalyses + animal studies albumin as a drug

2004 SAFE Trial
Albumin vs. normal saline in general ICU patients (n=6997)
- Mortality at 28 days identical (RR 1.0 [0.9-1.1])

Subgroups in SAFE:
TBI harm with albumin (p=0.01)
Sepsis trend to benefit (p=0.06)

2007 SAFE-TBI
=2yr f-up of TBI pt. (n=460) from SAFE
Increased mortality with albumin
RR 1.6 (1.2-2.3)

2014 ALBIOS Trial
Severe sepsis (n=1818) to receive open label 20% alb or crystalloids alone.
No difference in 28 day mortality (RR 1.00 [0.87-1.14]

Conclusion = no role of albumin as a volume expander in 2022 (expensive, no benefit, harmful in some)

HES

Up until 2008
No big data available on safety.
Benefits: quick restoration of volume, improved microcirculation etc.)

2008 VISEP Trial
Severe sepsis, HES 200/0.5 vs., Ringer's lactate, open-label
Prematurely stopped at n=537 d/t harm by HES (AKI/RRT)

2012 Trial 6S
Severe sepsis, HES 130/0.4 vs. Ringer's acetate
Increased mortality, increased renal failure

2012 CHEST Trial
General ICU (n=7000) to received HES 130/0.4 vs. normal saline
90-day mortality identical (RR 1.06 [0.96-1.18]), but more AKI and adverse events

Conclusion = no role of HES as a volume expander in the critically ill

Fyziologický roztok vs balancované krystaloidy

-1%

SPLIT trial
JAMA 2015, n=2 278, NS

SMART-MED, SMART-SURG
NEJM 2018, n= 15 802

SALT-ED
NEJM 2018, n=13 347

(BICAR-ICU, *Lancet* 2018)

Fajn, ale které články OPRAVDU změnily, co dělám na ICU?

Antonín Jabor, AmJRCCM 2000

Diagnosis of Metabolic Acid–Base Disturbances in Critically Ill Patients

VLADIMIR FENCL, ANTONÍN JABOR, ANTONÍN KAZDA, and JAMES FIGGE

Division of Pulmonary and Critical Care Medicine, Brigham and Women's Hospital, and Departments of Medicine, Brigham and Women's Hospital and Harvard Medical School, Boston, Massachusetts; Departments of Clinical Biochemistry, Hospital Kladno and Postgraduate Medical School, Prague, Czech Republic; Departments of Medicine, St. Peter's Hospital, and Biomedical Sciences, State University of New York, Albany, New York

We compare two commonly used diagnostic approaches, one relying on plasma bicarbonate concentration and "anion gap," the other on "base excess," with a third method based on physicochemical principles, for their value in detecting complex metabolic acid–base disturbances. We analyzed arterial blood samples from 152 patients and nine normal subjects for pH, P_{CO_2}, and concentra-

acid in plasma's chemical equilibria. Normal serum globulins do not carry a significant net electric charge at pH values prevailing in plasma (6, 7).

Hypoalbuminemia is a common finding in critically ill patients (8); it may confound the customary interpretation of acid–

Luciano Gattinoni, ICM 2011

Intensive Care Med (2011) 37:461–468
DOI 10.1007/s00134-010-2095-y

ORIGINAL

E. Carlesso
G. Maiocchi
F. Tallarini
F. Polli
F. Valenza
P. Cadringher
L. Gattinoni

The rule regulating pH changes during crystalloid infusion

N. Van Regenmortel, ICM 2018

ORIGINAL

Maintenance fluid therapy and fluid creep impose more significant fluid, sodium, and chloride burdens than resuscitation fluids in critically ill patients: a retrospective study in a tertiary mixed ICU population

Niels Van Regenmortel[1,2*], Walter Verbrugghe[1], Ella Roelant[3], Tim Van den Wyngaert[4,5] and Philippe G. Jorens[1,5]

Příběh první

Case 29 Diabetická ketoalkalóza

Fencl V, Jabor A, Kazda and Figge J: Am J Resp Crit Care Medicine 2000

Diagnosis of Metabolic Acid–Base Disturbances in Critically Ill Patients

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Division of Pulmonary and Critical Care Medicine, Brigham and Women's Hospital, and Departments of Medicine, Brigham and Women's Hospital and Harvard Medical School, Boston, Massachusetts; Departments of Clinical Biochemistry, Hospital Kladno and Postgraduate Medical School, Prague, Czech Republic; Departments of Medicine, St. Peter's Hospital, and Biomedical Sciences, State University of New York, Albany, New York

