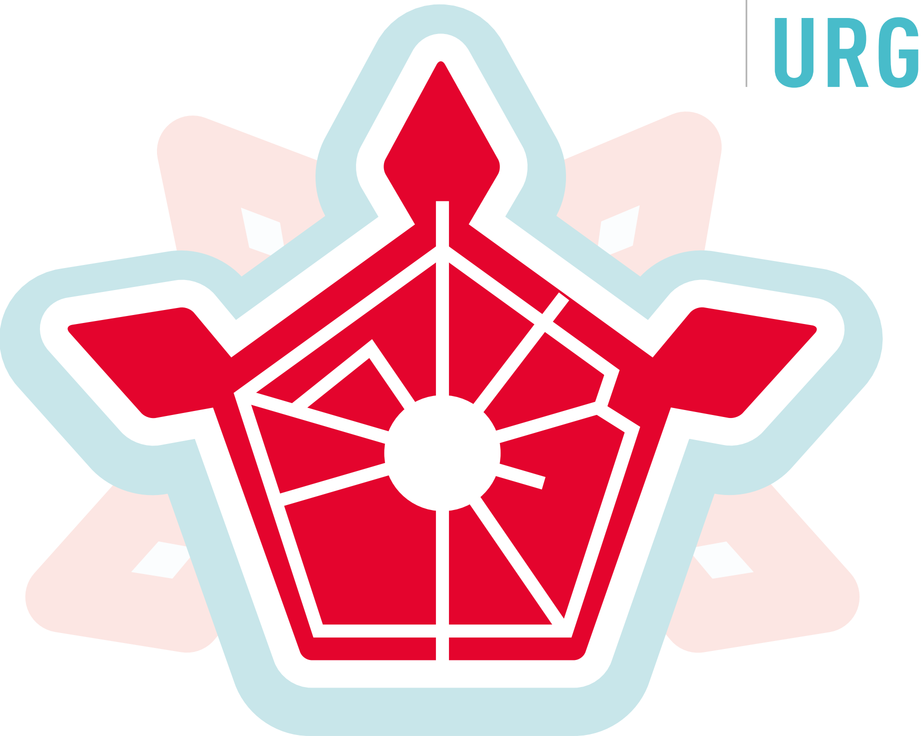
XXVI REUNIÓN SOCIEDAD ESPAÑOLA DE URGENCIAS DE PEDIATRÍA

PAMPLONA | 16 AL 18 DE JUNIO DE 2022



SUPERVIVENCIA SIN EVIDENCIA:
Aprendiendo para el futuro

SEUP
SOCIEDAD ESPAÑOLA DE
URGENCIAS DE PEDIATRÍA

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SUPERVIVENCIA SIN EVIDENCIA:
Aprendiendo para el futuro

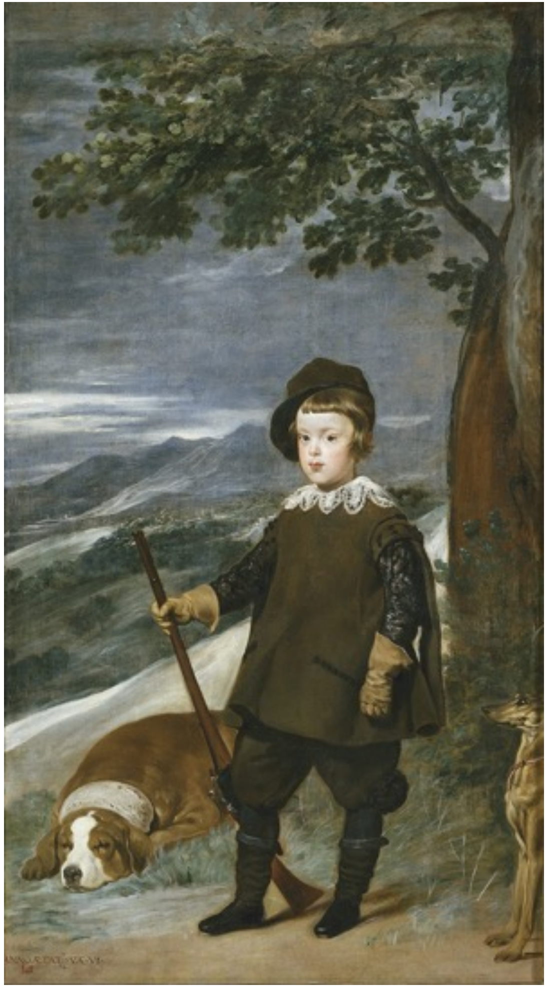
Actualización sobre fluidoterapia intravenosa en urgencias de pediatría

