



Pediatric Telehealth Rounds

Today's topic:

Feeling Parched: How to
restore fluid balance in
pediatric gastroenteritis

Speaker:

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Pediatrics



September 25, 2015

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Feeling Parched: How to restore fluid balance in Pediatric Gastroenteritis

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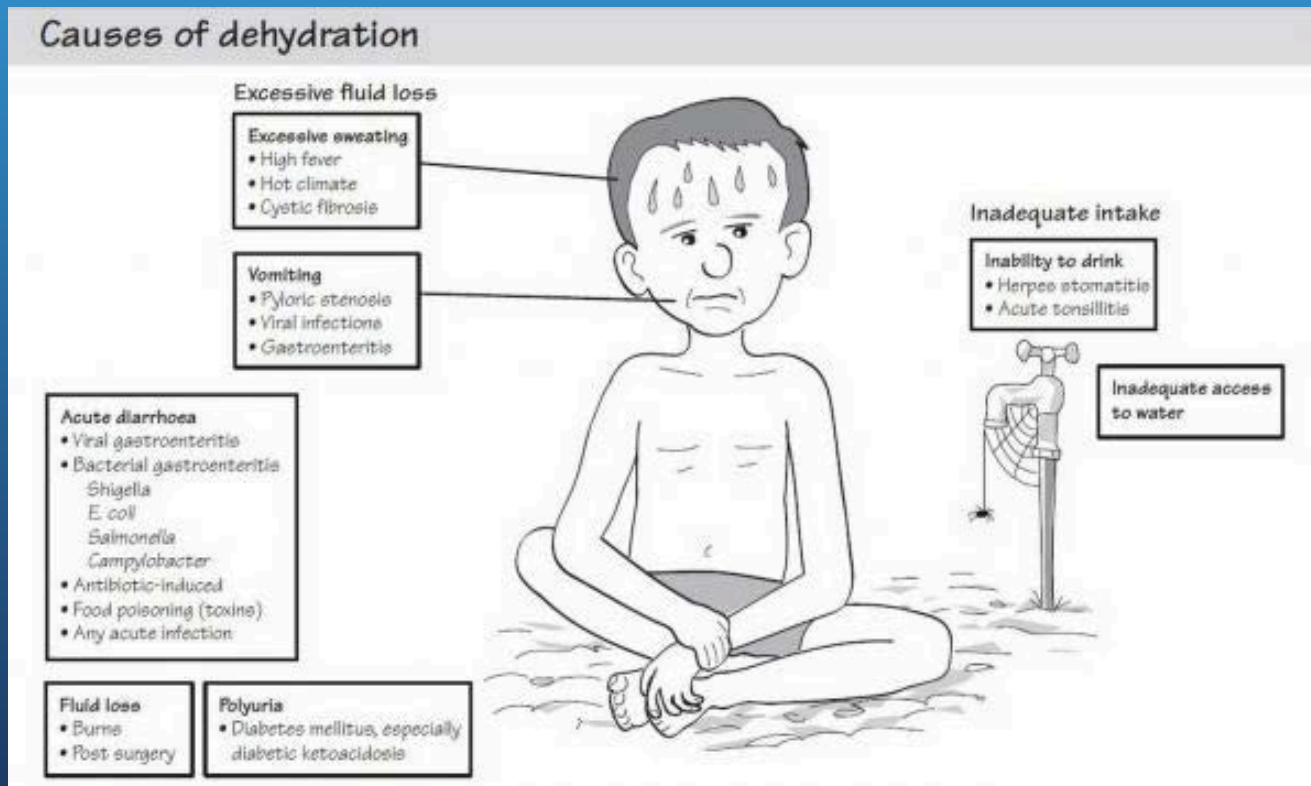
Dehydration is the leading cause
of pediatric morbidity and
mortality in the world

Objectives

- 1) How to assess whether a child has mild, moderate, or severe dehydration
- 2) How to translate deficit into fluid replacement (ORT Administration guidelines)
- 3) When to start IV hydration versus ORT

Causes of Dehydration

- Gastrointestinal tract
 - Diarrhea, vomiting, bleeding
- Skin
 - Fever, sweat, burns
- Urine
 - Glucosuria, diuretic therapy, diabetes insipidus
- Inadequate intake