We compare two commonly used diagnostic approaches, one relying on plasma bicarbonate concentration and "anion gap," the other on "base excess," with a third method based on physicochemical principles, for their value in detecting complex metabolic acid–base disturbances. We analyzed arterial blood samples from 152 patients and nine normal subjects for pH, Pco_2, and concentrations of plasma electrolytes and proteins. Ninety-six percent of the patients had serum albumin concentration ⩽ 3 SD below the mean of the control subjects. In about one-sixth of the patients, base excess and plasma bicarbonate were normal. In a great majority of these apparently normal samples, the third method detected simultaneous presence of acidifying and alkalinizing disturbances, many of them grave. The almost ubiquitous hypoalbuminemia confounded the interpretation of acid–base data when the customary

acid in plasma's chemical equilibria. Normal serum globulins do not carry a significant net electric charge at pH values prevailing in plasma (6, 7).

Hypoalbuminemia is a common finding in critically ill patients (8); it may confound the customary interpretation of acid–base data, owing to the contribution of albumin to plasma's acid–base equilibria. In particular, in the diagnostic system relying on plasma [HCO_3^-], hypoalbuminemia is known to cause uncertainty in the interpretation of the AG (2, 9–11); if AG is adjusted for abnormal albumin concentration (12, 13), its usefulness should improve (14). With the BE approach (3), no distinction is made between a deficit/excess of weak or strong nonvolatile acids (11); therefore, the alkalinizing effect

TABLE 3

EXAMPLES OF COMPLEX ACID–BASE DISTURBANCES

	Patient No.								
	18	59	63	81	29	51	88	41	53
Measured quantities									
Na^+, mEq/L	140	117	159	131	130	133	137	143	125
K^+, mEq/L	4.8	3.9	3.6	4.2	3.5	3.9	4.9	4.5	5.2
Ca^{2+}, mEq/L	3.4	3.0	4.2	3.6	4.0	4.2	3.2	4.0	3.2
Mg^{2+}, mEq/L	1.6	1.4	2.2	2.2	1.6	1.6	1.6	1.6	1.0
Cl^-, mEq/L	103	92	121	86	90	96	102	111	98
Pi, mmol/L	0.9	0.6	0.5	2.3	0.9	0.4	0.3	1.2	0.9
Albumin, g/L	15	6	9	8	20	10	6	18	13
pH	7.45	7.33	7.55	7.32	7.50	7.36	7.40	7.40	7.40
P_{CO_2}, mm Hg	48	30	29	41	30	45	39	41	39
Derived quantities									
HCO_3^-, mEq/L	33	15	25.5	21	23.5	25.5	24	25	24
$AG_{observed}$, mEq/L	7	13	16	28	20	15	16	11	8
$AG_{adjusted}$, mEq/L	15	23	25	37	26	24	25	18	16
BE_{pl}, mEq/L	+9	−10	+2	−4	0	+1	0	0	0
BE_{ecf}, mEq/L	+10	−10	+3.5	−4.5	+1	+1	0	0	0
SID, mEq/L	39	18	29	27	31	29	26	32	29
$Cl^-_{corrected}$, mEq/L	105	112	108	93	98	103	106	110	111
$XA^-_{corrected}$, mEq/L	9	18	17	30	20	19	19	9	8

