

Obrigada por ver esta apresentação
Gostaríamos de recordar-lhe que esta
apresentação é propriedade do autor.

É-lhe fornecida pela Sociedade Portuguesa de
Pediatria no contexto do 18º Congresso
Nacional de Pediatria, para seu uso pessoal,
tal como submetido pelo autor

© 2017 pelo autor

CONGRESSO NACIONAL
DE PEDIATRIA
25 – 27 OUT 2017
Centro de Congressos
Alfândega do Porto



Fluidoterapia de manutenção ***Salgado ou insosso?***

Augusto Ribeiro

CONGRESSO NACIONAL
DE PEDIATRIA
25 – 27 OUT 2017
Centro de Congressos
Alfândega do Porto



Maintenance parenteral fluids in the critically ill child

Karen Choong, Desmond Bohn

J Pediatr 2007;83 (2 Suppl): S3-10

“A prescrição e administração de fluídos endovenosos deve ser considerada um procedimento invasivo, e como tal deve ser tratada com o mesmo respeito e vigilância de qualquer prescrição farmacológica”



CONGRESSO
NACIONAL
DE PEDIATRIA
25 – 27 OUT 2017
Centro de Congressos
Alfândega do Porto



Sumário

1 História

2 Fisiologia

3 Norma

4 Mudança de paradigma

5 *Pro* SALGADO

6 *Pro* INSOSSO

7 Tendência

8 Sugestão

Fluidoterapia de manutenção *Salgado ou insosso?*

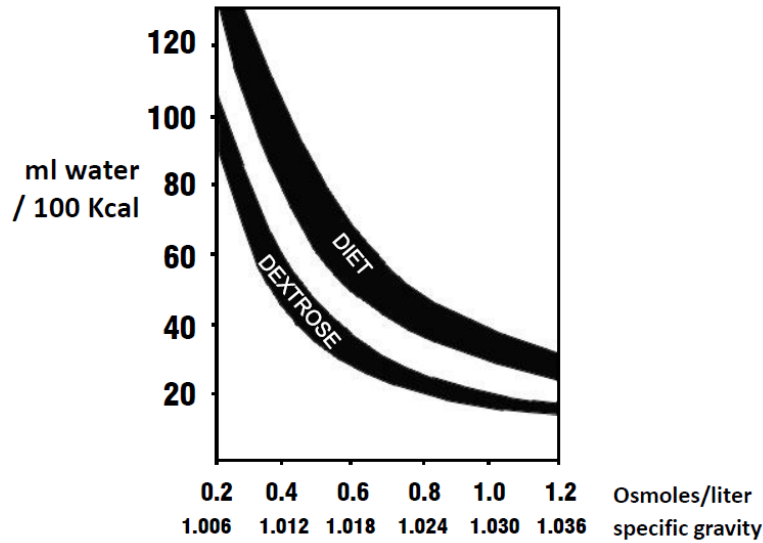
Breve nota histórica

1. Darrow and Pratt: *J.A.M.A.* 1950;143:365
2. William Wallace: *Am J Clin Path.* 1953;23:1133
3. Holliday and Segar: *Pediatrics.* 1957;19:823
4. Talbot NB, Crawford JD et al: *Pediatrics.* 1959;24:495

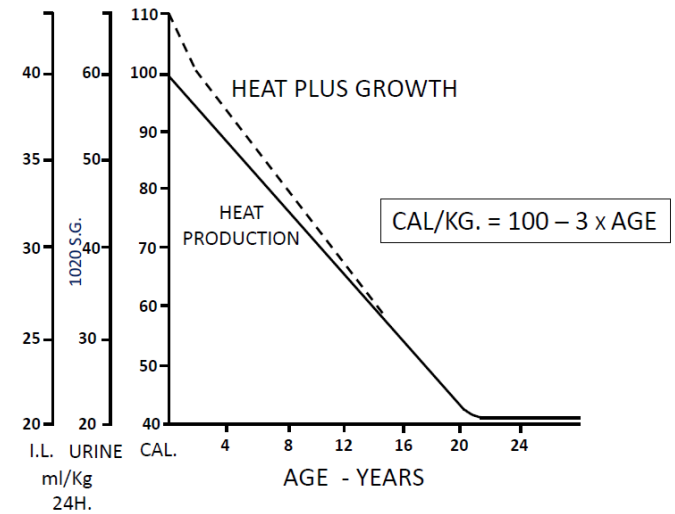
Correlacionaram as necessidades em água com:

1. Consumo energético
2. Idade
3. Peso
4. Superfície corporal cutânea

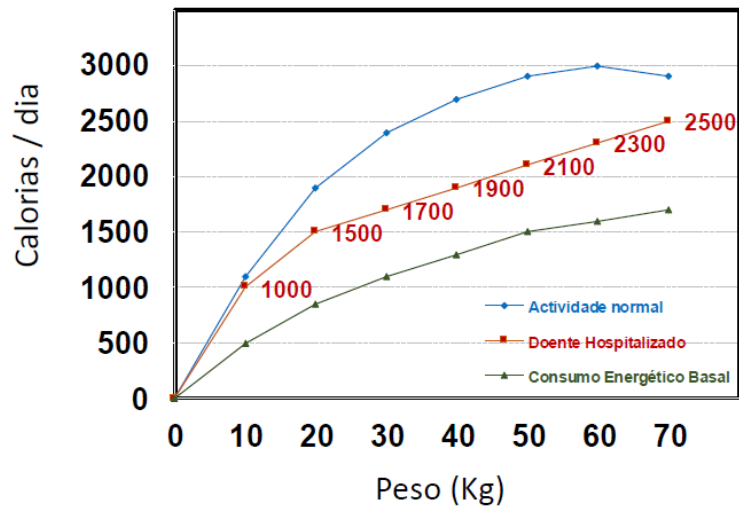
Daniel Darrow and Edward Pratt
JAMA 1950; 143:365-373



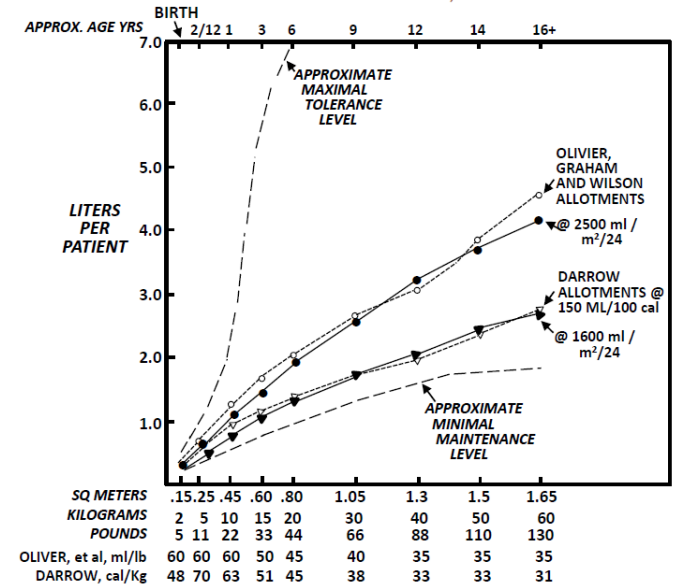
William Wallace
Am. J. Clin. Path. 1953; 23:1133



Holliday M. and Segar W.
Pediatrics 1957;19:823



Talbot NB, Richie RH and Crawford JD
Pediatrics 1959;24:495



Nota histórica

Fluidoterapia de manutenção *Salgado ou insosso?*

Breve nota histórica

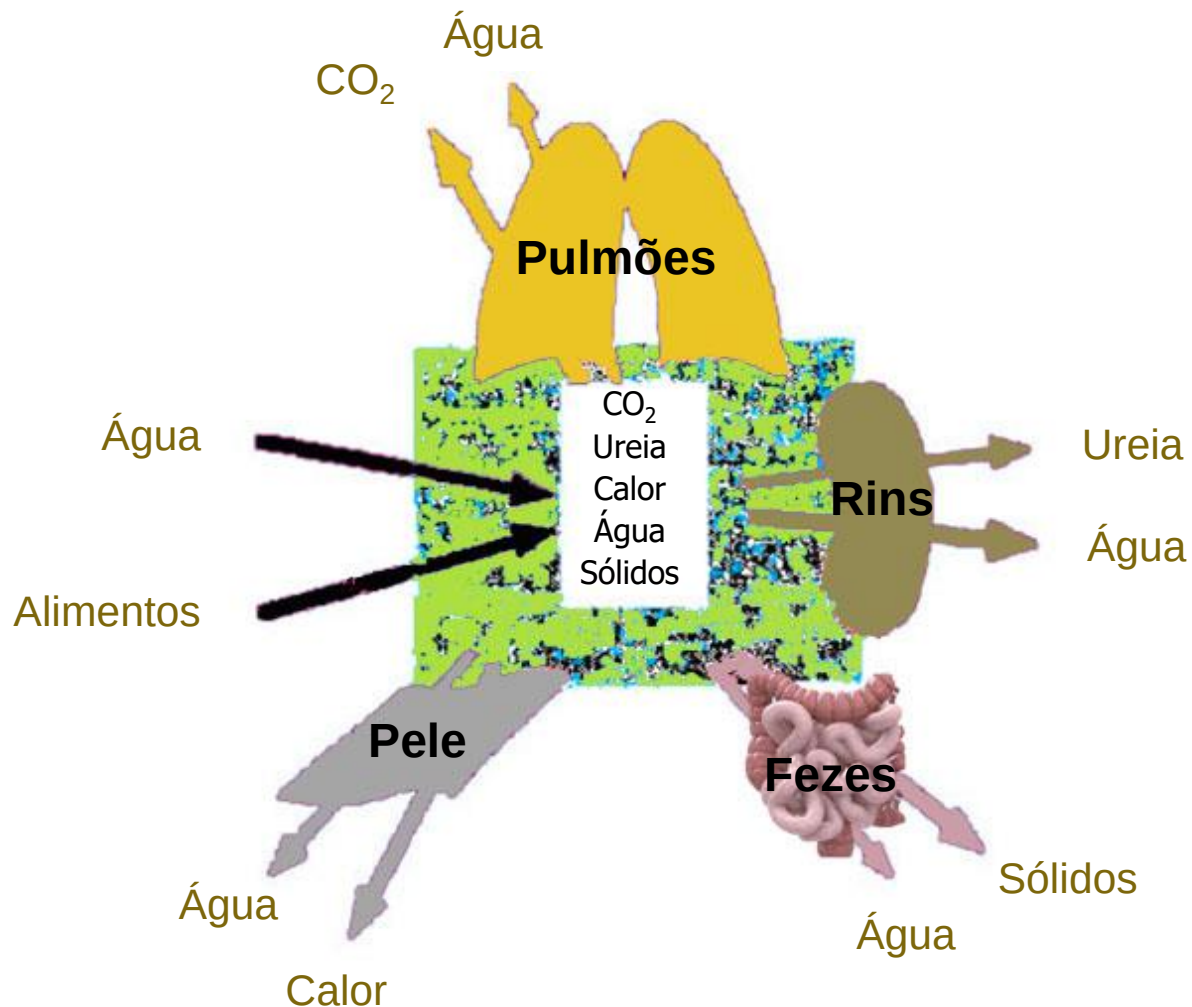
1990 - 2000

VIRAGEM DE PARADIGMA

1. Arieff et al: *BMJ*. 1992;304:1218-1222
2. McRae et al: *Int J Pediatr Otorhinolaringol*. 1994;30:227-232
3. Paut et al: *Ann Fr Anesth Réanim*. 2000;10:467-473
4. Halberthal et al: *BMJ*. 2001;322:780-782
5. Moritz et al: *Pediatr Nephrol*. 2005;20:1687-1700

