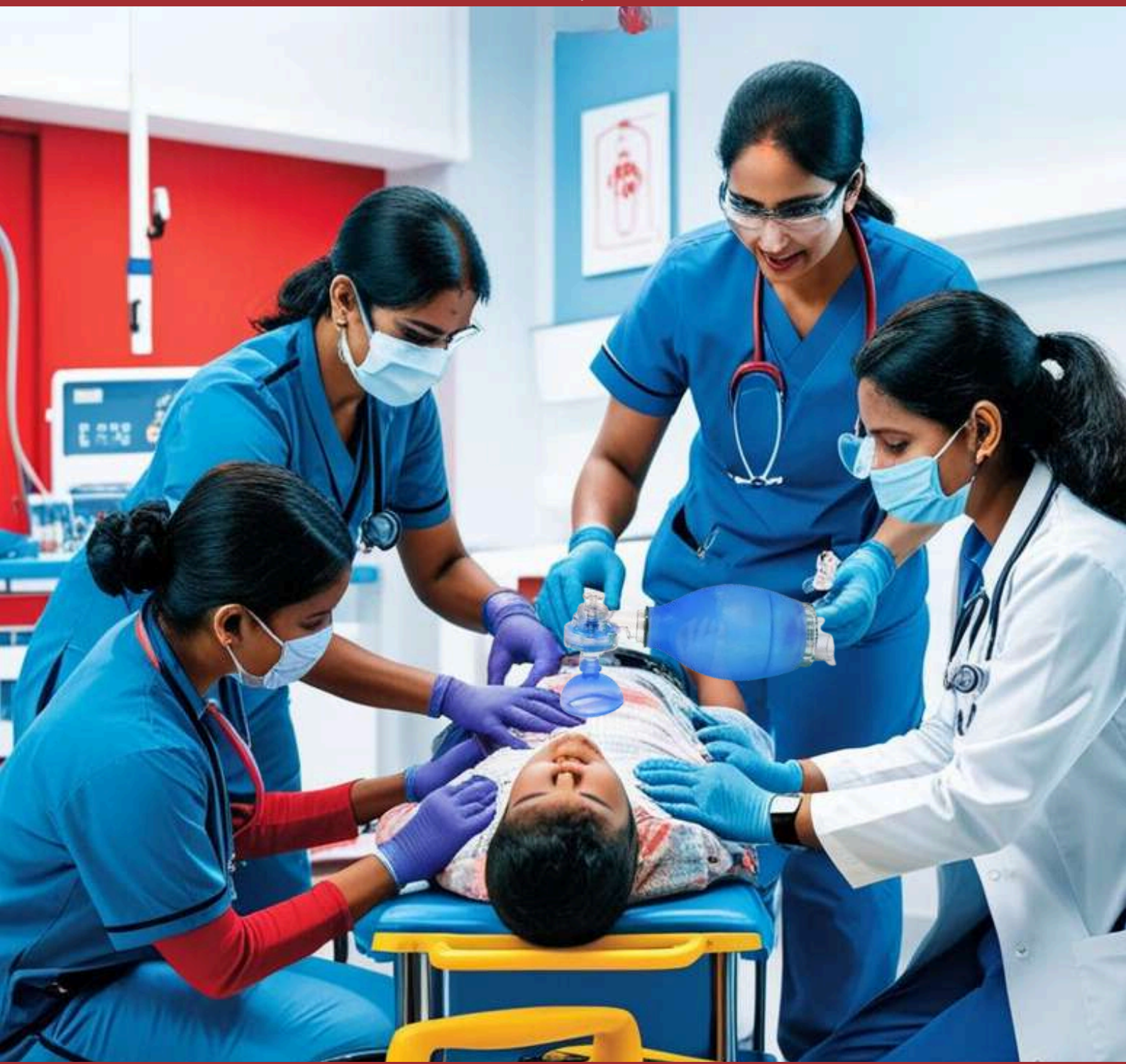
CODE PEM

IAP Pediatric Emergency Medicine Chapter's Quarterly Bulletin

Issue 3/Oct 2024



THEME : EVERY SECOND COUNTS & EVERY CHILD MATTERS!

ISSUE HIGHLIGHTS

1. Emergency Resuscitation Fluids in Pediatric Septic Shock
2. The Role of Artificial Intelligence (AI) in Pediatric Emergency Medicine
3. Do Not Attempt Resuscitation - a revisit

and more...!

Indian Academy of Pediatrics
Pediatric Emergency Medicine Chapter

Mission

To improve the care of sick children in emergency settings

Vision

To advance Pediatric Emergency Medicine through high quality patient and family-centred care, innovative research, advocacy and education.

Aim

1. To Promote Pediatric Emergency Medicine as a Super Specialty in India and abroad
2. Enhance the quality of pediatric emergency medical care in India
3. Raise public awareness of the scope of pediatric emergency medical services
4. Enhance and optimize Emergency and Disaster Preparedness
5. Response with reference to special need of children and adolescents in India
6. To encourage pediatric research activities by combining the efforts of individual Institutions.
7. To facilitate and coordinate Quality research activities in setting of Pediatric Emergency

Activities

1. Annual academic Conference "NAPEM" (National Assembly on Pediatric Emergency Medicine). Dates to be announced soon
2. Fellowship Program in Pediatric Emergency Medicine at various institutes
3. Various education activities including seminars, symposiums, workshops, Quizs on Pediatric Emergency Medicine

Membership

For membership click on the link for google form
https://docs.google.com/forms/d/e/1FAIpQLScb8TWyS-cQJY35pPjBx8qU_rl2Pu9_tJHY3w3WU4w0ttmQWQ/viewform?usp=sf_link

Type of Membership and Membership fee*
Associate life member (1000 INR), Life Member (2000 INR), Permanent Members: (5000 INR), Global Member (100 USD) – eligibility criteria are mentioned in google form
*All the applications will be scrutinized by the EB members for eligibility

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MESSAGE FROM THE CHAIRPERSON

Dr. Radhika Raman
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As I took up the responsibility as Chairperson of the IAP Pediatric Emergency Medicine (PEM) Chapter, my thoughts were focused on improving the perception of this sub-specialty. Though Pediatric emergency has been functioning as a separate entity for more than a decade, there is a need to amalgamate the scattered blocks and create a scientifically sound platform to achieve our goals. My gratitude extends to the IAP for their unwavering dedication in making the chapter possible. My heartfelt appreciation also to all those who have dedicated their career and laid the foundation and stepping stones for us to take the goals forward.

In the last couple of years we have been working on strengthening and streamlining the academic committees and the fellowship program. The unconditional support and guidance from the IAP has enabled Pediatric Emergency programs all over the country to be supported by the Indian college of Pediatrics (ICP). It is greatly appreciable that the first entry exam for the Post degree certificate course in Pediatric Emergency Medicine has been successfully conducted by the ICP and the next academic session will rollover soon.

Our chapter conducted the National assembly in Pediatric Emergency (NAPEM) conference at Bangalore in February 2024 which was well attended and the deliberations greatly commended. We are continuously working on conducting various workshops and courses aiming excellence in every sphere. Our vision is to create new avenues in academics in this specialty and with the able leadership of the IAP and ICP we will continue to provide high quality online academic sessions and courses. Our ultimate goal is to improve professional development and the practice of this specialty to benefit children in the remotest areas and ensure a comprehensive and integrated pediatric emergency service.

I wish our chapter grows by leaps and bounds and I look forward to furthering our goals with the support from everyone.

MESSAGE FROM THE GENERAL SECRETARY

Dr. Bharat Choudhary
Additional Professor
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Dear Members and Colleagues,
I hope this message finds you well. As we embark on another exciting year for IAP pediatric emergency medicine chapter, I am pleased to share some updates and highlights in this newsletter.

First of all I would like to congratulate our editorial team to come out with exciting edition of this newsletter.

We are thrilled to announce our Pediatric Emergency Medicine update scheduled from 18th-20th October 2024 at AIIMS Jodhpur. This year, our theme will be "Pediatric Emergency Medicine - need of the hour" featuring renowned speakers and workshop on Pediatric Trauma resuscitation. Our next annual conference is being hosted by Dr Prameela Joji at beautiful city Thiruvananthapuram from 28th Feb-2nd March 2025. Please mark your calendars and stay tuned for registration details.

I am happy to share that our one year certificate course in Pediatric emergency medicine is affiliated Indian College of Pediatrics (ICP) and first batch students has taken admissions at various centers. We continue to expand our other activities including IAP platform webinars, monthly CGRs. Recent additions of this newsletters include updated clinical guidelines, interesting case reports and research articles. I encourage you to explore these valuable materials to enhance your practice.

Our society remains committed to work towards improving the care of the children in pediatric emergency. I thanks all the OB members, EB members and other members of the society for their continuous support despite of their busy schedule to support this noble cause.

Thank you for your dedication to improving the health and safety of our youngest patients. Your involvement is crucial to the success of our society, and together we can continue to make a difference in outcome of sick children by quality care in pediatric emergency.

MESSAGE FROM THE EDITOR

Dr. Neha Thakur Rai
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Department of Pediatrics
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CODE PEM is the third issue of the newsletter of the National Chapter of Pediatric Emergency Medicine of the Indian Academy of Pediatrics (IAP-PEM). This newsletter is dedicated to the care of the ill or injured child and this year's theme is "EVERY SECOND COUNTS AND EVERY CHILD MATTERS." The general objective of the newsletter is "To unlock the path of excellence and shape the future of PEDIATRIC EMERGENCY." This guiding principle has been the key objective to inform, educate and entertain the target audience. IAP PEM Newsletter publishes clinically relevant original articles from an emergency medicine perspective. The newsletter is aimed at both the pediatrician who wants to know more about treating and being compensated for minor emergency cases and the emergency physicians who must treat children or adolescents.

The current newsletter features must-have information dedicated specifically to pediatric and adolescent emergencies. Brought to you by pioneers in the field of pediatric emergency medicine, this invaluable newsletter will address the most immediate acute care management problems such as pediatric airway management along with other aspects of emergency management such as diagnostic dilemmas, recent guidelines, future of pediatric emergency as well as mental health problems. The wide array of articles will be an academic feast for clinicians, researchers, academicians and students alike. Authors from across the country have submitted their valuable articles to enlighten the minds and souls of our esteemed readers.

The editorial board thanks our esteemed authors for their valuable contribution, in particular Dr Aaditya Katyal who has taken time out from his busy schedule and provided the interesting cover page as well as designed the newsletter for us. I also take this opportunity to announce that we will launch our official journal of IAP PEM chapter in 2025. Hoping to see you next year with an invaluable first issue of our official journal The journal will publish reports of outstanding clinical and experimental work as well as important contributions in the field of pediatric emergency and trauma across the world.

Finally, I hope all the readers of this newsletter do enjoy reading it and we look forward to your valuable input on our official email id iappemeditorial24@gmail.com

Virtual Gaming Simulation in Pediatric Emergency Medicine : Leveraging Affinity Learning for Highly Interactive Scenarios

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Acknowledgement: The creators of "What's Wrong with Simon?" have made significant contributions to healthcare education by providing this open-access, high-quality simulation for the benefit of nursing and paramedic professionals worldwide. The authors from George Brown College, SickKids Hospital, and Michener Institute contributed to the development of the affinity learning scenario.

Financial disclosures: NONE

INTRODUCTION

Pediatric emergency medicine presents unique challenges due to the specialized knowledge, quick decision-making, and precise interventions required to address critical health issues in children. [1] The high-stakes nature of pediatric emergencies means that healthcare professionals must be exceptionally well-prepared to manage situations that involve rapid physiological changes, smaller margins for error, and often heightened emotional tension, especially when interacting with concerned parents and caregivers.[2] Traditional training approaches, such as lectures, textbooks, and role-playing exercises, often fall short of adequately preparing medical professionals for real-life pediatric emergencies.[3] Moreover, these traditional methods lack the immersive and hands-on experiences that can truly simulate the intensity of emergency settings.[4] Virtual gaming simulations, on the other hand, have become an invaluable tool in addressing these gaps by providing an interactive, dynamic, and controlled environment where learners can practice the application of their knowledge and skills without the risk of causing harm.[5]

Virtual Serious Games and Virtual Gaming Simulation:

Since the 1980s, games have been used in nursing education with positive outcomes, though there is limited quantitative evidence to fully support their value. [6] The research suggests that serious games designed primarily for learning can effectively enhance student engagement, promote deep learning, and improve knowledge retention. [7] These games allow students to practice challenging scenarios, explore new responses, and work through creative solutions in a motivating environment. Virtual simulations provide a safe space for practice and have shown positive results, with nursing students reporting high levels of enjoyment, engagement, and learning motivation. [8] Virtual gaming simulation is a serious game whose purpose is education or training rather than entertainment, accessed by a computer. [9] The serious games consist of three integral components: simulation, learning, and gaming. [10] A virtual world allows students to practice a clinical scenario anywhere, independently, on any computer and may provide a cost-effective and accessible alternative or adjunct to in-person learning. [11]

The Importance of Virtual Gaming Simulations in Pediatric Emergency Medicine

Addressing the Complexities of Pediatric Emergencies

Pediatric patients are not just “small adults.” Their unique anatomical, physiological, and developmental characteristics require specialized medical care and knowledge. Emergencies involving children often escalate rapidly due to their small size and the accelerated rate at which medical conditions can deteriorate. For instance, a child with respiratory distress can progress to respiratory failure much faster than an adult. Therefore, medical professionals must be trained to recognize early signs of distress and take swift, appropriate action. [12]

Virtual gaming simulations can help medical professionals develop both the technical skills required to manage pediatric emergencies and the communication and emotional intelligence needed to support children and families in crisis situations. [13] By simulating high-pressure scenarios in a controlled environment, virtual simulations provide healthcare providers with a safe space to practice and refine these essential skills. [14]

Theoretical Framework for Designing Virtual Gaming Simulations on Affinity Learning

Kolb's Experiential Learning Model provides a solid framework for designing virtual gaming simulations (VGS) on platforms like Affinity Learning. According to Kolb (2015), knowledge is gained through transformative experiences, following a four-stage cycle: concrete experience, reflective observation, abstract conceptualization, and active experimentation. [15] In this framework, learners engage with real-world scenarios, reflect on their experiences, conceptualize new knowledge, and apply it in subsequent actions. [16]

In the VGS on Affinity Learning context, this model can be applied to create immersive, interactive experiences where students practice clinical skills. The platform’s design allows for deliberate opportunities for reflection, critical thinking, and problem-solving, which are crucial in fields like nursing. After completing a scenario, learners can reflect on their decisions, assimilate new concepts, and then replay the simulation to refine their understanding and improve their performance. This iterative process mirrors Kolb's cycle, reinforcing learning through experience and reflection. By integrating reflective moments into the simulation and the ability to replay scenarios, educators can ensure that students engage in active learning and gain the opportunity to revisit and refine their skills. This approach is equally effective in virtual gaming simulations and traditional simulation labs, where reflection occurs during the simulation and debriefing sessions. Affinity Learning’s tools provide an ideal platform to leverage Kolb's model, making virtual gaming simulations a valuable addition to experiential learning in healthcare education. [15, 16]

Affinity Learning: A Tool for Pediatric Emergency Virtual Gaming Simulation

One such platform that is revolutionizing simulation-based training in pediatric emergency medicine is the Affinity Learning platform: https://affinitylearning.ca/. This web-based platform allows educators and healthcare trainers to design and deliver highly interactive simulation scenarios that are both realistic and accessible across multiple devices. Affinity Learning https://affinitylearning.ca/ is an innovative platform designed to deliver web-based, interactive simulations that can be accessed across various devices, including mobile phones, tablets, and computers. This flexibility is particularly beneficial in healthcare education, as it allows learners to practice and engage with content anytime and anywhere, making learning more accessible and scalable. Below, we will explore the key features of the Affinity platform and how they can be applied specifically to pediatric emergency medicine training.

This article delves into how virtual gaming simulations transform pediatric emergency medicine training, mainly through the Affinity Learning platform. Fig1

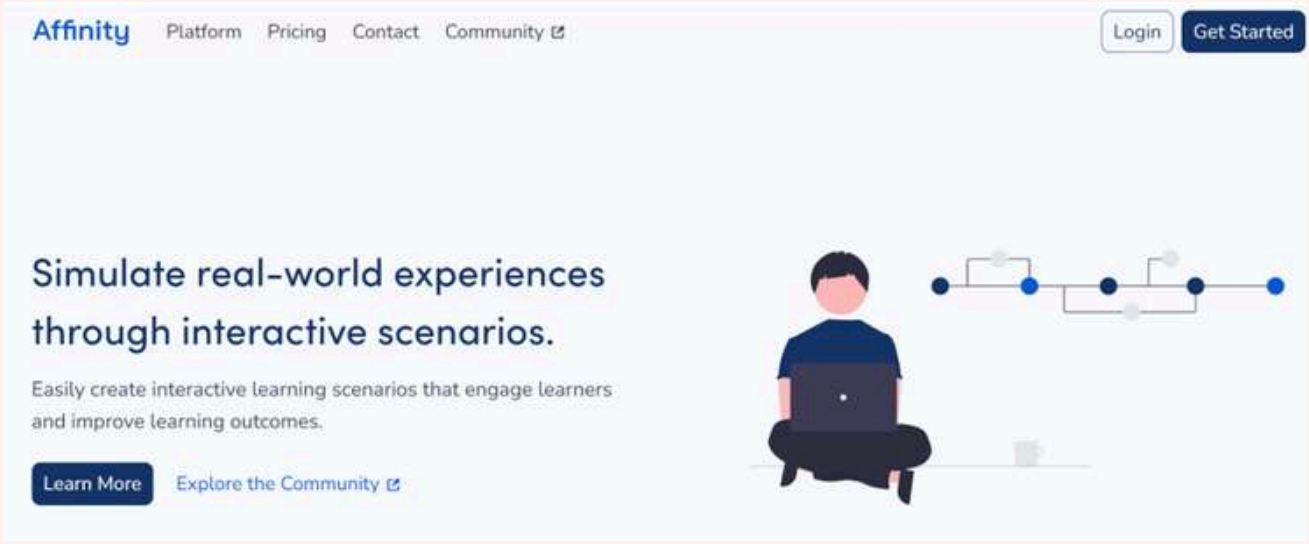

Fig 1: *Affinity learning platform*

Community Free Access in Affinity Learning: A Detailed Overview:
https://app.affinitylearning.ca/community/browse
The Community Free Access section of Affinity Learning represents a powerful feature that fosters collaboration, knowledge-sharing, and collective growth within the educational and training community. This section serves as a valuable hub where educators, trainers, learners, and professionals from various fields can access diverse shared learning resources, interactive simulations, and instructional materials—all free. By creating a space where users can contribute and browse through content generated by community members, Affinity Learning enhances both individual and collective learning experiences. It allows the learner to discover impactful learning experiences in your profession, freely usable under Creative Commons. Fig 2

https://creativecommons.org/licenses/by-sa/4.0/

Fig 2: *Community Page of Affinity Learning*

Key Features of Affinity Learning for Pediatric Emergency Medicine

1. **Interactive Learning Experiences:** Affinity Learning allows medical professionals to engage in real-world pediatric emergency scenarios within a simulated, web-based environment as shown in Fig 3. These interactive simulations allow learners to practice their knowledge acquisition, application, and decision-making skills without the risk of real-world consequences. This is particularly valuable in pediatric emergency medicine, where the stakes are incredibly high, and errors can have life-threatening consequences.