Kids are HIGH RISK

Higher rates
of
Gastroenteritis

Higher
surface area to
volume
ratio

Not always
able to
communicate
their
symptoms

Higher
Insensible
losses



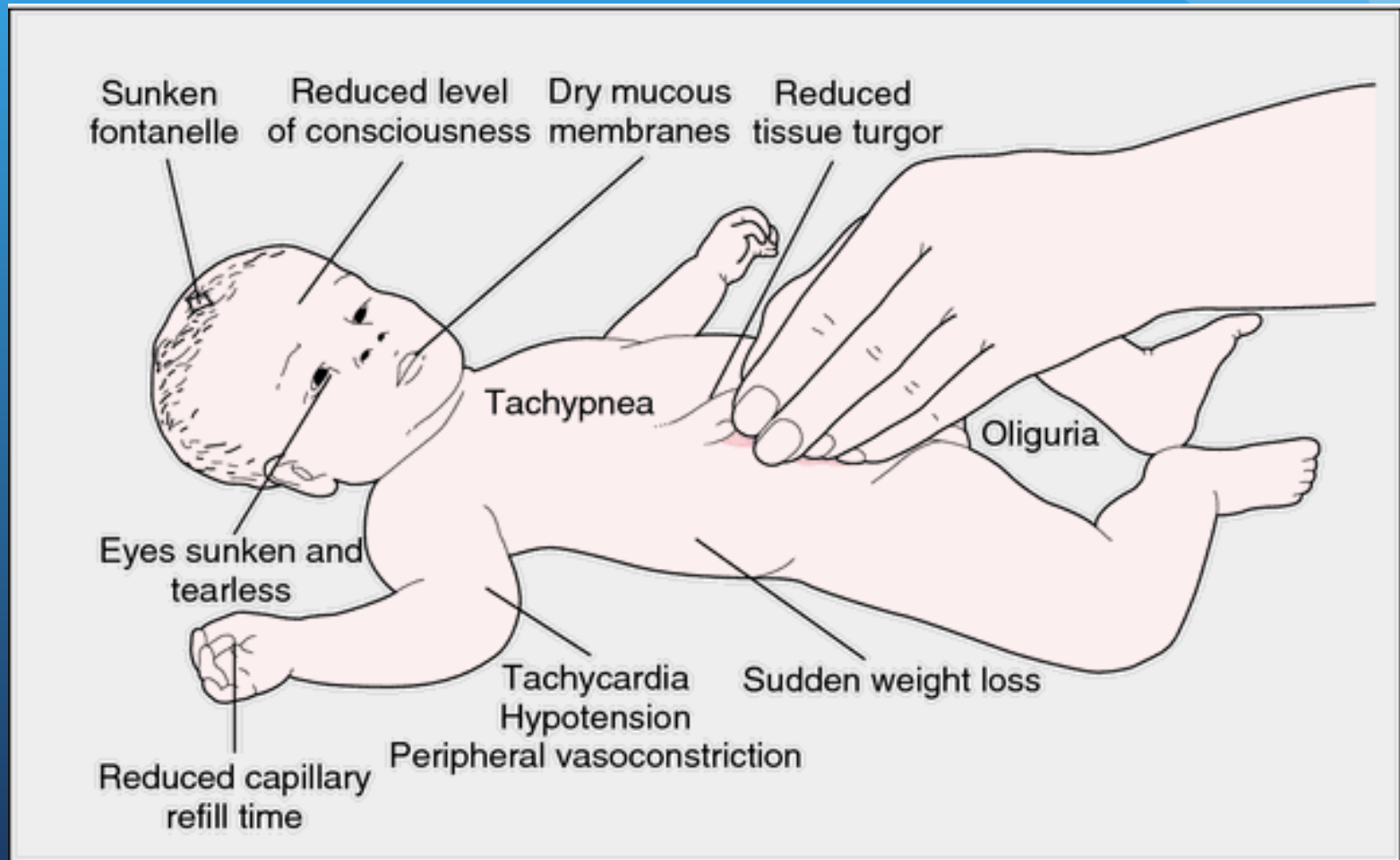
General Principles of Treatment

- Recognize the degree of dehydration
- Laboratory investigations should be done in clinically obvious moderate to severe dehydration
- Restore fluid balance:
 - Replace water and electrolyte deficits
 - Meet maintenance needs for fluids
 - Replace ongoing losses
- Measure urine output and aim for $>1\text{cc/kg/hr}$ for adequate hydration