Metabolismo e homeostasia

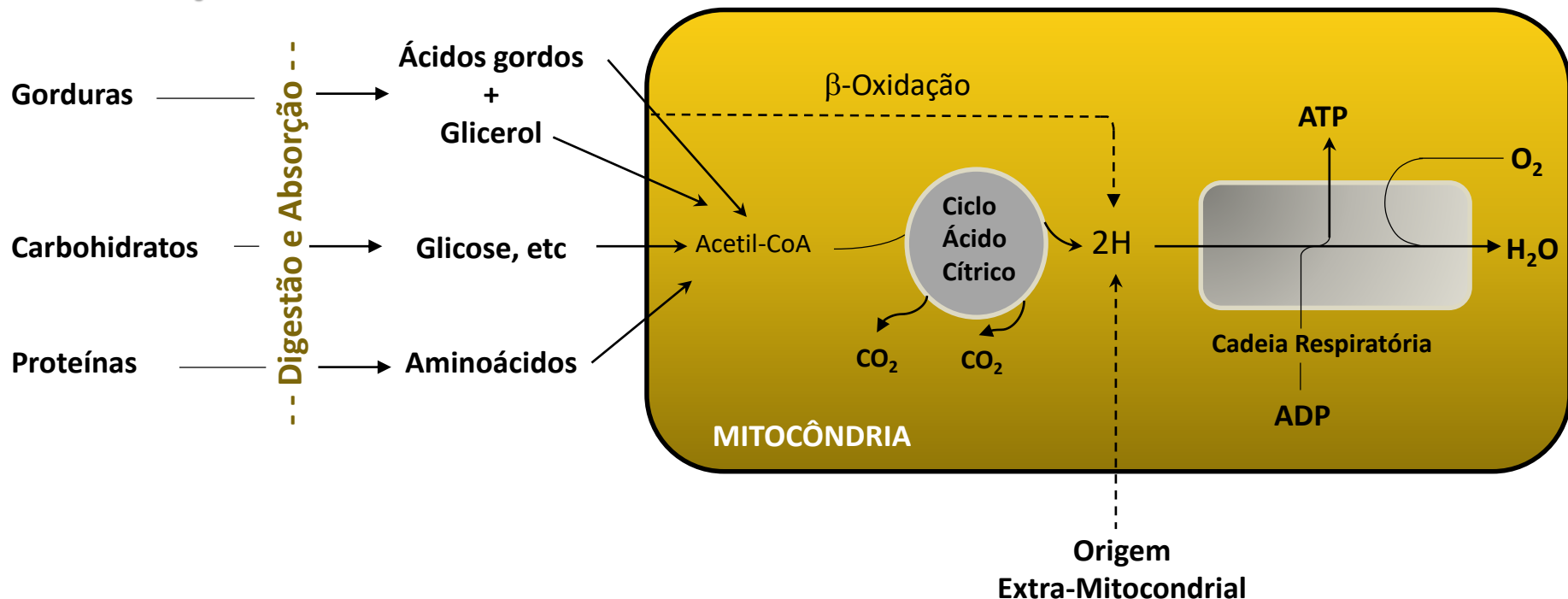
Perdas fisiológicas de água



Água endógena

Cadeia respiratória mitocondrial

Alimentação



Fluidoterapia EV

Métodos de cálculo

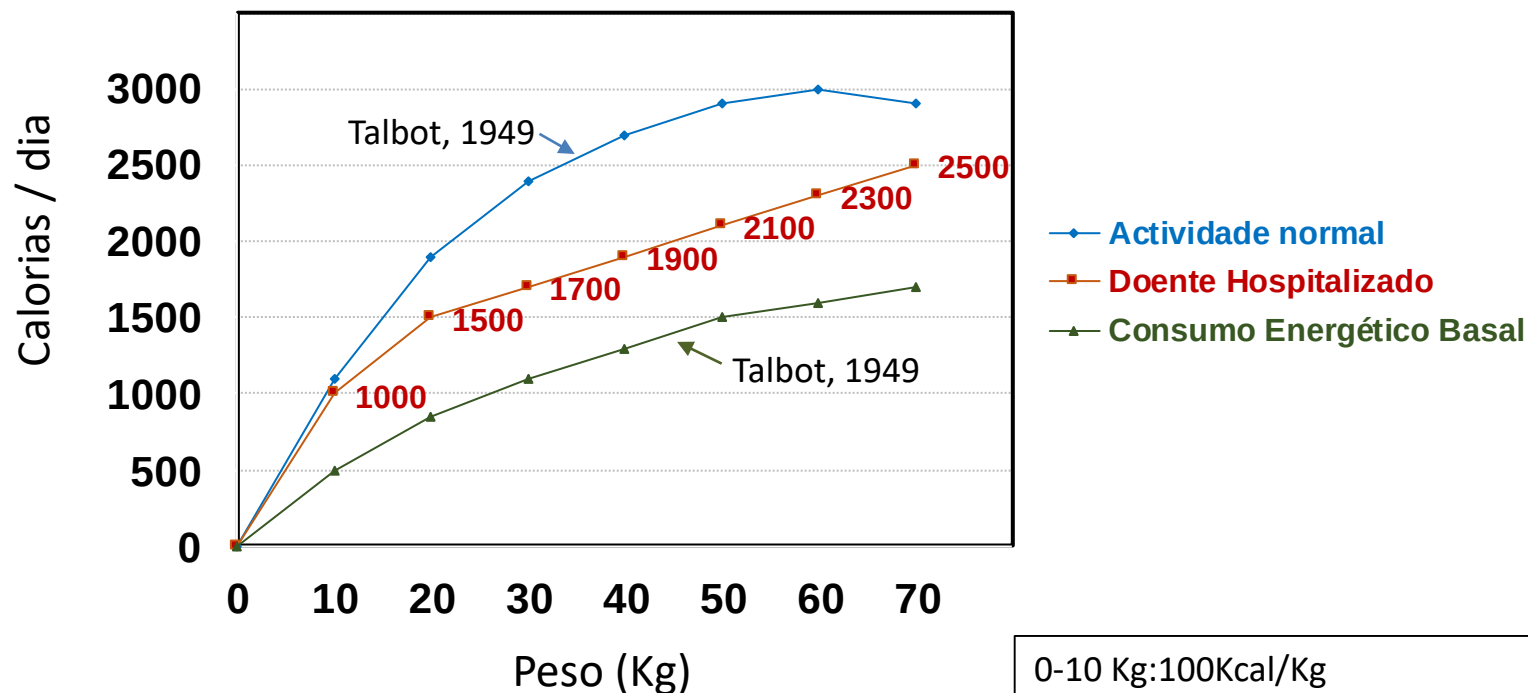
	FLUÍDOS (Quantidade de Água)	ELETRÓLITOS (necessidades)
Manutenção	Determinados por vários métodos: Consumo energético Holliday-Segar Superfície Cutânea	<u>Por 100 ml de água:</u> Na^+ 3 mEq; Cl^- 2 mEq; K^+ 2 mEq <u>Por m^2:</u> Na^+ 30 mEq; Cl^- 20 mEq; K^+ 20 mEq
Défice	Determinados pela variação do peso ou clinicamente.	Uso de tabelas
Perdas continuadas	Determinados por medição laboratorial.	Determinados por tabelas ou medição laboratorial.

Cálculo das necessidades hídricas através do peso

The maintenance need for water in parenteral fluid therapy

Malcolm A. Holliday and William E. Segar

Pediatrics 1957;19:823



0-10 Kg: 100Kcal/Kg
 10-20Kg: 1000 cal + 50 cal/Kg qKg>10Kg
 > 20 Kg: 1500 cal + 20 cal/Kg qKg>20Kg

Fluidoterapia de manutenção

Método de Holliday-Segar



CUSTO CALÓRICO:

Perdas insensíveis = 50

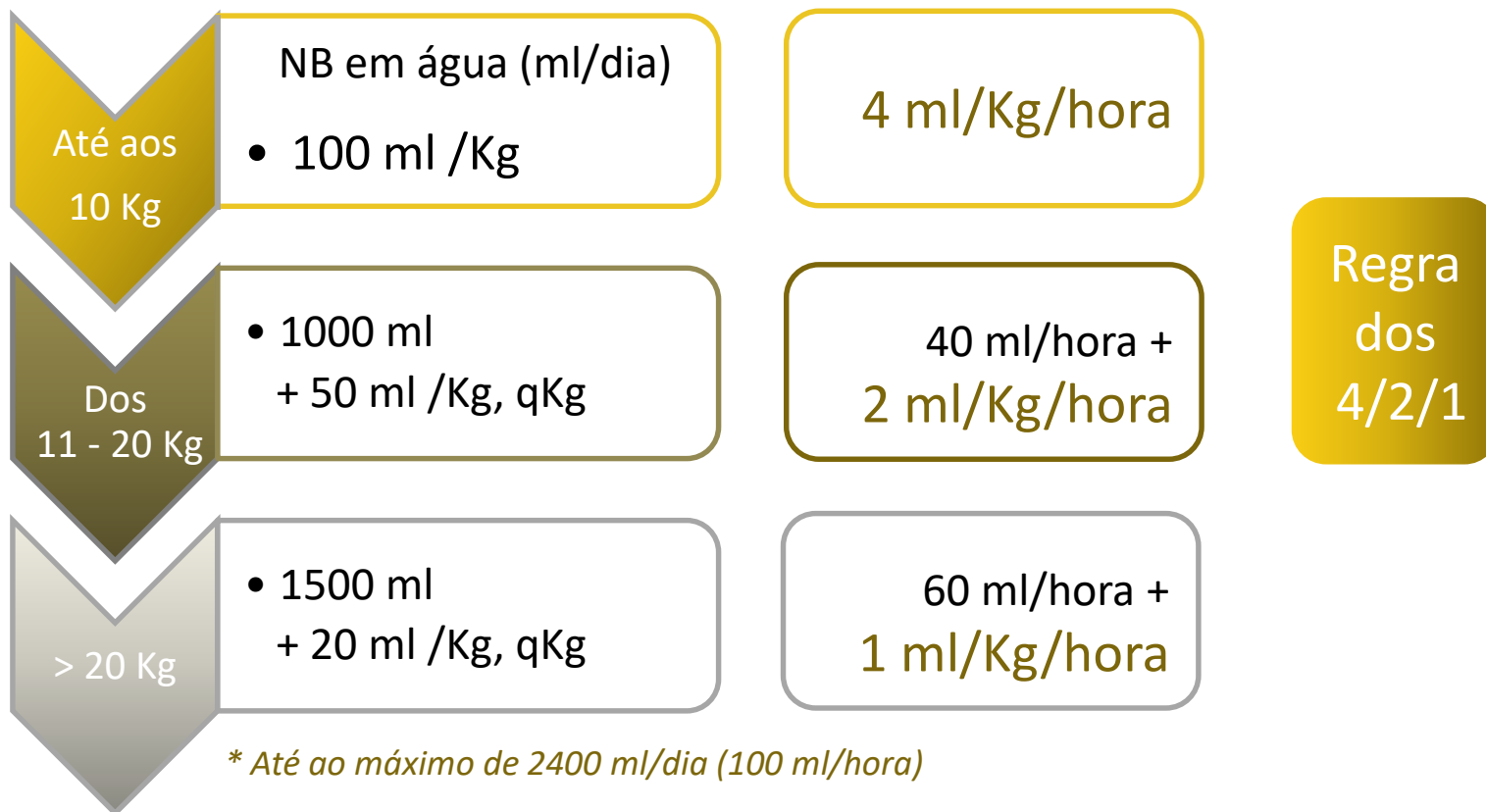
Perdas urinárias = 66,7

Água de oxidação = 16,7
(endógena)

H_2O
= 100 ml /100 Kcal
(1ml / 1 Kcal)

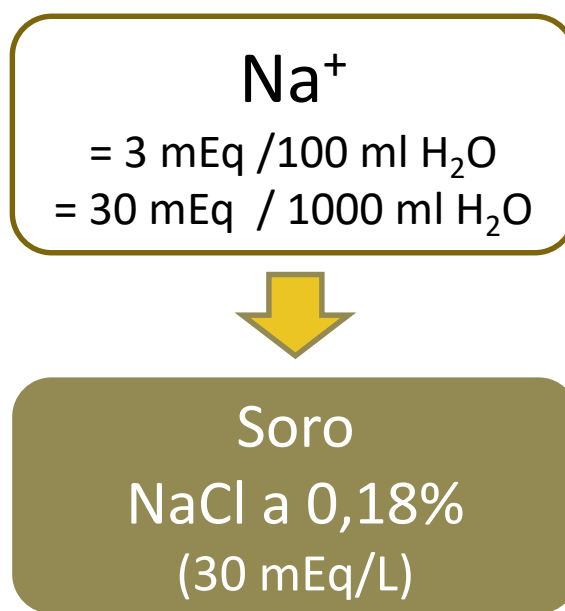
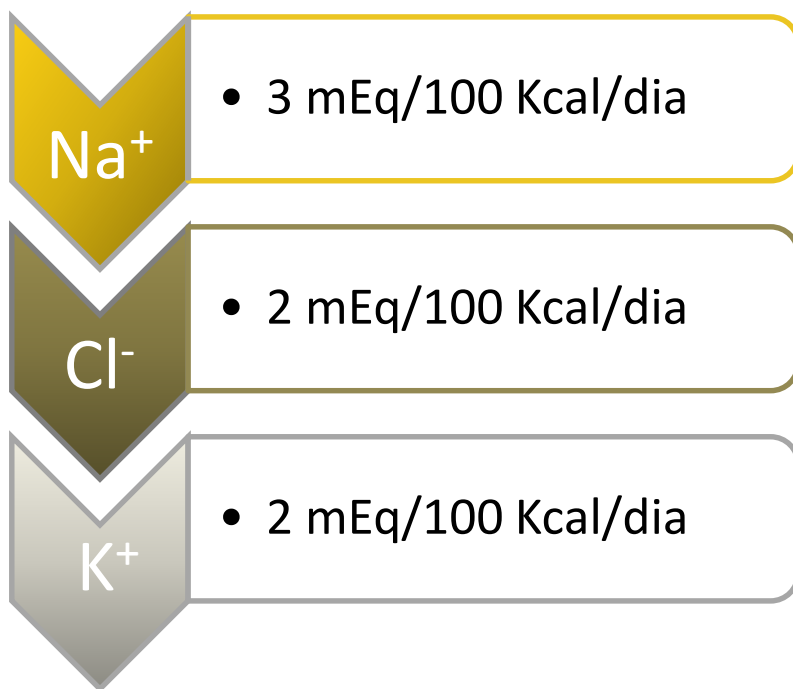
Fluidoterapia de manutenção

Método de Holliday-Segar



Fluidoterapia de manutenção

Método de Holliday-Segar



As necessidades em eletrólitos foram discutidas em apenas 1 parágrafo e indexadas à composição do leite materno e de vaca.

Fluidoterapia de manutenção

Fórmula de Holliday e Segar

- Desenvolvida a partir de:
 - consumo energético em “crianças saudáveis”.
 - composição do leite materno e do leite de vaca.
- Rápida, simples, que estima o consumo energético através do peso.
- Assume que por cada 100 calorias metabolizadas são necessários 100 ml H_2O (*ou seja, 1 ml H_2O / 1 Kcal*):
 - 50 ml/100 calorias por perdas insensíveis
 - 67 ml/100 calorias por urina
 - 17 ml/100 calorias ganhas pelo metabolismo endógeno
- Não adequada para recém-nascidos < 14 dias.

Características dos soros

	SÓDIO (mmol/L)	OSMOLARIDADE in vitro (mOsm/L H ₂ O)	TONICIDADE in vivo (mOsm/L H ₂ O)	ÁGUA LIVRE (volume/L)	%
Glicose 5%	0	286	0	1000	100
NaCl 0,18% + G4%	30	282	60	800	80
NaCl 0,3% + G5%	51	380	102	750	75
NaCl 0,45 %	77	154	154	500	50
NaCl 0,45 % + G5%	77	454	150	500	50
Lactato Ringer	131	278	280	160	16
NaCl 0,9 %	154	308	308	0	0
NaCl 0,9 % + G5%	154	586	308	0	0
Plasma-Lyte 148	140	584	280	≈ 0	

Osmolaridade plasmática ≈ 290 mOsm /L

Conceitos

❖ Osmolaridade (Tonicidade *in vitro*)

Número de osmóis do soluto por litro de solução.

$$2Na^+ + \text{Glicose}/18 + \text{Ureia}/6$$

$$285 - 295 \text{ mOsm/L}$$

❖ Tonicidade (*in vivo*)

Concentração total do soluto que é capaz de exercer força osmótica através da membrana celular.

$$2Na^+ + \text{Glicose}/18$$

Conceitos

❖ Isotónico

Com concentração de sódio similar à do plasma.

NaCl 0,9%

G5% + NaCl 0,9%

❖ Hipotónico

Com concentração de sódio inferior à do plasma.

G5% + NaCl 0,3%

G5% + NaCl 0,45%

Conceitos

❖ Água livre (AL)

Quantidade de água sem sódio, relativamente ao plasma.