Fig 3*: Real-world Scenarios*

2. **Intuitive Authoring Tools:** Affinity's intuitive authoring tools enable educators to rapidly create pediatric emergency simulations that cater to their trainees' specific learning objectives. Educators can incorporate a variety of interaction types, including decision points, multimedia elements (such as videos and audio), and real-time feedback mechanisms. For example, an instructor might design a scenario in which a child presents with signs of respiratory distress, and the learner must choose the appropriate diagnostic tests and treatment options. It allows rapid development of the learning modules incorporating interactive elements like decision branching, multiple choice questions, and text evaluations. Easily include existing educational materials like images, videos, or audio files within scenarios. The authoring media file video can be seen by clicking the file attached.

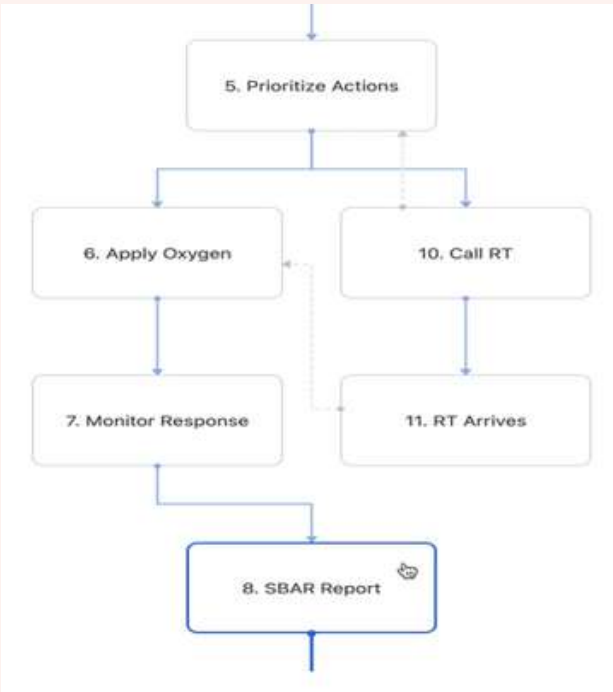

***Fig 4**: Intuitive Authoring Tool*

3. **Mobile-Friendly Access:** One of the standout features of Affinity Learning is its mobile accessibility. In today's fast-paced healthcare environment, medical professionals need to have flexible access to learning resources. Affinity allows learners to access simulations on their phones, tablets, or computers without installing additional software. This feature is particularly advantageous for busy healthcare professionals who may need to engage in training during breaks, commutes, or at home.

4. **Customizable Simulations for Pediatric Care:** Pediatric emergency simulations can be highly customized within the Affinity platform to meet the unique challenges of pediatric care. For example, educators can design scenarios focusing on common pediatric emergencies such as asthma attacks, febrile seizures, or anaphylaxis. Each scenario can be tailored to reflect the specific learning needs of different healthcare professionals, whether medical students, residents, nurses, or paramedics (Carter et al., 2021).

Immersive Learning Through Visual Interactions and 360° Media in Affinity Learning: Affinity Learning provides a range of visual interaction types that allow educators to create dynamic and immersive learning experiences. By choosing from a list of intuitive visual interactions, instructors can design scenarios tailored to specific learning objectives. These interaction types enable educators to make their existing educational content interactive by incorporating images, videos, and audio recordings, transforming static material into engaging, hands-on learning experiences. Additionally, Affinity Learning supports 360° media, allowing users to upload photos or videos captured with a 360-degree camera. This feature enhances learner immersion by enabling the use of hotspots, which allow learners to explore a virtual room or scene and interact with the objects within it. This combination of interactive media creates a deeply engaging and versatile learning environment suitable for a wide range of educational applications as shown in Fig 5.

***Fig 5**: Visual Interactions and 360o Media Incorporation*

5. **Enhancing Decision-Making Skills:** Affinity Learning empowers learners to enhance their decision-making skills by providing opportunities to influence the outcomes of simulated scenarios as shown in Fig 6. Educators can create dynamic learning experiences by designing divergent pathways using branching techniques, where each decision a learner makes leads to a unique learning path. These branching modules are highly customizable, allowing educators to map out multiple potential outcomes based on learners' choice during the simulation. This feature enables learners to experience the consequences of their decisions in real-time, fostering critical thinking and promoting a deeper understanding of the subject matter.

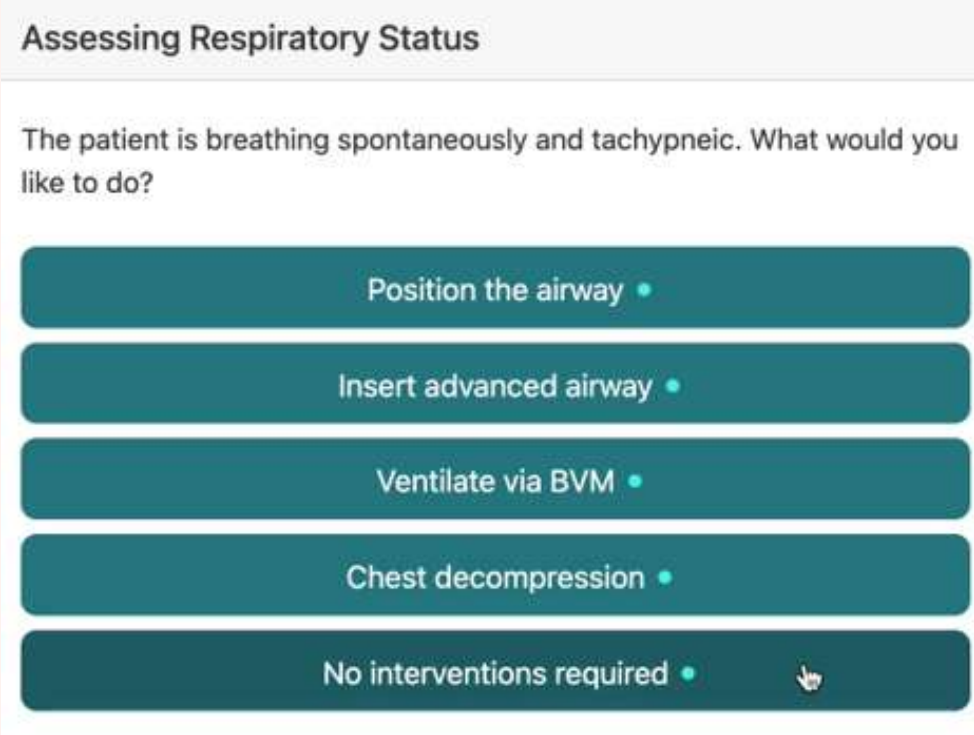

***Fig 6**: Decision-making Skills*

6. **Real-Time Feedback, Analytics and Seamless LMS Integration:** Immediate feedback is crucial for reinforcing learning, particularly in a field as critical as pediatric emergency medicine. Affinity Learning offers real-time feedback within its simulations, allowing learners to understand the consequences of their actions and decisions immediately. Additionally, educators can use the platform's analytics tools to track learner progress, identify areas where learners may be struggling, and adjust the simulations accordingly. It allows for seamless integration with any Learning Management System (LMS) that supports the LTI standard. This feature enables learners to access Affinity scenarios directly from their LMS accounts with just one click, streamlining the learning experience. Additionally, Affinity offers the ability to sync completion status, scores, and detailed learner results with the organization's LMS. Learners can also download their scenario results as a PDF upon completion, ensuring easy access and documentation of their performance.

How to Create Highly Interactive Pediatric Emergency Simulations Using Affinity Learning

Creating highly interactive pediatric emergency simulations on the Affinity Learning platform involves several steps that allow educators to craft engaging, realistic, and educational scenarios for healthcare professionals. Affinity Learning offers comprehensive walk-throughs to assist authors in navigating the platform and making the most of its features. These tutorials are designed to guide authors in creating engaging and effective simulations, while learners can use them to understand better how to interact with scenarios and track their progress. Available video tutorials cover various topics, including authoring scenarios and utilizing the platform's interactive features. You can access these helpful walk-throughs via the following links: *Video 1*, Video 2, Video 3, and Video 4. These resources ensure that both authors and learners can fully utilize Affinity Learning's platform for an optimal educational experience.

The video links are as follows:

Video 1: Creating your first scenario from scratch
https://vimeo.com/891490281/16a981813f?share=copy

Video 2: Sharing scenarios as links
https://vimeo.com/891592837/2213ec89ac?share=copy

Video 3: Creating your first landing page
https://vimeo.com/892114856/8754d3d338?share=copy

Video 4: Adding videos to your scenarios
https://vimeo.com/891493887/49be7fb5be?share=copy

Below is a detailed guide on how to create these simulations:

Step 1: Define Learning Objectives for Pediatric Emergencies
The first and most crucial step in designing any simulation is to define clear and specific learning objectives. In pediatric emergency medicine, these objectives might teach learners to recognize early warning signs of critical conditions, stabilize pediatric patients, or manage the emotional dynamics of dealing with children and their families during emergencies. For example, a simulation might focus on managing pediatric septic shock. The learning objectives could include recognizing the symptoms of sepsis, initiating appropriate fluid resuscitation, administering antibiotics, and monitoring vital signs. By clearly defining these objectives, you ensure that the simulation is focused and aligned with the skills and knowledge learners need to acquire. [17]

Step 2: Develop a Pediatric-Specific Scenario Framework
Once your learning objectives are established, the next step is to develop a scenario framework that accurately reflects the complexities of pediatric emergency medicine. This involves designing a realistic situation that mirrors the types of emergencies healthcare professionals will likely encounter in pediatric care settings. Using Affinity's authoring tools, you can create a scenario where a child is brought into the emergency department with symptoms of respiratory distress. The learner would be required to assess the patient, make a diagnosis (e.g., asthma exacerbation), and initiate appropriate treatments (e.g., bronchodilators, steroids, and oxygen therapy). The scenario should include decision points where the learner's choices influence the outcome. For instance, if the learner fails to initiate treatment quickly enough, the child's condition might deteriorate, providing a critical learning moment of the importance of timely intervention.

Step 3: Incorporate Interactive and Multimedia Elements
Incorporating interactive elements into the simulation is essential to maximizing engagement. Affinity Learning allows educators to embed various interactions, including multiple-choice questions, decision trees, and multimedia components such as videos, images, and audio clips.

For a pediatric emergency scenario, consider incorporating video clips of simulated patients presenting with different symptoms, audio recordings of respiratory sounds (e.g., wheezing or stridor), and images of diagnostic test results (e.g., X-rays or blood gas analyses). These multimedia elements enhance realism and help learners to develop their diagnostic skills. Additionally, interactive decision points can simulate the fast-paced nature of pediatric emergencies, where every second counts and learners must make rapid, informed decisions.

Step 4: Customize Simulations Based on Learner Levels and Roles
One of the most powerful features of the Affinity platform is its ability to customize simulations for different learner levels and roles. Pediatric emergency simulations can be tailored to the needs of various healthcare professionals, from medical students to seasoned pediatricians, nurses, or paramedics. For novice learners, you might design a scenario that includes more guidance and feedback, helping them understand the reasoning behind each step of the clinical decision-making process. For more advanced learners, you can create a more challenging scenario with minimal guidance, requiring them to rely on their experience and knowledge to manage the situation. Affinity's adaptive learning capabilities allow the simulation to adjust based on the learner's performance, providing additional hints or increasing the difficulty as needed. For example, a pediatric resuscitation scenario might include detailed prompts and feedback for a first-year resident. At the same time, an experienced emergency physician might face a more complex case with less explicit guidance, such as a child in cardiac arrest with multiple complicating factors like hypothermia or trauma.

Step 5: Test and Refine the Simulation
After creating the pediatric emergency simulation, it's critical to test it thoroughly to ensure that it functions smoothly and aligns with the intended learning objectives. Affinity Learning provides tools that allow you to test the simulation from the learner's perspective, making it easy to identify areas where adjustments may be needed. During testing, consider seeking feedback from colleagues or learners with pediatric emergency medicine experience. They can offer insights into whether the scenario accurately reflects real-world conditions and whether the difficulty level is appropriate for the target audience. Based on this feedback, you can refine the scenario by adjusting the timing of events, modifying decision points, or adding additional multimedia elements.

Case Study: "What's Wrong with Simon?" – An Interprofessional Pediatric Simulation:

To illustrate how Affinity Learning can be used to create an interactive pediatric emergency simulation, let's explore a case study in which a scenario is designed to teach learners how to manage pediatric respiratory distress as an interprofessional team.
https://app.affinitylearning.ca/community/play/306

Overview: The "What's Wrong with Simon?" case study is a virtual clinical simulation designed to provide healthcare students and professionals with critical opportunities to enhance their knowledge, skill application, and decision-making abilities in a pediatric emergency setting. Created for nursing and paramedic professionals, the simulation offers a realistic scenario where learners must respond to a child experiencing a deteriorating respiratory condition in an emergency department.

Learning Objectives: The simulation focuses on developing key competencies such as critical thinking, problem-solving, and effective communication within an interprofessional care team. Learners are tasked with making timely decisions in a high-pressure environment, testing different approaches to managing the pediatric patient's respiratory issues.

Interactive Elements: Participants are invited to explore various outcomes by choosing different care paths. These choices simulate real-world complexities that healthcare professionals encounter in pediatric emergency situations, emphasizing teamwork, collaboration, and interdisciplinary cooperation.

Educational Impact: With over 3.3k views, this simulation is freely accessible under the Creative Commons CC BY-SA license, allowing educators to integrate it into their curriculum. It provides a dynamic, risk-free environment for learners to practice critical emergency response skills and interprofessional collaboration.

CONCLUSION

Virtual gaming simulations are revolutionizing the way healthcare professionals are trained, especially in critical fields like pediatric emergency medicine. Platforms like Affinity Learning provide an accessible and customizable tool for creating highly interactive, engaging, and realistic simulations that prepare learners for the challenges of real-world pediatric emergencies. By offering hands-on practice in a safe, controlled environment, these simulations enable medical professionals to refine their skills, build confidence, and ultimately provide better care for their pediatric patients. Through interactive learning experiences, intuitive authoring tools, and real-time feedback, Affinity Learning empowers educators to design simulations that meet specific learning objectives and adapt to different learners' needs. As pediatric emergency medicine continues to evolve, virtual gaming simulations will undoubtedly play a crucial role in ensuring that healthcare providers are well-prepared to respond to the unique needs of children in crisis.

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CONCORDANCE BETWEEN VENOUS BLOOD GAS ANALYSIS AND LAB AUTOANALYZER IN MEASUREMENT OF HEMOGLOBIN, HEMATOCRIT, GLUCOSE AND ELECTROLYTES IN CHILDREN PRESENTING TO ED

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ABSTRACT

Background: Speed and accuracy of diagnostic tests is very important. While the lab auto analyzer (AA) and venous blood gas analysis (BGA) test the same parameters, significant time gap exists in availability of the results, with the BGA being available in five minutes and lab AA taking as long as one hour. Early availability of results would mean better and appropriate decision making. In this study, we tested the hypothesis that BGA and lab AA could be used interchangeably.[1]

Methodology:
Fifty-eight paired samples for electrolytes and blood gas were ordered, while hundred paired samples were ordered for blood gas and hemogram. Concentration pairs of following analytes were assessed: Sodium, Potassium, Calcium, Chloride, Bicarbonate, Hemoglobin, Hematocrit and Glucose. Agreement was determined using concordance correlation coefficient (CCC) and Bland-Altman analysis. The difference in results was also assessed against United States Clinical Laboratory Improvement Amendments (US-CLIA) 2019 rules. The test results were interchangeable if they were within the US-CLIA variability criteria.[1][2]

Results:
Median time interval between sampling for BGA and AA was five minutes. The CCC values ranged from 0.7160(0.6166-0.7929) for Hematocrit to 1 for Calcium. The largest bias was for Glucose followed by Hematocrit. The number of readings outside the US-CLIA acceptable variation was also highest for Hematocrit(72.1%) followed by Glucose(52.6%).

Conclusion:
We conclude there is substantially good concordance between AA and BGA machines for different analytes and can be used interchangeably for all analytes except Glucose.

Keywords: Blood gas analysis (BGA), Autoanalyzer(AA), US-CLIA, Analytes, Electrolytes

INTRODUCTION

Electrolyte abnormalities are common in critically ill children. Identifying and treating them on time is essential for best clinical outcome. Blood gas analysis is being employed in ED as a point of care testing for measurement of serum electrolytes. It also provides additional information such as hemoglobin, hematocrit and lactate levels.[2][3][4] The turn-around time for blood gas analysis is five minutes. Routinely measured electrolytes by central lab auto analyzer is time consuming, turn-around time being 30 minutes when individual electrolyte is measured to as long as one hour for the entire panel. When the decision making in an emergency situation demands that we have access to rapid results and testing for the same by blood gas analysis is deemed a better option. Multiple studies in the past have tested the concordance between the test results of blood gas analysis and lab auto analyzer with differing results. High degree of concordance was observed in Potassium values while significant difference was observed in measurement of Sodium and Chloride.

We tested the hypothesis that results of the same test performed on BGA machine and AA machine have high degree of concordance in pediatric population presenting with medical or surgical emergency and that the two test methods could be used interchangeably.[2][5]To test this hypothesis, we prospectively analyzed the concordance between the electrolytes, hemoglobin, hematocrit and glucose values obtained from these two test methods over a period of four months.

METHODS

The study was a prospective observational study conducted over a period of four months in the Emergency department of a tertiary care hospital catering to children between 0-18 years of age. A total of 110 samples were sent for venous blood gas analysis. Of these, 58 were paired samples tested for electrolytes. Hundred were paired samples that tested for complete hemogram.

Blood gas analysis and serum electrolytes testing by auto analyzer was done on COBAS B 221machine. The mode selected for each analysis was different, whole blood was used for BGA and serum obtained after centrifugation was tested for serum electrolytes. Complete hemogram was done on PENTRA ES 60 machine with whole blood.

Test results from the two methods were included for analysis if they were performed simultaneously. Simultaneously measured concentration pairs of the following analytes were extracted from the two test methods: Hemoglobin, hematocrit, glucose, sodium, potassium, chloride, calcium, and bicarbonate.

The accuracy of the test results is ensured since the central laboratory participates in an external and internal quality assessment program. Both the machineries undergo 2 point calibration every eight hours. The sample for BGA was collected in a pre-heparinised 1 ml SMITHS MEDICAL PORTEX sampling syringe. The sample for electrolytes testing by AA was collected in 2ml vacutainer with serum clot activator. Two ml potassium EDTA vacutainer was used to collect sample for complete hemogram.[2]

STATISTICAL ANALYSIS

We determined the agreement between the results obtained by AA and BGA methods using concordance correlation coefficient (CCC) and Bland-Altman analysis. Other tests of significance were not conducted since the sample size is relatively small. Hence the results have been reported as 95% confidence intervals (CI) for CCC.

US-CLIA proposes the criteria for acceptable performance of tests in terms of target values and acceptable limits. Target value was taken as the value obtained on AA.The difference in results from two test methods was assessed against the United States Clinical Laboratory Improvement Amendments(US-CLIA) 2019 rules[2][6] according to which following variations are acceptable :
Sodium +/- 4mmol/L ; Potassium +/- 0.3 mmol/L ; Chloride +/- 5% ; Hemoglobin +/- 4% ; Hematocrit +/- 4% ; Glucose +/- 8%

The test results were interchangeable if they were within the US-CLIA variability criteria and wouldn't alter the clinical management.

