

MEETING ABSTRACT

Open Access

Measurement of inferior vena cava and aorta with bedside ultrasound to assess degree of dehydration in children

Hyuksool Kwon¹, Jin Hee Lee^{1*}, Kyuseok Kim¹, Young Ho Kwak², Do Kyun Kim²

From 10th WINFOCUS World Congress on Ultrasound in Emergency and Critical Care Kuala Lumpur, Malaysia. 16-19 November 2014

Background

Clinical dehydration scale (CDS) has been developed and undergone validation for measuring dehydration in children. However, these included few objective subjects with dehydration requiring fluid replacement (DRFR). Moreover, interobserver reliability can be diverse and this can cause confusion between health care providers.

Objective

This study was designed to validate the use of ultrasound in the prospective identification of children with dehydration by investigating whether the inferior vena cava-aorta ratio (IVC/Ao) correlated with the CDS in children.

Patients and methods

A prospective observational pilot study was carried out in a pediatric emergency department (PED) between October 2013 and June 2014 at the tertiary university teaching hospital in South Korea. Single investigator obtained transverse images using bedside US. The CDS was measured before the IVC/Ao calculation. Subjects were asked to return after improvement in the CDS and symptoms. Greater than or equal to 1 in the CDS was judged to be dehydration requiring fluid replacement (DRFR). Relation between the CDS, the DRFR, and the IVC/Ao was measured.

Results

34 children older than 3 months were enrolled. There was correlation between the CDS and the IVC/Ao (Spearman's rho was = -0.76; 95% confidence interval [CI] = -0.87, -0.57). The linear regression model between the DRFR

and the IVC/Ao resulted in an R2 value of 0.54 ($p < 0.001$) and a slope of -1.56 (95% CI = -2.06 to -1.06). The IVC/Ao discriminative ability of DRFR was assessed with an area under the receiver operating characteristic curve of 0.93 (95% = CI 0.84, 1.00). An IVC/Ao cutoff of 0.63 produced a sensitivity of 82% and a specificity of 100% for DRFR.

Conclusion

IVC/Ao, as measured by bedside US, was an accurate measurement of dehydration in children.

Authors' details

¹Department of Emergency Medicine, Seoul National University Bundang Hospital, Bundang-gu, Seongnam-si, Gyeonggi-do, Republic of Korea.

²Department of Emergency Medicine, Seoul National University College of Medicine, Seoul, Republic of Korea.

Published: 9 March 2015

References

1. Gorelick MH, Shaw KN, Murphy KO: **Validity and reliability of clinical signs in the diagnosis of dehydration in children.** *Pediatrics* 1997, **99**(5):E6, PubMed PMID: 9113963. Epub 1997/05/01. eng.
2. Steiner MJ, DeWalt DA, Byerley JS: **Is this child dehydrated?** *JAMA : the journal of the American Medical Association* 2004, **291**(22):2746-54, PubMed PMID: 15187057. Epub 2004/06/10. eng.
3. Chen L, Kim Y, Santucci KA: **Use of ultrasound measurement of the inferior vena cava diameter as an objective tool in the assessment of children with clinical dehydration.** *Academic emergency medicine : official journal of the Society for Academic Emergency Medicine* 2007, **14**(10):841-5, PubMed PMID: 17898246. Epub 2007/09/28. eng.
4. Goldman RD, Friedman JN, Parkin PC: **Validation of the clinical dehydration scale for children with acute gastroenteritis.** *Pediatrics* 2008, **122**(3):545-9, PubMed PMID: 18762524.
5. Kosiak W, Swieton D, Piskunowicz M: **Sonographic inferior vena cava/aorta diameter index, a new approach to the body fluid status assessment in children and young adults in emergency ultrasound-preliminary study.** *The American journal of emergency medicine* 2008, **26**(3):320-5, PubMed PMID: 18358944. Epub 2008/03/25. eng.