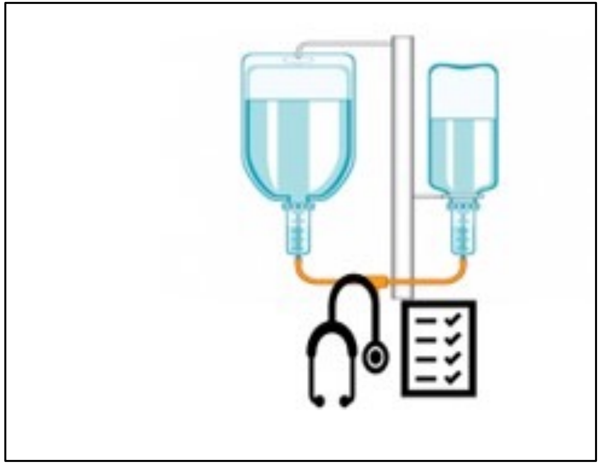
Pasado, presente y ¿futuro?

Juan Carlos Molina Cabañero. S. Urgencias
Hospital Infantil Universitario Niño Jesús. Madrid

No tengo conflictos de interés en relación a la presentación

Niño ≠ Adulto pequeño





¿Cuáles son las necesidades basales de agua en los niños?

DC Darrow, MA Holliday, WE Segar (1938 -1957)

Agua en función de la tasa metabólica

1 ml = 1 kcal

100 kcal = 100 ml

Volumen de agua	ml
Pérdidas insensibles	**45**
Sudoración	**10**
Heces	**5**
Renal	**50**
Agua de oxidación	**10**
	100 ml

¿Cuáles son las necesidades basales de agua en los niños?

Peso	
< 10 kg	
11 – 20 kg	1000 ml + 50 m kg entre 11 - 20
> 20 kg	1500 ml + ada kg > 20

Fiebre

Diarrea

Vómitos

Taquipnea

Convulsiones

MA. Holliday, WE. Segar

Composición de los sueros

Pasado

Presente

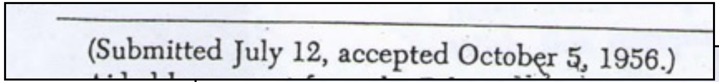
Futuro

Kahoot!

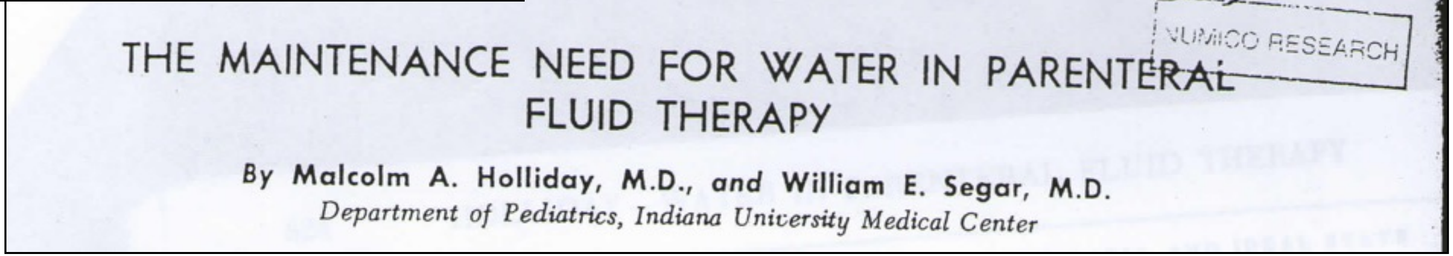
1

¿Cómo se calcularon inicialmente las necesidades basales de iones para la sueroterapia de mantenimiento en los niños?

a) En función del gasto energético
b) En función del gasto de agua
c) En función de la composición de la leche materna
d) Extrapolándolas de las necesidades de los adultos



(Submitted July 12, accepted October 5, 1956.)