As per the central laboratory quality control assessment of the equipment used, a difference of 1gm/dL in Hemoglobin and 3% in Hematocrit is considered acceptable. This was taken into consideration in final interpretation of the results.
All analyses were performed using SPSS version 21.

RESULTS

A total of 110 matched pairs of RFT and VBG results were obtained for analysis from 58 patients. The median (IQR) time interval between sampling for RFT/CBC and VBG in each result pair was 5 (3-7) minutes. Table 1 reveals the analysis of the electrolytes and metabolites performed by the RFT and VBG machines. The number of outliers for all analytes was below 2%, therefore minimizing any influence on the fit of statistical models. The CCC values were moderate to substantial for all assays. The bias was generally small.

The largest bias was for Glu. The limits of agreement (LOA) relative to bias were largest for Glu (Figure 1), with 52.6% of readings outside the US-CLIA variation rule. The number of readings outside the US-CLIA acceptable variation was highest for hematocrit (71.1%) followed by Glucose(52.6%) and Hb (29.1%).

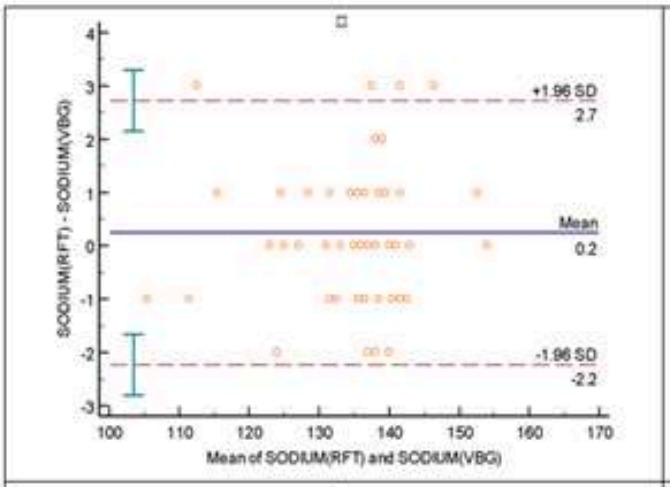
Electrolyte abnormalities noted most commonly was hyponatremia(24) followed by acidosis(23) and hypokalemia(16) respectively. Agreeability of the analytes between the two tests is of importance in treating the same since early intervention is associated with better clinical outcome. The following table shows the results.

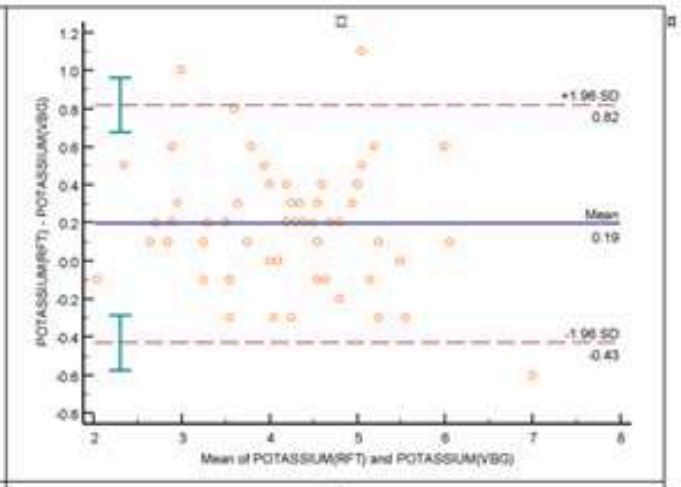
Analyte	N	RFT		VBG		Mean Difference (Bias)	Limits of agreement		No. of pairs outside US-CLIA limits	Concordance correlation coefficient	95% CI For CCC
		Mean	SD	Mean	SD		Lower	Upper			
SODIUM	58	134.81	8.856	134.57	8.770	0.241	-.090	.573	0	0.9894	0.9822-0.9937
POTASSIUM	58	4.27	.958	4.074	1.0137	0.1948	.1112	.2785	16(27.6%)	0.9295	0.8863 - 0.9567
CHLORIDE	58	99.53	7.769	98.74	8.290	0.793	-.060	1.646	2 (3.4%)	0.9140	0.8601-0.9477
CALCIUM	57	1.2318	.31051	1.2319	.31057	-.00018	-.00053	.00017	0	1.0000	1.0- 1.0
BICARB	54	17.74	5.902	17.80	5.938	-0.056	-.167	.056	NA	0.9976	0.9958 - 0.9986
Hb	103	11.389	2.1747	11.5327	2.35005	-0.14334	-.28864	.00196	30 (29.1%)	0.9442	0.9195-0.9614
HCT	100	34.563	7.2272	37.870	7.5041	-3.3070	-4.2569	-2.3571	71(71.7%)	0.7160	0.6166-0.7929
GLU	57	163.52	144.598	154.82	129.373	8.696	1.978	15.415	30(52.6%)	0.9810	0.9708-0.9876

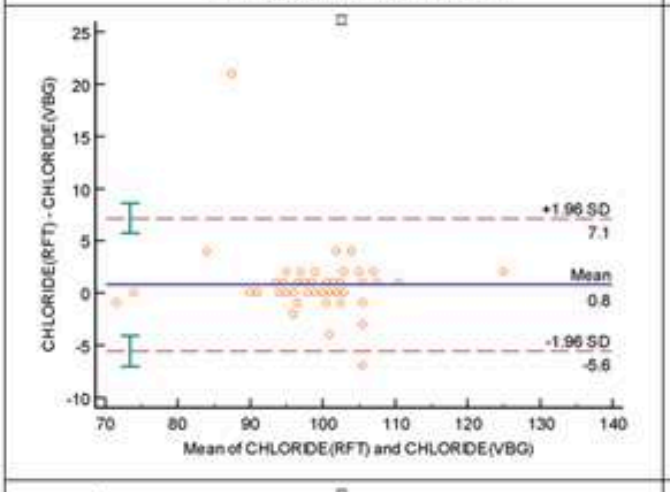
***TABLE 1**: AGREEMENT ANALYSES BETWEEN AA AND BGA AS CONTINUOUS DATA*

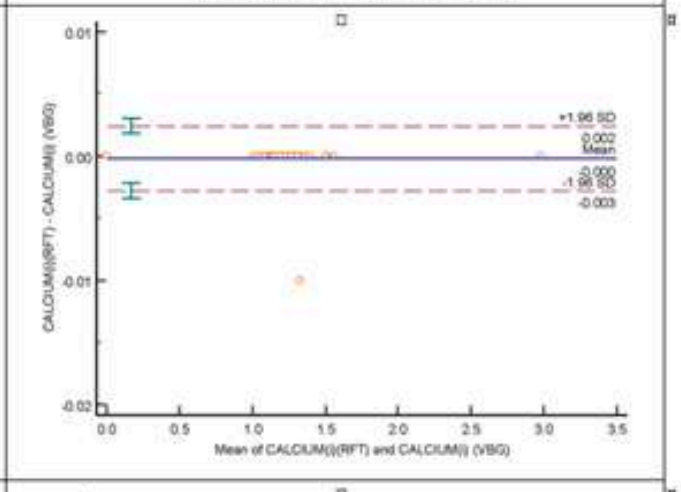
(Hb : Hemoglobin, HCT : Hematocrit, GLU : Glucose, RFT : Renal function test. Here,RFT refers to testing of electrolytes alone and Blood Urea and Serum Creatinine have not been included)

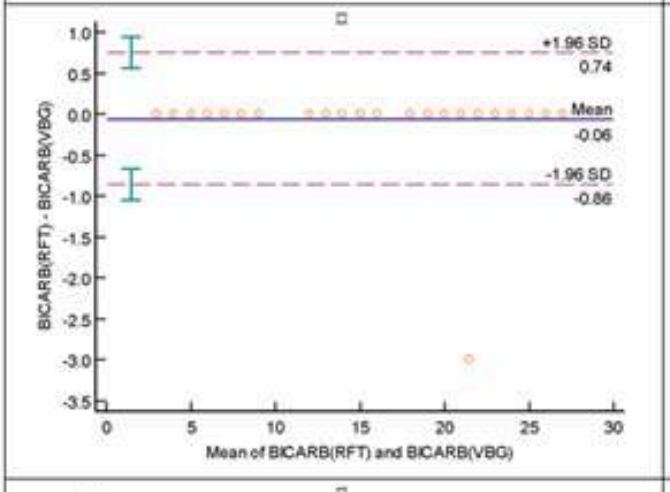
BLAND-ALTMAN PLOT FOR BGA AND AA FOR DIFFERENT ANALYTES

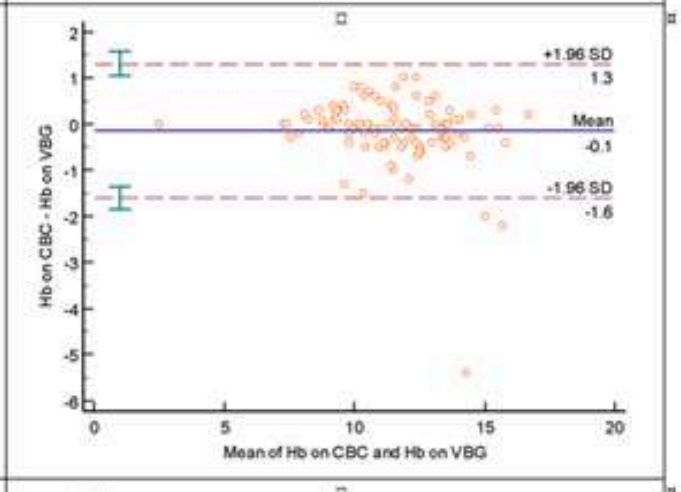


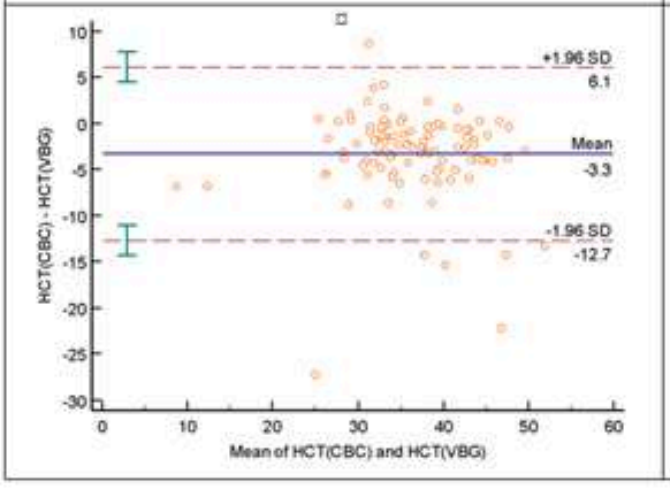


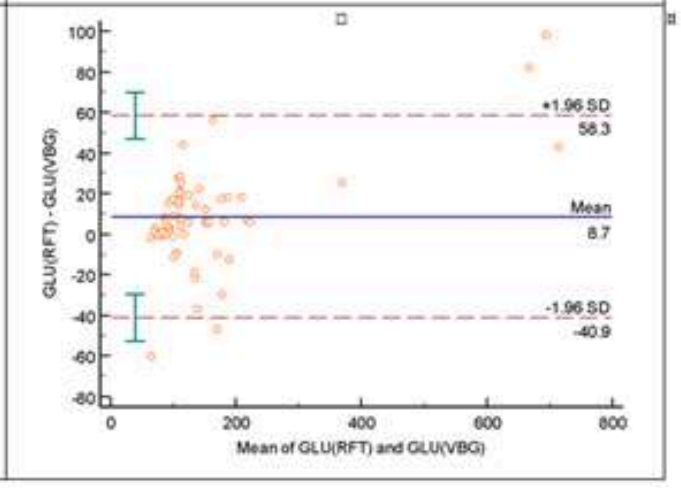












DISCUSSION

A good concordance has been observed between the two test methods with low bias. The limits of agreement relative to the bias was large for Glu with 52.6% readings outside the US-CLIA variability limits. For rest of the analytes, the two tests yielded similar results. It is of clinical interest that there is negligible bias for major electrolytes implying that those two tests can be used interchangeably. Hematocrit reading for 71.1% of pairs was outside the US-CLIA variability limits.

It is interesting to note both the tests yielded similar results for Sodium which has important clinical implications. Abnormal Sodium levels are associated with high morbidity and mortality. It is of utmost importance that Sodium levels be corrected gradually and carefully so as to decrease adverse outcome. Unlike previous studies that have not shown Sodium levels in the two tests at agreeable levels, our study yielded compatible results.[1] Symptomatic hyponatremia could be identified and treated early due to the same. Strict laboratory quality control measures use of better equipment at our NABL accredited laboratory is to be credited for this.

The bias was largest for Glucose levels. This difference may be associated with erring on the side of caution while managing a case of Diabetic ketoacidosis or hypoglycemia.US-CLIA 2019 variability limits is +/- 8 %. For practical purposes, the bias is negligible at 8mg/dL and both the tests can be used interchangeably. Previous studies have shown the bias to be greater than 10gm/dl, with blood gas analysis overestimating the blood glucose levels. The difference observed is due to utilization of glucose by the RBCs before processing. In critically ill patients, blood glucose levels are controlled to less than 10 mg/dl and the study is well within the limits.
The bias observed for Potassium is 0.19, which is within the acceptable limits in reported literature. 27.6 % of the readings were outside the US-CLIA variability limits. This is a well acknowledged bias as Potassium is released form platelets during clotting, thereby associated with spurious difference in values between the two tests. Practically accepted bias is 0.1-0.7 mmol/L as per literature[5]; hence the bias can be considered negligible for practical reasons but requires greater sample size to study the trend.

With the largest variability being observed in Hematocrit but with a mean difference of 3 %, the bias and variability was clinically considered negligible. Early access to Hematocrit values has greatly helped in making a diagnosis of Severe Dengue when children presented to ER with nonspecific complaints and in shock. This has helped manage Dengue shock more effectively decreasing ICU stay and better clinical outcome.

It can be concluded that BGA and AA can be used interchangeably for most analytes except Glucose. However keeping in mind, the clinical condition and the laboratory accuracy standards, even for analytes with variability beyond the US-CLIA limits, it can be considered negligible. This negligence is not associated with change in clinical outcome.

CONCLUSION

With good quality control assessment, BGA and AA results can be used interchangeably for most analytes. This is associated with reduced patient cost on unnecessary tests and single test sample yielding maximum information. It also saves time and enables clinician to take appropriate corrective measures early in ED.

Conflict of interest – none
Source of funding – none
Author contribution
Radhika Raman- conception, design , data analysis and manuscript review.
Aswini -Data collection, analysis , manuscript preparation.

WHAT THIS STUDY ADDS

- Accuracy of BGA is of immense value in the golden hour of resuscitation. Agreement in the values of analytes in the two tests is associated with confident decision making in cases of electrolyte abnormalities.
- Unnecessary repeating of investigations can be avoided in labs where periodic quality control assessment is done which ensures accuracy of test results. This is associated with reduced patient cost in treatment.
- Hematocrit aggregability in BGA and AA has not been tested widely. This study has shown good agreeability which is helpful especially in the setting of Dengue fever.

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Mental First Aid - Role of Child Life Services in Paediatric Emergency Care

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ABSTRACT

Child Life Services is a specially designed program incorporating branches of psychology - developmental psychology, family psychology into paediatric care ensuring and improved patient experience by managing stress, anxiety and trauma. In this article, the history, conception of CLS is briefly analyzed, followed by an evaluation of the success of the program in the pediatric care.

INTRODUCTION

Child Life Programs play a crucial role in paediatric hospital care, emphasizing comprehensive support for both children and their families. Hospitalization can be a daunting experience, and when a child is admitted, the entire family undergoes a challenging journey filled with fear, anxiety, and uncertainty. Addressing these emotions is vital to prevent long-lasting effects like Nosocomephobia or white coat syndrome.

Child Life Services Therapists play a multifaceted role, meeting a child's needs by engaging them, providing coping strategies for families, and serving as advocates. This holistic approach not only benefits the children and families but also contributes to the efficiency of the healthcare system. Acceptance of medical procedures, improved staff efficiency, patient and family-centered care, and increased satisfaction are among the positive outcomes facilitated by Child Life Services.

Development of Child Life Services

Child Life Program's first baby step started in the 1920's where play therapy and procedural education was initiated (1). In 1922, Emma Plank was a pioneer who established the first Child Life Program at Boston Children's Hospital under the guidance of Anna Freud, a psychologist who worked immensely in Child Development (2). In the 1930s, Anne Smith designed a play program in the Children's Memorial Hospital in Chicago under the guidance of work created by eminent psychologists like Jean Piaget, John Bowlby and James Robertson (3).

In 1953, Margaret McFarland published "A new Approach to the Treatment of Hospitalized Children". All these women are pioneers who developed the field, emphasizing the importance of play, education and family centered care.

While in charge of the Child Life and Education Program at the City Hospital of Cleveland, Emma Plank penned the book, "Working with Children in Hospitals: A Guide for the Professional Team", in 1962 (4).

Over the years, with more recognition of the positive impact of the work done by CLS grew, its incorporation into hospitals started increasing. Robert Dombro coined the term "Child Life" and with an organisational body called as the Child Life Council was formed in 1982. This was later changed to Association of Child Life Professionals in the year 2016.

CLS is a well-established program in the United States. Association of Child Life Professionals holds a yearly conference and there are universities which train these Child Life Specialists where they undergo rigorous training and internship programs.

Child Life Services in India

Child Life Services is a novel concept in India. Currently they are working in pockets and there is a role of a “Play Lady” in some hospitals where there are specialists who engage with children. Though this is a well-intentioned volunteer who likes children and tries to contribute to their overall well-being, the needs are much greater in a hospital set up. There is a need for special skills and training that goes into being a child life specialist. Under the guidance of Dr. Chetan Ginigeri, who has worked extensively in Child Safety, there has been a program initiated to train and mould psychologists to understand the needs of children and their families in Paediatric Care. This includes psychoeducation, procedural preparation, understanding medical care, family counselling and therapeutic interventions along with play therapy, art therapy, distraction techniques to name a few.

CLS is a concept that requires unique skill, handling and management in India owing to our vast diversity. There has to be sensitivity and appropriate skills in psychological and medical domain, knowledge to handle and care for children and families when in trauma – physical and mental. Hence, the specialist has to undergo intensive training to connect to the patients and families.

Research based evidence of CLS that was used

Before initiating the program, there was a lot of evidence-based research that commenced. The program took findings from studies to understand the objective and goal of CLS. It was imperative to understand that CLS interventions decreased anxiety and stress in children and parents and also their interventions mitigate the risk of medical trauma and PTSD (Brewer et al., 2017; Garcia et al., 2019) (5,6). There is also improvement in coping strategies with enhanced resilience (Blomdahl et al., 2017; Hernandez et al., 2018) (7,8).CLS interventions also reduce pain perception and distress in children (Kuttner et al., 2018; Pietras et al., 2018) (9,10).Families report higher satisfaction with care when CLS are involved (Coyne et al., 2016; Dahlquist et al., 2018) (11, 12).CLS promote family involvement and empowerment by their family-centred approach (Smith et al., 2017; Todd et al., 2017) (13, 14).

Success of Child Life Service in India

Child Life Specialists provide professional assistance to children and families, helping them navigate the complexities of hospitalization. Recognizing the interconnection of physical and mental health, therapists create a safe space for expression, fostering coping skills that contribute to an environment of safety and trust.