	Qtd. em [Na ⁺] (mmol/L)	Qtd. em água livre		
		(ml)	(partes)	(%)
<i>NaCl 0,9%</i>	154	0	0	0
<i>NaCl 0,45%</i>	77	500	1/2	50
<i>NaCl 0,3%</i>	51	666	2/3	66
<i>G5%</i>	0	1000	1	100

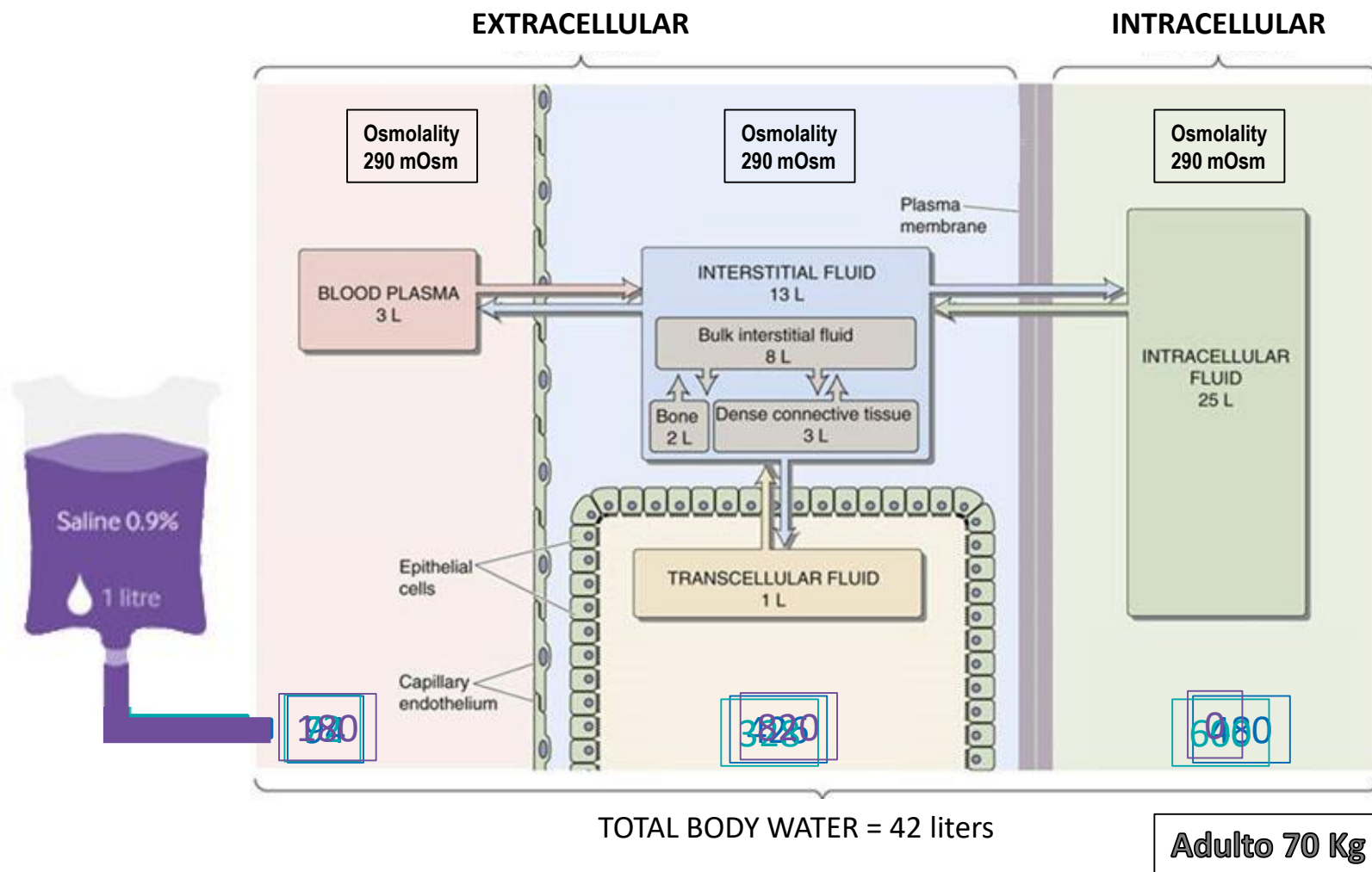
$$[\text{Na}^+] \text{ plasmático} = [\text{Na}^+] \text{ sangue (140 mmol/L)} / 0,93 = 150 \text{ mmol/L}$$

Características dos soros

	SÓDIO (mmol/L)	OSMOLARIDADE in vitro (mOsm/L H ₂ O)	TONICIDADE in vivo (mOsm/L H ₂ O)	ÁGUA LIVRE (volume/L)	%
Glicose 5%	0	286	0		100
NaCl 0,18% + G4%	30	282	60	HIPO TÓNICOS	80
NaCl 0,3% + G5%	51	380	102		75
NaCl 0,45 %	77	154	154		50
NaCl 0,45 % + G5%	77	454	150		50
Lactato Ringer	131	278	280	ISO TÓNICOS	16
NaCl 0,9 %	154	308	308		0
NaCl 0,9 % + G5%	154	586	308		0
Plasma-Lyte 148	140	584	280	≈ 0	

Osmolaridade plasmática ≈ 290 mOsm /L

Efeito nos compartimentos orgânicos provocado por diferentes tipos de soros



Norma

(1957 >>> 2000)



Complicações neurológicas e mortes associadas à hiponatremia

Table 3 Neurological injury due to hospital-acquired hyponatremia in children receiving hypotonic fluids. *D₅* 5% dextrose; *ND* not disclosed

Author	Age (years)	Setting	Intravenous fluid	Sodium value (mEq/l)	Complication
Duke [99]	0.15	Meningitis	0.18% NaCl	137 to 131	Cerebral edema, dilated pupil
Jenkins [19]	ND	ND	Hypotonic	<130	2 deaths
Jackson [100]	1.5	Influenza	D ₅ water	120	Death, cerebral edema
	3	Meningitis	D ₅ water	128	Death, cerebral edema
Keating [12]	3	Dehydration	D ₅ water	133 to 114	Death, cerebral edema
	2	Hip surgery	Hypotonic	112	Death, cerebral edema
Gregorio [101]	4	Gastroenteritis	D ₅ 0.45% NaCl	136 to 118	Respiratory arrest, seizure, cerebral demyelination
Hoom [15]	ND	ND	Hypotonic	142–128	Death, cerebral edema, cardiac arrest
Arief [3]	3.5	Tonsillitis	Hypotonic	139 to 114	Quadriplegia
	5	Tonsillectomy		141 to 123	Death
	4	Tonsillectomy		139 to 115	Death
	15	Tonsillectomy		141 to 101	Death
	3.5	Tonsillectomy		138 to 121	Death
	12	Fracture setting		137 to 120	Mental retardation
	4	Fracture setting		139 to 118	Death
	3	Tonsillectomy		137 to 113	Death
	1.5	VP shunt		137 to 114	Vegetative
	9	Fracture setting		137 to 120	Vegetative
	15	Fracture setting		138 to 102	Vegetative
	4	Tonsillectomy		138 to 107	Death
	2	Orchiopexy		138 to 116	Death
	6	Nasal packing		138 to 119	Death
	12	Appendectomy		137 to 123	Death
	12	Pneumonia		134 to 116	Vegetative
Halberthal [4]	ND	ND	Hypotonic	<130	5 deaths, 1 neurological damage
Playfor [20]	1	Gastroenteritis	D ₄ 0.18% NaCl	137 to 120	Death, respiratory arrest, cerebral edema
Armour [102]	4	Renal transplant	Hypotonic	139 to 119	Death, respiratory arrest, cerebral edema
Eldredge [103]	5	Cerebral palsy, slit ventricles, heal cord repair	D ₅ 0.225% NaCl	127	Death, cardio-respiratory arrest
	8	Slit ventricles, spinal surgery	D ₅ 0.45% NaCl	129	Insertion of subdural bolt with eventual recovery
Paut [104]	ND	Postoperative	Hypotonic	118	Death
McRae [105]	10	Tonsillectomy	Hypotonic	115	Death, pulmonary edema, cerebral edema
	6	Tonsillectomy	D ₅ 0.2% NaCl	122	Death, respiratory arrest, cerebral edema
Hughes [106]	3	Spinal surgery	D ₄ 0.18% NaCl	118	Death, respiratory arrest, cerebral edema
Cowley [107]	ND	Spinal surgery	Hypotonic	118	Death, respiratory arrest, cerebral edema
McJunkin [7]	<15	LaCrosse encephalitis	D ₅ 0.45% NaCl	138 to 134	13 with neurological deterioration: 3 cerebral herniation, 6 status epilepticus, 1 coma
Moritz	0.06	Dehydration	D ₅ 0.225% NaCl	141 to 119	Cardio-respiratory arrest, cerebral edema, neurological devastation
	5	Tympanoplasty	Hypotonic	123	Cardiac arrest, cerebral edema, neurological devastation
	0.9	Gastroenteritis	D ₅ 0.3% NaCl	136 to 126	Death, cardio-respiratory arrest, cerebral edema

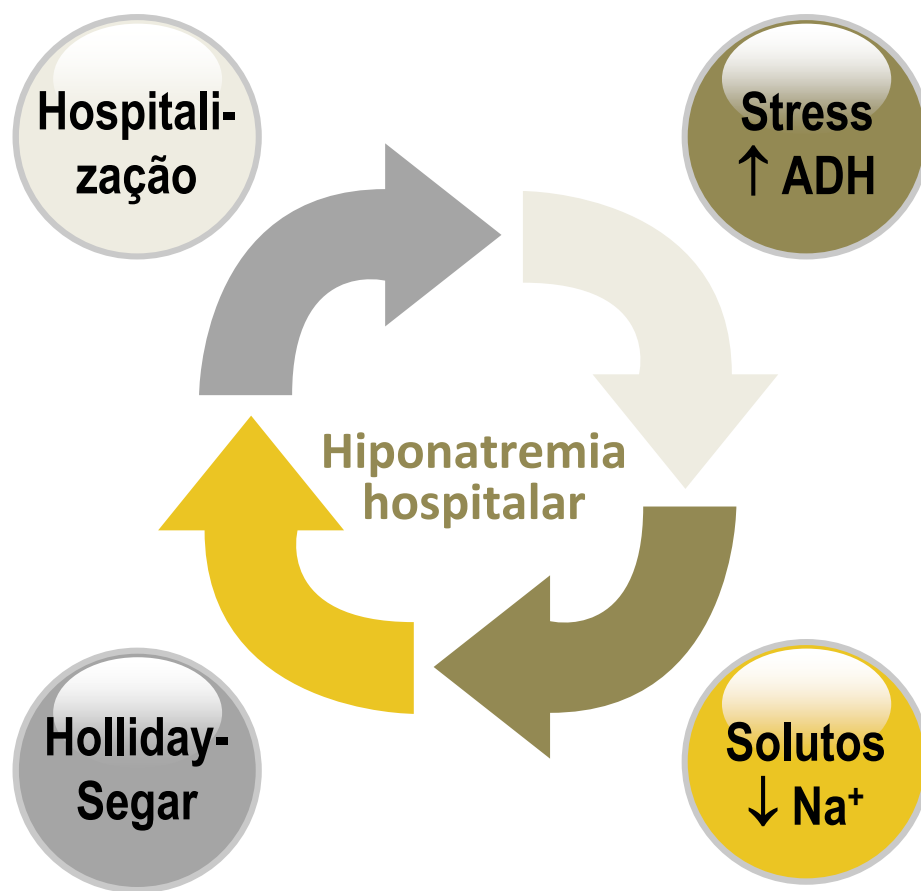
Pediatr Nephrol
2005; 20:
1687 - 1700

Incidência de hiponatremia em crianças hospitalizadas

Autor	Sódio sérico (mmol/L)	Incidência (%)
Hoorn et al. 2004	< 135 na admissão com pneumonia comunidade	22
Don et al. 2008	< 135 em doentes de urgência	45
Armon et al. 2008	Em doentes hospitalizados	
	< 135	24
	< 130	5
Hasegawa et al. 2009	< 130 em doentes hospitalizados	17
Hanna et al. 2010	< 135 em doentes hospitalizados	18,5

Fluidoterapia de manutenção

Fatores associados à hiponatremia

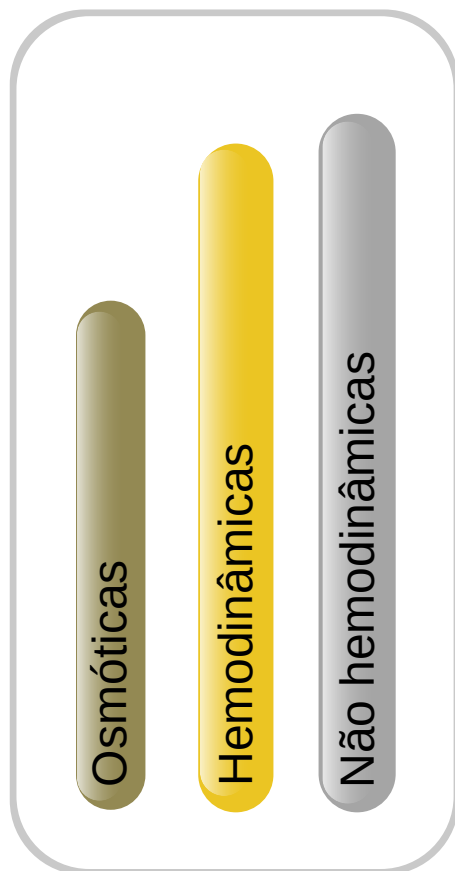


Efeito ADH



Hiponatremia hospitalar

Causas de elevação de ADH



1

Osmóticas

2

Hemodinâmicas (↓ VEC)

- **Perdas GI** (vômitos e diarreia)
- **Perdas cutâneas** (fibrose quística)
- **Perdas renais** (diuréticos, CSW, hipoaldost.)
- **Estados edematosos** (ICC, cirrose, SN, hipoalb.)
- **Diminuição da RVS** (sepsis, hipotireoidismo)

3

Não hemodinâmicas

- **Doenças do SNC, pulmonares e oncológicas**
- **Fármacos** (Ciclofosfamida, vincristina, morfina, ...)
- **SIHAD**
- **Nauseas, vômito, dor, stress**
- **Pós-operatório**
- **Deficiência de cortisol**

Hiponatremia hospitalar

Risco aumentado

(pneumonia, bronquiolite, meningite, pós-op, CIP)



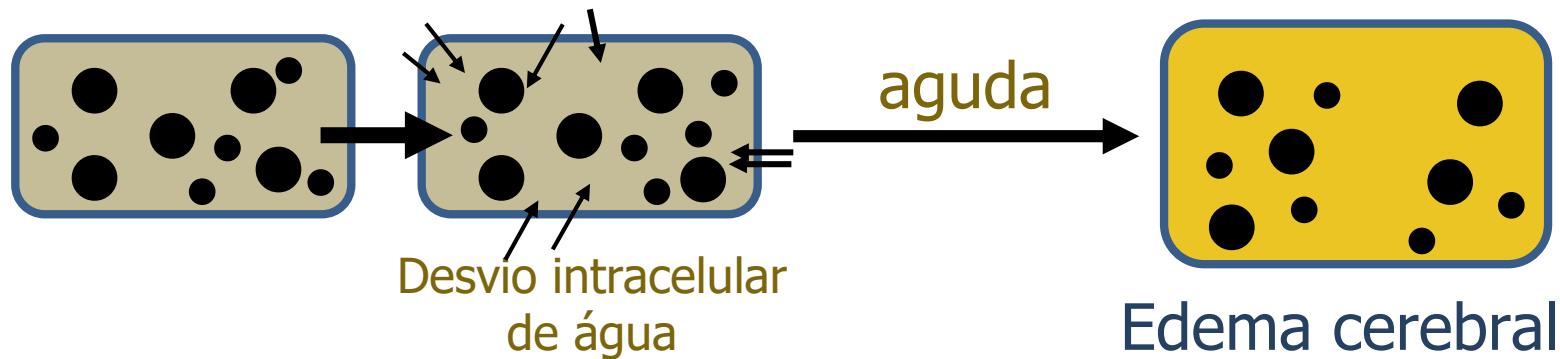
Causas fisiológicas

- Aumento de:
 - ADH
 - Sensibilidade à ADH
 - Ingestão de água livre
 - Água livre iatrogénica (soros hipotónicos)
- Aumento de:
 - ADH (efeito natriurético)
 - Volume extracelular
 - PNA