NUMICO RESEARCH

THE MAINTENANCE NEED FOR WATER IN PARENTERAL FLUID THERAPY

By **Malcolm A. Holliday, M.D., and William E. Segar, M.D.**
Department of Pediatrics, Indiana University Medical Center

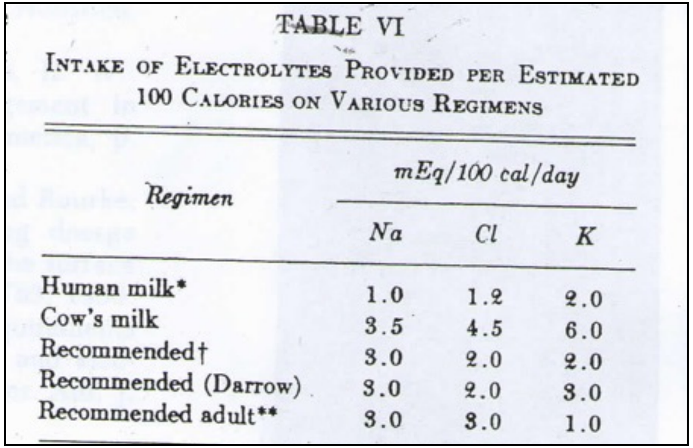


TABLE VI

INTAKE OF ELECTROLYTES PROVIDED PER ESTIMATED 100 CALORIES ON VARIOUS REGIMENS

Regimen	*mEq/100 cal/day*		
	Na	*Cl*	*K*
Human milk*	1.0	1.2	2.0
Cow's milk	3.5	4.5	6.0
Recommended†	3.0	2.0	2.0
Recommended (Darrow)	3.0	2.0	3.0
Recommended adult**	3.0	3.0	1.0

S. S. F
0,9

154
mEq/l

S. S. 1/3
0,3

Apiroserum GLUCOSALINO 1/5
Para inyección intravenosa gota a gota
GS 1/5

51
mEq/l

S. S. 1/5
0,2

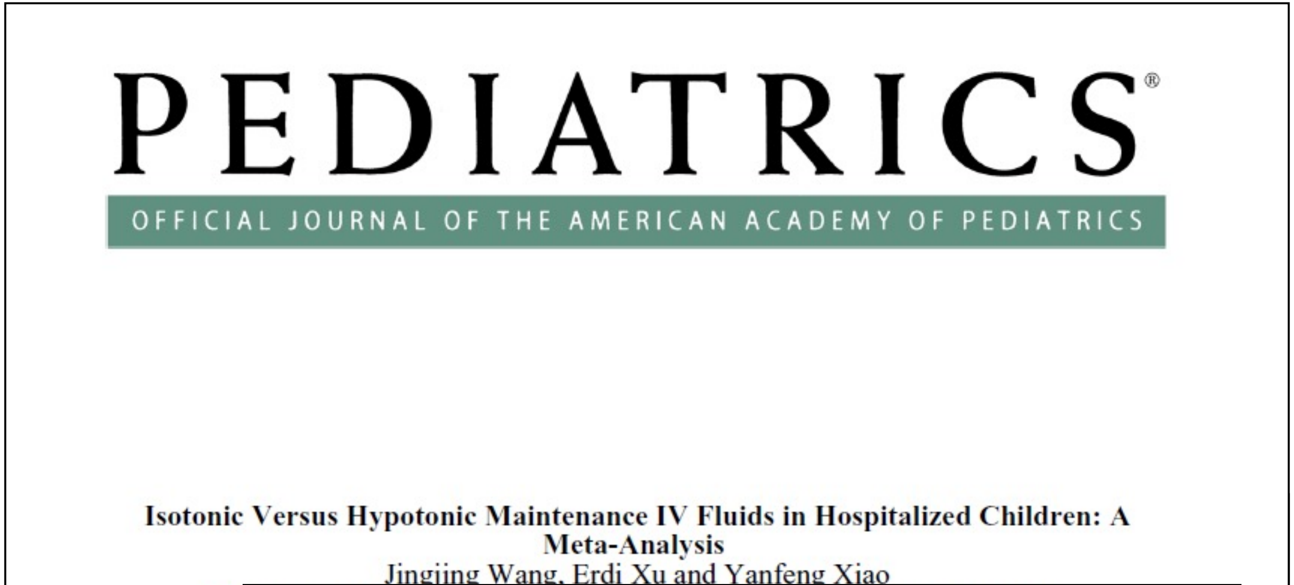
31
mEq/l

Kahoot!