Negative emotions experienced by children during hospitalization, including fear, anxiety, confusion, and helplessness, can be alleviated through therapeutic interventions.In contrast to relying solely on gadgets for distraction, CLS adds a human touch to interaction, understanding, and distraction when needed. By addressing negative emotions such as fear, anxiety, and distress, therapists aim to normalize the hospital experience, ensuring reduced post-traumatic stress disorder (PTSD) and promoting a sense of relief, joy, and satisfaction.

There have been incidents where we have seen children and families better cope with anxiety and stress leading to better management of emotions, better coping skills enhanced resilience, reduced pain perceptions and distress along with reduced medical trauma and higher family satisfaction with care leading to enhanced patient and our medical staff satisfaction. The team is also able to handle psychosocial issue often having earned the trust of the patient, are in a unique position to discuss psychosocial issues like parental separation and divorce, mental illness and substance abuse at home, housing problems, abuse, bullying, and food insecurity that might be aggravating or interrelating with their illness.

CONCLUSION

Child Life Services play a crucial role in paediatric emergency departments, supporting children and families during stressful and potentially traumatic experiences. CLS

1. Provide emotional support and comfort
2. Use play therapy to reduce anxiety and stress
3. Prepare children for procedures and medical interventions
4. Support pain management and coping strategies
5. Facilitate communication between families and medical staff
6. Enhance family-centred care
7. Address cultural and linguistic diversity
8. Collaborate with multidisciplinary teams
9. Provide resources and referrals for follow-up care

Research highlights the benefits of Child Life Services in paediatric emergency departments:

1. Reduced anxiety and stress in children and parents
2. Improved coping and resilience
3. Enhanced patient satisfaction
4. Better pain management
5. Increased parental involvement and empowerment
6. Shorter length of stay and reduced medical costs

Some innovative practices in pediatric emergency Child Life Services include:

1. Procedural preparation and support
2. Virtual reality and distraction therapy
3. Emergency department-based play therapy
4. Family-centered care initiatives
5. Cultural sensitivity and diversity training
6. Collaboration with emergency medical services (EMS) teams
7. Community outreach and education

By integrating Child Life Services into pediatric emergency care, we can promote a more supportive, family-centered, and trauma-informed environment for children and families during emergency situations.

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Do Not Attempt Resuscitation - A Revisit

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Abstract:

With the fascinating history of resuscitation that dates back to 1700's and the CPR taking it's form in 1924 when a team of six cardiologists came together in Chicago forming the American Heart Association, it is an important lifesaving technique that every health care worker must be trained to acquire the correct skill. CPR does not significantly alter the outcome of the illness and there are conditions when CPR is performed may prolong the suffering of the patient. Do Not Attempt Resuscitation has evolved over the period and is being practiced in various countries. While offering DNAR to the parent(s)/Surrogate(s), every effort should be made to clearly understand the medical, legal and ethical implications of the same. We hereby look upon the present guidelines to get a better idea on the concept of DNAR in the paediatric population with the legal implications.

Introduction:

High quality Cardiopulmonary Resuscitation (CPR) is a life saving measure comprising of chest compressions and artificial ventilation to maintain circulatory flow and oxygenation in an event of cardiac arrest. Out of hospital cardiac arrests comprise the majority of the cardiac arrests in children. With CPR done by a good skilled bystander, the percentage of survival to discharge stands at 19.2% of whom only 16.9% have favourable neurological survival[1]. There are situations in children where the hope of intact survival is low, and this puts the child through a long intensive care along with mental and financial agony of the parents and the caretakers.

Definitions:

1. **Euthanasia:** The term euthanasia is derived from the Greek words "eu" and "thanatos" meaning "good death". Euthanasia literally means putting a person to painless death especially in case of incurable suffering or when life becomes purposeless as a result of physical or mental handicap[2].
2. **Do Not Attempt Resuscitation**: a decision not to initiate or perform CPR the background of terminal illness in accordance with prior expressed wishes of the patient or surrogate[3]
3. **Withholding Life Sustaining Treatment:** A decision made not to initiate or escalate a life sustaining treatment in terminal illness in accordance with the expressed wishes of the patient or surrogate[3,4]
4. **Withdrawal Of Life Sustaining Treatment:** A decision made to seize or remove a life sustaining intervention in terminal illness in accordance with the expressed wishes of the patient or surrogate[3,5]
5. **End Of Life Care:** An approach to a terminally ill patient that shifts the focus of care to symptom control, comfort quality of life and quality of dying rather than treatments aimed at cure or prolongation of life[3,6].
6. **Advance Directives:** A statement made by a person with decision making capacity stating his/her wishes regarding how to be treated or not treated at a stage when he/she loses such capacity.

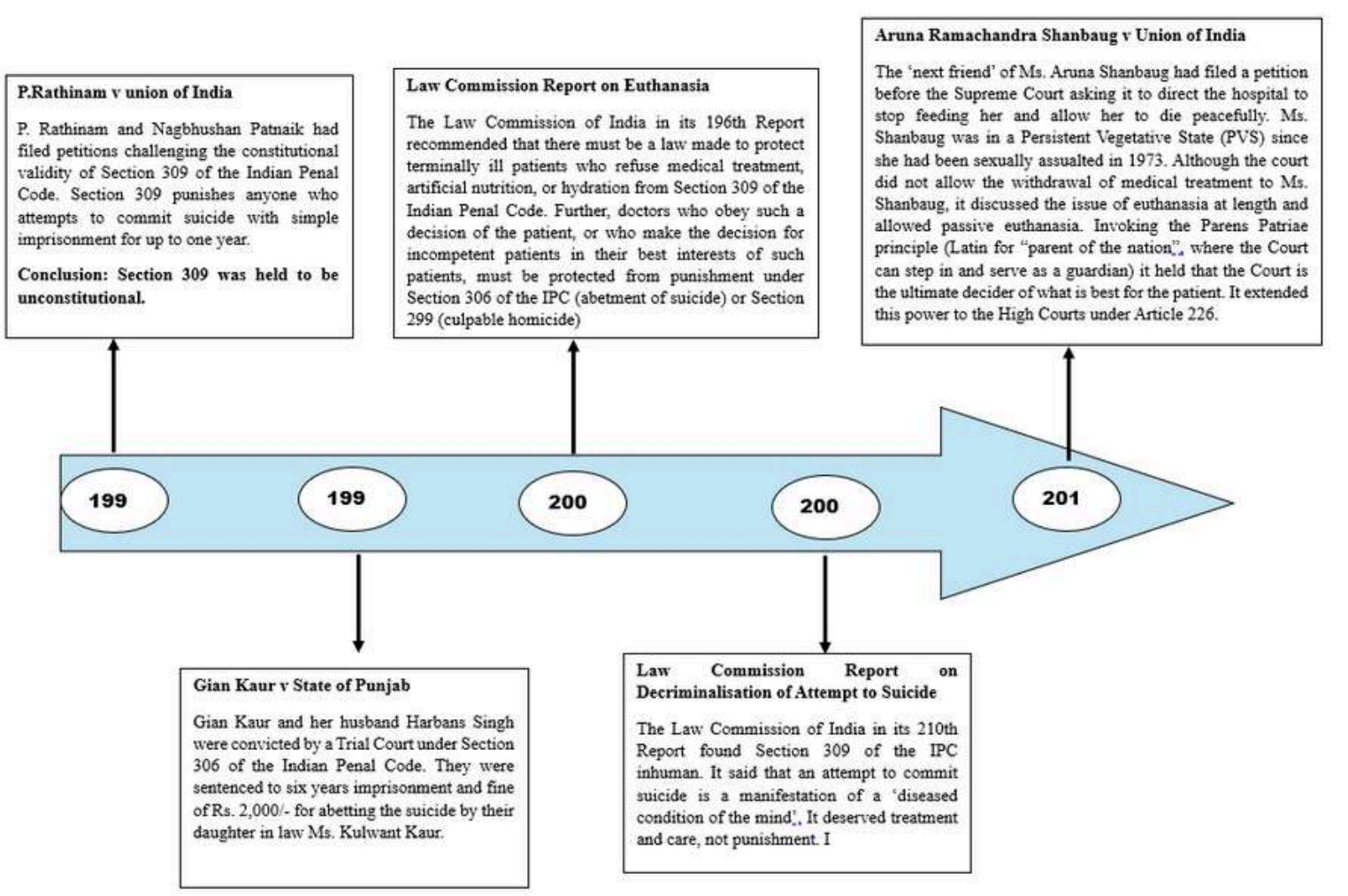
The Indian Legal Framework:

Article 21[7] of the constitution of India talks about "right to life" which has been widely interpreted by the judiciary system. Right to life means a human being has an essential right to live, particularly that such human being has the right not to be killed by another human being, but the question arises that if a person has a right to live, whether he has a right not to live i.e. whether he has a right to die.

Apollo Specialty Hospital & Anr. vs R. Muthukrishnan on 31 August, 2016[8]:
The complainant's son had been diagnosed with Acute Myeloid Leukemia and had received chemotherapy following which he was in remission. He later presented with relapse of AML wherein the parents were suggested after detailed sessions to undergo haplo identical stem cell transplant. The boy underwent BMT following which he developed different complications. The parents were counselled in detail about the complications and prognosis and had consented for "Do Not Resuscitate protocol". The complainant had alleged that he was unaware of the BMT and instead of offering palliative care, a DNR protocol was followed by the hospital. After going through the research literature, obtaining expert opinions, reviewing of the documents and the DNR consent taken, the complaint was dismissed.

This judgment highlights the importance of documentation and obtaining of the consents in the medical field which could be the only source of evidence in the court of law.
Pictorially represented is the tracing of the landmark judgements from the Supreme court on the right to die with dignity

Picture 1 : *The evolution of the legal Framework on the right to die with dignity*



Guidelines:

1.The Indian Society of Critical Care Medicine (ISCCM) in 2019 provided framework for DNR discussions documentation and review. Initiating an End-of-Life discussion could be challenging to the treating clinician whose judgement towards death may be subjective owing to his own bias and attitude. The guidelines provide a bedside check list on when to initiate the discussions of EOL care with patient/caretaker both for adult and paediatric population. [10]

2. The Indian Council of Medical Research (ICMR) has come out with a policy document on the initiation of Do Not Attempt Resuscitation(DNAR) providing an algorithmic approach along with a framework on frequent reviews and questions of DNAR. [11]

3.A consensus statement was brought out by the Indian Academy of Paediatrics where the guidelines on the selection of candidates with guidance on what to do once the “Do Not Resuscitate” is initiated. [12]

4.According to the National Medical Commission, practising euthanasia constitutes unethical conduct. However, on specific occasions, the question of withdrawing supporting devices to sustain cardiopulmonary function even after brain death shall be decided only by a team of doctors and not merely by the treating physician alone. The team would constitute the doctor in charge of the patient, the Chief Medical officer/ Medical Officer in charge of the hospital and a doctor nominated by the in charge of the hospital from the hospital staff or in accordance with the provisions of the Transplantation of Human Organ Act 1994. [13]

Who are the candidates for DNAR?

1.A child with a progressive debilitating is incurable or terminal illness where the treating physician feels that CPR would be inappropriate or non-beneficial and is likely to prolong the suffering of the patient.
2.A factor that might be unique to the patient where the patient has made an informed living will to refuse CPR. [13] A person less than 18 years cannot legally make this choice wherein such cases, it is made by the parents/guardian of the child keeping in mind the best interests of the child.
3.A patient whose outcome is doubtful/ has financial constraints/ the next of kin is unavailable for discussion on DNAR/ difference of opinion in the family members regarding DNAR/ unavailability of written consent are not candidates for consideration of Do Not Attempt Resuscitation.
4.According to the ICMR guidelines, the final decision of DNAR lies with the treating physician in the best interests of the child. The reasons for the decision must be documented. Documentation must also be done in case the parent/surrogate do not consent for DNAR.

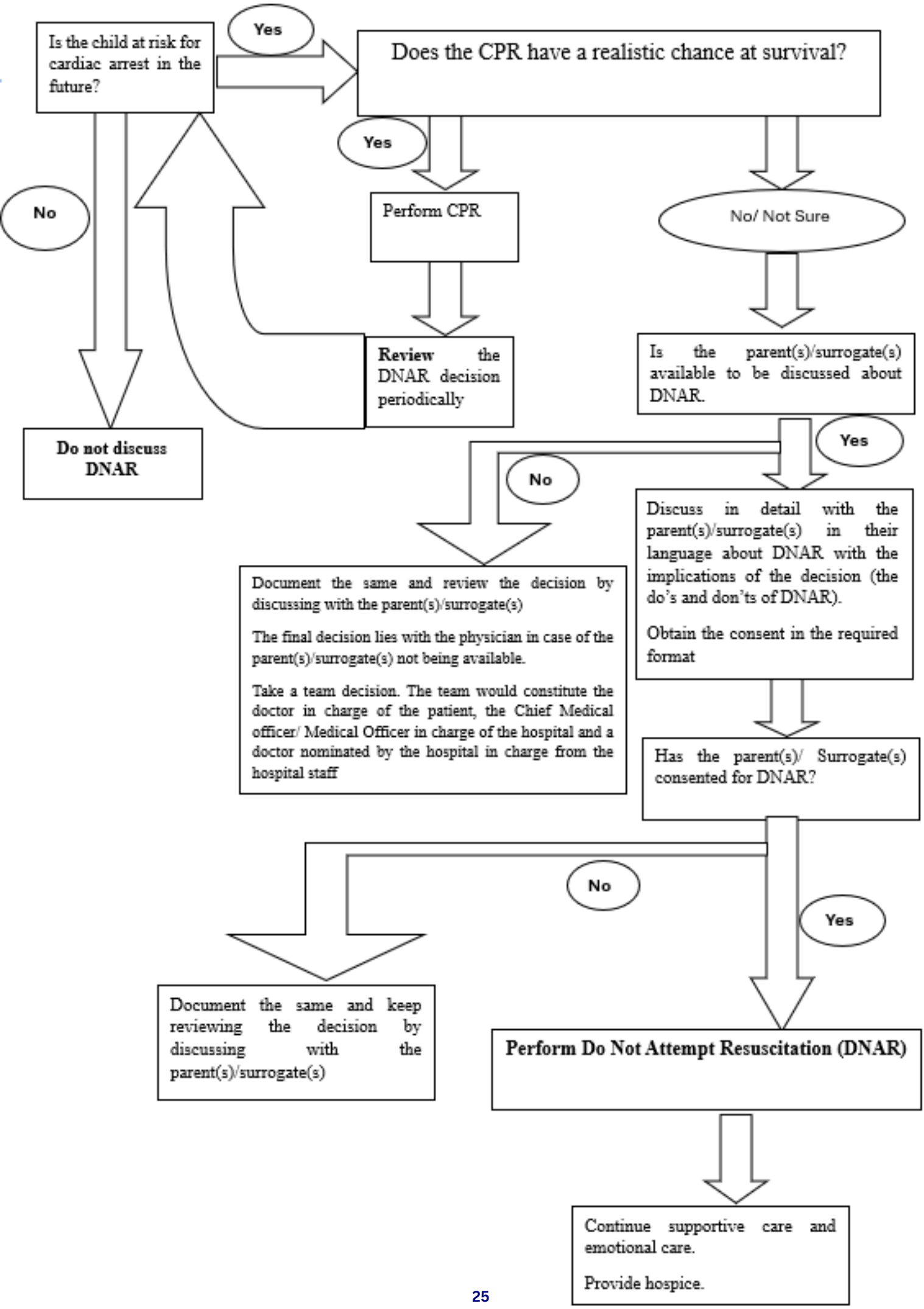
Which is the best time to discuss the DNAR?

1.The discussion of DNAR must be done on a case-to-case basis with an adequate time, space and opportunity with the parents/surrogate making them understand about DNAR and its implications
2.In the anticipation of an expected cardiorespiratory arrest during the present hospitalisation. This would provide the treating physician enough time and help communicate better with the parents/surrogate. Do not discuss DNAR during an active resuscitation
3.In a rural setup, combined decision may be taken with the help of another physician a psychologist or social worker or counsellor or the hospital administrator. This is done when the treating physician is unsure about the futility of CPR, or a consensus is not established between the treating physician and the patient/surrogate
4.During communication with the parent(s)/surrogate(s), it must be conveyed that the treatment for potentially reversible causes would be given along with supportive care. All such decisions must be documented.
5.All communications with the parent(s)/surrogate(s) should be in the language that they understand with the signature of the treating physician(s), parent(s)/surrogate(s) which is dated and timed correctly.
6.In case the parent(s)/surrogate(s) do not agree on DNAR, the same must be documented by the treating physician(s).
7.Frequent reviews on the decision of DNAR must be done and is to be revised if the clinical condition of the patient changes.

Do’s & Dont's after DNAR is signed:

1.Treat all reversible causes (clearing airway, providing suction, providing oxygen, preventing bleeding, splinting appropriately, analgesia for pain management, emotional support to the patient and family, providing hospice)
2.A health care provider is not required to do chest compression, insert advance airway, administer cardiac arrest drugs, defibrillate once the DNAR is consented and signed.

Algorithmic approach to DNAR



Conflict of interest: None

Acknowledgements:
I hereby thank Ms Lakshmi L M (Nursing officer, Department of Paediatric Emergency) for being compassionate with the patients and being the pillar of support in the department.

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IVC/Aorta ratio: A Novel Parameter for Intravascular Fluid Status

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Point of Care Ultrasound (POCUS) is a modality that is proving to be of great value in the emergency departments and Intensive Care Units. POCUS is operator friendly, non-invasive, quick, cost-effective, can be performed bedside and can provide crucial information in guiding emergency resuscitation. Recently, POCUS is increasingly being proven as a non-invasive modality for assessing intravascular status and fluid responsiveness. Inferior vena cava (IVC) diameter was one of the first sonographic parameters to be studied in this context. However, it has been found in studies that the IVC diameter varies with age and some anthropometric measurements, necessitating a normogram. Also, the diameter changes with the phases of respiratory cycle, making its interpretation difficult. The variations in the caval diameter with phases of respiration has led to the establishment of IVC collapsibility and distensibility indices in spontaneously breathing and mechanically ventilated patients respectively. Studies conducted on these caval indices as markers of intravascular volume status and fluid responsiveness have shown inconsistent results (1). Change in the mode of respiratory support during the course of fluid resuscitation can hinder the use of these parameters for assessment of the effect of fluid administered on the intravascular volume status.

Inferior vena cava to Aorta (IVC/Ao) ratio is another sonographic parameter that is being popularly investigated. Both the IVC and aortic diameters vary with age and anthropometric measurements such as body surface area and hence, obtaining a ratio of these two sonographic measurements eliminates the need for normograms or reference values (2). The IVC is a highly compliant, thin-walled vessel whose diameter decreases significantly with decrease in intravascular volume. On the contrary, the aorta is non-compliant and as its diameter is not much affected by the volume of circulating fluid, it can act as an internal control. IVC/Ao ratio does not depend on the mode of respiratory support and would require a single measurement taken at any given point of time. The caval aorta ratio has been found to increase significantly following fluid resuscitation and the change in the ratio has been found to significantly correlate with the changes in vital parameters including heart rate, blood pressure, capillary refilling time and pulse volume (3).

IVC/Ao ratio has also been observed to correlate significantly with the Central Venous Pressure (CVP), a criterion standard for assessing intravascular volume status. It has also been established as a good predictor of the degree of dehydration. Studies done on the caval aorta ratio have shown that the values obtained in transverse and longitudinal views were similar and can be used interchangeably. Also, it has been proven that with a minimal training of around 4 hours, inexperienced physicians can measure this sonographic parameter with accuracy comparable to that of experienced radiologists (4).