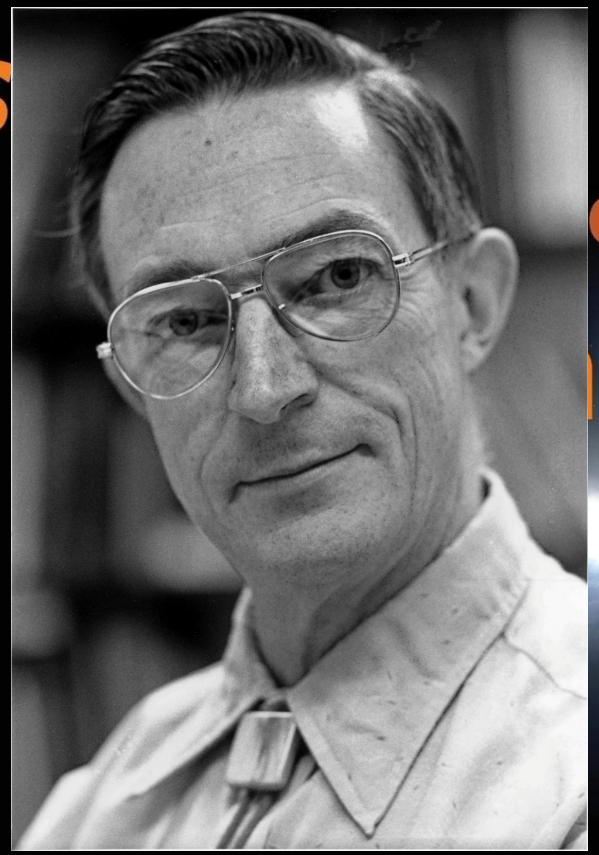
Definition of abbreviations: $AG_{observed}$ and $AG_{adjusted}$ = anion gap observed and adjusted -abnormal albumin, respectively; BE_{pl} and BE_{ecf} = base excess in plasma and in extracellular fluid, respectively (18); $Cl^-_{corrected}$ and $XA^-_{corrected}$ = chloride and unidentified anions, corrected for water excess/deficit, respectively; Pi = inorganic phosphate; .

Edited by

John A Kellum

Paul WG Elbers

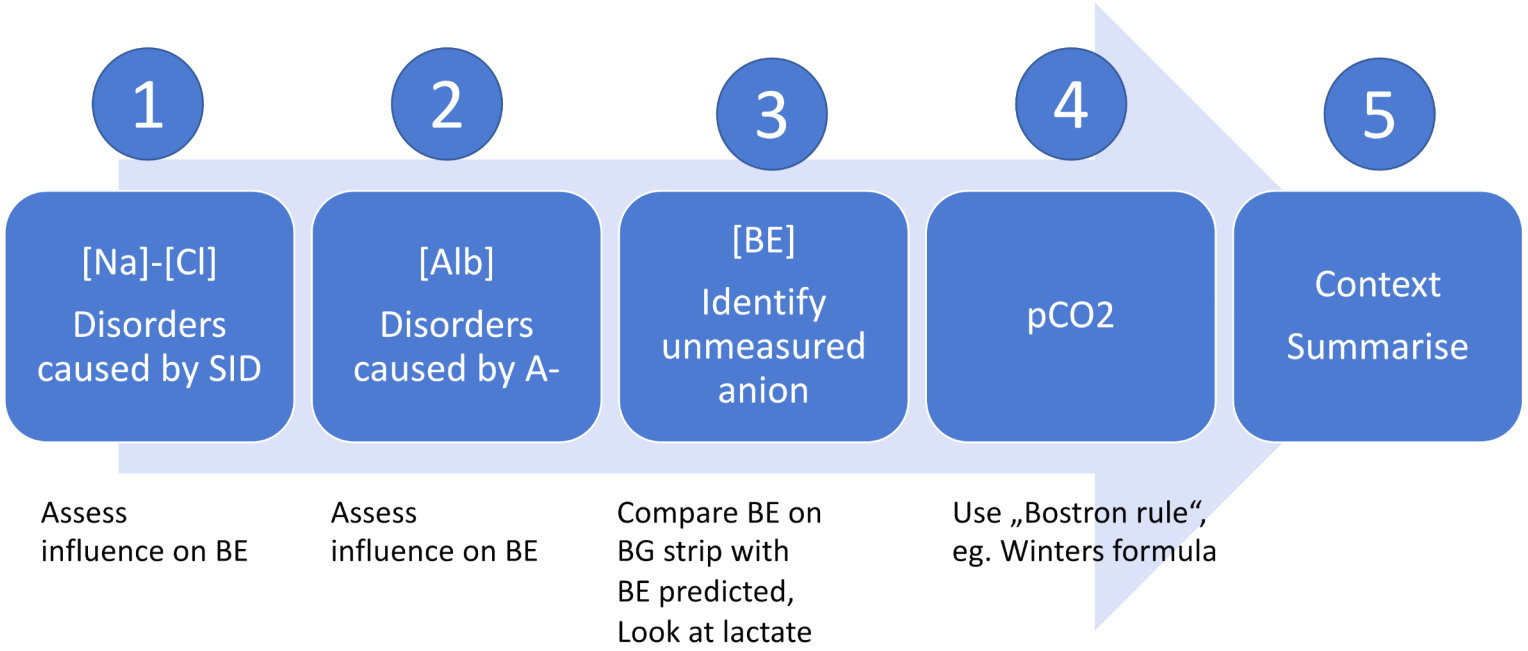
10TH ANNIVERSARY EDITION



's apply it
ctice

look
base

Summary: Five parameters to look at



Link na video:

Více o hodnocení komplexních poruch acidobazické rovnováhy na:
https://www.akutne.cz/news-detail/cs/1089-akutni-stredy-webinare-portalu-akutne-cz/

Příběh druhý

Vliv tekutin na acidobazický status

Carlesso et al.: Intensive Care Medicine , 2011

Intensive Care Med (2011) 37:461–468
DOI 10.1007/s00134-010-2095-y

ORIGINAL

E. Carlesso
G. Maiocchi
F. Tallarini
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L. Gattinoni

The rule regulating pH changes during crystalloid infusion

Received: 15 July 2010
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Electronic supplementary material
The online version of this article (doi:10.1007/s00134-010-2095-y) contains supplementary material, which is available to authorized users.

G. Maiocchi
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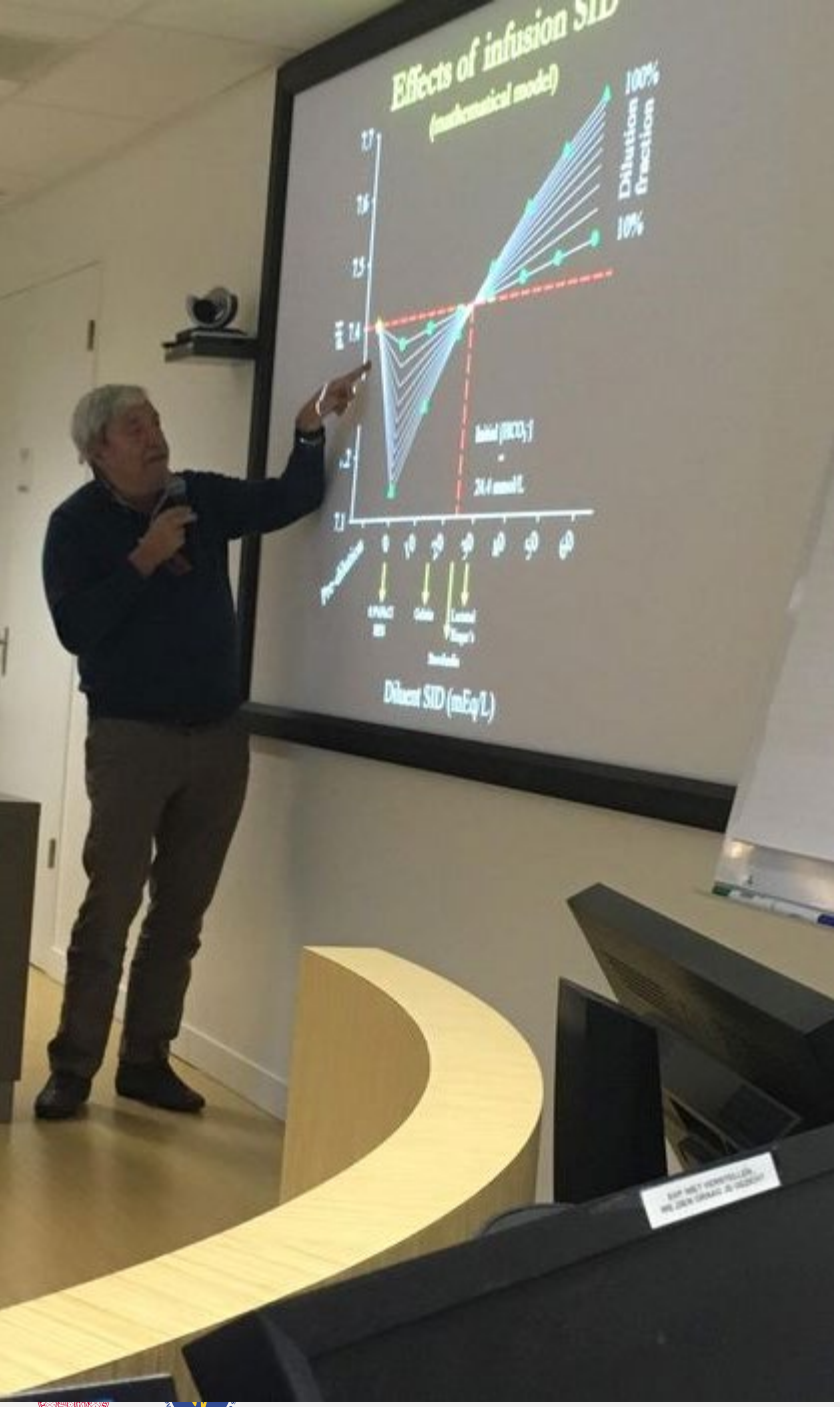
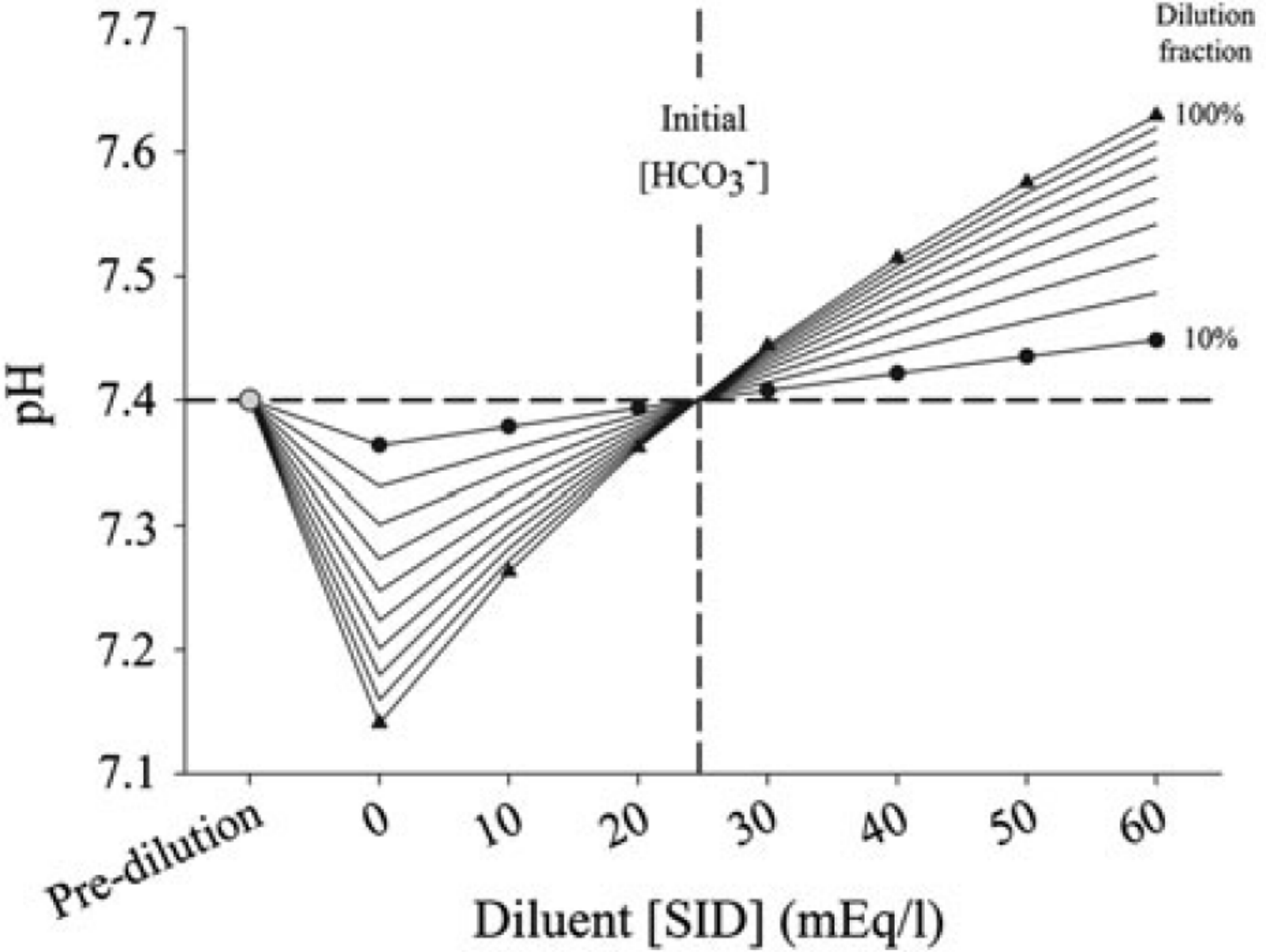
Abstract *Purpose:* To define the rule according to which crystalloid solutions characterized by different strong ion difference (SID) modify the acid–base variables of human plasma. *Methods:* With a previously validated software, we computed the effects of diluting human plasma with crystalloid solutions ([SID] 0–60, 10 mEq/l stepwise). An equation was assuming constant PCO_2 throughout the process. The experimental data confirmed the theoretical analysis. In fact, at the baseline $[HCO_3^-]$ of 18.3 ± 0.3 mmol/l (PCO_2 35 mmHg) the pH was 7.332 ± 0.004 and remained 7.333 ± 0.003 when the diluting [SID] was 18.5 ± 0.0 mEq/l. At baseline $[HCO_3^-]$ of 19.5 ± 0.3 mmol/l (PCO_2 78 mmHg) the pH was 7.010 ± 0.003 and remained 7.004 ± 0.003 when the diluting [SID] was 19.1 ± 0.1 mEq/l. At both PCO_2 values infusion with [SID] lower or greater than baseline $[HCO_3^-]$ led pH to decrease or