2

¿Qué se debe tener en cuenta al usar sueros hipotónicos como sueroterapia de mantenimiento?

a) Pueden producir un cuadro de SiADH
b) Están indicados cuando el volumen a infundir no es elevado
c) Pueden causar acidosis metabólica si se infunde un volumen elevado
d) Deben indicarse fundamentalmente en niños menores de 6 meses



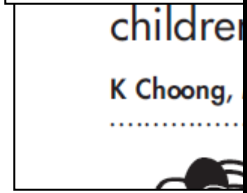
PEDIATRICS®

OFFICIAL JOURNAL OF THE AMERICAN ACADEMY OF PEDIATRICS

Isotonic Versus Hypotonic Maintenance IV Fluids in Hospitalized Children: A Meta-Analysis

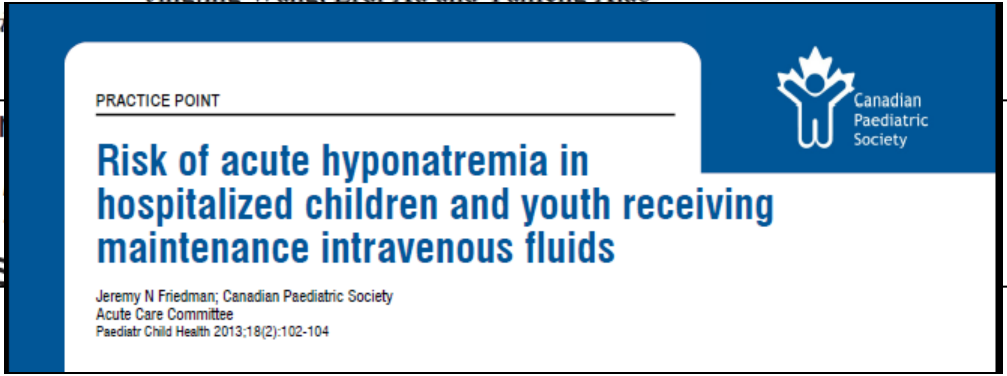
Jingjing Wang, Erdi Xu and Yanfeng Xiao

Pe



childre

K Choong,



PRACTICE POINT

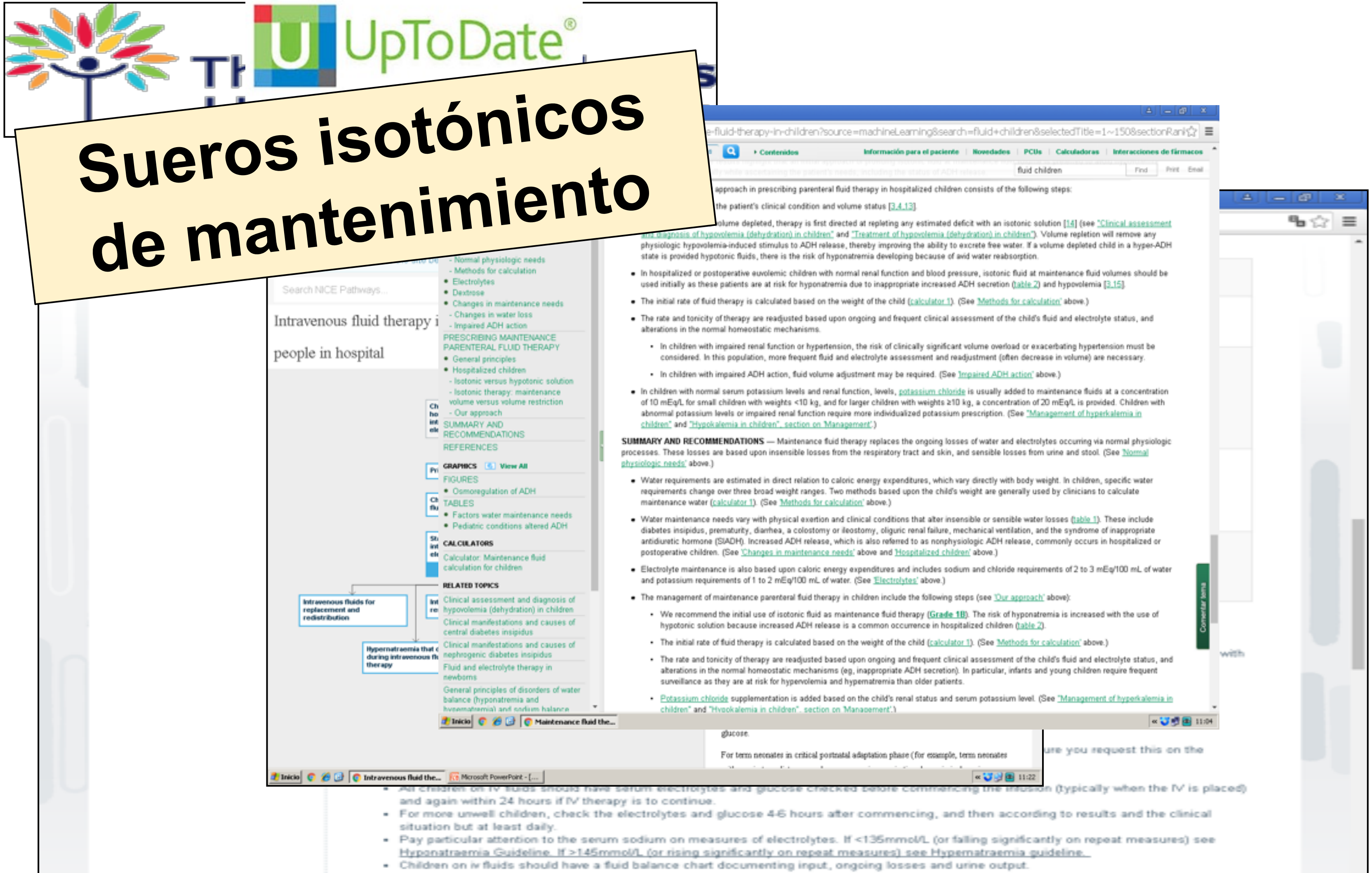
Canadian Paediatric Society

Risk of acute hyponatremia in hospitalized children and youth receiving maintenance intravenous fluids

Jeremy N Friedman; Canadian Paediatric Society Acute Care Committee

Paediatr Child Health 2013;18(2):102-104

Sueros isotónicos de mantenimiento



Intravenous fluid therapy i

people in hospital

Intravenous fluids for replacement and redistribution

Hypernatraemia that d during intravenous flu therapy

- Normal physiologic needs
- Methods for calculation
- Electrolytes
- Dextrose
- Changes in maintenance needs
  - Changes in water loss
  - Impaired ADH action

PRESCRIBING MAINTENANCE PARENTERAL FLUID THERAPY

- General principles
- Hospitalized children
  - Isotonic versus hypotonic solution
  - Isotonic therapy: maintenance volume versus volume restriction
  - Our approach

SUMMARY AND RECOMMENDATIONS

REFERENCES

GRAPHICS View All

FIGURES

- Osmoregulation of ADH

TABLES

- Factors water maintenance needs
- Pediatric conditions altered ADH

CALCULATORS

Calculator: Maintenance fluid calculation for children

RELATED TOPICS

Clinical assessment and diagnosis of hypovolemia (dehydration) in children

Clinical manifestations and causes of central diabetes insipidus

Clinical manifestations and causes of nephrogenic diabetes insipidus

Fluid and electrolyte therapy in newborns

General principles of disorders of water balance (hyponatremia and hypernatremia) and sodium balance

approach in prescribing parenteral fluid therapy in hospitalized children consists of the following steps:

the patient's clinical condition and volume status [3,4,13].

olume depleted, therapy is first directed at repleting any estimated deficit with an isotonic solution [14] (see "Clinical assessment and diagnosis of hypovolemia (dehydration) in children" and "Treatment of hypovolemia (dehydration) in children"). Volume repletion will remove any physiologic hypovolemia-induced stimulus to ADH release, thereby improving the ability to excrete free water. If a volume depleted child in a hyper-ADH state is provided hypotonic fluids, there is the risk of hyponatremia developing because of avid water reabsorption.

- In hospitalized or postoperative euvolemic children with normal renal function and blood pressure, isotonic fluid at maintenance fluid volumes should be used initially as these patients are at risk for hyponatremia due to inappropriate increased ADH secretion (table 2) and hypovolemia [3,15].
- The initial rate of fluid therapy is calculated based on the weight of the child (calculator 1). (See 'Methods for calculation' above.)
- The rate and tonicity of therapy are readjusted based upon ongoing and frequent clinical assessment of the child's fluid and electrolyte status, and alterations in the normal homeostatic mechanisms.
  - In children with impaired renal function or hypertension, the risk of clinically significant volume overload or exacerbating hypertension must be considered. In this population, more frequent fluid and electrolyte assessment and readjustment (often decrease in volume) are necessary.
  - In children with impaired ADH action, fluid volume adjustment may be required. (See 'Impaired ADH action' above.)
- In children with normal serum potassium levels and renal function, levels, potassium chloride is usually added to maintenance fluids at a concentration of 10 mEq/L for small children with weights <10 kg, and for larger children with weights ≥10 kg, a concentration of 20 mEq/L is provided. Children with abnormal potassium levels or impaired renal function require more individualized potassium prescription. (See "Management of hyperkalemia in children" and "Hypokalemia in children", section on 'Management'.)