Hiponatremia

Resposta da célula cerebral à hipotonia

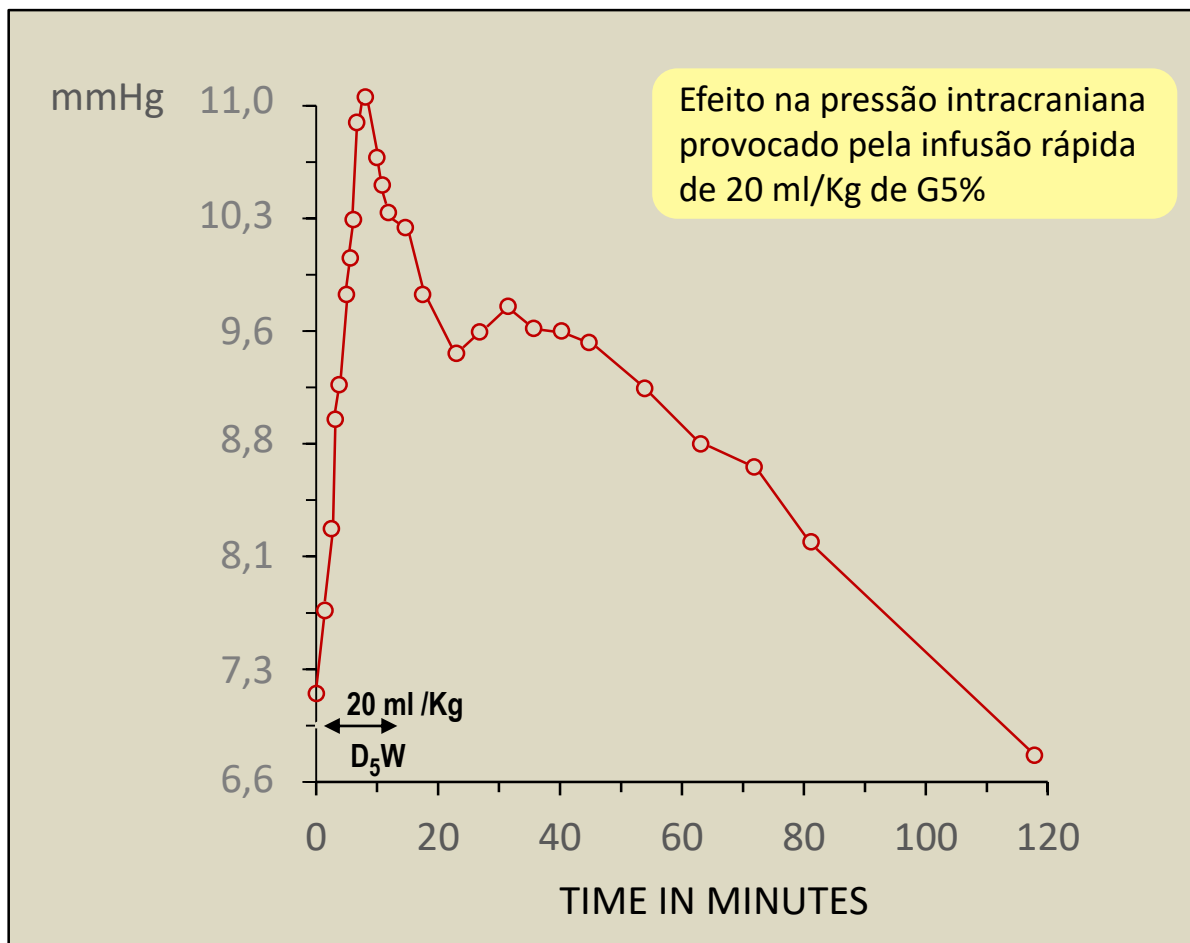
Hipo-osmolaridade do LEC



Efeito dos soros hipotónicos

Laurence Finberg

Pediatrics in Review 1981; 3: 113

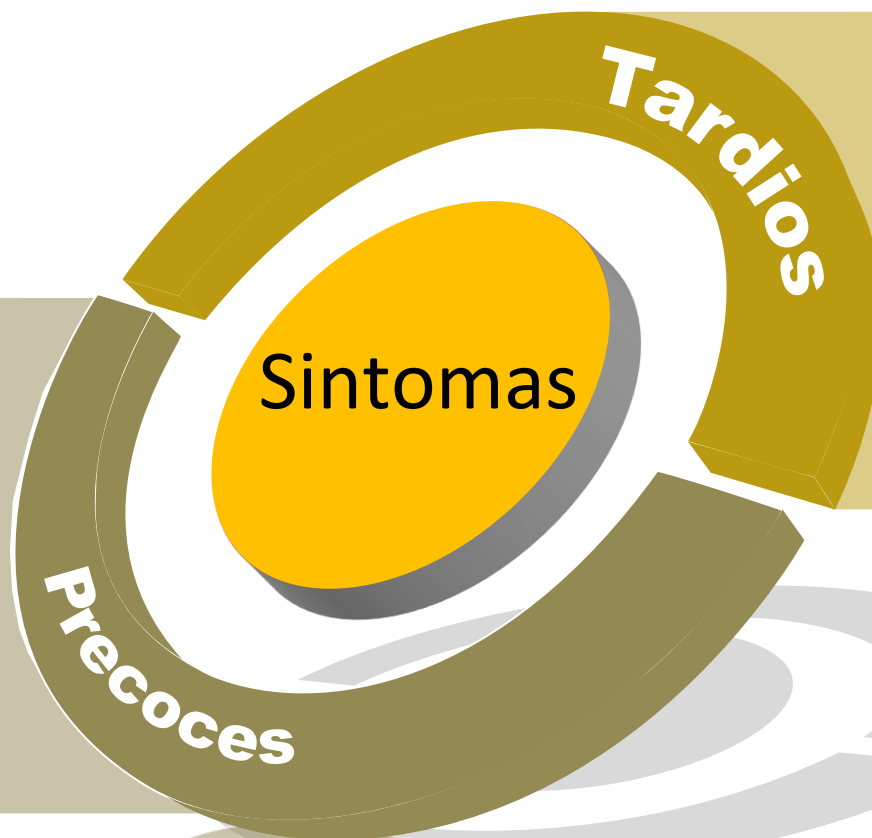


Encefalopatia hiponatrémica

Clínica

PRECOCES

- Náuseas
- Vômitos
- Cefaleias
- Alt. Consciência:
 - ▶ Letargia
 - ▶ Agitação
 - ▶ desorientação



TARDIOS

- Convulsões
- Coma (ECG ≤ 8)
- Midríase, anisocoria
- Descorticação
- Edema pulmonar
- Apneia
- Arritmia; isquemia



CONGRESSO
NACIONAL
DE PEDIATRIA
25 — 27 OUT 2017

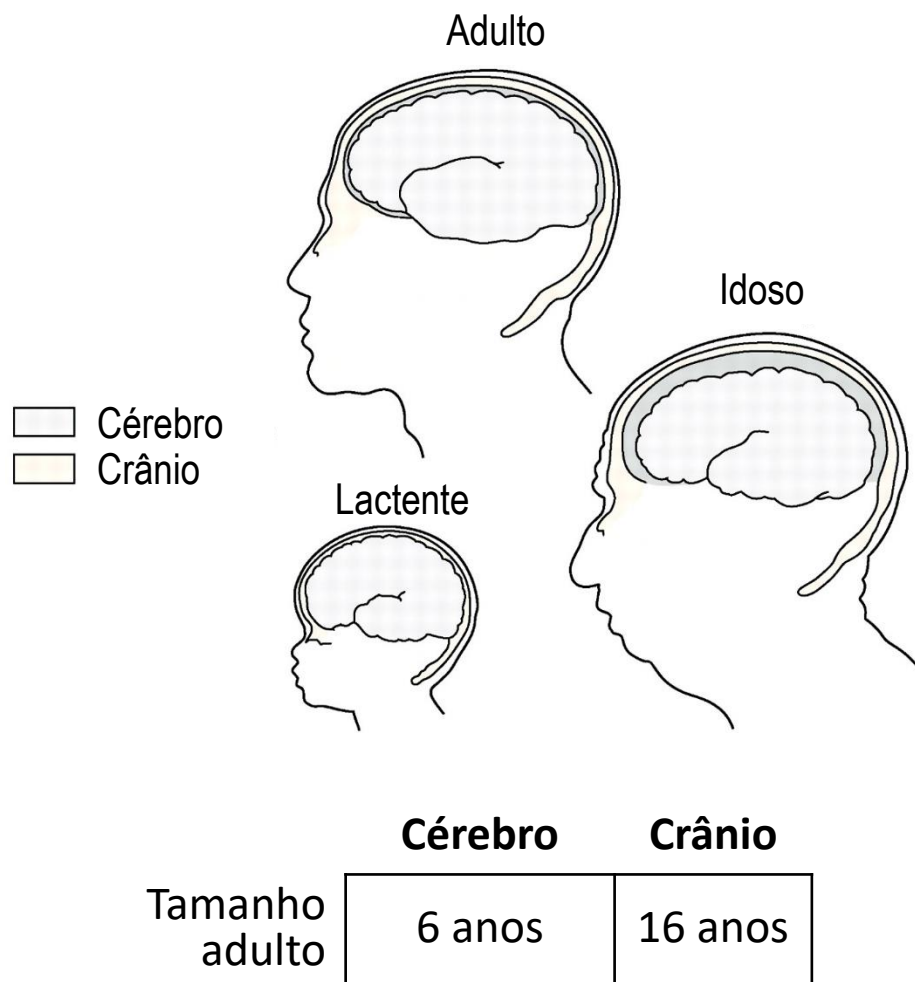


SPP

SOCIEDADE
PORTUGUESA
DE PEDIATRIA

Encefalopatia hiponatrémica

fatores de risco



- Idade
 - CRIANÇAS
- Género feminino
 - Estrogéneos
- ADH elevada
 - Pós-operatórios
- Hipóxia
- Doenças do SNC

Holliday & Segar

Falhas

INDEXAÇÃO DO REE AO PESO

CONSUMO ENERGÉTICO EM REPOUSO (REE)

- Baseado na massa magra.
(Illner K et al. Am J Physiol Endocrinol Metabol. 2000)
- 60% do REE é explicado por apenas 4 órgãos
($\approx 5,5\%$ do peso).

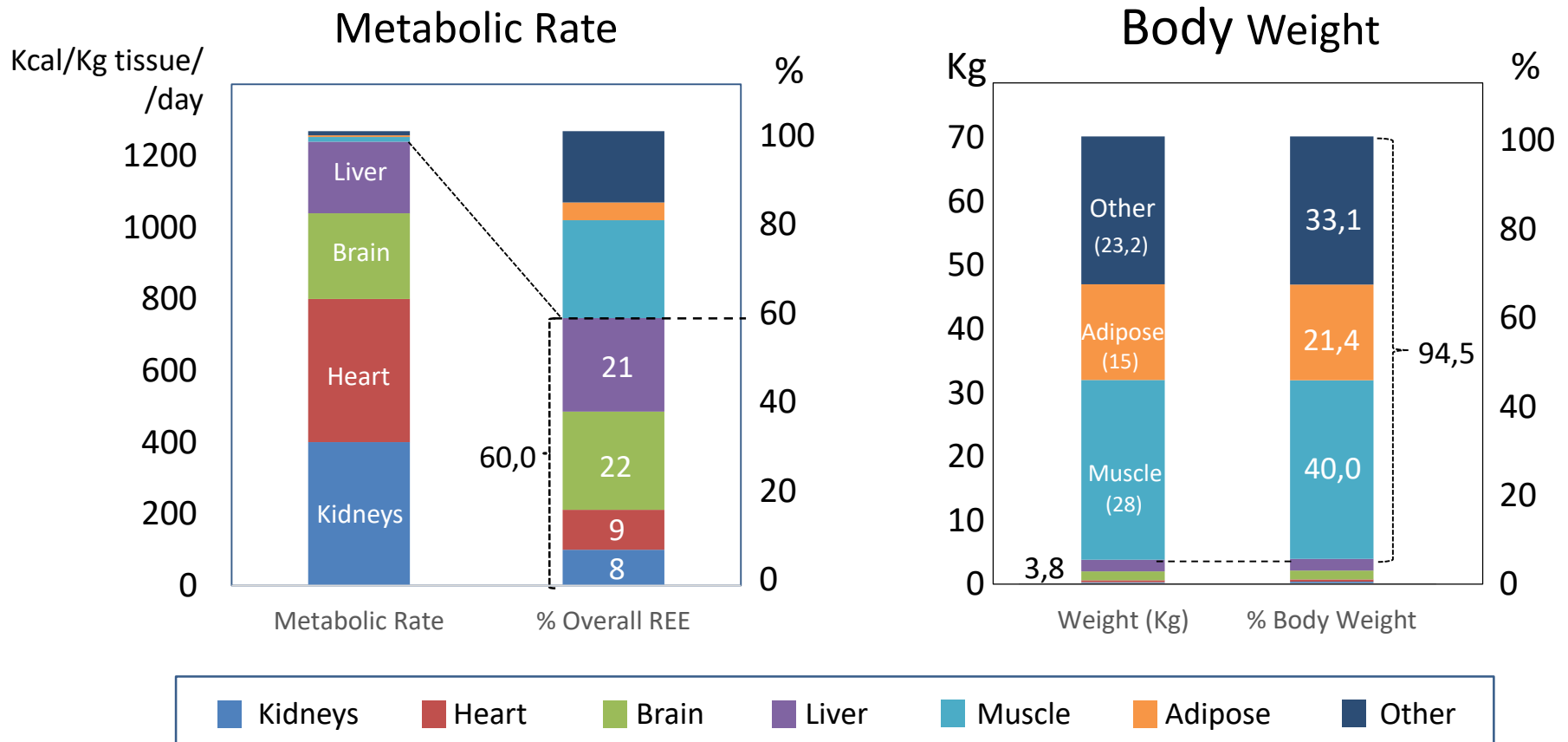
CRIANÇA DOENTE $\neq$ SAUDÁVEL

CONSUMO ENERGÉTICO (EE) MENOR

- REE é 50% do utilizado pelo H&S.
- Crescimento suspenso (50% das EE).
- Hipometabolismo.
- Inatividade.