Recognizing and Measuring Dehydration

- Clinical signs and symptoms



Measuring Dehydration

- Clinical signs and symptoms
- Laboratory Data
 - Electrolytes (Na, K, Cl)
 - BUN
 - Creatinine
 - Venous gas



Clinical Dehydration Scale

TABLE 1 CDS¹⁰

Characteristic	Score of 0	Score of 1	Score of 2
General appearance	Normal	Thirsty, restless, or lethargic but irritable when touched	Drowsy, limp, cold, or sweaty; comatose or not
Eyes	Normal	Slightly sunken	Very sunken
Mucous membranes (tongue)	Moist	Sticky	Dry
Tears	Tears	Decreased tears	Absent tears

Modified Vesikari Score

TABLE 1 Modified Vesikari Score (MVS) Components

	0 Points	1 Point	2 Points	3 Points
Diarrhea duration, d	0	1–4	5	≥6
Maximal no. of diarrheal stools per 24-h period	0	1–3	4–5	≥6
Vomiting duration, d	0	1	2	≥3
Maximal no. of vomiting episodes per 24-h period	0	1	2–4	≥5
Maximal recorded fever, rectal, °C	<37.0	37.1–38.4	38.5–38.9	≥39.0
Health care provider visits	None		Outpatient ^a	ED ^b
Treatment	None	Rehydration	Hospitalization	

^a Community-based health care provider visit related to vomiting, diarrhea, fever, or fluid refusal.

^b ED health care provider visit related to vomiting, diarrhea, fever, or fluid refusal.

WHO Classification

TABLE 1. Symptoms associated with dehydration

Symptom	Minimal or no dehydration (<3% loss of body weight)	Mild to moderate dehydration (3%–9% loss of body weight)	Severe dehydration (>9% loss of body weight)
Mental status	Well; alert	Normal, fatigued or restless, irritable	Apathetic, lethargic, unconscious
Thirst	Drinks normally; might refuse liquids	Thirsty; eager to drink	Drinks poorly; unable to drink
Heart rate	Normal	Normal to increased	Tachycardia, with bradycardia in most severe cases
Quality of pulses	Normal	Normal to decreased	Weak, thready, or impalpable
Breathing	Normal	Normal; fast	Deep
Eyes	Normal	Slightly sunken	Deeply sunken
Tears	Present	Decreased	Absent
Mouth and tongue	Moist	Dry	Parched
Skin fold	Instant recoil	Recoil in <2 seconds	Recoil in >2 seconds
Capillary refill	Normal	Prolonged	Prolonged; minimal
Extremities	Warm	Cool	Cold; mottled; cyanotic
Urine output	Normal to decreased	Decreased	Minimal

Sources: Adapted from Duggan C, Santosham M, Glass RI. The management of acute diarrhea in children: oral rehydration, maintenance, and nutritional therapy. *MMWR* 1992;41(No. RR-16):1–20; and World Health Organization. The treatment of diarrhoea: a manual for physicians and other senior health workers. Geneva, Switzerland: World Health Organization, 1995. Available at http://www.who.int/child-adolescent-health/New_Publications/CHILD_HEALTH/WHO.CDR.95.3.htm.

