Journal of Chemical Health Risks

www.jchr.org

JCHR (2024) 14(3), 2588-2592 | ISSN:2251-6727

Association Between Inferior Vena Cava Diameter and Height, Weight, and Abdominal Girth in Indian Children.

[1]Dr.Vismaya Sreenivasan, [2]Dr.K. Rangasamy, [3]Arun joe Eldow,

[1]Post Graduate, Department of Paediatrics, Vinayaka Mission's Kirupananda Variyar Medical College and Hospital, Vinayaka Mission's Research Foundation, Salem,Tamil Nadu-636308,India.

[2]Professor and HOD, Department of Paediatrics, Vinayaka Mission's Kirupananda Variyar Medical College and Hospital, Vinayaka Mission's Research Foundation, Salem,Tamil Nadu-636308,India.

[3]Consultant Pediatrician,Smita Memorial Hospital,Todupuzha,Kerala-685608,India.

Corresponding Author: Dr.K.Rangasamy,

Professor and HOD , Department of Paediatrics,Vinayaka Mission's Kirupananda Variyar Medical College and Hospital, Vinayaka Mission's Research Foundation, Salem,Tamil Nadu 636308,India.

Email: ramrangsdr@gmail.com

(Received: 08 February 2024 Revised: 11 March 2024 Accepted: 08 April 2024)

KEYWORDS

IVC Diameter, ABDOMINAL GIRTH,HEIGHT,WEIGHT,POCUS,IVC Volume

ABSTRACT:

OBJECTIVES: India plays a significant role in global childbirth, yet childhood mortality, particularly due to diarrhoea-induced dehydration, remains a significant concern, contributing to more than 10% of child mortality in the country. This study aims to evaluate association of IVC diameter with parameters like height weight and abdominal girth

MATERIALS AND METHODS: This prospective observational study was conducted at Vinayaka Mission Kirupananda Variyar Medical College in Salem, Tamil Nadu, over a period of one year. Data from 150 outpatient children aged 5 to 12 were analyzed to establish relationships between IVC diameter, height, weight, and abdominal girth. Statistical analyses were performed using SPSS software, presenting quantitative data as mean and standard deviations and qualitative data as percentages.

RESULTS: The study included 54% females and 46% males. The mean IVC diameter was 8.5 ± 2.25. Correlation tests were used to assess associations between variables, with significance set at $p < 0.05$. The results highlighted IVC dimensions in Indian children and demonstrated correlations between height, weight, and abdominal circumference with IVC diameters.

CONCLUSION: This study provides valuable insights into the relationship of IVC diameter in Indian children with their height, weight, and abdominal girth. The findings underscore the importance of measuring IVC in evaluating dehydration levels, emphasizing the need for further research with a larger sample size to improve clinical accuracy and applicability.

INTRODUCTION

Diarrhoea and dehydration pose significant health risks for children worldwide, diarrhoea-induced dehydration remains a significant concern, contributing to more than 10% of child deaths annually. Timely and accurate fluid resuscitation is crucial, especially in cases of acute gastroenteritis or trauma, necessitating precise diagnosis methods for intravascular fluid calibration.[1,2,3]

Accurate assessment of fluid status is vital for effective therapy in pediatric emergency settings, as it helps prevent shock or mortality. However, existing measurement methods face challenges such as interobserver variability and reliance on historical evidence, impacting sensitivity and specificity. Point-of-care ultrasonography (POCUS) is increasingly embraced in pediatric emergency medicine for its quick, non-invasive, and objective assessment of volume status

POCUS allows clinicians to obtain and analyze bedside images rapidly, with the diameter of the inferior vena cava (IVC) serving as a reliable indicator of intravascular volume, surpassing invasive methods. This non-invasive approach minimizes risks associated with central venous access, particularly advantageous in pediatric cases. The simplicity, speed, and repeatability of IVC

Journal of Chemical Health Risks

www.jchr.org

JCHR (2024) 14(3), 2588-2592 | ISSN:2251-6727

ultrasonography enhance its effectiveness in determining volume status, especially when measured throughout respiratory cycles in hemodynamically stable patients.

In addressing severe dehydration in children, particularly in developing countries, POCUS emerges as a valuable tool, enabling prompt treatment initiation and preventing deaths. While the World Health Organization (WHO) and the United Nations Children's Fund (UNICEF) emphasize the importance of research on context-specific risk factors and interventions for childhood diarrhea, further studies are needed to accurately predict illness outcomes.

The lack of normative data on IVC diameter in Indian children underscores the necessity for comprehensive research. Establishing baseline information and correlations with age, sex, and somatic parameters will facilitate a risk-based approach to treatment. This study aims to fill this gap in knowledge and contribute to improved healthcare practices for children in India by focusing solely on the association between IVC diameter and height, weight, and abdominal girth.