SUMMARY AND RECOMMENDATIONS — Maintenance fluid therapy replaces the ongoing losses of water and electrolytes occuring via normal physiologic processes. These losses are based upon insensible losses from the respiratory tract and skin, and sensible losses from urine and stool. (See 'Normal physiologic needs' above.)

- Water requirements are estimated in direct relation to caloric energy expenditures, which vary directly with body weight. In children, specific water requirements change over three broad weight ranges. Two methods based upon the child's weight are generally used by clinicians to calculate maintenance water (calculator 1). (See 'Methods for calculation' above.)
- Water maintenance needs vary with physical exertion and clinical conditions that alter insensible or sensible water losses (table 1). These include diabetes insipidus, prematurity, diarrhea, a colostomy or ileostomy, oliguric renal failure, mechanical ventilation, and the syndrome of inappropriate antidiuretic hormone (SIADH). Increased ADH release, which is also referred to as nonphysiologic ADH release, commonly occurs in hospitalized or postoperative children. (See 'Changes in maintenance needs' above and 'Hospitalized children' above.)
- Electrolyte maintenance is also based upon caloric energy expenditures and includes sodium and chloride requirements of 2 to 3 mEq/100 mL of water and potassium requirements of 1 to 2 mEq/100 mL of water. (See 'Electrolytes' above.)
- The management of maintenance parenteral fluid therapy in children include the following steps (see 'Our approach' above):
  - We recommend the initial use of isotonic fluid as maintenance fluid therapy (**Grade 1B**). The risk of hyponatremia is increased with the use of hypotonic solution because increased ADH release is a common occurence in hospitalized children (table 2).
  - The initial rate of fluid therapy is calculated based on the weight of the child (calculator 1). (See 'Methods for calculation' above.)
  - The rate and tonicity of therapy are readjusted based upon ongoing and frequent clinical assessment of the child's fluid and electrolyte status, and alterations in the normal homeostatic mechanisms (eg, inappropriate ADH secretion). In particular, infants and young children require frequent surveillance as they are at risk for hypervolemia and hypernatremia than older patients.
  - Potassium chloride supplementation is added based on the child's renal status and serum potassium level. (See "Management of hyperkalemia in children" and "Hypokalemia in children", section on 'Management'.)

glucose.

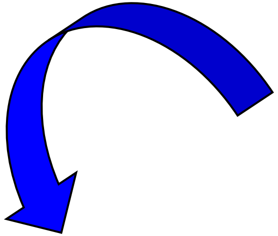
For term neonates in critical postnatal adaptation phase (for example, term neonates

with

ure you request this on the

- All children on IV fluids should have serum electrolytes and glucose checked before commencing the infusion (typically when the IV is placed) and again within 24 hours if IV therapy is to continue.
- For more unwell children, check the electrolytes and glucose 4-6 hours after commencing, and then according to results and the clinical situation but at least daily.
- Pay particular attention to the serum sodium on measures of electrolytes. If <135mmol/L (or falling significantly on repeat measures) see Hyponatraemia Guideline. If >145mmol/L (or rising significantly on repeat measures) see Hypernatraemia guideline.
- Children on iv fluids should have a fluid balance chart documenting input, ongoing losses and urine output.

Estímulos no fisiológicos



Intervenidos SNC
Meningitis
Bronquiolitis
Neumonías
Dolor

Sueros isotónicos de mantenimiento

Kahoot!