Energy Needs of the Body

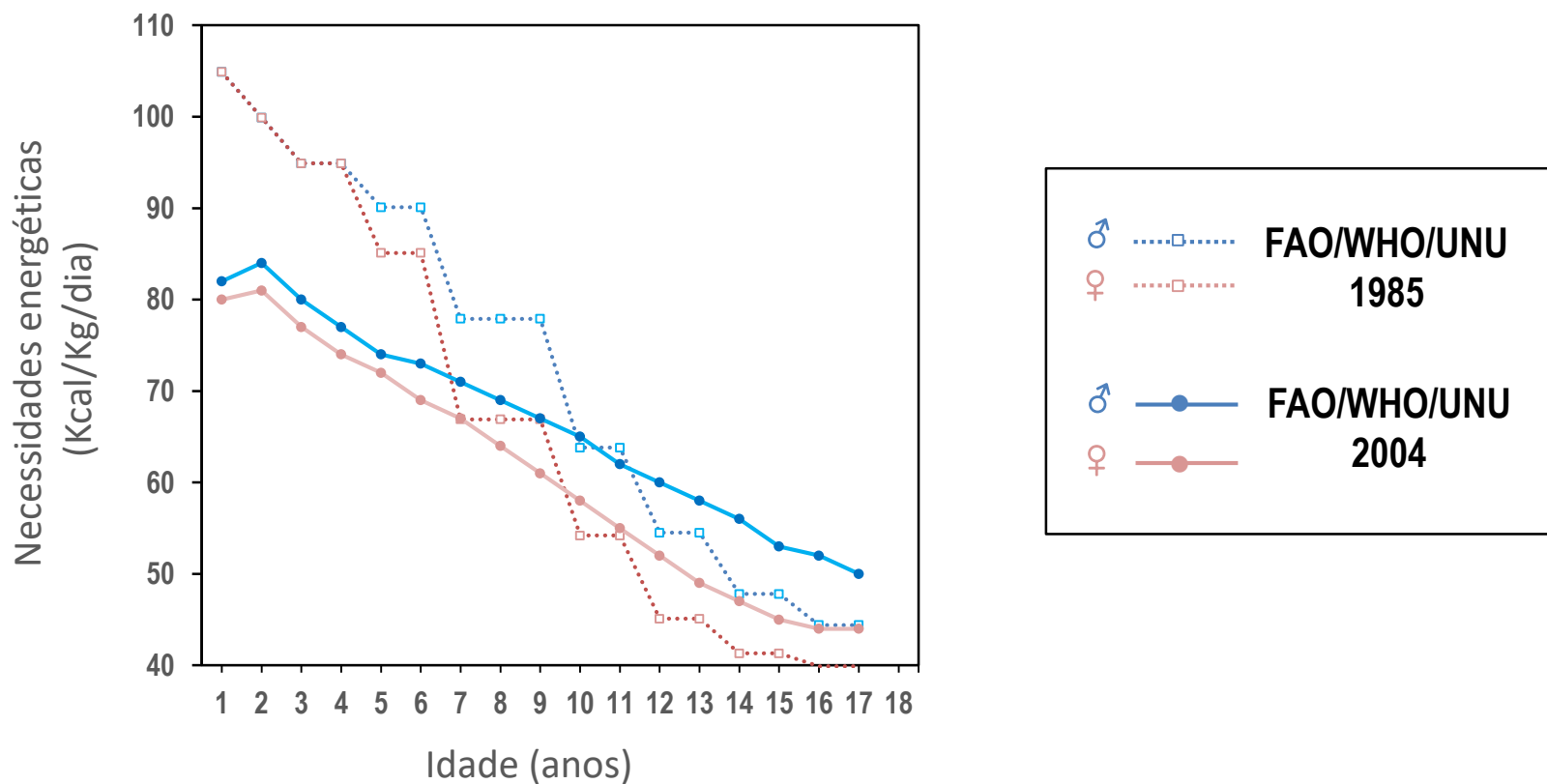
Dissecting the energy needs of the body
McClave SA, Snider HL
Curr Opin Clin Nutr Metab Care 2001;4(2):147-7



Necessidades energéticas diárias

Nancy F. Butte

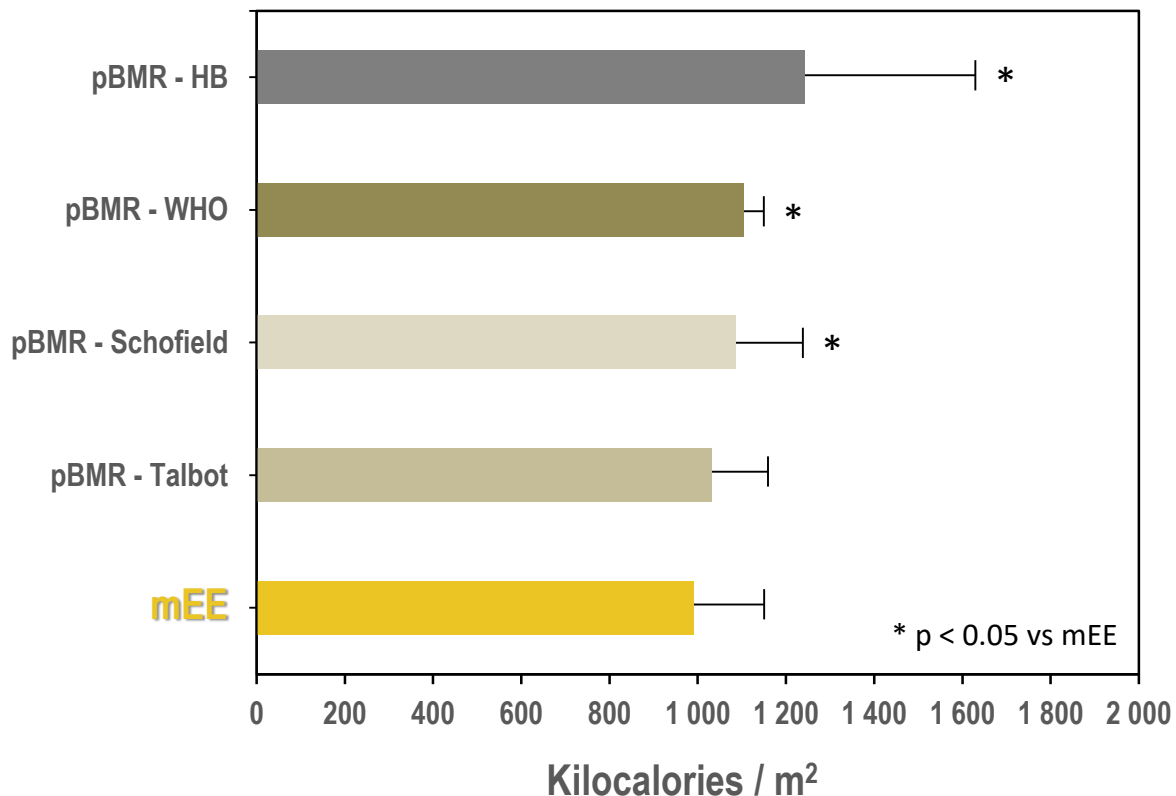
Energy Requirements of Infants, Children and Adolescents
Pediatric Nutrition in Practice 2015; 113: 34-40



adptado de ...

Consumo energético nas crianças gravemente doentes

George Briassoulis et al.
Crit Care Med 2000 Vol.28, Nº 4: 1166 - 1172



mEE: measured Energy Expenditure
(indirect calorimetry)

pBMR: predicted Resting Energy
Expenditure (formulas)

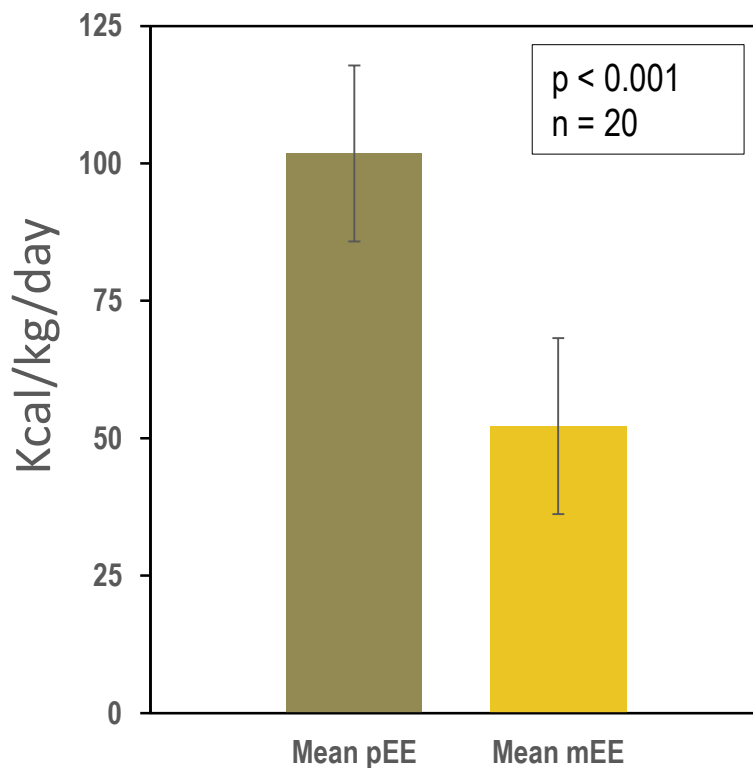
O hipermetabolismo não
foi observado nas crianças
gravemente doentes.

Em 50 – 60% dos doentes
o mEE foi < 90 % da pBMR

Measured Energy Expenditure in Critically ill Infants and Young Children

Walter Chwals et al.

J Surg Res 1988; 44: 467 - 472



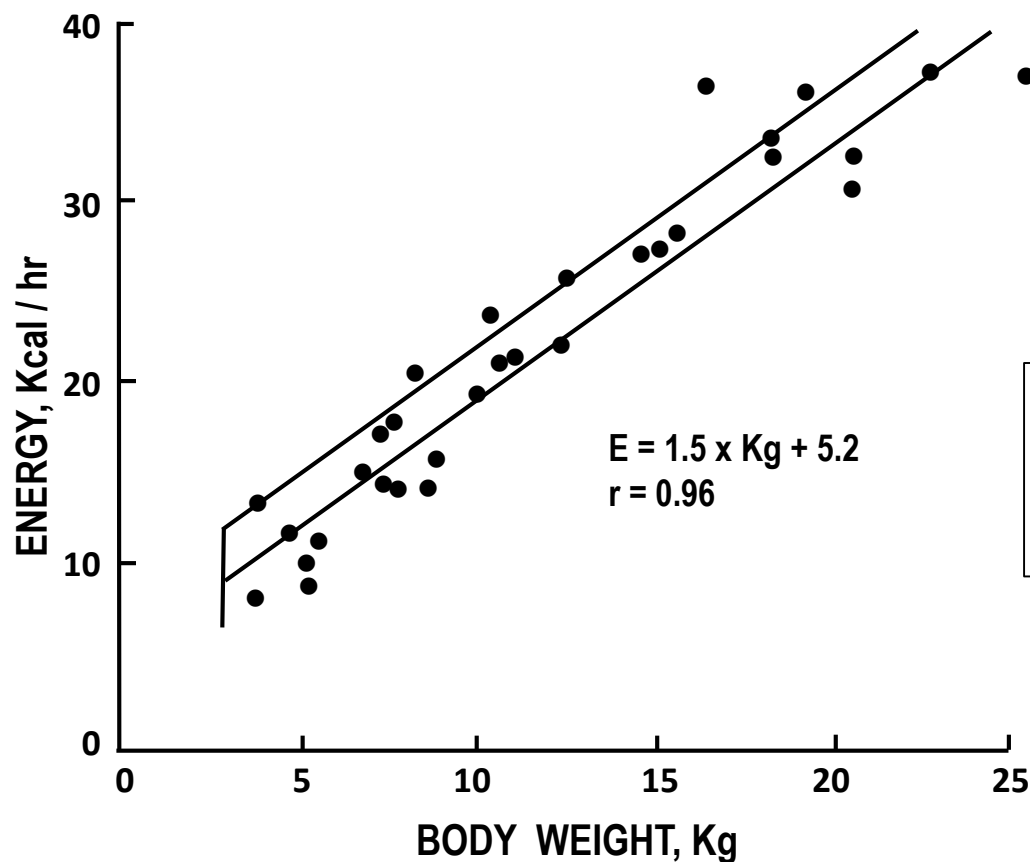
O consumo energético médio medido (mEE) foi 52,6% $\pm$ 17% inferior ao consumo energético previsto (pEE)