METHODOLOGY

For this prospective observational study, data were gathered from children aged 5 to 12 who visited the outpatient clinic of VMKV Medical College and Hospital. The study spanned one year and focused on children with minor illnesses not requiring admission, those seeking immunization, and those attending follow-up visits after discharge from acute illnesses, alongside their accompanying children. Exclusion criteria included patients needing admission, those with significant illnesses, experiencing diarrhea, vomiting, or conditions causing volume loss/overload, individuals showing objective signs of hypovolemia, abnormal vital signs during examination, and those with a medical history of end-organ failure or heightened intra-abdominal pressure. The sample size consisted of 150 participants.

After obtaining parental consent, eligible children were enrolled based on inclusion criteria, and data including height, weight, abdominal girth, and IVC diameter were collected using the specified methodology.

Statistical analysis was carried out using SPSS for Windows, version 18. Quantitative data were presented as means ± standard deviation (SD), while qualitative data were expressed as percentages. The comparison between two means was conducted using Student's t-test, assuming normal distribution of the data. Pearson's correlation test was utilized to explore associations between variables.

RESULT

The main goal of the study was to establish relationship between inferior vena cava diameter with different factors. Analysis of the study findings was conducted using SPSS software version 23.0 following data input into MS Excel. Quantitative data were represented by mean and standard deviations, while qualitative data were depicted as percentages and ratios. Correlation analysis utilized Spearman or Pearson, depending on the data distribution, with a significance level set at $p < 0.05$ for significant associations in the investigations.

In this study, the gender distribution consisted of 54.0% females and 46.0% males among participants aged 5 to 12 years. The majority of participants fell within the 5-9 years age groupThe mean age of the study population was determined to be 6.78 ± 3.025 years. Gender distribution across age groups was relatively even.

The mean height of the participants was 119.890 ± 18.556cm, ranging from 105 cm to a maximum of 1450cm. Participant weights ranged from 16kg to 46kg, with a mean of 24.95 ± 6.565 kg. Abdominal girth measurements ranged from 46 cm to 97cm, with a mean of 64.67 ± 11.013 cm.

	N	Minimum	Maximum	Mean	Std. Deviation
AGE	150	5	12	6.78	3.025
HEIGHT	150	105	150	119.890	18.556
WEIGHT	150	16	46	24.95	6.565

Journal of Chemical Health Risks

www.jchr.org

JCHR (2024) 14(3), 2588-2592 | ISSN:2251-6727

ABDOMINAL GIRTH	150	46	97	64.67	11.013

In this study, Pearson correlation tests were performed to examine the relationship between IVC volume and height, weight, and abdominal girth. A significance level of $p < 0.05$ was used to determine meaningful correlations. The results indicated positive correlations between IVC volume and weight, height, and abdominal girth.

Height exhibited a significant correlation with IVC volume, evidenced by a robust positive correlation with an R value of 0.886, and this relationship was statistically significant ($p < 0.05$).

Likewise, weight demonstrated a notable correlation with IVC volume, revealing a robust positive correlation with a Pearson correlation test R value of 0.878. This observation also revealed a statistically significant relationship ($p < 0.05$). There is a positive relationship between weight and IVC volume, suggesting that as weight increases, there is a corresponding increase in IVC diameter.

Furthur ,The current investigation also revealed a notable correlation between abdominal girth and IVC volume, evidenced by a robust positive correlation with a Pearson correlation test R value of 0.767, indicating a statistically significant connection ($p < 0.05$). This suggests a positive association, indicating that as abdominal girth expands, there is a corresponding increase in IVC diameter.

CORRELATION OF IVC VOLUME WITH DIFFERENT VARIABLES

		IVC VOLUME (in mm)	HEIGHT	WEIGHT	ABDOMINAL GIRTH
IVC VOLUME (in mm)	Pearson Correlation	1	.886	.878	.767
	Sig. (2-tailed)		.000	.000	.000
	N	150	150	150	150

DISCUSSION

The main objective of our study was to find the correlation between IVC volume and height weight,abdominal girth

Observations made by Jianjun Gu et al. revealed that in their study on Chinese children, the mean age was 6.8 +/- 3.41. Interestingly, males outnumbered females in their population under study, contrary to our findings. This similarity might be attributed to the comparable sample sizes. Similarly, Kushagra Taneja et al. conducted research on typical values for inferior vena cava diameter and its correlation with somatic markers in healthy Indian children. The mean age of their study participants was 4.72 +- 3.72 years, lower than in our study. Among the 475 subjects, 285 (60%) were male and 190 (40%) were female.

Jianjun Gu et al. found in their survey of Chinese children that the mean height was 117 +/- 20.25, with a mean weight of 22.69 +/- 8.1. The average abdominal circumference was 55.16 +/- 7.8. These findings were consistent with our study, possibly due to similar inclusion criteria focusing on males within the same age range. The highest IVC value in their sample was 10.06mm +/- 2.42, similar to our investigation.

A study by Neurinda Permata et al. involved children aged between 1 month and 18 months. The majority were male (58.6%), with most falling between the age groups of one and 11 months. In our study, there were more

Journal of Chemical Health Risks

www.jchr.org

JCHR (2024) 14(3), 2588-2592 | ISSN:2251-6727

females, and a larger proportion were aged between 3-6 years (61 out of 200).