CPS Guideline:
ORT and early
refeeding in
gastroenteritis

	Mild	Moderate	Severe
Volume Loss	3-5%	6-9%	>/= 10%
Thirst	Increased	Increased	Increased
Urine Output	Decreased	Decreased	Oliguria, Anuria
Skin			
Colour	Normal	Pale	Mottled
Turgor	Normal	Reduced	Tenting
Fontanelle	Normal	Slightly decreased	Sunken
Mucous Membranes	Normal, slightly dry	Dry	Parched
Tears	Normal	Decreased	Absent/Eyes sunken
Respiratory	Normal	Deep, increased RR	Deep and Rapid
Cardiovascular			
Pulse	Normal	Increased	Increased
BP	Normal	Normal to Low	Low, Orthostatic drop
Cap Refill	Normal	2-4 seconds	>4 seconds
CNS/Behaviour	Normal	Irritable	Irritable, lethargy, coma
Investigations	Normal/Mildly Abnormal	Abnormal	Grossly abnormal

Translating this into Treatment

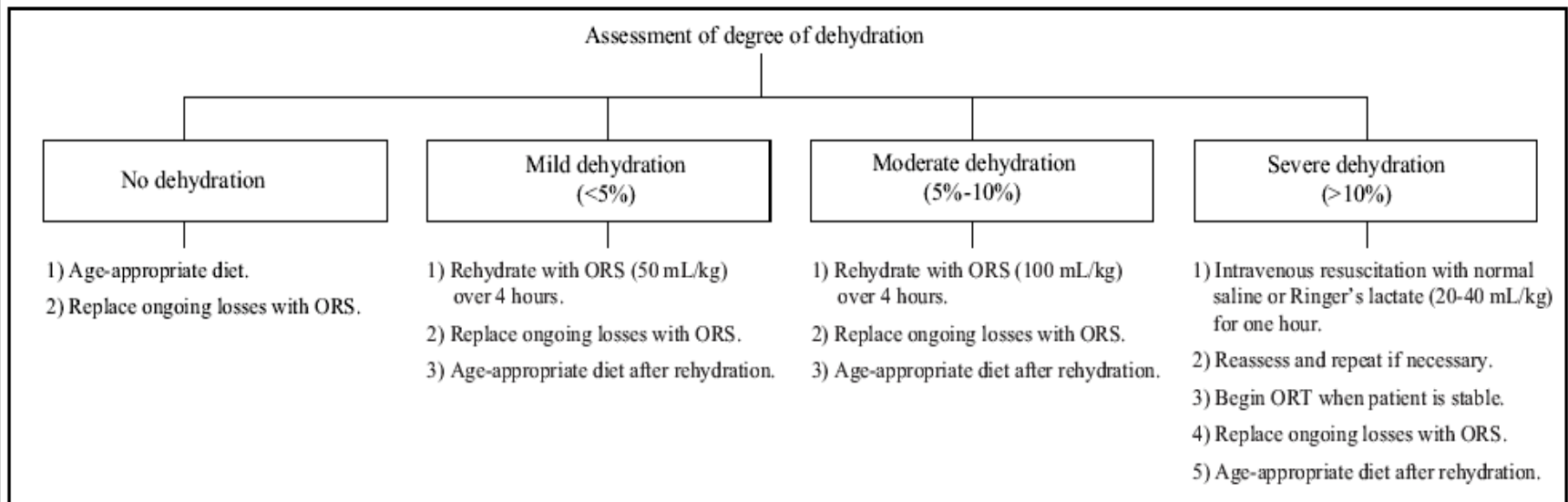


Figure 1) Algorithm for managing acute gastroenteritis in children. ORS Oral rehydration solution; ORT Oral rehydration therapy

Leung A, Prince T. Oral Rehydration Therapy and Early Refeeding in the management of childhood gastroenteritis. Canadian Paediatric Society Nutrition and Gastroenterology Committee Paediatr Child Health 2006;11(8):527-31

CPS Recommendations for ORT

- Oral Rehydration Therapy (ORT) should be the treatment of choice in children with mild or moderate dehydration.
- Oral Rehydration Solutions (ORS) should be given at frequent intervals, gradually increased in volume until the child can drink as desired.
- Fluid therapy should include the following elements:
 - Rehydration, replacement of ongoing losses, and maintenance.
- Premixed ORS, rather than powdered or homemade ones, should be used.
- Carbonated drinks and sweetened fruit juices are discouraged.
- No free water



CPS Recommendations for ORT

- Contraindications to ORT include:
 - Protracted vomiting despite small, frequent feeding
 - Severe dehydration with shock-like state
 - Impaired consciousness
 - Paralytic ileus and monosaccharide malabsorption.
- Children without dehydration should continue to be fed an age-appropriate diet.