Fulltext link:


Effects of infusion SID
(mathematical model)
Dilution fraction
100%
10%
Diluent SID (mEq/L)

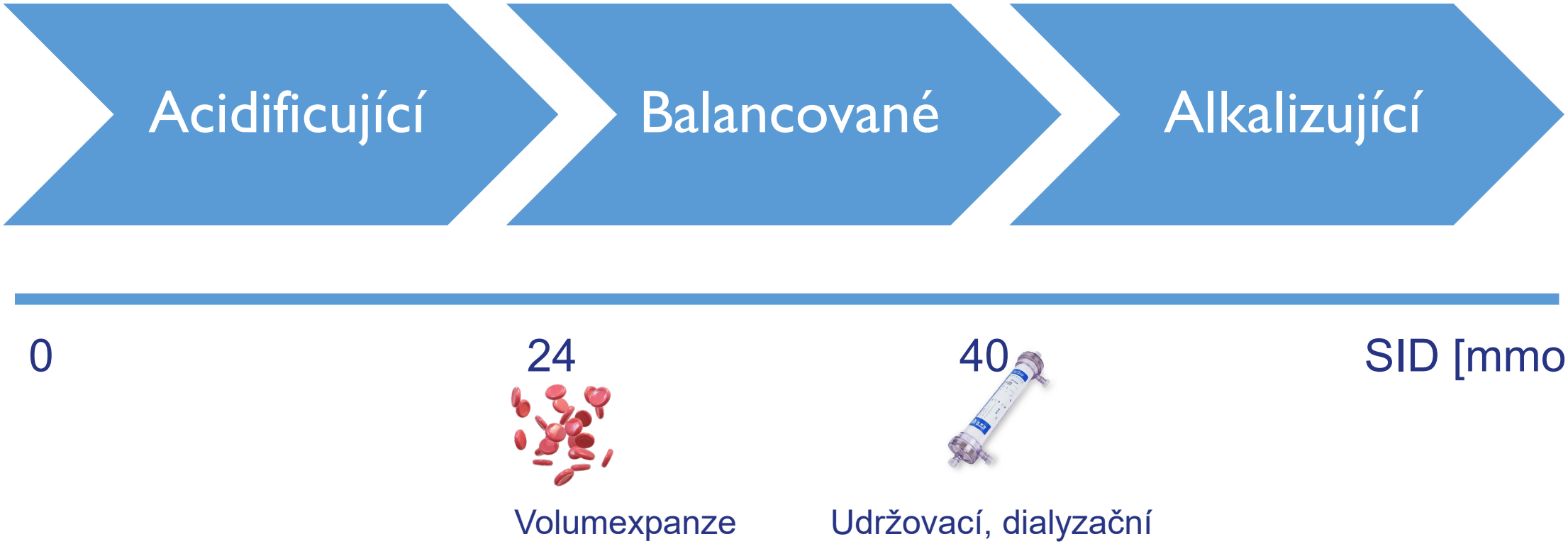

7.7
7.6
7.5
7.4
7.3
7.2
7.1
pH
Initial
[HCO3-]
Dilution fraction
100%
10%
Pre-dilution
0
10
20
30
40
50
60
Diluent [SID] (mEq/l)