3

Respecto al S.S. fisiológico como base en la terapia de mantenimiento, ¿con cuál de las siguiente opciones estás más de acuerdo ?

a) Puede producir acidosis hiperclorémica
b) Aunque no es tan “fisiológico” como parece, es un suero seguro
c) Puede causar hipernatremia en los niños menores de un año
d) Las “soluciones balanceadas” son una mejor opción

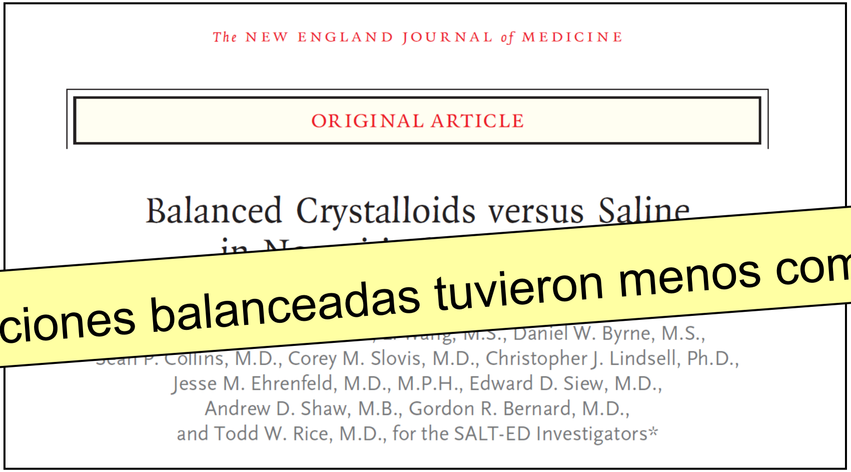
Plasma – S. Salino Fisiológico 0,9

	Osmolaridad	Na	Cl
Plasma	275 - 295	140	100
S. Salino 0,9	308	154	154

plast-apyr
FISIOLÓGICO
500 ml
SOLUCIÓN DE IRRIGACIÓN
Fresenius Kabi

Acidosis metabólica hiperclorémica

Mala evolución clínica



The NEW ENGLAND JOURNAL of MEDICINE

ORIGINAL ARTICLE

Balanced Crystalloids versus Saline

M.S., Daniel W. Byrne, M.S.,
P. Collins, M.D., Corey M. Slovis, M.D., Christopher J. Lindsell, Ph.D.,
Jesse M. Ehrenfeld, M.D., M.P.H., Edward D. Siew, M.D.,
Andrew D. Shaw, M.B., Gordon R. Bernard, M.D.,
and Todd W. Rice, M.D., for the SALT-ED Investigators*

- Pacientes con soluciones balanceadas tuvieron menos complicaciones

UCIP - USA

13.347 adultos. Prospectivo, aleatorio

S. Salino 0,9 vs Soluciones balanceadas

- La hipercloremia se asocia de forma independiente a peor evolución en los niños con shock séptico

Erin K. Stenson, MD[1,2]; Natalie Z. Cvijanovich, MD[3]; Nick Anas, MD[4]; Geoffrey L. Allen, MD[5]; Neal J. Thomas, MD[6]; Michael T. Bigham, MD[7]; Scott L. Weiss, MD[8]; Julie C. Fitzgerald, PhD, MD[8]; Paul A. Checchia, MD[9]; Keith Meyer, MD[10]; Michael Quasney, MD, PhD[11]; Mark Hall, MD[12]; Rainer Gedeit, MD[13]; Robert J. Freishtat, MD[14]; Jeffrey Nowak, MD[15]; Shekhar S. Raj, MD[16]; Shira Gertz, MD[17]; Jocelyn R. Grunwell, MD, PhD[18]; Hector R. Wong, MD[1,2]

Pediatric Critical Care Medicine

Retrospectivo

890 niños con shock séptico

29 UCIP de USA

	S. Balanceadas	Plasma
Na	140	140
Cl	98	100
K	5	4,5
Mg	1,5	1
Acetato	27	Bicarbonato 22
Gluconato	23	
Osmolaridad	275 - 295	295

Soluciones balanceadas

Actualmente, no están indicadas como sueroterapia de mantenimiento

No llevan glucosa

Tienen poco potasio

Faltan estudios en niños

Mas caras

Soluciones balanceadas

Acetato K 1M

FISIOLÓGICO 500 ml
SOLUCIÓN DE IRRIGACIÓN

NaCl-0,9
G-5
B BRAUN

Suero Salino Fisiológico
154 mEq Cl Na
0,9 g de Na Cl /100 ml

Suero Glucosalino 5% - 0,9
154 mEq Cl Na
0,9 g - 5 g de glucosa /100 ml

Sueros hipotónicos

S. S. Fisiológico

¿ Sol. Balanceadas ?

Gracias, por la atención.