Shivanand Patil et al. conducted a comparative study on Indian children, reporting a range of inferior vena cava diameter from 0.46 to 2.26 cm. During expiration, the diameter ranged from 0.97 to 2.26 cm, and during inspiration, it ranged from 0.46 to 1.54 cm.[5]

In a related study by Shelby Kutty et al., normative data from 120 children were collected, with maximal and minimal diameters of the IVC and SVC reported as 12.1 +/- 3.8 mm[6]and 8.9 +/- 3.8 mm, respectively. Tomas Zaoral et al. found significant associations between IVCmax and IVCmin with age, height, and weight[7].

Hegde et al. used computed tomographic data on healthy children to explore IVC . BSA was considered in their linear regression analysis. However, it's possible that the model's statistical stability and accuracy were reduced by utilizing BSA rather than height and weight. [8]

Dipti A et al, Fosen EV et al, and Guiotto G et al, used sonographic IVC characteristics for direct fluid management in adults[9,10,11].

CONCLUSION

In conclusion, we have presented the association for Inferior Vena Cava (IVC) diameter with various parameters like height weight and abdominal girth . Our findings revealed noteworthy positive correlations between height, weight, and abdominal circumference with IVC diameters. These associations establish an essential reference range for IVC, facilitating its utilization in assessing and predicting dehydration levels. The obtained reference ranges may also aid in developing additional equations. To enhance accuracy and applicability, future research should evaluate the normal values in larger sample sizes, exploring the relationships between these measurements among other parameters, to refine IVC diameter calculations for different age groups and somatic characteristics.

REF ERENCE

[1] Ministry of Health, Family Welfare-Government of India. Child Health :: National Health mission [Internet]. Gov.in. [cited 2022 Oct 25]. Available from: https://nhm.gov.in/index1

[2] Study on child health status in India [Internet]. Thehindubusinessline.com. 2017 [cited 2022 Oct 25]. Available from: https://www.thehindubusinessline.com/opinion/disquieting-story-of-child-health-in-india/article9765700.ece

[3] UNICEF. WHO . End Preventable Deaths: Global Action Plan for Prevention and Control of Pneumonia and Diarrhoea. World Health Organization; Geneva, Switzerland: 2013. [(accessed on 20 October 2022)]. Available online: http://apps.who.int/iris/bitstream/handle/10665/79200/9789241505239_eng.pdf;jsessionid=837AEC1288C76D2368F1E8F8DAB86B55?sequence=1

[4] Point of care ultrasound: An overview [Internet]. American College of Cardiology. [cited 2022 Oct 7]. Available from: https://www.acc.org/latest-in-cardiology/articles/2017/10/31/09/57/point-of-care-ultrasound

[5] Patil S, Jadhav S, Shetty N, Kharge J, Puttegowda B, Ramalingam R, Cholenahally MN. Assessment of inferior vena cava diameter by echocardiography in normal Indian population: A prospective observational study. Indian Heart J. 2016 Dec;68 Suppl 3(Suppl 3):S26-S30. doi: 10.1016/j.ihj.2016.06.009. Epub 2016 Jul 1. PMID: 28038721; PMCID: PMC5198879.

[6] 6.Kutty S, Li L, Hasan R, Peng Q, Rangamani S, Danford DA. Systemic venous diameters, collapsibility indices, and right atrial measurements in normal pediatric subjects. J Am Soc Echocardiogr. 2014 Feb;27(2):155-62. doi: 10.1016/j.echo.2013.09.002. Epub 2013 Oct 9. PMID: 24120318.

[7] 7. Zaoral T, Kordos P, Nowakova M, Travnicek B, Zapletalova J, Pavlicek J. Baseline diameter of the inferior Vena Cava measured with sonography in euvolemic children and its relationship to somatic variables. Ultraschall Med [Internet]. 2022;43(4):e25–34. Available from: http://dx.doi.org/10.1055/a-1232-1217

[8] 8.Hegde SV, Lensing SY, Greenberg SB. Determining the normal aorta size in children. Radiology. 2015;274:859–865. doi: 10.1148/radiol.14140500

[9] Dipti A, Soucy Z, Surana A, Chandra S. Role of inferior vena cava diameter in assessment of volume status: a meta-analysis. Am J Emerg Med.

Journal of Chemical Health Risks

www.jchr.org

JCHR (2024) 14(3), 2588-2592 | ISSN:2251-6727

2012;30:1414–1419.e1.
doi: 10.1016/j.ajem.2011.10.017.

[10] Fossen DV, Fontana ME, Unverferth DV, Walker S, Kolibash AJ, Bashore TM. Safety and efficacy of inferior vena caval occlusion to rapidly alter ventricular loading conditions in idiopathic dilated cardiomyopathy. Am J Cardiol. 1987;59:937–942. doi: 10.1016/0002-9149(87)91129-5.

[11] Guiotto G, Masarone M, Paladino F, Ruggiero E, Scott S, Verde S, et al. Inferior vena cava collapsibility to guide fluid removal in slow continuous ultrafiltration: a pilot study. Intensive Care Med. 2010;36:692–696. doi: 10.1007/s00134-009-1745-4