Overview of SID of fluids

Infusion fluid	Na+	Cl-	K+	Buffer	SID [mM]*
Normal saline	154	154	-	-	**0**
Ringer	147	155	4	-	**0**
Hartmann‘s	131	111	5	Lactate 29mM	**29**
PlazmaLyte	140	98	5	Acetate 27mM Gluconate 23mM	**50**
Gelofusine	154	120	-	Succinate-	**34**
Voluven HES 130/0.4 6%	154	154			**0**
Volulyte HES 130/0.4 6%	137	110	4	Acetate 34mM	**34**
Fresh Frozen Plasma	Var.	**Var.**	Var.	Mostly citrate	**~120**

* Provided that organic ion is fully metabolised

Efektivní SID infúzních roztoků a vliv na acidobazickou rovnováhz



Příběh třetí

Creep fluids

Van Regenmortel, N: Intensive Care Medicine 2018

Intensive Care Med (2018) 44:409–417
https://doi.org/10.1007/s00134-018-5147-3

ORIGINAL

Maintenance fluid therapy and fluid creep impose more significant fluid, sodium, and chloride burdens than resuscitation fluids in critically ill patients: a retrospective study in a tertiary mixed ICU population

Niels Van Regenmortel[1,2*], Walter Verbrugghe[1], Ella Roelant[3], Tim Van den Wyngaert[4,5] and Philippe G. Jorens[1,5]