Thus, the IVC /Aorta ratio is a single point measurement which can be measured irrespective of the age, body surface area or mode of ventilatory support of the patients. It is also a simple and quick sonographic measurement and can hence be used extensively in our daily practice. In the context of Indian pediatric population, normal range of IVC/Aorta ratio has not been established. Also, further research should be done to evaluate this parameter as a predictor of fluid responsiveness in children with shock.

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Emergency Resuscitation Fluids in Paediatric Septic Shock - Which is better?

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Septic shock is a dire emergency and fluid resuscitation is a vital intervention. The composition of resuscitation fluid is crucial in managing shock, preventing organ dysfunction and improving patient outcomes. There are three types of fluids in use for resuscitation in children; Balanced fluids (Ringer solutions and Plasmalyte), unbalanced fluids (Normal Saline) and Colloids (albumin and hydroxyethyl starch). Upadhyay et al 2005, in their RCT of 31 children found no difference in crystalloids versus colloids (gelatin) in terms of clinical hemodynamic stability (1). But 11 included children had dengue hemorrhagic fever shock. Maitland et al 2011 showed that the risk of mortality was similar in albumin and normal saline groups (relative risk (RR), 0.78 (95% CI: 0.782-1.29). They documented mortality at 48 hours after admission in more than 2000 children but more than 50% of the study population had malaria (2). Pulmonary edema was more common in albumin group. Therefore colloids cannot be recommended as fluid of choice for septic shock.

Another interesting comparison is between balanced solutions versus normal saline. Emrath et al analyzed a large but retrospective data during 2004-2012 and showed that overall mortality was not affected much (3). Propensity score analysis showed similar mortality, 13.4% versus 15.5% in balanced solutions versus normal saline (p-0.05). Acute kidney injury (AKI) and renal replacement therapy (RRT) use rates were also similar. Weiss et al in 2017, retrospectively analyzed 12,529 children during 2000-2013 (4). Mortality was not different in both groups (RR, 0.99; 95% CI (0.9-1.09). Similarly AKI and new dialysis rates were not different in balanced or unbalanced fluids.

There have been 4 RCTs comparing these two types of fluids but most RCTs were small size (5-8). These RCTs have been done in India, Thailand and USA. One RCT is a pilot study (6). The total number of children enrolled was 841. These RCTs have been meta-analyzed in two recent meta-analysis for different outcomes (9-10). A meta-analysis by Sankar et al showed that mortality did not differ in balanced or unbalanced fluid group (RR, 0.99; 95% CI 0.81 to 1.22; moderate certainty; n=841; RCTs=4). Hyperchloremia was assessed in some RCTs in different ways. Some studied change in levels of chloride and some studies analyzed proportion of children with hyperchloremia (5-7). The meta-analysis of three RCTs showed lower rates of hyperchloremia in balanced solutions (RR 0.69; 95% CI 0.58 to 0.82; moderate certainty; n=565; RCTs=3). Hyperchloremia has been associated with increased risk of AKI. The proposed mechanism could be decreased renal blood flow and reduced GFR. The meta-analysis showed that AKI rates were lower in balanced fluid groups (RR 0.67; 95% CI 0.53 to 0.85; moderate certainty; n=841; RCTs=4). Similarly there may be increased need of renal replacement therapy due to AKI and fluid overload. The need for RRT has been reported in three RCTs. In one RCT, none of the children underwent RRT in any fluid therapy group. Two RCTs analyzed 769 children. Anantasit et al showed similar need for RRT. Sankar et al showed that need of RRT was lower in balanced fluids as compared to normal saline (RR 0.51, 95% CI 0.34-0.75). Metabolic acidosis was less frequent in balanced solutions. One RCT reported lower proportion of children with metabolic acidosis in balanced group at 24 hours (71% in balanced fluids and 79% in normal saline; p=0.019); and 48 hours (55% versus 65% respectively; p= 0.02) (7).

Duration of hospital stay was reported in all four RCTs. One RCT (Balamuth et al) showed that hospital stay was shorter in balanced fluids by 2 days but this was a pilot study. Anantasit et al, Sankar et al and Trepatchayakorn et al showed that duration was similar in both groups.

Pediatric emergency is the first contacts where optimum management of septic shock may define the final outcome of the child. Although type of resuscitation fluid does not have any influence over mortality and data is scant to suggest any effect on outcomes such as duration of hospital stay. But balanced solutions are associated with decreased risk of hyperchloremia, AKI and need of RRT. Therefor balanced solutions may be used as empirical treatment for fluid resuscitation in pediatric septic shock in pediatric emergency department.

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Pediatric Emergency visits and Parental Emotions - Role of a Nurse

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Nurses play a crucial role in supporting parents coping with the stress and anxiety of visiting a pediatric emergency department with their child. They serve as both medical caregivers and emotional anchors, offering reassurance and clear communication in a high-stakes environment. By actively listening to parents' concerns and validating their feelings, nurses can help alleviate some of the fear and uncertainty that often accompany such visits.

They provide essential information about the child's condition and the care process, which empowers parents and fosters a sense of partnership in their child's treatment. Additionally, nurses can offer practical support, such as guiding parents on how to comfort their child during procedures or helping them navigate the healthcare system. By combining clinical expertise with empathy and understanding, nurses not only contribute to the child's well-being but also help parents feel more supported and less isolated during a challenging time.

As parents navigate the often overwhelming experience of visiting a pediatric emergency department, their emotional landscape is shaped by a complex interplay of fear, anxiety, and the instinctual desire to protect their child.

Focused and conscientious communication consistently carried out by nurses using fundamental communication skills and associated behaviors could help nurses communicate more effectively with parents during emotion-laden situations.

Linda D. Scott “Perceived Needs of Parents of Critically Ill Children2007” study supports the need to investigate interventions to better address parental needs of critically ill children. By consistent identification, prioritization, and incorporation of parental needs into the plan of care, nurses can assist the parents in the recognition and fulfillment of needs that have less perceived importance. Research-based interventions will facilitate improved parental adaptation to their child's critical hospitalization (1).

Prugh, D. G., Staub, “A study of the emotional reactions of children and families to hospitalization and illness” study of emotional reactions to hospitalization appears to answer certain questions and to pose others for further investigation. All children in the series showed some observable reaction to the experience of hospitalization and treatment for illness, as distinct from the effect of the illness itself. The majority of children exposed to the traditional program of hospital management exhibited reactions calling for special and at times strenuous modes of adaptation, relatively self-limited in character but often persisting for a number of weeks or months following discharge (2).

Embong H, ”Heightened anxiety state among parents of sick children attending emergency department” The results of this study indicate that parents of a child presented acutely to the ED had a substantial degree of anxiety. This is consistent with other studies performed in ED setting but on specific groups (3).

Founders in the healthcare space must recognize that these visits are not just about medical treatment; they are deeply personal journeys rife with psycho-social challenges. Parents may grapple with feelings of guilt, questioning their choices, and the fear of the unknown, while also seeking reassurance and support from medical professionals. By fostering an environment that acknowledges these emotional nuances, founders can help create a more compassionate and understanding experience that addresses both the physical and psychological needs of families in crisis.

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POISONING IN INDIA: A CHANGING TREND

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Pediatric poisoning in children is a serious concern that requires immediate attention and awareness. Over the past decade, poisoning has become an increasing cause for concern not only in India but globally. Childhood poisoning is one of the most commonly encountered emergencies in pediatric practice. In this review, we surveyed and evaluated various observational studies on the prevalence of poisoning across India and their changing trends. Pesticides, corrosives, venoms, drugs, and other miscellaneous agents were regarded in this review analysis as poisons. In 2016, global statistics indicate that approximately 800,000 individuals succumbed to suicide, resulting in an annual worldwide suicide rate of 10.5 per 100,000 population. Alarmingly, India reported nearly double this rate, with 18.5 suicides per 100,000. Notably, the World Health Organization (WHO) identifies that 79% of suicides occur in low- and middle-income countries, where the methods employed often reflect the resources available.[1] A prevalent method of suicide in India is the ingestion of poison, predominantly pesticides.

Most of the cases of childhood poisoning are accidental and, thus, preventable. While the developed world has accurate information on the incidence of poisoning in children, there is a lack of data on childhood poisoning in developing countries like India, and the real burden of the problem may be far more than reported. Further complicating the situation is the prevalence of envenomation, with the WHO estimating around 100,000 annual deaths due to snakebites alone. Notably, India accounts for approximately half of these fatalities, largely due to its diverse ecosystem, which includes numerous venomous species.

Childhood poisoning in the age group of one to three years reflects the highest incidence of cases, and this elevated occurrence in young children can be attributed to their natural inquisitiveness, increased oral exploratory behavior, emerging mobility, and manual dexterity, and they are vulnerable to accidental poisoning. Intentional poisoning becomes more likely in the adolescent age group, mainly due to arguments with parents or stress. [2,3]

Household products are a common cause of poisoning, and kerosene oil has been reported as one of the most common causes of poisoning in children in metro cities of India, while insecticide poisoning is more commonly seen in rural areas.[4] However, with the decreasing use of kerosene as a fuel and the ever-increasing use of chemical-based mosquito repellent, hand sanitizers, and over-the-counter medicines, the epidemiology of childhood poisoning is changing rapidly and needs to be reviewed frequently. There have been several descriptive studies from India on the profile of poisoning in the pediatric population, but very few have focused on changing trends and urban-rural population comparison. A study conducted by MP Roy et al in 2017, 195 cases of acute poisoning among children (age<12 y) in a tertiary hospital were identified over one year. Two-thirds (63%) of them were males and 75% were below five years of age. Poisoning by medicines was most common (17%) followed by ingestion of corrosives/detergents (16%) and kerosene (14%).[5]

Notably, children from lower middle-class households constituted more of the cases as the correlation between low educational attainment of parents, larger family sizes, limited storage spaces, and household overcrowding plays a pivotal role in the increased risk of poisoning in this demographic. Hydrocarbons, specifically kerosene oil, emerged as the most frequent poison ingested. This trend aligns with contemporary literature, emphasizing kerosene's prevalence due to its widespread use as a household item. Additionally, adolescents exhibited a marked incidence of suicidal poisoning, with a notable female predominance, consistent with research. Clinical presentations predominantly featured vomiting, necessitating the administration of antidotes such as atropine, PAM, physostigmine, N-acetyl cysteine (NAC), and vitamin K to pediatric patients when indicated. A study done Tiwari A et al. 2020 reported that the mean duration of hospital stay was 4.2 days, although those who succumbed to poisoning experienced a shorter hospitalization. Remarkably, 97.03% (98) of children survived and were discharged, underscoring the efficacy of timely medical intervention. Nevertheless, mortality was recorded in 2.97% (3) of cases, particularly in instances where altered sensorium was presented at admission, leading to poor outcomes in all such cases. [6]

In summary, childhood poisoning continues to be a significant contributor to illness and death, influenced by social and economic factors. Despite the rapid progress in society, kerosene remains a prevalent cause of poisoning in children. The highest number of kerosene poisoning cases occurred during the summer, while snake bites and organophosphorus poisoning were more common during the rainy season. Snake bites are the leading cause of poison-related deaths in children.[7] The incidence of acute childhood poisoning has remained relatively constant over time. Poisoning from substances such as drugs and organophosphorus compounds is a concerning occurrence, especially during adolescence.[8] A worrying gap in emergency care was highlighted by the data, which showed that most children had not received any pre-referral therapy before being admitted to the hospital. Governments, healthcare providers, and communities must work together to establish a nation that prioritizes mental health and successfully restricts access to harmful substances. Keeping all chemicals, cleaning supplies, and pharmaceuticals out of children's reach is critical. Furthermore, the possibility of unintentional poisonings can be significantly decreased by ensuring these goods are kept in childproof containers. Seeking medical attention as soon as possible is crucial in cases when poisoning is suspected. By increasing knowledge and advocating for precautions, we can shield our kids from the risks associated with food poisoning. Regional toxicological centers must be established to support hospitals in quickly identifying toxins and providing treatment recommendations. Additionally, public awareness initiatives must be launched to reduce morbidity and mortality from this glaringly avoidable issue. By recognizing the typical causes of poisoning and adopting the appropriate safety measures, we can contribute to the avoidance of such situations. Because of these structural vulnerabilities, women are more likely to act suicidally, which calls for a multidimensional approach to mental health and gender justice. It is imperative to close these gaps to create well-informed policies and initiatives that address the particular difficulties encountered by various populations in India. Let's work together to create a safe environment for our little ones. Remember, prevention is key when it comes to pediatric poisonings. Stay informed, stay safe.

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The Role of Artificial Intelligence (AI) in Pediatric Emergency Medicine

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Artificial intelligence (AI) has emerged as a transformative tool in healthcare, offering innovative solutions to various medical challenges. In pediatric emergency medicine, AI's potential is particularly significant. Emergency departments (EDs) dedicated to children face unique challenges due to the specific physiology of young patients, the need for rapid, accurate diagnosis, and the emotional intensity often associated with treating children in acute situations. AI can alleviate some of these challenges by enhancing diagnostic accuracy, improving clinical decision-making, and optimizing the efficiency of emergency care delivery.

1. AI-Assisted Diagnostics and Imaging

One of the primary roles AI is playing in pediatric emergency medicine is in diagnostics, particularly in medical imaging. AI algorithms, especially those based on machine learning and deep learning, have successfully interpreted complex medical images such as X-rays, MRIs, and CT scans. These technologies can assist radiologists and emergency physicians by identifying subtle abnormalities that may be missed due to the time-sensitive nature of emergency care or human error.

For example, in pediatric radiology, AI systems can help detect fractures, signs of pneumonia, brain hemorrhages, and other conditions that require immediate intervention. Since pediatric patients differ anatomically from adults, these systems are trained specifically on pediatric datasets, ensuring higher accuracy in interpretation. AI's ability to rapidly analyze imaging data can significantly reduce the time needed to diagnose critical conditions, which is particularly valuable in emergencies where time is of the essence.

2. Early Detection of Sepsis and Other Critical Conditions

Sepsis, a life-threatening condition caused by the body’s overwhelming response to infection, is a leading cause of morbidity and mortality in children. Early recognition and treatment are crucial for improving outcomes. AI has shown great promise in the early detection of sepsis by continuously analyzing data from electronic health records (EHRs) and identifying patterns that may not be apparent to clinicians.

Predictive algorithms can alert physicians to the risk of sepsis hours before clinical symptoms manifest, giving doctors a critical head start in initiating life-saving treatments. These AI tools rely on the analysis of physiological data such as heart rate, respiratory rate, blood pressure, and laboratory results to predict which children are at risk of developing sepsis. By incorporating AI into routine monitoring, emergency departments can improve early detection and reduce the chances of sepsis-related complications or death.

3. Optimizing Resource Allocation and Triage

Triage in pediatric emergency medicine is crucial for prioritizing the most urgent cases and efficiently allocating resources. AI-based systems can enhance triage by automating the assessment process. Machine learning algorithms can analyze patient data, including presenting symptoms, medical history, and vital signs, to predict the severity of the condition and recommend appropriate triage levels.

In busy emergency departments, this can help ensure that critically ill children are identified and treated more quickly while also preventing unnecessary use of resources for less urgent cases. AI-driven triage systems can also help reduce overcrowding by predicting patient inflow, identifying peak times, and adjusting staffing needs accordingly.

4. Clinical Decision Support Systems (CDSS)

Clinical decision support systems (CDSS) are AI tools designed to assist healthcare providers in making evidence-based decisions. In pediatric emergency settings, CDSS can help physicians manage complex cases by providing real-time recommendations based on a patient's symptoms, medical history, and current condition.

For example, in diagnosing and treating respiratory conditions—one of the most common reasons for pediatric emergency visits—AI-powered CDSS can analyze symptoms and suggest possible diagnoses such as asthma, bronchiolitis, or pneumonia. The system can recommend diagnostic tests, provide treatment guidelines, and even predict the likelihood of complications. By providing evidence-based support, these systems can reduce diagnostic errors, ensure that care follows best practices, and improve patient outcomes.

5. AI in Personalized Medicine for Pediatric Patients

Pediatric patients are not just small adults; they require personalized care that considers their growth, development, and individual health needs. AI can play a vital role in this by analyzing vast amounts of data to tailor medical care to the individual child. Personalized medicine, powered by AI, considers genetic, environmental, and lifestyle factors to develop customized treatment plans.

In pediatric emergency medicine, this approach can be life-saving. For instance, children with chronic conditions like asthma or epilepsy may require individualized treatment protocols when presenting with acute exacerbations. AI systems can analyze a child's past medical history, genetic data, and current symptoms to suggest treatments that are most likely to be effective, reducing the trial-and-error approach that can delay optimal care.

Challenges and Ethical Considerations

Despite its promise, AI in pediatric emergency medicine also presents challenges. One of the key issues is the quality and availability of pediatric-specific data. AI algorithms require large datasets to learn and improve, but pediatric data can be more difficult to obtain because children represent a smaller and more variable patient population. Additionally, ethical concerns around data privacy, informed consent, and the potential for AI to perpetuate biases present challenges that need to be carefully managed.

There is also the question of accountability: if an AI system provides an incorrect recommendation or misses a critical diagnosis, who is responsible? Ensuring that AI systems are used as supportive tools rather than replacements for clinical judgment is essential.

Conclusion

AI is poised to revolutionize pediatric emergency medicine by enhancing diagnostic accuracy, improving early detection of critical conditions, optimizing triage, and supporting personalized care. While challenges remain, particularly around data quality and ethical considerations, the integration of AI into pediatric emergency departments has the potential to significantly improve outcomes for young patients. As AI technology continues to advance, its role in pediatric emergency care will likely expand, offering new ways to tackle some of the most pressing challenges in the field.

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Role of Simulation in Pediatric Emergency - The way forward

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Background:

Pediatric Emergency is a broad specialty which deals with a wider age group from birth up to 18 years of age. A busy emergency room (ER) routinely deals with complex cases with multidisciplinary involvement. ER is a critical environment where stakes are very high as many a times it's a life and death situation. Despite this there are many specific acute situations which are rare to present but when occurs in ER demands a prompt response from ER team (1). Hence it is crucial to maintain the coordination and efficiency of ER team as far as the rapid response and decision making is concerned.

Human factors in high stake ER environment are crucial but often neglected component of acute care training. The unique operating characteristics of ER predisposing to human error are mentioned in Box -1.

Box - 1

Unique operating characteristics of ER predisposing to human error [2]
High turnover of patients
Diversity of clinical condition
Time constraints
Limited information - History and investigations
Involvement of other specialties with limited understanding of working in ER
Rapidly changing and evolving situations
Multiple interruptions and distractions

Simulation - A powerful tool of teaching:

Several other fields like aviation, military and space have been using simulation as a method of training and quality improvement. Simulation in healthcare has been in existence by other means like experimenting on animal models, cadaver dissection which gives experience like a real life situations. Existing teaching courses like Advance life support (ALS), advance trauma life support (ATLS) which are mandatory checkboxes before a candidate is employed in acute care area focuses more on clinical skills and team dynamics. These courses are more about 'What and how' it is to be done rather than emphasizing 'why' it is to be done. This creates a gap between acquiring a knowledge (what) and its implementation (why).

Simulation is a technique, not a technology, to replace or amplify real experiences with guided experiences, often immersive in nature, that evoke or replicate substantial aspects of the real world in a fully interactive fashion (3). It is a technique to create an experience similar to the real world but in a controlled environment. There has been a significant growth and acceptance of medical simulation over the last two decades. There is increasing evidence that simulation training improves health care education, practice, and patient safety (4).