 Breakfast	 Lunch	 Snack	 Dinner
Cereal made with whole grain	Sandwich made with whole wheat bread	Popcorn	Brown rice with stir-fried vegetables
Whole wheat toast with jam	Whole grain pita stuffed with your favorite fixings	Oatmeal cookie	Whole grain pasta topped with sauce
Oatmeal	Hamburger on a whole grain bun	Whole grain granola bar	Wild rice
Whole grain pancakes or waffles	Soup with barley or brown rice	Stir cereal made with whole grain into yogurt	Whole grain dinner roll

ORT Solutions

Powers, KS. Dehydration: Isonatremic, Hyponatremia, Hypernatremic Recognition and Management. Peds in Review. 2015; 36(July): 274-285.

Guidelines for ORT Administration

Powers, KS. Dehydration: Isonatremic, Hyponatremia, Hypernatremic Recognition and Management. Peds in Review. 2015; 36(July): 274-285.

ORT is just not working

- Although gastroenteritis is usually a self-limited infection, persistent vomiting related to this illness can be tricky to control to let ORT restore hydration
- If vomiting persists dehydration can progress, leading to intravenous insertion, electrolyte abnormalities and/or hospital admission.
- So what do we do if the patient isn't tolerating ORT?



**WHAT ABOUT
ANTIEMETICS?**

Ondansetron (Zofran)



- According to the CPS:
 - Oral ondansetron therapy, as a single dose, should be considered for infants and children six months to 12 years of age who present to the ED with:
 - Vomiting likely secondary to gastroenteritis
 - Mild to moderate dehydration
 - Or who have failed ORT
- Three randomized controlled studies and a meta-analysis were identified that examined the use of oral ondansetron for vomiting due to acute gastroenteritis
 - Less likely to vomit
 - Less IVF required
 - Most found less hospitalization, while others found no difference

Ondansetron (Zofran)

- Most common side effect: Diarrhea
 - Not routinely recommended in children with gastroenteritis whose predominant symptom is moderate to severe diarrhea.
- Suggested dosing:
 - 8 kg to 15 kg: 2mg
 - 15 kg to 30 kg: 4mg
 - Greater than 30kg: 6mg to 8mg
- Oral rehydration therapy should be initiated 15 min to 30 min after administration

Dimenhydrinate (Gravol)

- Uhlig et al. 2009 completed a prospective randomized, placebo-controlled, multicenter trial
- Placebo VS Rectal dimenhydrinate in kids with no or mild dehydration, all on ORT
- Found:
 - No difference in weight gain, hospitalization, fluid intake, general well being or adverse effects
 - Less vomiting



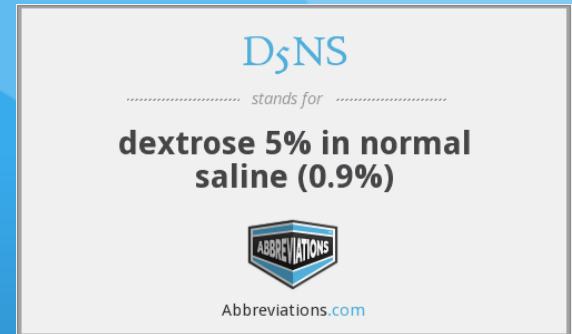
Dimenhydrinate (Gravol)

- Concluded:
 - Dimenhydrinate significantly reduces vomiting in children with gastroenteritis and is well tolerated
 - However, the antiemetic effect of dimenhydrinate is mild and oral rehydration therapy and clinical outcomes have not shown improvement
 - Unclear if bigger impact on children with a higher degree of dehydration.
- Dosing (by age and weight)
 - 2 - 5 years: 12.5 - 25 mg PO every 6-8 hours (max 75 mg/day)
5 mg/kg/day in four divided doses
 - 6 - 12 years: 25 - 50 mg PO every 6-8 hours (max 150 mg/day)
5 mg/kg/day in four divided doses
 - >12 years: 50 - 100 mg PO every 4-6 hours (max 400 mg/day)