pEE, predicted energy expenditure mEE, measured energy expenditure

Consumo energético em crianças anestesiadas

Sten G. E. Lindahl

Anesthesiology. 1988;60:377-382

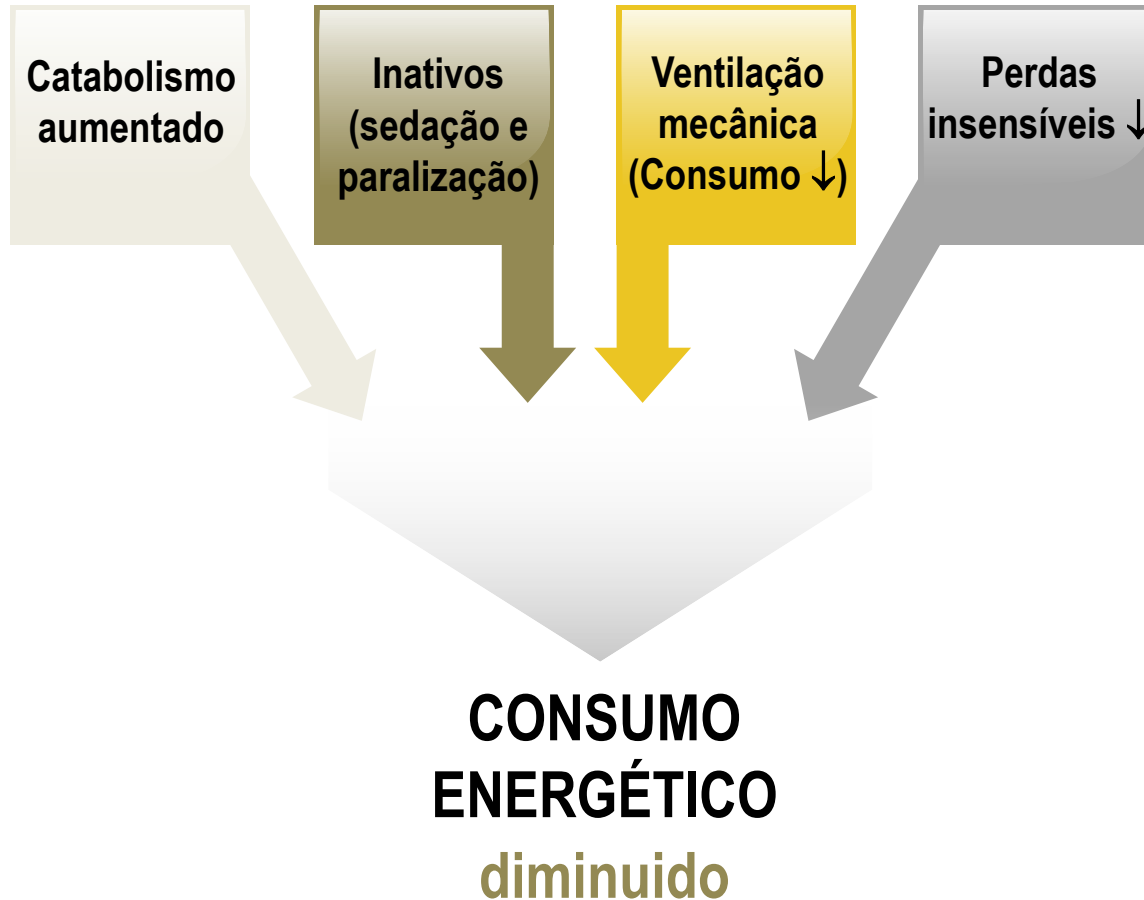


O consumo energético
foi 50% inferior ao usado
por Holliday & Segar

Holliday & Segar

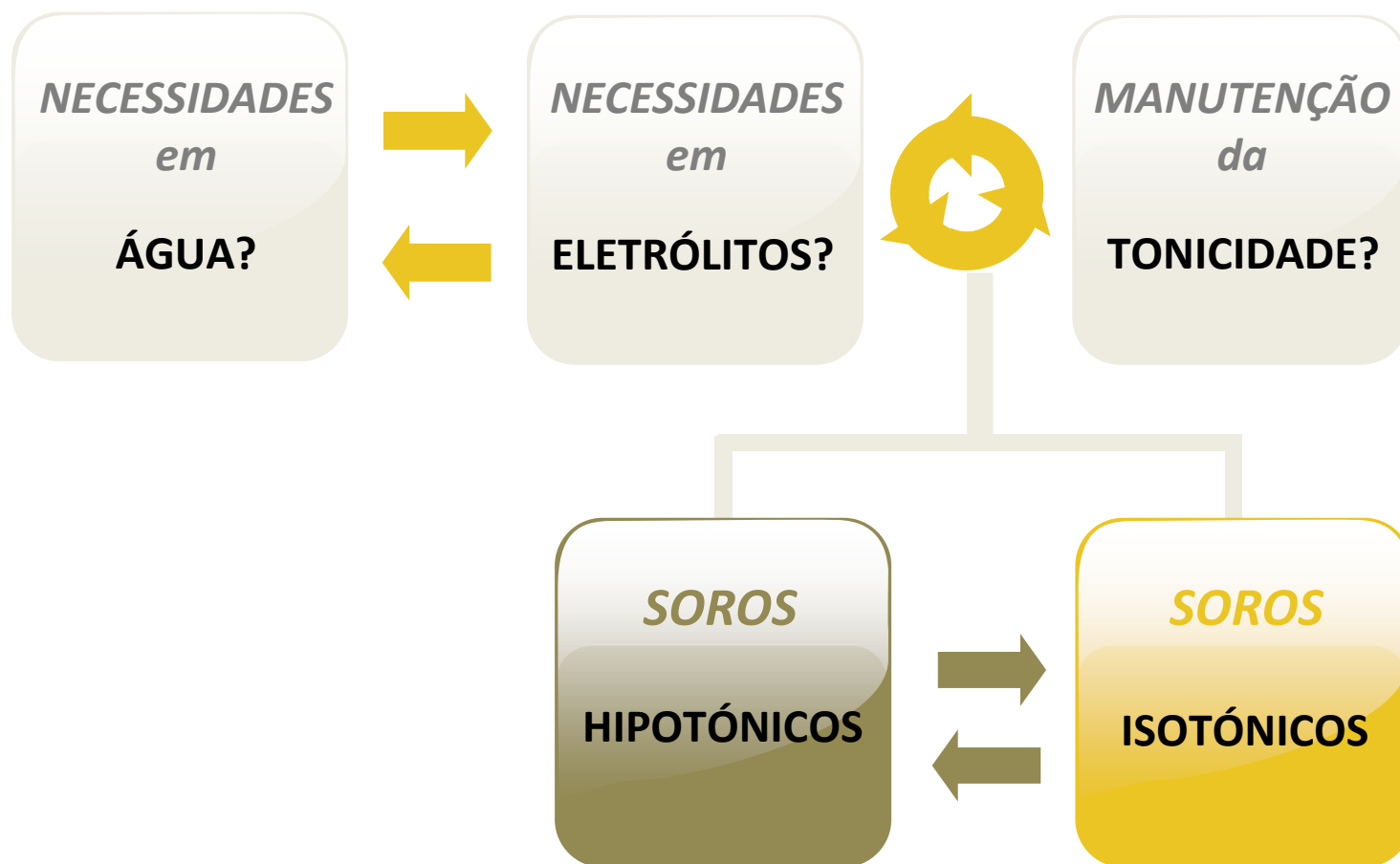
Falhas

Doente em CI pediátricos



Fluidoterapia de manutenção

Prescrição de fluídos



Viragem de paradigma

(desde 2000 >>>>)





Ações a promover

1. Remover NaCl 0,18% com Glicose 4% das farmácias.
2. Produzir *Guidelines*.
3. Fornecer treino e supervisão.
4. Usar tabelas para balanço e prescrição.
5. Reportar casos de hiponatremia.

**National Patient Safety Agency**

Patient safety alert

22



Alert

28 March 2007

Immediate action ☐

Action ☒

Update ☐

Information request ☐

Ref: NPSA/2007/22

Reducing the risk of hyponatraemia when administering intravenous infusions to children

The National Patient Safety Agency (NPSA) is issuing advice to healthcare organisations on how to minimise the risks associated with administering infusions to children.

The development of fluid-induced hyponatraemia in the previously well child undergoing elective surgery or with mild illness may not be well recognised by clinicians. To date, the NPSA's National Reporting and Learning System (NRLS) has received only one incident report (that resulted in no harm), but it is likely that incidents have gone unreported in the UK.

Since 2000, there have been four child deaths (and one near miss) following neurological injury from hospital-acquired hyponatraemia (see definition on page 7) reported in the UK.¹⁻³ International literature cites more than 50 cases of serious injury or child death from the same cause, and associated with the administration of hypotonic infusions.⁴

Action for the NHS and the independent sector

The NPSA recommends that NHS and independent sector organisations in England and Wales take the following actions by 30 September 2007 to minimise the risk of hyponatraemia in children:

- 1 Remove sodium chloride 0.18% with glucose 4% intravenous infusions from stock and general use in areas that treat children. Suitable alternatives must be available. Restrict availability of these intravenous infusions to critical care and specialist wards such as renal, liver and cardiac units.
- 2 Produce and disseminate clinical guidelines for the fluid management of paediatric patients. These should give clear recommendations for fluid selection, and clinical and laboratory monitoring.
- 3 Provide adequate training and supervision for all staff involved in the prescribing, administering and monitoring of intravenous infusions for children.
- 4 Reinforce safer practice by reviewing and improving the design of existing intravenous fluid prescriptions and fluid balance charts for children.
- 5 Promote the reporting of hospital-acquired hyponatraemia incidents via local risk management reporting systems. Implement an audit programme to ensure NPSA recommendations and local procedures are being adhered to.

For response by:

- All NHS and independent sector organisations in England and Wales

For action by:

- The chief pharmacist/pharmaceutical advisor should lead the response to this alert, supported by the chief executive, medical director, nursing director and clinical governance lead/risk manager

We recommend you also inform:

- Clinical governance leads and risk managers
- Clinical directors – paediatrics and child health
- Clinical directors – anaesthetics
- Clinical directors – surgery
- Directors of NHS laboratories
- Medical staff
- Nursing staff
- Pharmacy staff
- Patient advice and liaison service staff in England
- Procurement managers

The NPSA has informed:

- Chief executives of acute trusts, primary care organisations, ambulance trusts, mental health trusts and local health boards in England and Wales
- Chief executives/regional directors and clinical governance leads of strategic health authorities (England) and regional offices (Wales)
- Healthcare Commission
- Healthcare Inspectorate Wales

- Medicines and Healthcare products Regulatory Agency
- Business Services Centre (Wales)
- NHS Purchasing and Supply Agency
- Welsh Health Supplies
- Royal colleges and societies
- NHS Direct
- Relevant patient organisations and community health councils in Wales
- Independent Healthcare Forum
- Independent Healthcare Advisory Services
- Commission for Social Care Inspection

SOROS HIPOTÓNICOS

Alertas

Institute for Safe Medication Practices

A Nonprofit Organization Educating the Healthcare Community and Consumers About Safe Medication Practices

[Home](#) [Support ISMP](#) [Newsletters](#) [Webinars](#) [Report Errors](#) [Educational](#) [Store](#) [Consulting](#) [FAQ](#) [Tools](#) [About Us](#) [Contact Us](#)



Google Custom Search

Search x



PLAIN D5W OR HYPOTONIC SALINE SOLUTIONS POST-OP COULD RESULT IN ACUTE HYPONATREMIA AND DEATH IN HEALTHY CHILDREN

From the August 13, 2009 issue

ISMP recently learned about the tragic deaths of two 6-year-old children stemming from severe postoperative hyponatremia. The fatal events occurred at two different hospitals. In at least one of these cases, it is clear that the rapid administration of plain D5W (dextrose 5% in water) postoperatively resulted in acute hyponatremia secondary to free water retention (also called water intoxication, which is described below). Postoperative children are at high risk for developing hyponatremia, and many fatalities from this disorder have been reported in the literature.(1-14) When the serum sodium concentration rapidly falls below 120 mEq/L over 24 to 48 hours—as in the two events described below—the body's compensatory mechanism is often overwhelmed and severe cerebral edema ensues, resulting in brainstem herniation, mechanical compression of vital midbrain structures, and death.(15)

Resources

[Acute Care Main Page](#)
[Current Issue](#)
[Past Issues](#)
[Highlighted articles](#)
[Action Agendas – Free CEs](#)
[Special Error Alerts](#)
[Subscribe](#)

Newsletter Editions

Acute Care
[Community/Ambulatory](#)
[Nursing](#)
[Long Term Care](#)
[Consumer](#)



CONGRESSO
NACIONAL
DE PEDIATRIA
25 – 27 OUT 2017



SPP

SOCIEDADE
PORTUGUESA
DE PEDIATRIA

SOROS HIPOTÓNICOS

Alertas



GOV.UK

MHRA

[Home](#) > [Drug Safety Update](#)

Intravenous 0.18% saline/4% glucose solution ('hypotonic saline') in children: reports of fatal hyponatraemia

[Recorte de Ecrã Inteiro](#)

From: [Medicines and Healthcare products Regulatory Agency](#)
Published: [29 October 2012](#)
Therapeutic area: [Anaesthesia and intensive care, Nutrition and dietetics, and Paediatrics and neonatology](#)

Do not use in children aged 16 years or less, except in specialist settings under medical supervision

[Contents](#)

[Review outcome](#)

[Further information](#)

Article date: October 2012

Intravenous hypotonic saline (0.18% saline/4% glucose infusion solution) is given to maintain normal fluid and electrolyte requirements, or to replenish substantial deficits or continuing losses.

Following the restart of a public inquiry primarily into the deaths of three children in the UK who died of cerebral oedema secondary to hyponatraemia after administration of intravenous hypotonic saline, the Commission on Human Medicines (CHM) has recently reviewed all data on the benefits and risks of this solution when used in children.

Isotonic versus hypotonic solutions for maintenance intravenous fluid administration in children (Review)

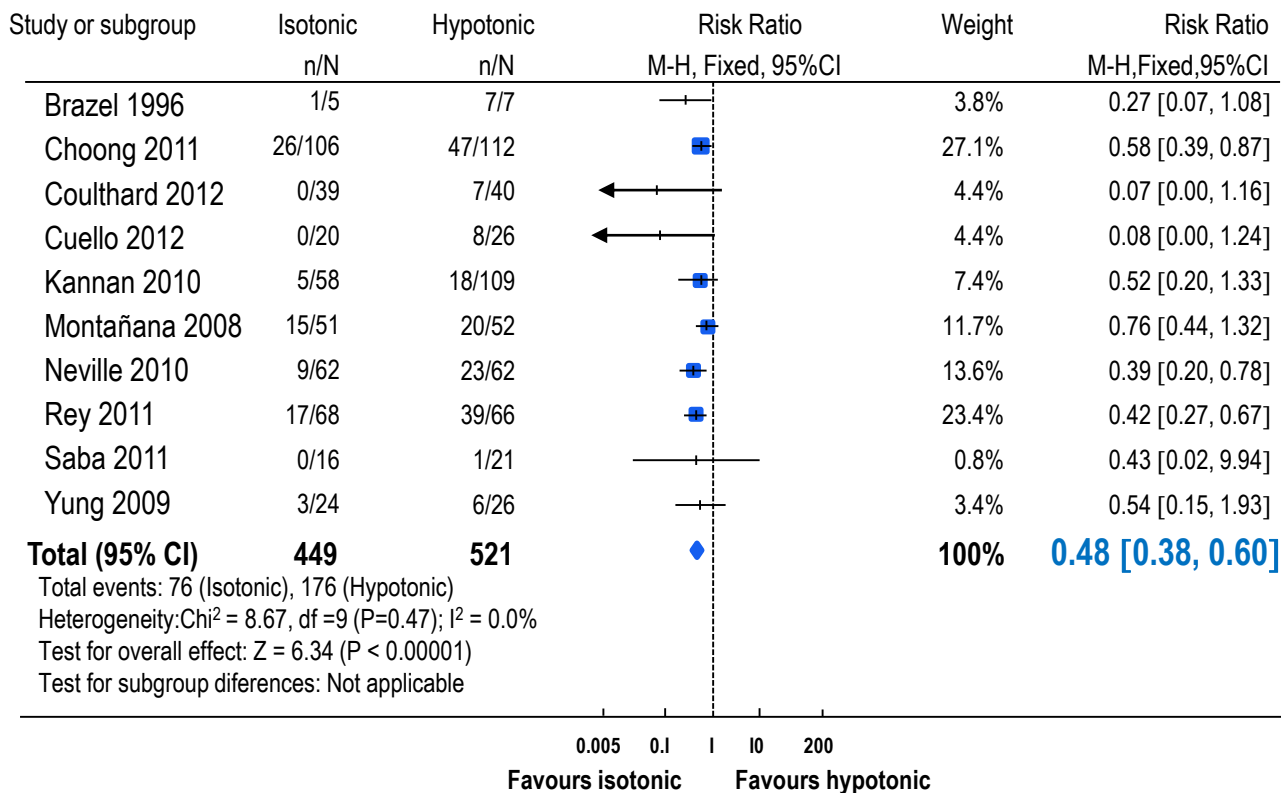
Cochrane Database of Systematic Reviews 2014,
 Issue 12. Art. No.: CD009457. DOI: 10.1002/14651858.CD009457.pub2.