Figure 1 illustrates the utilization of simulation in achieving wide range of benefits from improving caregiver's confidence to improving patient outcome.

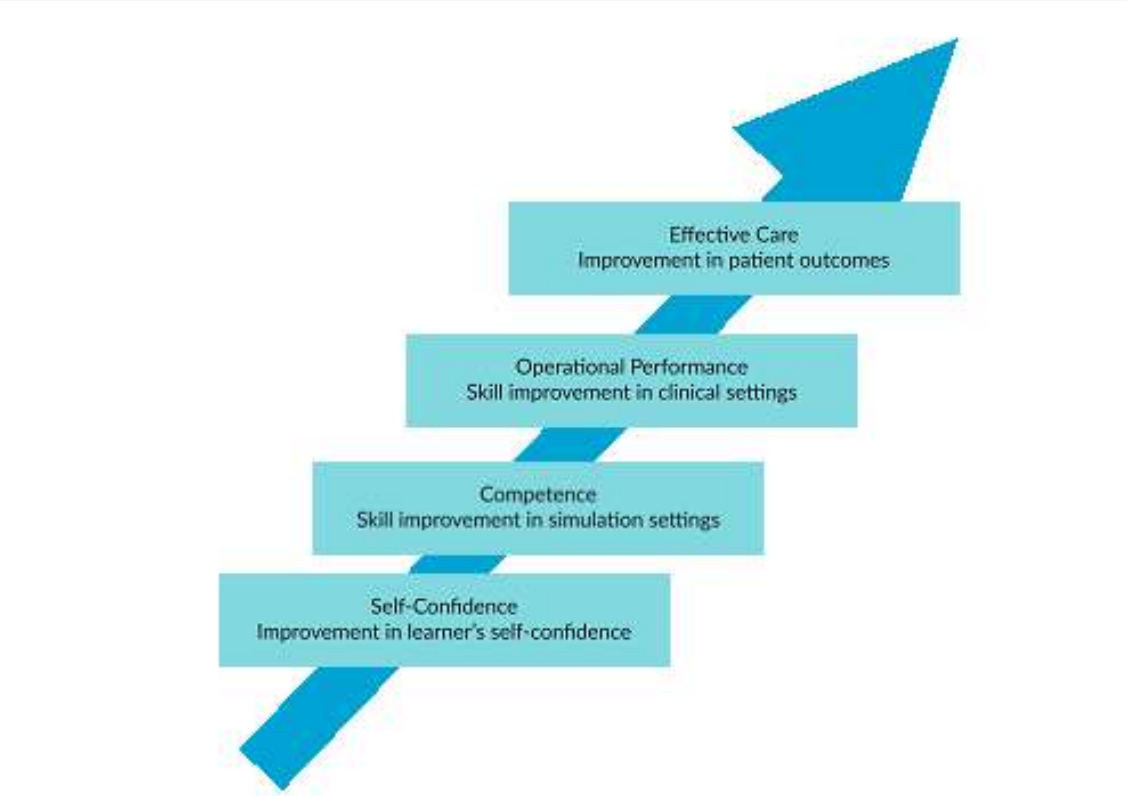

Figure 1 *- Benefits of simulation in healthcare*

Simulation training zones:

A structured framework is needed for SBE to be implemented. In the beginning SBE can focus on highest priorities competencies like recognition of a sick child in emergency, intravenous and intraosseous cannulation. Subsequently other competencies which involves communication skills, counseling a difficult family and multidisciplinary situations in acute settings can be integrated which focuses more on team and system dynamics. Weinstock et al at Boston Children's Hospital have introduced simZones (5) which focuses on specific learning outcome for the learners.

Zone 0 - Auto feedback or virtual reality skill practice for individual learners

Zone 1 - Hands on skill training like skills workshops focusing on procedural skill eg: placement of line/tube for individual learners

Zone 2 - Acute situational training like running a code where participants learn about implementation of already acquired skills and knowledge in the system.

Zone 3 - It is employed for the purpose of system and team development. Participants are native teams working together and simulation training in this zone looks at the team performance.

Medical Council of India (MCI) curriculum (6):

MCI in 2018 has proposed a competency-based curriculum which focuses on Attitude, Ethics, and communication apart from clinical skills. The new MCI curriculum aspires that medical graduate with structured training in knowledge, attitude, communication able to deliver more holistic and compassionate care. Integrating didactic learning with simulation-based education (SBE) will provide shorter learning curve, better retention, and performance in real situations.

The way forward -

There are several hurdles to integrate simulation in the curriculum. At organizational level providing a dedicated space, availability of manikins and technical and operational support is a challenge. Innovating low-cost high-fidelity simulation and reserving a high-cost manikins for specific learning objectives is cost effective strategy. At an individual level both facilitator and a learner should feel psychologically safe to foster positive learning (7). Creating a pool of dedicated simulation faculties, sharing resources, combining simulation with lectures are solutions to overcome the barriers. Time has come to implement right mix of traditional learning, simulation based learning, and actual patient care experience to improve outcome in acute care areas.

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PULSE OXIMETRY – ITS USE BEYOND OXYGEN SATURATION

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Pulse oximeter is commonly used to check oxygen saturation and heart rate. In the hospital setting, we use different forms of monitors based on the critical care areas where the patients are being managed. It ranges from finger pulse oximeters, nellcor monitors, multipara monitors.

Pulse oximeter tells us the saturation of oxygen, heart rate (both expressed as a number) and a pleth waveform / tracing.

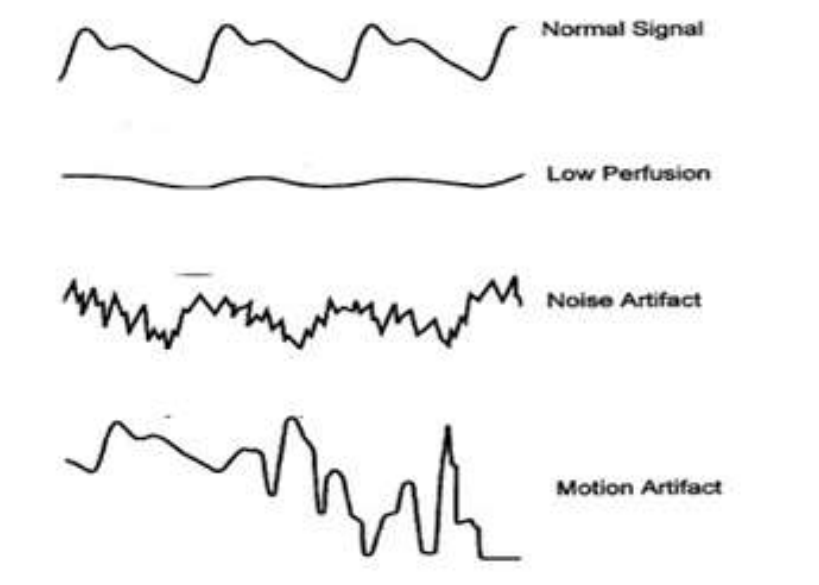


Figure 1 *: Various pulse oximetry plethysmography tracing and possible inferences.*

This pleth indicates the volumetric changes associated with pulsatile arterial blood flow. Plethysmographic pulse wave morphology varies from site to site based on physiological factors and underlying medical conditions. These waveforms and its variation are used for assessing signal integrity, perfusion changes and dysrhythmias. Its use beyond demonstrating oxygen saturation levels are emerging widely.

Respiratory waveform variability of the pulse oximeter plethysmogram might be useful to assess pulsus paradoxus in patients with airway obstruction. It might also be used to measure the breathing frequency. The change in pulse pressure over the respiratory cycle has been used to assess fluid responsiveness in mechanically ventilated.

Pulsus paradoxus

During inspiration, negative pressure in the thorax increases venous return, in turn increased flow to right side of the heart. The decreased intra thoracic pressure also expands the compliant pulmonary vasculature causing pooling of blood in lungs decreasing the flow to left side of the heart and thereby decreasing stroke volume and lowering systolic blood pressure during spontaneous inspiration. Pulsus paradoxus > 10 mm Hg (as measured by sphygmomanometer) is indicative of cardiac tamponade, upper-airway obstruction and obstructive lung diseases. The systolic blood pressure changes during the respiratory cycle can be detected by changes of the amplitude of the plethysmogram measured by the pulse oximeter.

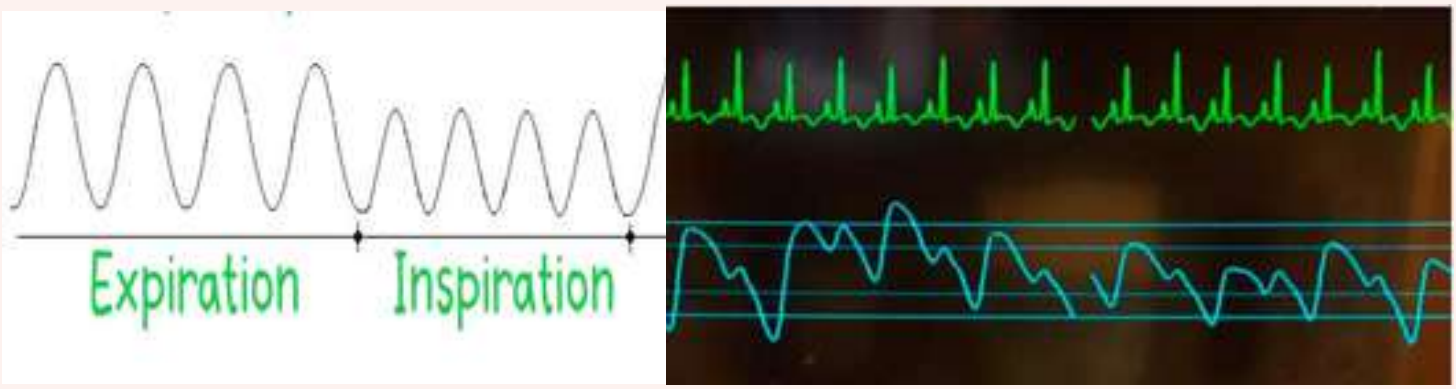


***Fig 2** : A regular variation in the amplitude of the plethysmographic waveform in accordance with the respiratory cycle of the patient (pencil diagram on left, monitor picture on right).*

Irregular cardiac rhythm

The most common cause of an irregular plethysmography tracing is a crying / agitated child due to a motion artifact. But when there is an irregular tracing in a calm child it is important to check the cardiac status for arrhythmias. The rhythm and the amplitude of the pleth graph depends on the stroke volume and the rhythm of cardiac contraction.

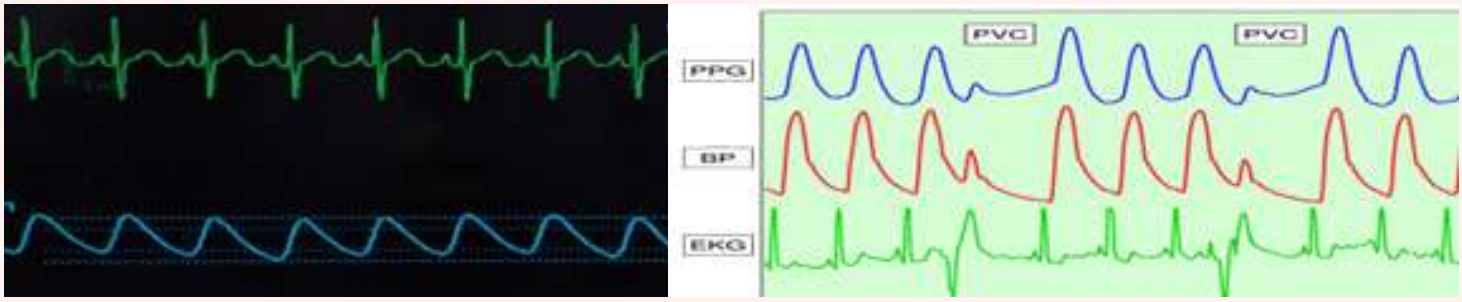


***Fig 3** : Normal plethysmograph tracing correlating to regular cardiac rhythm (left). Missed pleth tracing marked in blue correlating to premature ventricular contraction , ECG marked in green (right).*

Pulsus Alternans

Alternating large and small volume pulse which can be picked by manual examination, pulse oximeter plethysmography, spygmomanometry and arterial blood pressure tracing is a sign of left ventricular failure. Left ventricular failure causes decreased stroke volume. This results in an increased end diastolic ventricular volume which makes the subsequent stroke volume larger and produces a higher volume pulse. Thus producing an alternating large and small volume pulse.

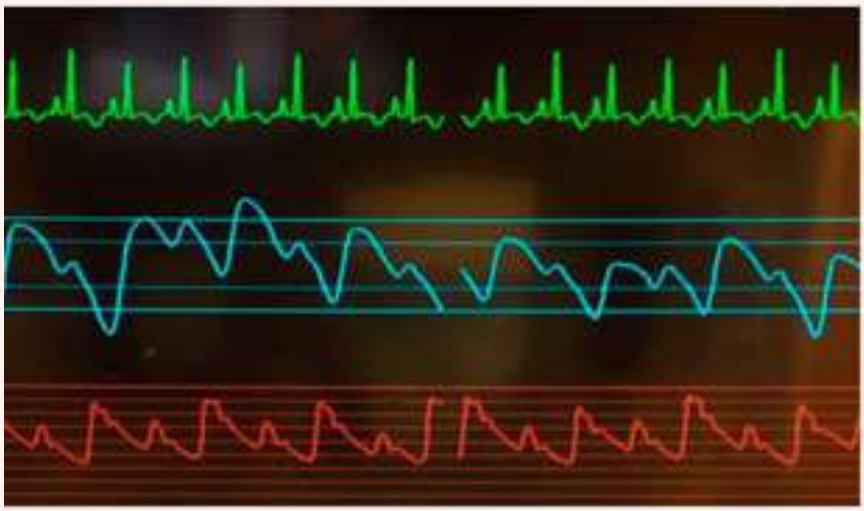


***Figure 4**: Picture of ECG and pleth tracing showing alternating high and low volume- pulsus alternans.*

Peripheral perfusion index

The perfusion index (PI) is the ratio of the pulsatile blood flow to the nonpulsatile or static blood in peripheral tissue. Perfusion Index thus represents a noninvasive measure of peripheral perfusion that can be continuously and noninvasively obtained from a pulse oximeter.

Optimal pulse oximetry monitoring accuracy is dependent on the selection of a monitoring site (fingertip, hand, toe, foot, forehead, ear) characterized by good perfusion with oxygenated blood. The PI provides instant and continuous feedback as to the perfusion status of the selected monitoring site. The PI value is relative to a particular monitoring site of each patient as physiological conditions vary between monitoring sites and individual patients.

Figure 5 *: Pulse oximeter showing PI as a value.*

Perfusion index is a range (0.02 to 20 %) and the trend of PI is what guides the hemodynamic status of the patient. A higher Pi represents vasodilataion and larger stroke volume, lower Pi represents vasoconstriction and a smaller stroke volume.

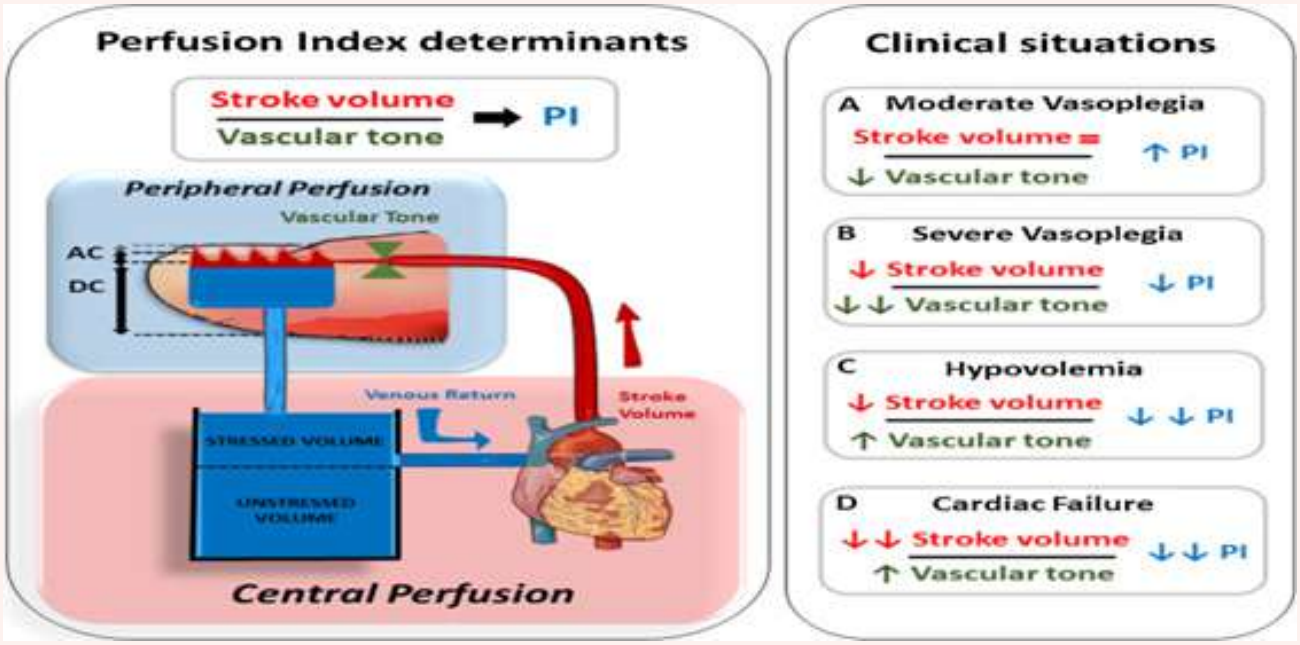


Figure 6 *: Determinants of perfusion index and changes in various clinical situations (Ref 6)*

A lower Pi indicates poor peripheral perfusion at that site and is found to negatively co relate with lactate levels. Pi has been widely experimented and used in various domains including anaesthesia, trauma resuscitation, critical care units and pain management centers.

Pleth Variability Index

Multiple improvisations are being done with pulse oximetry where the pleth tracing is extracted and automatic calculations of dynamic changes that occur during respiration are captured and delivered as Pleth variability index.