When to use Intravenous Fluids (IVF)

- Hyponatremic dehydration (Low Na)
- Failed ORT
- Protracted vomiting despite small, frequent feeding
- Severe dehydration with a shock-like state
- Impaired consciousness
- Paralytic ileus and monosaccharide malabsorption

Rehydration with IVF



- Typical maintenance fluids in pediatrics
 - D5NS with 20 meq/L KCL
- Calculate maintenance fluids using the 4:2:1 rule
 - First 10 kg x 4 cc/hr
 - Second 10 kg x 2 cc/hr
 - Remaining kg after that 1 cc/hr
 - OR if child is >20 kg, just add 40 to the weight

Rehydration with IVF

- Consider giving NS boluses for resuscitation in patients with moderate to severe dehydration
 - 20 cc/kg of NS bolus
 - Tend to give up to a total of 60 cc/kg - monitor closely for signs of fluid overload (hepatomegaly, crackles in chest) and for response after bolus
- Lactated Ringers solution is not routinely used in pediatrics
 - Relatively hypotonic with higher levels of potassium
 - Can lead to hyponatremic dehydration
- For ongoing losses (i.e. ongoing emesis, NG drainage, diarrheal losses), we replace typically 1:1 for volume



Summary



- Maintenance, deficit, and ongoing fluid and electrolyte losses need to be calculated.
- Mild-to-moderate dehydration can be treated effectively with ORT.
- Children with moderate-to-severe dehydration should have electrolytes measured to determine content and rate of fluid replacement.
- Children with severe dehydration and altered perfusion need acute fluid resuscitation and should receive immediate fluid bolus(es) with normal saline.

References

- Cheng, A. Emergency department use of oral ondansetron for acute gastroenteritis-related vomiting in infants and children. *Paediatr Child Health* 2011;16(3):177-9.
- DeCamp LR, Byerley JS, Doshi N, Steiner MJ. Use of antiemetic agents in acute gastroenteritis: A systematic review and meta- analysis. *Arch Pediatr Adolesc Med* 2008;162:858-65.
- Freedman SB, Adler M, Seshadri R, Powell EC. Oral on- dansetron for gastroenteritis in a pediatric emergency depart- ment. *N Engl J Med* 2006;354:1698-705.
- Friedman JN, Goldman RD, Srivastava R, Parkin PC. Develop- ment of a clinical dehydration scale for use in children between 1 and 36 months of age. *J Pediatr*. 2004;145(2):201-207.
- Goldman RD, Friedman JN, Parkan PC. Validation of the Clinical Dehydration scale for Children with Acute Gastroenteritis. *Pediatrics*. 2008. 122(8): 545-9.
- Leung A, Prince, T. Oral Rehydration Therapy and Early Refeeding in the management of childhood gastroenteritis. Canadian Paediatric Society Nutrition and Gastroenterology Committee *Paediatr Child Health* 2006;11(8):527-31.
- Lexicomp Online® , Pediatric & Neonatal Lexi-Drugs® , Hudson, Ohio: Lexi-Comp, Inc.; January 29, 2015.
- Powers, KS. Dehydration: Isonatremic, Hyponatremia, Hypernatremic Recognition and Management. *Peds in Review*. 2015; 36(July): 274-285.
- Roslund G, Hepps TS, McQuillen KK. The role of oral on- dansetron in children with vomiting as a result of acute gastritis/gastroenteritis who have failed oral rehydration therapy: A randomized controlled trial. *Ann Emerg Med* 2008;52:22-9.
- Ramsook C, Sahagun-Carreón I, Kozinetz CA, Moro-Suther- land D. A randomized clinical trial comparing oral on- dansetron with placebo in children with vomiting from acute gastroenteritis. *Ann Emerg Med* 2002;39:397-403.
- Uhlig U, Pfeil N, Gelbrich G, Spranger C, Syrbe S, Huegle B, et al. Dimenhydrinate in Children with Gastroenteritis: A prospective RCT. *Pediatrics* 2009;124:e622-e632.

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Thank you!

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Pediatric Telehealth Rounds

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Seizure Management

Dr. Das

September 25, 2015



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