Analysis I.I. Comparison I Isotonic versus hypotonic, Outcome I Hyponatraemia.

Review: Isotonic versus hypotonic solutions for maintenance intravenous fluid administration in children

Comparison: I Isotonic versus hypotonic

Outcome: I Hyponatraemia

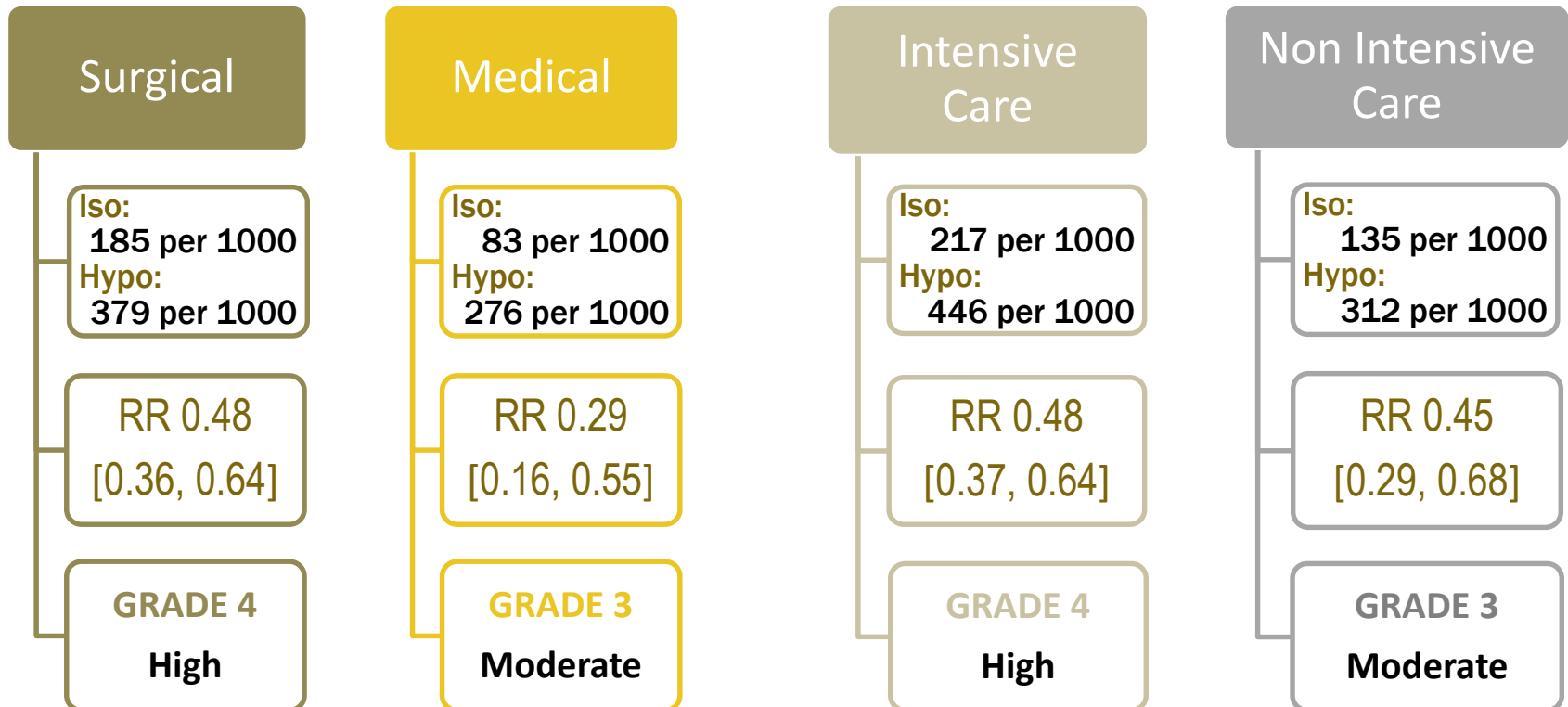


Isotonic versus hypotonic solutions for maintenance intravenous fluid administration in children (Review)

Cochrane Database of Systematic Reviews 2014

Pró Salgado

Subgroup analysis risk of hyponatraemia

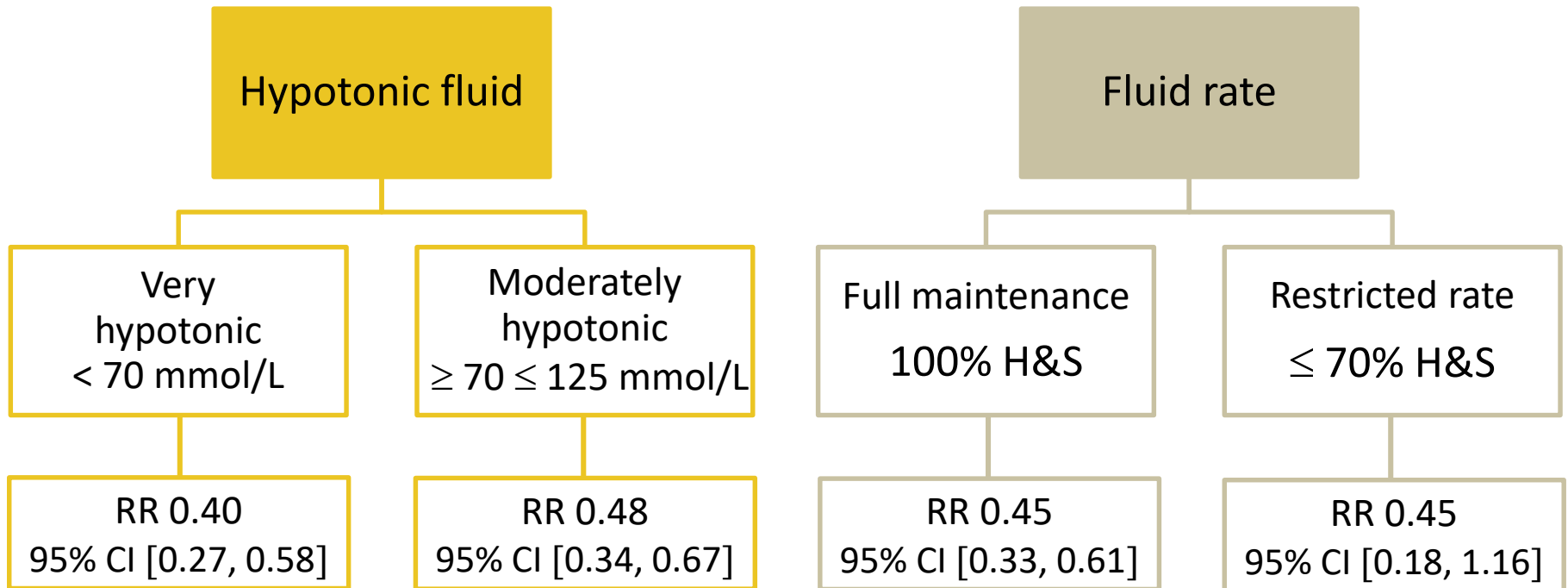


Isotonic versus hypotonic solutions for maintenance intravenous fluid administration in children (Review)

Cochrane Database of Systematic Reviews 2014

Pró Salgado

Subgroup analysis risk of hyponatraemia



Isotonic versus hypotonic solutions for maintenance intravenous fluid administration in children (Review)

Cochrane Database of Systematic Reviews 2014

		Patients	Relative risk	GRADE
Adverse events	Hypernatraemia	Iso: 16/437 Hypo: 17/500	RR 1.24 [0.65, 2.38]	Low
	Overhydration	Iso: 9/307 Hypo: 8/308	RR 1.14 [0.46, 2.87]	Low
	Cerebral oedema	Iso: 0 Hypo: 0	RR incalculable	Very low
	Seizures	Iso: 0/466 Hypo: 1/530	RR 0.62 [0.03, 15.02]	Low
	Death	Iso: 1/466 Hypo: 0/530	RR 5.59 [0.23, 135.17]	Low

Outras meta-análises

Pró Salgado

■ Wang J et al. *Pediatrics* 2014;133:105-13

Hiponatremia (pNa < 136 mmol/L)

Hiponatremia grave (pNa < 130 mmol/L)

Hipernatremia (pNa > 145 mmol/L)

hipotónicos vs isotónicos

RR 2.24; 95% CI [1.52, 3.31]

RR 5.29; 95% CI [1.74, 16.06]

RR 0.73; 95% CI [0.22, 2.48]

■ Foster B et al. *J Pediatrics* 2014;165:163-9

Hiponatremia (pNa < 135 mmol/L)

Hiponatremia moderada (pNa < 130 mmol/L)

Hipernatremia (pNa > 145 mmol/L)

hipotónicos vs isotónicos

RR 2.37; 95% CI [1.72, 3.26]

RR 6.10; 95% CI [2.15, 17.3]

RR 0.81; 95% CI [0.32, 2.04]

■ Padua A et al. *Pediatr Nephrol* 2015;30:1163-1172

Hiponatremia (pNa < 135 mmol/L)

Hiponatremia grave (pNa < 130 mmol/L)

Hipernatremia (pNa > 145 mmol/L)

isotónicos vs hipotónicos

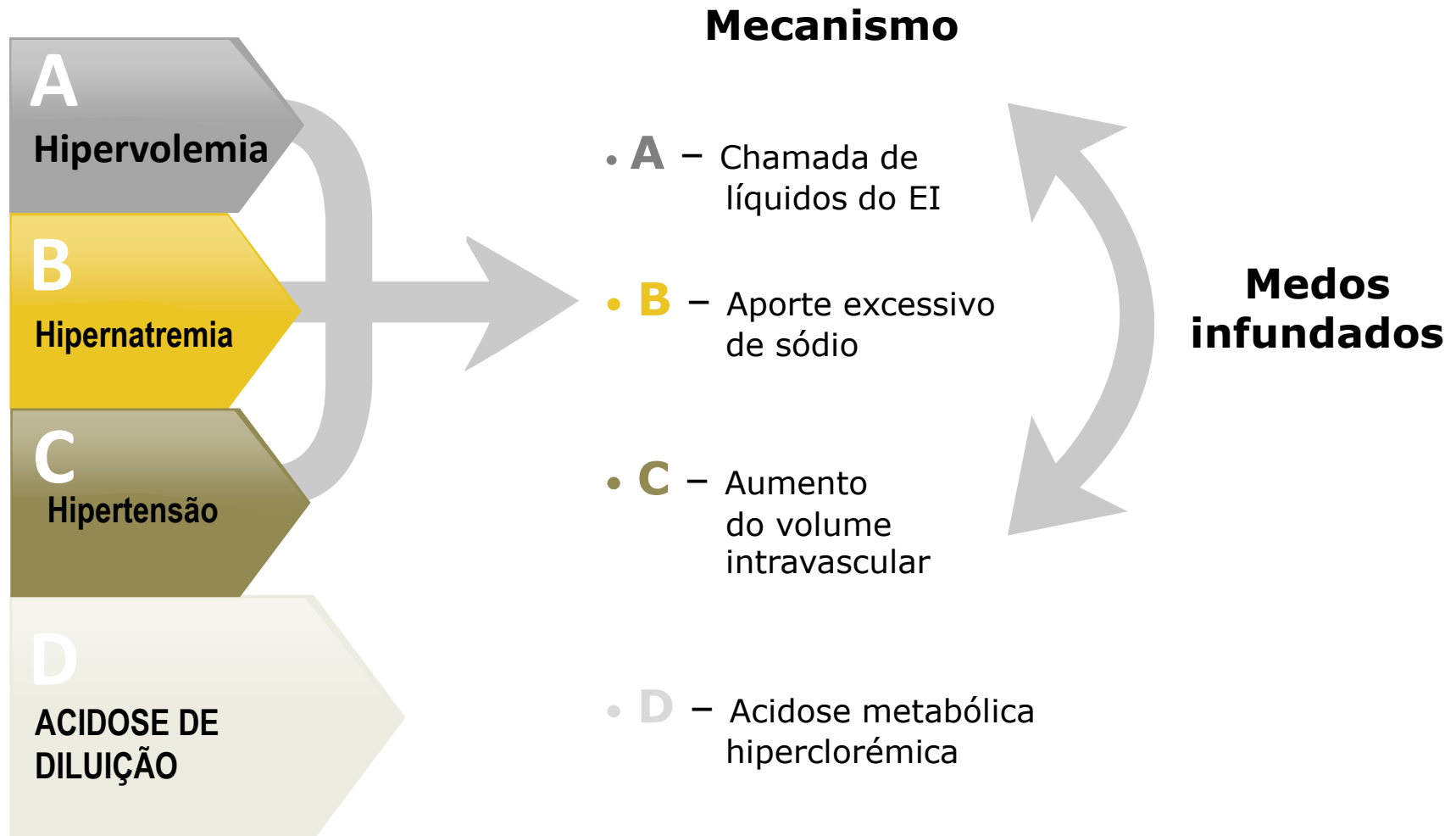
RR 0.50; 95% CI [0.40, 0.62]

RR 0.21; 95% CI [0.10, 0.45]

RR 0.83; 95% CI [0.41, 1.67]

Fluidoterapia com solutos isotónicos

Medos infundados



Argumentos Pró- hipotónicos

Pró Insosso

- *Holliday and Segar*
Pediatrics 1957;19:823
“... specific clinical situations dictate alterations”
- *Holliday M, Segar W and Friedman A*
Pediatrics 2003;111:424-425
“An additional safeguard would be to give half the average recommended maintenance fluid (50 ml instead of 100 ml/100 Kcals per day) for the first day”
- *Holliday M, Ray P and Friedman A*
Arch Dis Child 2007; 92: 546–550
“... the non-osmotic stimulation of antidiuretic hormone seen in acutely ill children is often due to hypovolaemia”