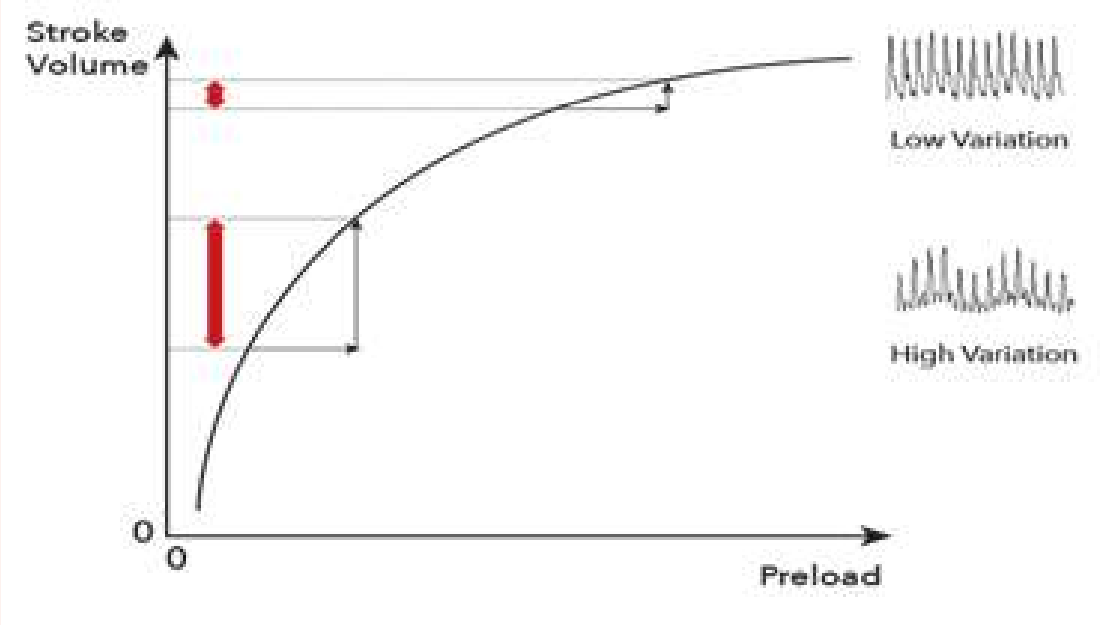
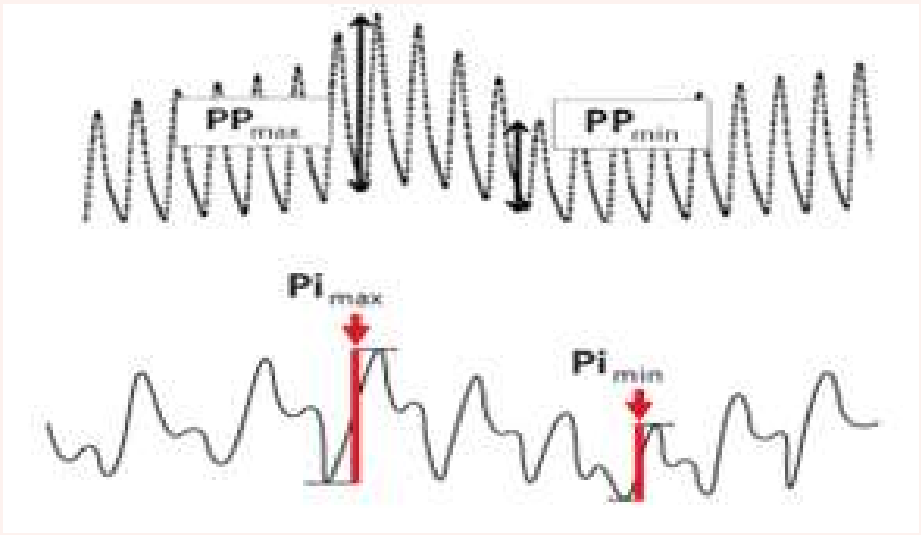


Figure 7 *: Upper part of the Frank Starling graph shows low variation in the amplitude of the pleth tracing when the preload is adequate (ensuring good stroke volume), which is a physiological change happening during spontaneous respiration. The lower part of the graph, depicts a lower preload state, in addition to decreased stroke volume, the variation with respiration becomes high. (picture courtesy – professional.massimo.com)*



$$PVi = \frac{Pi_{max} - Pi_{min}}{Pi_{max}} \times 100$$

Figure 8 : Arterial tracing showing pulse pressure variation (above) and plethysmography tracing (below) in a patient with decreased preload (on the left). Pleth variability index is calculated based on the measured changes in perfusion index (formula on the right).

PVi is dynamic index ranging from 0-100, higher variability in pleth waveform or high PVi is associated with preload dependence and fluid responders. This allows PVi to be used as a noninvasive dynamic indicator of fluid responsiveness.

Pulse oximetry is widely being researched for non-invasive monitoring of patients in varied settings. With advancements in newer technology, many limitations in its use are being addressed to make it more reliable.

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No-Stitch Solutions: Revolutionizing Pediatric Wound Care

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Pediatric lacerations are a common injury treated in emergency departments and painless non-invasive wound repair is essential in pediatric care due to the unique psychological and physiological needs of children. Traditional suturing methods can cause significant distress, fear, and pain, potentially leading to long-term anxiety associated with medical procedures. Moreover, these techniques often require procedural sedation and analgesia which may pose risk to a child with its own unique set of complications and monitoring requirements.

Additionally, children's delicate skin heals differently from adults, with a higher risk of scarring. Non-invasive techniques, such as tissue adhesives, hair apposition, and Steri-Strips, not only minimize pain and discomfort but also reduce procedure time and improve cosmetic outcomes. These methods help ensure a smoother recovery, making the medical experience less traumatic for both the child and their family.

1. Tissue Adhesives

Tissue adhesives, such as 2-octyl cyanoacrylate (e.g., Dermabond) and n-butyl cyanoacrylate (e.g., Histoacryl), are liquid adhesives that polymerize upon exposure to moisture, creating a strong bond that holds wound edges together. These adhesives form a protective barrier that allows wounds to heal without requiring traditional sutures. Typically, tissue adhesives are used for low-tension, clean wounds that are less than 5 cm in length and are often used for facial wounds or other cosmetically sensitive areas (1,3).

***Picture 1**: Wound repair using tissue glue - pre & post application*

Advantages:

- Rapid application minimizing pain-typically taking less than half the time needed for suturing (1, 2). For instance, one study showed that repairs using tissue adhesive took approximately 7 minutes compared to 17 minutes for sutures (2).
- Eliminates the need for suture removal, decreasing follow-up visits.
- Provides similar cosmetic outcomes to sutures for low-tension wounds.
- Tissue adhesives are waterproof, reducing the need for bandages or dressings.

Pitfalls: Inadequate for high-tension wounds or deep lacerations. Misapplication may lead to poor cosmetic outcomes or wound dehiscence (4).

2. Hair Apposition Technique (HAT)

The Hair Apposition Technique (HAT) is a non-invasive method used predominantly for scalp lacerations. It involves twisting and tying together hair strands across the wound & applying a small amount of tissue adhesive, thus pulling the edges of the laceration together. This technique is useful in pediatric cases, as it does not require needles or anesthesia and avoids shaving the scalp, making it less distressing for children (5).

***Picture 2**: Hair Apposition Technique. (picture courtesy - aliem.com/trick-of-trade-hair-apposition/)*

Advantages:

- Completely painless and requires no anesthesia.
- Quick and effective, especially for linear scalp lacerations.
- Avoids the need for removing hair or sutures, improving cosmetic outcomes.

Pitfalls: Not suitable for areas without enough hair or wounds with irregular edges. May fail in high-tension areas over the scalp or moving parts.

3. Adhesive strips (Steri-Strips)

Adhesive strips like Steri-Strips are adhesive skin closure strips applied directly over the wound to hold the edges together. They are best suited for superficial, low-tension lacerations, especially in areas where sutures may not be necessary. They are often used to reinforce wounds after suturing or tissue adhesive application, and are particularly useful in pediatric cases due to their painless application and removal (6).

Advantages:

- Simple, painless, and easy to apply .
- Can be used in combination with sutures or tissue adhesives to reinforce wounds .
- Provides good cosmetic outcomes for low-tension wounds.

Pitfalls: Not effective for high-tension or deep wounds. Steri-Strips may peel off prematurely if exposed to moisture or friction.

4. Zip Closure Techniques

ZipStitch is a wound closure device combining the principles of suture and adhesive tape. It consists of flexible strips of adhesive tape that are connected by adjustable, self-locking bands. These bands can be tightened to bring the edges of the wound together, simulating the effect of sutures but without the need for needles or anesthesia.

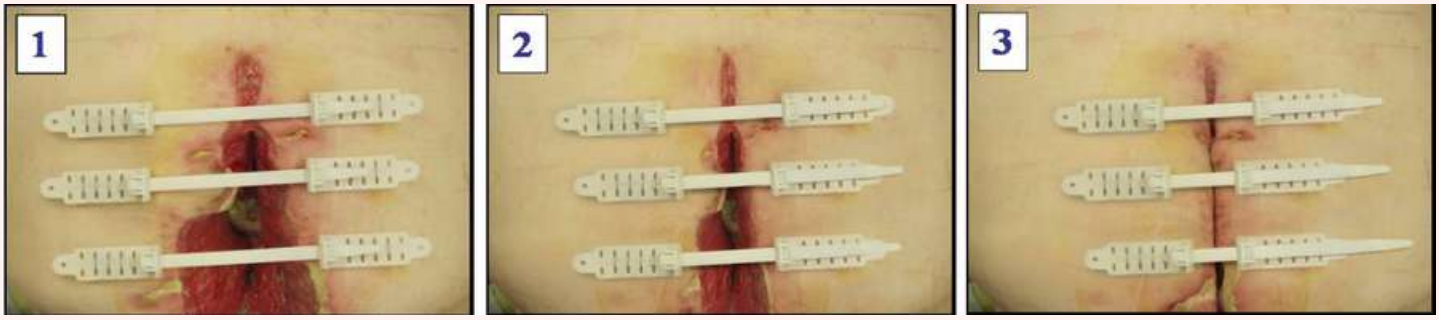
***Picture 3**: ZipStitch application (picture courtesy Mediss ZipStitch)*

Advantages:

- Provides adjustable tension, ensuring secure wound closure.
- Non-invasive and painless, reducing the need for sedation in children.
- Can be left in place until the wound is fully healed, eliminating the need for follow-up removal.

Pitfalls: May not be ideal for smaller or irregular wounds. Expensive compared to simpler adhesive methods like Steri-Strips or tissue glue.

The **TopClosure Tension Relief System (TRS)** is an innovative device designed to aid in the closure of large, high-tension wounds, which might otherwise require skin grafts or flaps. The system uses a skin-stretching mechanism, employing stress-relaxation and mechanical creep to bring wound edges closer together gradually. It allows for primary closure of wounds that would typically need more invasive reconstructive techniques, such as tissue expanders or flaps (7).



Picture 4- *TopClosure Tension Relief System (picture courtesy - Topclosure.com)*

Advantages:

- Enables primary wound closure for large defects, reducing the need for skin grafts or flaps.
- Decreases surgical complexity, duration of hospital stay, and costs.
- Minimizes donor-site morbidity and enhances cosmetic outcomes.

Pitfalls: Complications such as minor skin tears or local necrosis can occur if excessive tension is applied too quickly. Requires careful monitoring to avoid these issues.

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Camphor Poisoning: A rare but potential cause of seizures in children.

Prof. Dr. Ashish Marwah

Kalpana Chawla Government Medical College & Hospital, Karnal

Case Scenario

A 4 year, previously well, female child presented to us with vomiting, fever and generalized tonic-clonic seizures (GTCS) since last 45 min and altered sensorium. On admission, the child was mildly febrile and irritable (GCS- 10/15). Vital parameters, cardiovascular and respiratory examination was normal with no focal neurological signs. No history related to trauma, ear discharge or animal bite was elicited. The child had a repeat convulsion in the hospital which was aborted with injection lorazepam followed by injection Valproate loading. Investigations including blood glucose (88 mg %), electrolytes (Na+ 146 meq/l, K + – 4.5 meq/l), ionized calcium-1.1 mmol/l, cerebrospinal fluid examination (acellular, protein-22 mg %, glucose – 66 mg%, culture- sterile), computed tomography of head and electroencephalogram were normal. The child had a characteristic aromatic odour emanating from skin, breadth and vomitus. On questioning about odour, father revealed that the child had accidentally consumed around 2-3 teaspoons of oil used for joint pains by grandparents about 2 hours before. The oil bottle showed camphor as a constituent. The child made a complete neurological recovery in next 48 hours and was discharged. On follow up at 1 and 3 months, the child was seizure free.

Discussion

Camphor is a common household product used in India as a constituent of balms, oils and other indigenous medicines. It has propensity to cause seizures and encephalopathy in children following ingestion, inhalation and/ or skin exposure [1]. The exact mechanism of camphor induced seizures is unknown, but believed to be at neuronal level upon the oxidation cycle of the cytochrome oxidase system leading to rapid oxidation and depletion of high energy phosphorous compounds [2]. GTCS are usually the first sign of neurotoxicity [3]. Treatment is supportive with emphasis on airway management and control of seizures. Induction of emesis or gastric lavage are not recommended in view of rapid absorption of camphor [3].

Conclusion

Our case highlights two important facts. Firstly, camphor toxicity still remains an important yet under recognized cause of seizure among children in our country. Also, in India, camphor products are sold over the counter without proper labeling about its concentration or warning. Such practices should be strongly discouraged by community education. Secondly, all health care providers should be made aware about camphor toxicity/ similar indigenous medicines which can cause serious adverse effects including seizures in children.

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ACQUIRED PERSISTENT HYPOGLYCEMIA

Dr. Mohamed Ismath A.M.S., Dr. Sharada Sathishkumar*

Mehta Multispecialty Hospitals, Chennai

Accidental tablet consumption is a very common occurrence among children worldwide. Our case was one such instance where a toddler walked into our ED with low sugars which failed to correct with initial dextrose bolus correction.

The Case :

A previously healthy and well thriving 2.5 years old toddler girl weighing 13.6 KG was brought to emergency room at around 10 PM with history of consumption of one glipizide tablet (5mg) at 8 am the same morning. Child was noted to have increased sleepiness and lethargy from noon. With a suspicion of possible intake of oral medication belonging to grandparents, random blood glucose was checked at home using glucometer which read 42 mg/dl at 7:30 pm. Despite attempts to feed child with high sugar containing oral solutions, the sugar level further dropped to 38 mg/dl, hence brought to ER.

Clinical status at arrival - The child was drowsy but voice responsive. She was afebrile, with normal hydration, mild tachypnea (32 per minute) with increased BP (110/60) CBG on arrival was 42 mg/dl and ketones 0.1 mg/dl. Hepatomegaly was noted on abdominal examination.

Therapeutic intervention - Emergency treatment was administered with bolus of 10% dextrose (2ml/kg) followed by 5% DNS at full maintenance. Repeat blood sugar read 37 mg/dl. Hence another bolus with 25% dextrose and changed to 10% DNS maintenance fluid. Blood investigations were unremarkable except for mild hypokalemia (3.2 mEq/L) and mild metabolic acidosis (19.5 mmol/L). In view of prolonged hypoglycaemia, child was given Inj. Octreotide (1 mcg/kg) as slow I.V push. Child was shifted to PICU and continued on 10% DNS maintenance. Second dose of Octreotide was given 8 hours later while blood sugar levels were monitored. Dextrose titration was continued for 12 hours. Child was euglycemic for the next 24 hours, and she was discharged the day after.

Serial blood glucose monitoring as follows:

Time	11 pm	12 am	12:45 am	1:30 am	2:30 am	3:30 am	4:30 am	5:30 am	6:30 am	8:30 am
Blood Glucose (mg/dl)	37	72	57	90	105	125	116	117	116	90

Discussion

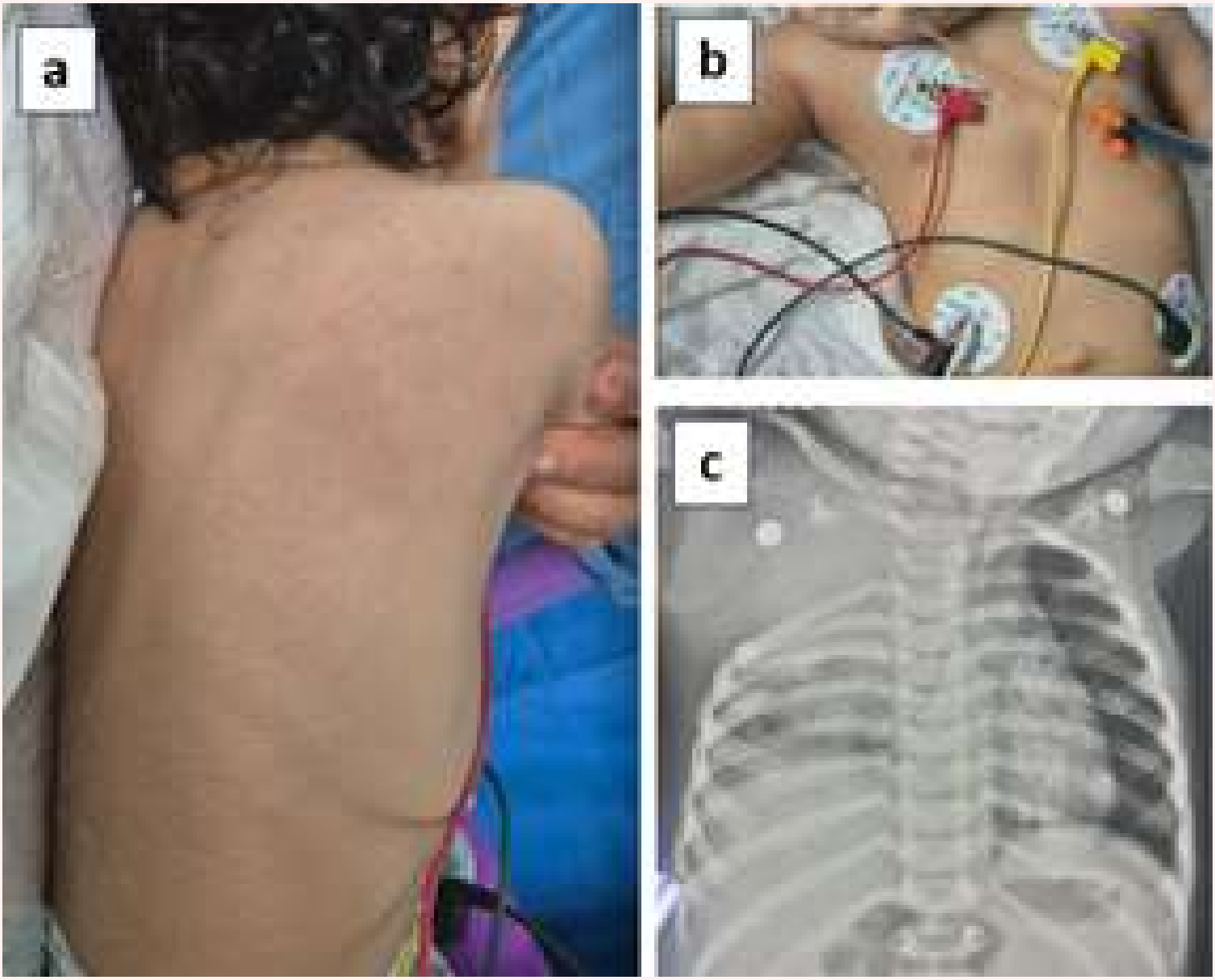
Oral hypoglycaemic agents especially sulfonylureas increase insulin secretion & lead to persistent hypoglycaemia & its complications. Even a single dose can lead to severe hypoglycaemia. Oral hypoglycaemic agents poisoning can be life threatening especially in young children. Onset of hypoglycaemia starts in 1-2 hours, peaks at 8 hours and prolonged till 18-24 hours. Extended-release preparations like glipizide need a longer observation period. Children can have autonomic symptoms like tachycardia, palpitations, sweating, anxiety and irritability and neurological manifestation like drowsiness, lethargy, altered sensorium, seizures or coma. Investigations to be done include serial blood glucose monitoring, blood gases, Electrolytes, Ketones, Insulin level for overdose of sulfonylurea. Metformin toxicity causes lactic acidosis. Initial resuscitation should be aimed at control of seizures if any, airway management for respiratory depression with immediate correction of hypoglycaemia using dextrose preparations. Octreotide should be considered if strongly indicative of sulfonylurea poisoning as it promotes insulin hyper secretion. Child can be discharged if maintaining normal blood sugar for 12 hours post cessation of Octreotide. Preventive parental counselling at discharge should be done to avoid recurrence.