* Correspondence: gienee@snuh.org

¹Department of Emergency Medicine, Seoul National University Bundang Hospital, Bundang-gu, Seongnam-si, Gyeonggi-do, Republic of Korea
Full list of author information is available at the end of the article

6. Diarrhoea and Vomiting Caused by Gastroenteritis: **Diagnosis, Assessment and Management in Children Younger than 5 Years**. London: National Collaborating Centre for Women's and Children's Health; 2009.
7. Chen L, Hsiao A, Langhan M, Riera A, Santucci KA: **Use of bedside ultrasound to assess degree of dehydration in children with gastroenteritis**. *Academic emergency medicine : official journal of the Society for Academic Emergency Medicine* 2010, **17**(10):1042-7, PubMed PMID: 21040104. Pubmed Central PMCID: PMC3058669. Epub 2010/11/03. en.
8. Colletti JE, Brown KM, Sharieff GQ, Barata IA, Ishimine P: **The management of children with gastroenteritis and dehydration in the emergency department**. *The Journal of emergency medicine* 2010, **38**(5):686-98 [http://PubMed PMID: 19345549. Epub 2009/04/07. eng].
9. Cheron G, Jais JP, Cojocar B, Perez N, Biarent D: **The European Paediatric Life Support course improves assessment and care of dehydrated children in the emergency department**. *European journal of pediatrics* 2011, **170**:1151-7, PubMed PMID: 21340485. Epub 2011/02/23. eng.
10. Freedman SB, Parkin PC, Willan AR, Schuh S: **Rapid versus standard intravenous rehydration in paediatric gastroenteritis: pragmatic blinded randomised clinical trial**. In *BMJ Clinical research* 2011, **343**:d6976, PubMed PMID: 22094316. Pubmed Central PMCID: PMC3219422. Epub 2011/11/19. eng.
11. Maitland K, Kiguli S, Opoka RO, Engoru C, Olupot-Olupot P, Akech SO, *et al*: **Mortality after fluid bolus in African children with severe infection**. *The New England journal of medicine* 2011, **364**(26):2483-95, PubMed PMID: 21615299. Epub 2011/05/28. eng.
12. Kinlin LM, Freedman SB: **Evaluation of a clinical dehydration scale in children requiring intravenous rehydration**. *Pediatrics* 2012, **129**(5):e1211-9, PubMed PMID: 22529270. Epub 2012/04/25. eng.
13. Molyneux S, Njue M, Boga M, Akello L, Olupot-Olupot P, Engoru C, *et al*: **'The words will pass with the blowing wind': staff and parent views of the deferred consent process, with prior assent, used in an emergency fluids trial in two african hospitals**. *PloS one* 2013, **8**(2):e54894, PubMed PMID: 23408950. Pubmed Central PMCID: PMC3569446. Epub 2013/02/15. eng.
14. Ng L, Khine H, Taragin BH, Avner JR, Ushay M, Nunez D: **Does bedside sonographic measurement of the inferior vena cava diameter correlate with central venous pressure in the assessment of intravascular volume in children?** *Pediatric emergency care* 2013, **29**(3):337-41, PubMed PMID: 23426248. Epub 2013/02/22. eng.
15. Pruvost I, Dubos F, Chazard E, Hue V, Duhamel A, Martinot A: **The value of body weight measurement to assess dehydration in children**. *PloS one* 2013, **8**(1):e55063, PubMed PMID: 23383058. Pubmed Central PMCID: 3558475.
16. Todd J, Heyderman RS, Musoke P, Peto T: **When enough is enough: how the decision was made to stop the FEAST trial: data and safety monitoring in an African trial of Fluid Expansion As Supportive Therapy (FEAST) for critically ill children**. *Trials* 2013, **14**:85, PubMed PMID: 23531379. Pubmed Central PMCID: PMC3617035. Epub 2013/03/28. eng.

doi:10.1186/2036-7902-7-S1-A23

Cite this article as: Kwon *et al.*: Measurement of inferior vena cava and aorta with bedside ultrasound to assess degree of dehydration in children. *Critical Ultrasound Journal* 2015 **7**(Suppl 1):A23.

Submit your manuscript to a SpringerOpen® journal and benefit from:

- Convenient online submission
- Rigorous peer review
- Immediate publication on acceptance
- Open access: articles freely available online
- High visibility within the field
- Retaining the copyright to your article

Submit your next manuscript at ► springeropen.com