Argumentos Pró- hipotónicos

Rubbing salt in the wound

The case against isotonic parenteral maintenance solution

M Hatherill

Arch Dis Child 2004; 89:414- 418

**RESTRIÇÃO
HÍDRICA
(Usar menor
volume)**

1

**BALANÇO DE
TONICIDADE
(Incluir AL das PI)**

2

**EVIDÊNCIA
INSUFICIENTE
(falta de ensaios)**

4

**MECANISMO DA
HIPONATRÉMIA
(anti-diurese)**

3

- Produção não osmótica de ADH
 - realizar restrição hídrica
- Balanço de soluto
 - incluir a água livre das perdas insensíveis.
- Mecanismo da hiponatremia
 - antidiurese (diluição) >> natriurese (desalinização)
- Evidência insuficiente
 - falta de estudos controlados randomizados



CONGRESSO
NACIONAL
DE PEDIATRIA
25 – 27 OUT 2017
Centro de Congressos
Alfândega do Porto

NICE Guideline 2015

Conclusões

- Use a fórmula de Holliday-Segar para calcular o volume.
- Inicialmente use cristalóides isotónicos.
- Monitorize ionograma e glicose.
- Baseie a prescrição subsequente no ionograma.
- Se risco de ADH aumentada:
 - Restrição hídrica (50-80%)
 - PI (300-400 ml/m²/dia)+ diurese

National Clinical Guideline Centre

IV fluids in children

Intravenous fluid therapy in children and young people
in hospital

NICE Guideline NG29

Methods, evidence and recommendations

December 2015

*Commissioned by the National Institute for
Health and Care Excellence*



SOROS HIPOTÓNICOS

Alertas

For Maintenance Fluids

- 0.9% sodium chloride + 5% glucose +/- potassium chloride 20 mmol/L

Alternatively and ONLY under direction of Specialist:

- 0.45% sodium chloride + 5% glucose +/- potassium chloride 20 mmol/L or
- Plasma-Lyte 148 + 5% glucose

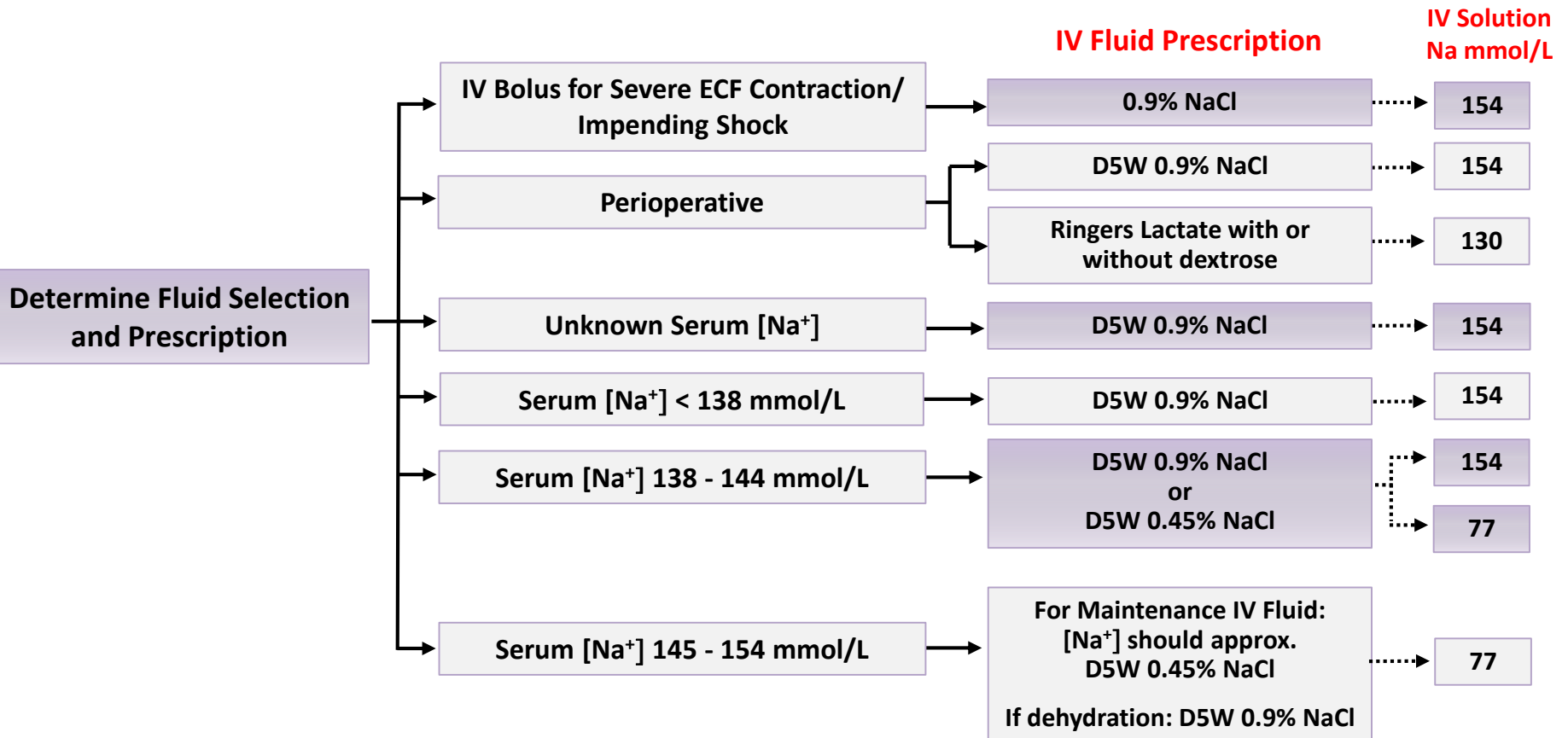
If electrolytes are outside the normal range,
discussion with a specialist is necessary

For Maintenance Fluids

Fluid and Electrolyte Administration in Children

Version: 2

IV Fluid Maintenance in Children: Assessment and Prescribing Recommendations

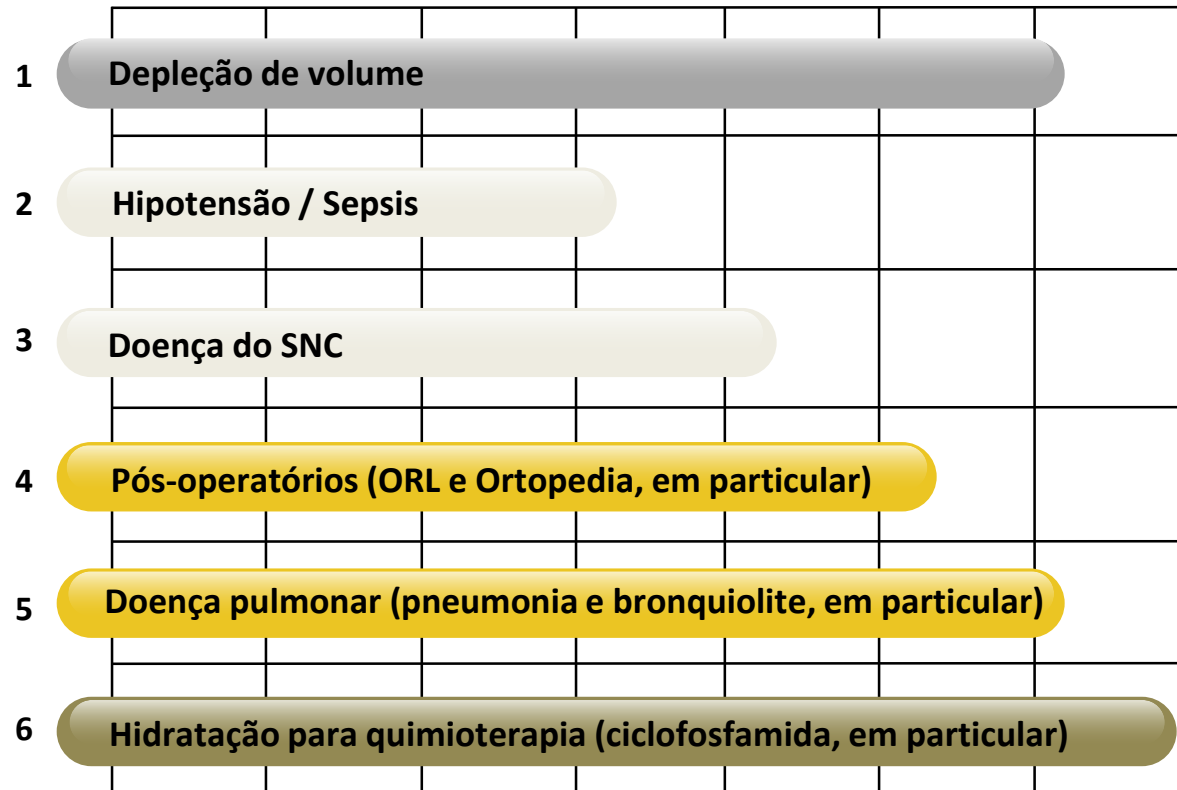


Fluidoterapia EV

Indicações primárias para uso de NaCl a 0,9%

Pró Salgado

prevenção da hiponatremia hospitalar



Fluidoterapia de manutenção

Pró Insosso

Indicações para uso de soros hipotónicos

Hipernatremia Diabetes insípida central	Manutenção + Défice (água livre) + perdas continuadas SOLUTOS HIPOTÓNICOS (?)
Defeitos da concentração renal DI nefrogénica Displasia renal	Manutenção + Défice (água livre) + perdas continuadas SOLUTOS HIPOTÓNICOS
Insuficiência: cardíaca renal hepática	Restrição de fluídos (50-75% da manutenção) SOLUTOS HIPOTÓNICOS

Malcolm A. Holliday, M.D, January 12, 1924–March 26, 2014

Steven J. Wassner • Russell W. Chesney •
Aaron Friedman • Cyril Chantler • Anthony A. Portale

Last paper

Fluid therapy for children: facts, fashions and questions

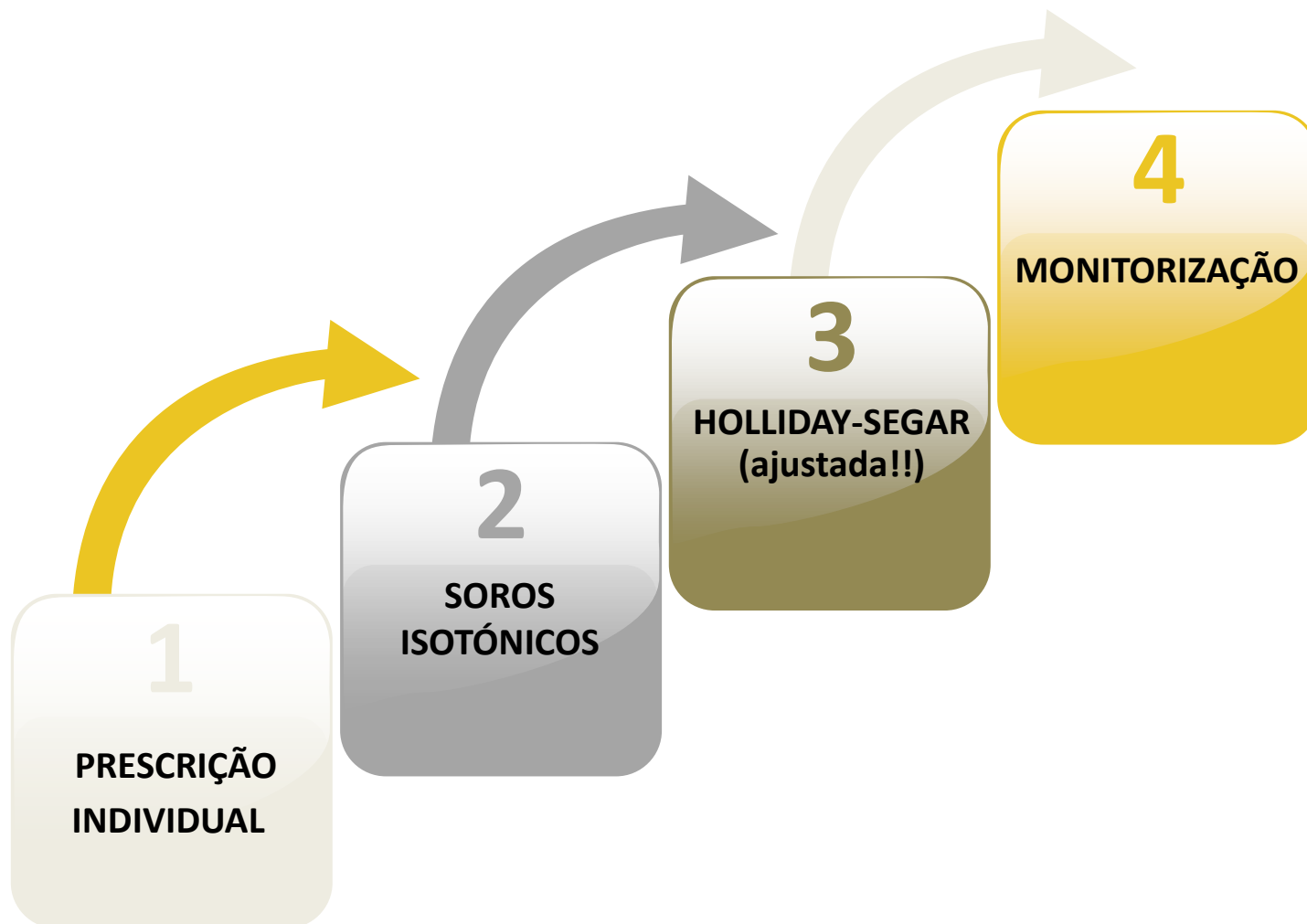
Malcolm A Holliday, Patricio E Ray and Aaron L Friedman

Arch Dis Child 2007; 92: 546-550



“ ... no hydration or laboratory method will ever replace the presence of a physician with good clinical judgment and the careful follow up that each critically ill patient deserves”

Conclusões





CONGRESSO
NACIONAL
DE PEDIATRIA
25 – 27 OUT 2017
Centro de Congressos
Alfândega do Porto



Bibliografia

- Cochrane Library www.cochranelibrary.com
 - Isotonic versus hypotonic solutions for maintenance intravenous fluid administration in children (Review) (2014)
- NICE – National Institute for Health and Care Excellence www.nice.org.uk/guidance/qs131
 - IV fluids in children.
Intravenous fluid therapy in children and young people in hospital. (NG29) (December 2015)
- NSW Guidelines (GL2015_008)
http://www1.health.nsw.gov.au/pds/Pages/doc.aspx?dn=GL2015_008
 - Standards for Paediatric Intravenous Fluids
NSW Health (second edition)
- Toronto Sickkids
<http://www.sickkids.ca/clinical-practice-guidelines/clinical-practice-guidelines/index.aspx>
 - Fluid and Electrolyte Administration in Children

OBRIGADO