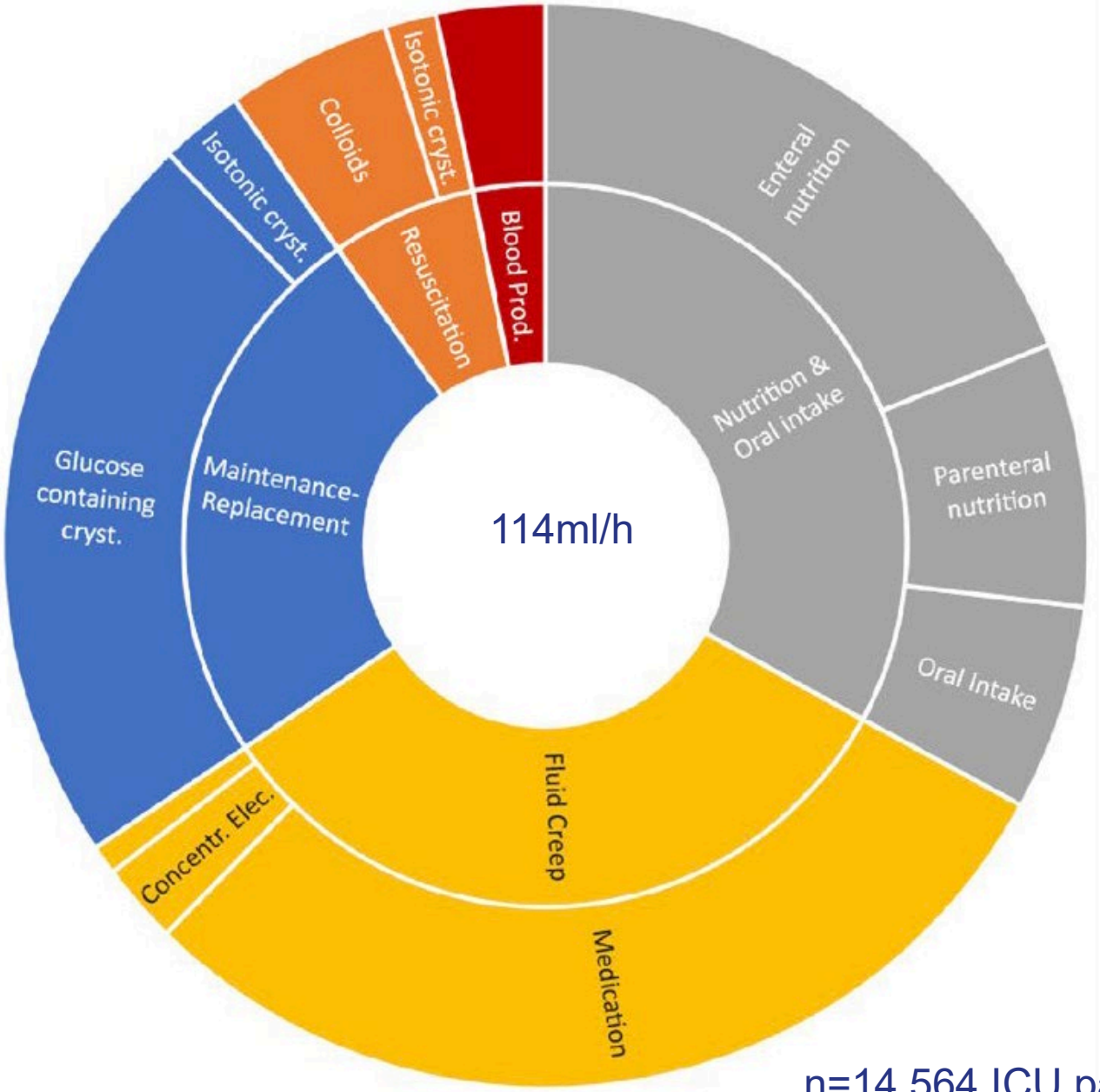
Abstract

Purpose: Research on intravenous fluid therapy and its side effects, volume, sodium, and chloride overload, has focused almost exclusively on the resuscitation setting. We aimed to quantify all fluid sources in the ICU and assess fluid creep, the hidden and unintentional volume administered as a vehicle for medication or electrolytes.

Methods: We precisely recorded the volume, sodium, and chloride burdens imposed by every fluid source administered to 14,654 patients during the cumulative 103,098 days they resided in our 45-bed tertiary ICU and simulated the impact of important strategic fluid choices on patients' chloride burdens. In septic patients, we assessed the impact of the different fluid sources on cumulative fluid balance, an established marker of morbidity.

Results: Maintenance and replacement fluids accounted for 24.7% of the mean daily total fluid volume, thereby far exceeding resuscitation fluids (6.5%) and were the most important sources of sodium and chloride. Fluid creep represented a striking 32.6% of the mean daily total fluid volume [median 645 mL (IQR 308–1039 mL)]. Chloride levels can be more effectively reduced by adopting a hypotonic maintenance strategy [a daily difference in chloride burden

Link na free fulltext:



n=14 564 ICU pacientů

Průměrně

757 ml/den tekutin

v naředěných lécích

131mmol Na+/den

Dr Ashley Miller

Maintenance Fluid

@icmteaching

Assess

Can the patient meet their fluid needs orally or enterally?

If so no IV fluid

Consider fluid and electrolyte needs
- History
- Examination
- Fluid balance
- U&Es, Hb
- Weight chart

Fluid overload
- Positive fluid balance
- Peripheral oedema

If so no IV fluid
(unless specific indication)

Fluid deficit
- Compatible history (not drinking, D&V etc)
- Water loss: ↑Na, ↑Hb, ↑urea
- GI losses: →Na, ↑Hb, ↑urea

Prescribe
(modify as below)

1.2 ml/kg/h 4% glucose 0.18% sodium chloride + 20 - 40 mmol K per L

25-30 ml/kg/d water | 1mmol/kg/d Na, K, Cl | 50-100g/d glucose

Modify
Complex fluid or electrolyte replacement issues or losses?

Ongoing abnormal fluid or electrolyte losses:
(treat as for **fluid deficit**)
- Vomiting / NG loss
- Biliary drainage loss
- Stoma losses
- Diarrhoea
- Polyuria (DI)

Na <135 or >145

K <3.5 or >5.5

Fluid overload
- **No IV fluid**
- Consider diuretics

Fluid deficit
- Water loss with ↑Na: **5% glucose**
- GI losses with → Na: **Compound Sodium Lactate**
- Volume to replace deficit
- Usual maintenance thereafter

Reassess
at least daily

Stop IV fluid when no longer needed. Aim to switch to oral or enteral ASAP.

Které články OPRAVDU změnily, co dělám na ICU?

Antonín Jabor, AmJRCCM 2000

Používám rutinně elektroneutralitu v hodnocení vnitřího prostředí

Luciano Gattinoni, ICM 2011

Sleduji SID roztoků, které podávám a v jaké situaci

N.Van Regenmortel, ICM 2018

U stabilních pacientů nahrazuji udržovací infúze nasogastrickou vodou

Děkuji za pozornost

Save the dates:

ČSIM Mikulov 18.-20.6.2023

4EU Summer School of Acid Base Praha 14.-15.9. 2023

IFAD-mini Praha 16.9. 2023

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