Uncommon neck and chest mass presenting as acute quadriparesis.

Dr. Siva Vyasam, Dr. Suresh Kumar Angurana*

PGIMER Chandigarh

A 1-year-male presented with a short history of fever, irritability, decreased movement in both lower limbs, and difficulty in breathing. On examination, he had pallor, normal sensorium, weak cry, decreased voice, weak neck muscles; reduced power, and tone in limbs with exaggerated reflexes (lower >> upper limbs); and paradoxical respiration. Differential diagnoses of Acute Transverse Myelitis (ATM) or Laundry-Guillain-Barré Syndrome (LGBS) were considered. Management included oxygen support, and intravenous methylprednisolone (30 mg/kg). Further examination revealed a mass in the right supraclavicular, axillary, infraclavicular, and suprascapular region (Figures a and b). Chest radiograph revealed homogeneous opacity in the right upper hemithorax with destruction of the first two ribs and pushed down 3rd and 4th ribs (Figure c). Contrast-enhanced computed tomography (CECT) of the thorax revealed a large heterogeneous mass lesion in the right hemithorax with extension into the spinal canal (Figure d-g). Biopsy was suggestive of infantile fibrosarcoma. Chemotherapy with vincristine and cyclophosphamide was initiated which resulted in some improvement in power, respiratory weakness, and voice and child was shifted to ward for further care.



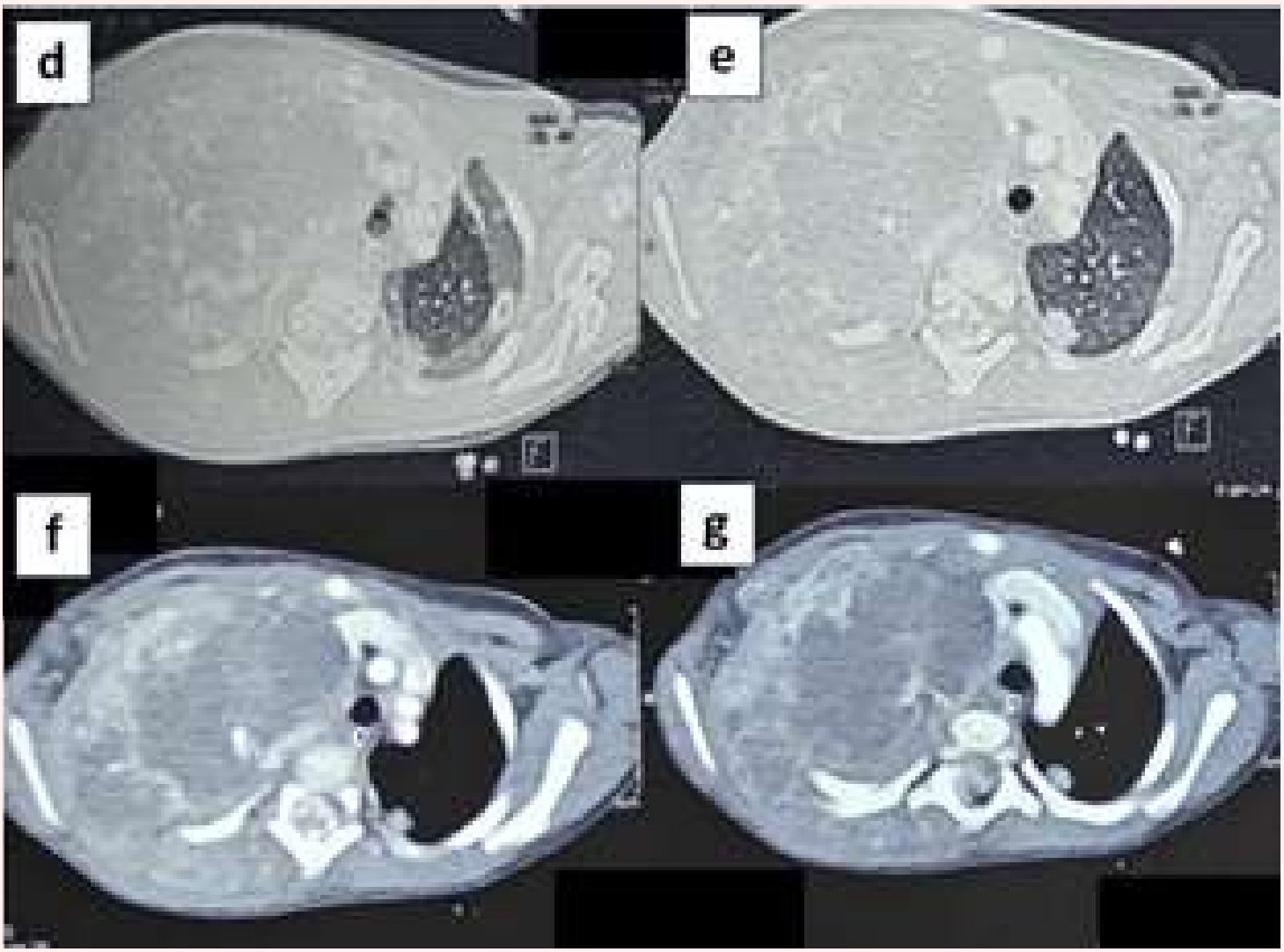


Figure 1: *(a and b) A diffuse mass in the right supraclavicular, axillary, infraclavicular, and suprascapular region. (c) Chest radiograph showing homogenous opacity with calcification with destruction of first two ribs and pushed down third and fourth rib. (d-g) CECT chest showing a well-defined heterogeneous mass in the right hemithorax measuring 8 X 7.6 X 8.7 cm extending superiorly up to the root of the neck causing compression and inferiorly into posterior mediastinum and extending into the spinal canal from C7 to D2. Right first rib is completely encased by a lesion & not visualized. There is displacement of right subclavian vessels, brachiocephalic vessels and superior venacava. Near complete collapse of the right lung.*

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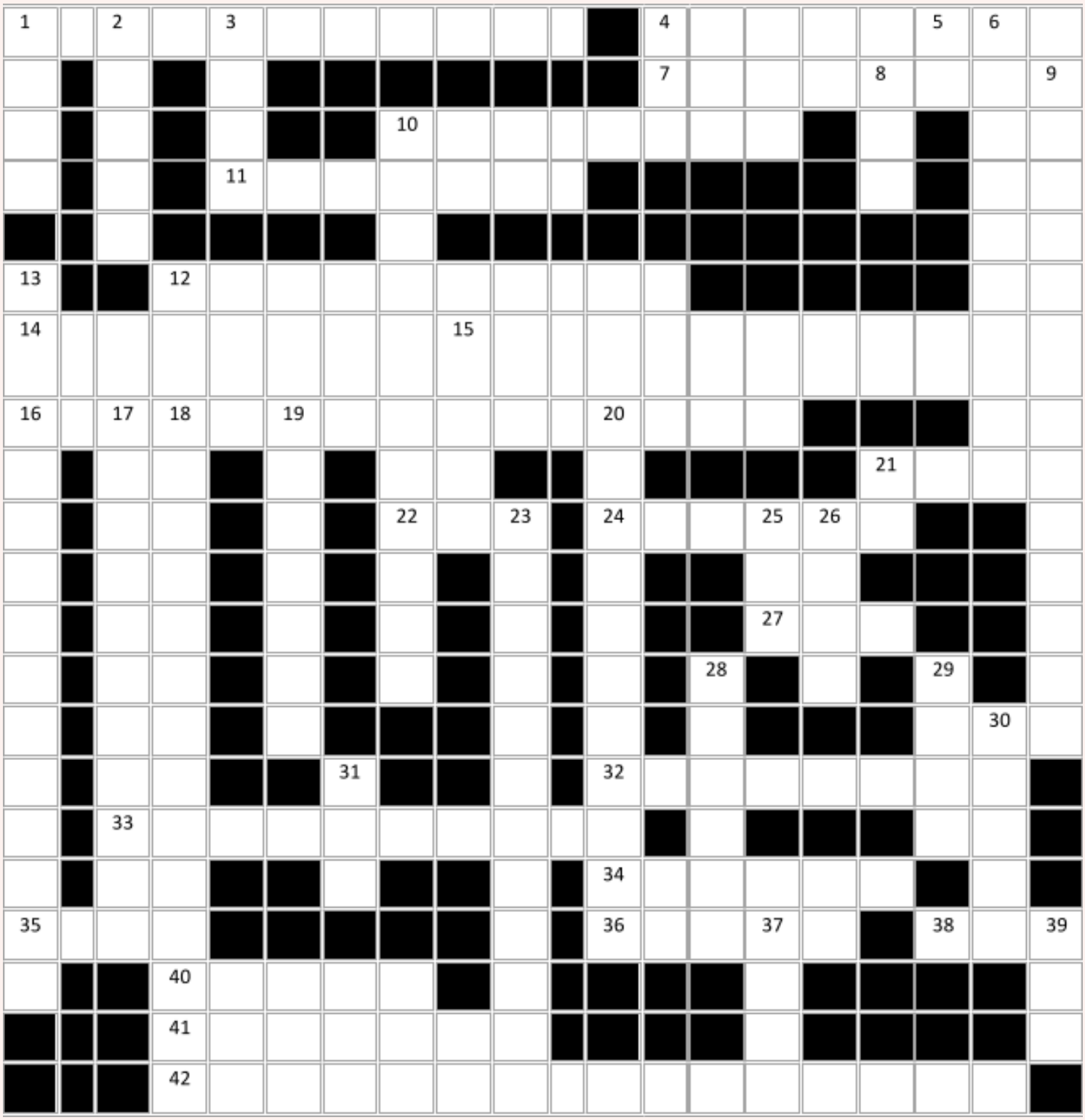
Dr. Jovin Chris Antony

AIIMS Raipur



Across clues

1. Novel recombinant urate oxidase enzyme used in emergency management of tumour lysis syndrome (11)
4. An accidental, yet important cause for Pediatric Primary ARDS (8) 7. Adjunctive agent for gastrointestinal decontamination procedures in various drug/toxin overdoses (8) 10. Subtle, but useful screening tool in suspicious cases of child physical and sexual abuse in ER (8)
11. First prototype of this lifesaving device in the ER was first developed in 1956 by German engineer Dr. Holger Hesse and Danish anaesthesiologist Dr. Henning Ruben (4,3)
12. This novel educational strategy revolutionized the emergency room management learning for the trainee doctors (10)
14. Lifesaving procedure used in the ER for certain dreaded complications of sickle cell anemia causing significant mortality and morbidity (8,11)16. CNS complication seen in children with high grade fever, commonly mistaken for seizure (7,8)
21. Gold standard investigation in the diagnosis of children with pulmonary embolism (abbr; 4)
22. An easily insertable advanced airway, commonly used in the ER for kids (abbr;3)
24. A potent polyvalent snake antivenin used in the American continent for the bites of rattle snakes and Crotalids (6)
27. Useful strategy for the protection of healthcare workers, especially during epidemic outbreaks (abbr;3)
32. Accidental consumption of this causes high anion gap metabolic acidosis and retinal toxicity (8)
33. Commonly used drug in the ER for management of myocardial pathology in children (10)
34. This Apocynoideae family ornamental plant, commonly grown for their vivid coloured flowers, has life-threatening cardiac glycosides; causes severe hyperkalemia as well (6)
35. This phenomenon with ER significance is seen in children with chronic adeno-tonsillitis as well as in morbid obesity (abbr; 3)
36. Life-threatening immune complication of blood transfusion causing secondary ARDS (abbr; 5)
38. A tool, initially developed for assessing severity of head injury in adults, now incorporated into the PALS algorithm of disability assessment (abbr; 3)
40. A method of triage assessment in massive casualty event (abbr; 5)
41. Lifesaving drug in severe hyperkalemia (7)
42. This head CT finding prompted the Pediatric Emergency Physician to suspect child physical abuse in an infant brought with depressed sensorium with trivial mechanism of trauma (8, 8)

Down clues

1. Non-inflammatory encephalopathic syndrome in children with hepatic metabolic defects, after recovery from a viral infection symptomatically treated with NSAIDs (4)
2. A complication expected in children presenting to the ER, post brain tumour surgery presenting with vomiting, headache, and in severe cases with seizures, and encephalopathy (abbr; 5)
3. An important component of RFT conventionally used to look for acute insult due to its earlier elevation in renal pathology compared to others (4)
4. The request for this screening blood test by the ER physician clinched the diagnosis for a child who presented with atypical pneumonia, anemia and jaundice (abbr; 3)
5. Lifesaving technique for difficult vascular access during emergencies needing immediate fluid resuscitation (abbr; 2)
6. Administration of this drug by the ER physician who was called for help in the newborn resuscitation area, saved a floppy baby who was born via emergency LSCS under general anaesthesia (8)8. An important clinical entity used for assessment of peripheral perfusion in children in day-to-day ER practice (abbr; 3)
9. A novel and safe first line antiepileptic drug widely used in the emergency practice for status epilepticus in children (13) 10. An ER physician cured this common accidental musculoskeletal emergency in a young child with a supination-flexion manoeuvre (6,5) 13. The lifesaving procedure of choice in pulseless ventricular tachycardic arrest (14) 15. A vesciculo-bullous dermatological emergency with mucosal involvement, encountered in children after intake of certain prescribed drugs (abbr; 3) 17. Late and ominous sign of hypoxia in adults and older children, but may be seen earlier in infants, due to their incompletely developed central and autonomic nervous system (11) 18. An important complication of heat related hazards in children, that leads to AKI (14) 19. A surrogate emergency point of care lab parameter that tells us the status of tissue perfusion (7) 20. One of the prime goals of mechanical ventilation in difficult lung compliance pathologies like ARDS (11) 23. Commonly used antibiotic implicated to have reduced the emergency visits of children with toxic presentations with stridor (11) 25. An important lifesaving blood component in the management of hemotoxic snake envenomation (abbr; 3) 26. Abbreviation of a common scoring scale to assess the sensorium in infants and smaller children (4) 28. Accidental ingestion of the seeds of this Indian shrub causes cycloplegia, mydriasis, dry skin & mucus membranes, and in severe cases, delirium and coma (6) 29. Whole bowel irrigation is a lifesaving procedure for the decontamination of toxic ingestion of this substance which, in its physiologically normal levels is essential for the body (4) 30. An important screening tool for pain assessment in infants and younger children in the ER (abbr; 5) 31. This procedure is activated in the ER management of life-threatening hemorrhagic shock (abbr; 3) 37. This abbreviated usage is a common practice in ER once the patient party decides to discontinue the further warranted treatment and wishes to get discharged (4) 39. This multisystem disorder presents to the ER with various musculoskeletal, cutaneous, renal, cardiovascular, neurological and haematological manifestations in several life-threatening ways (abbr; 3)

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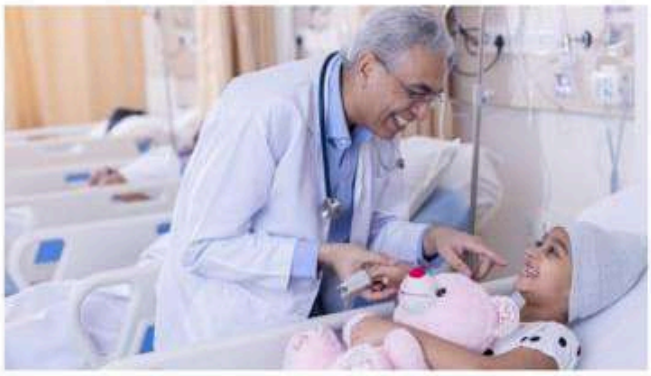

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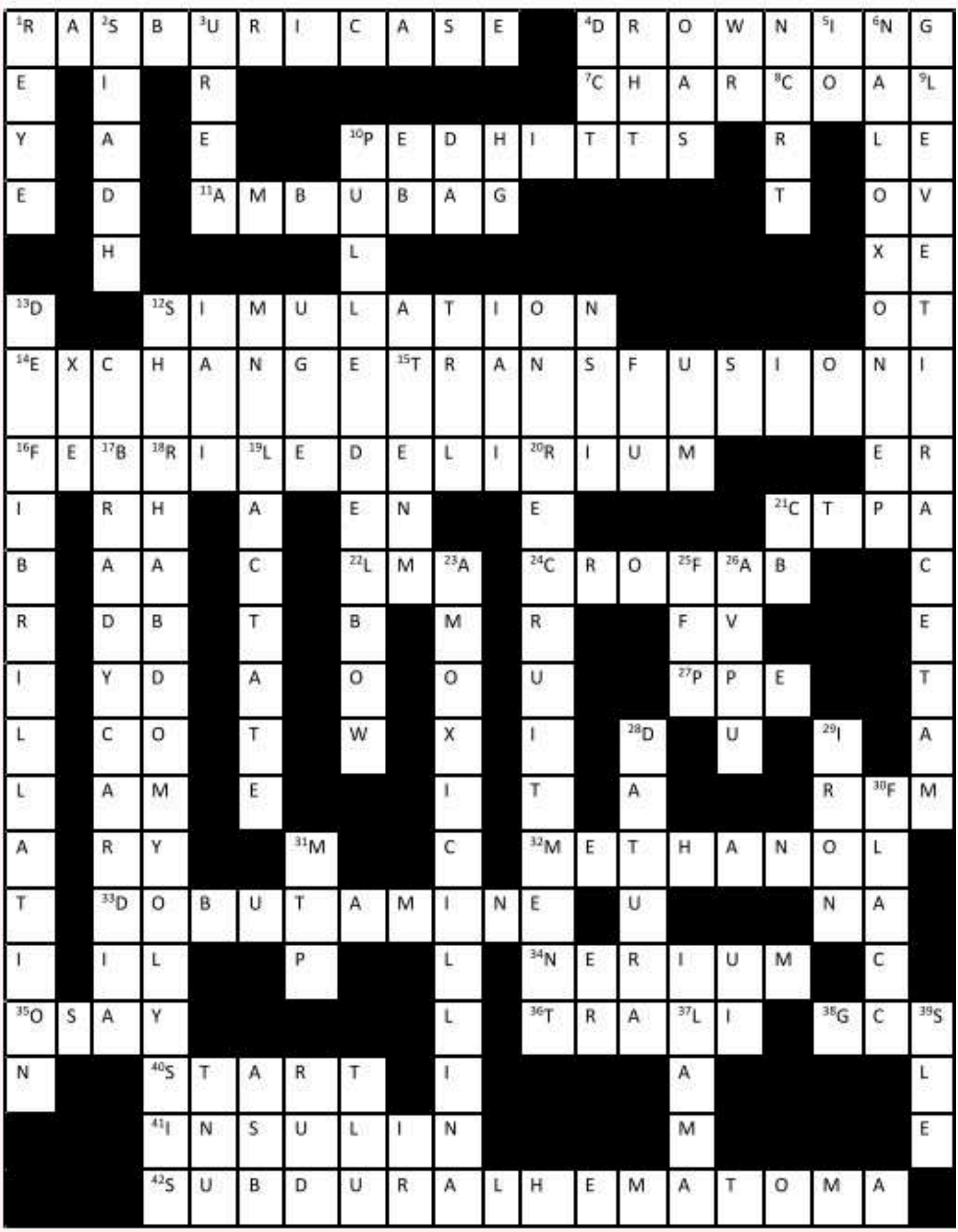

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