

**Adrenaline..!**

**Shock please..!**

# CODE PEN

**Start CPR..!**

**Code blue..!**

**IAP- Pediatric Emergency Medicine Chapter's Quaterly Bulletin**

**Issue 2/ Apr 2023**



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## Highlights

1. Heat Stroke
2. Case report- ALCAPA
3. Trauma- Journal Watch
4. CPR and its variations
5. ER Challenge

## From the Editor's Desk

Greetings from the desk of the editor..!

Much has happened in the last three months. Let me share the many wonderful milestones in our journey to strengthen Pediatric Emergency Medicine.

The last annual General body meeting of the Society of Trauma and Emergency was held on March 9<sup>th</sup>, 2023, via zoom. It was decided to formally dissolve STEP and integrate with the newly created IAP-PEM. The members of STEP would automatically become members of IAP-PEM without additional membership fees. The amount in the STEP account would be transferred to the account started for IAP-PEM.

Till date, 12 national conferences "National Assembly of Pediatric Emergency Medicine-NAPEM" have been conducted under the banner of the STEP. The 13<sup>th</sup> NAPEM was conducted under the auspices of the newly created IAP-PEM. The 14<sup>th</sup> NAPEM has been scheduled on March 2<sup>nd</sup> and 3<sup>rd</sup> 2024 with the pre-conference workshops on the 1<sup>st</sup> of March 2024. This long-awaited congress will be held in Bangalore at the NIMHANS auditorium.

The best news comes last. Over, the last few years, several attempts had been made to the NBE for recognition of PEM as a super specialty. In March this year, the National Board of Examinations (NBE) has made a landmark in the history of PEM in our country. The august body has accorded PEM as a separate sub-specialty with permission to conduct a 2-year post-doctoral Fellowship training program in Pediatric Emergency Medicine. The committee comprising of Dr. Suresh Gupta (SGRMH-N. Delhi), Dr. Jayshree Muralitharan (PGIMER-Chandigarh), Dr. Debasis Adikari (CMC-Vellore), Dr. Anil Goel (AIIMS-Raipur) and myself were some of the members who finalized the curriculum and accreditation requirements.

The current E-Journal has been organized by the Associate Editor Dr. Sharada Sathishkumar and the editorial team. It includes many exciting topics. I thank and congratulate the contributing authors:

Dr. Asha Jyothi Penugonda,

Dr. Lakshmi Muthukrishnan,

Dr. Radhika Raman,

Dr, Gunda Srinivas,

Dr. Neha Thakur(Rai),

Dr. Sayantan Ghosh Bag

Regards & Thank you

**Dr. Indumathy Santhanam,**

Editor-in-chief.

# IAP- Pediatric Emergency Medicine Chapter

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4	Dr Debasis Adhikari	Treasurer	Professor & Head, Paediatric Emergency Medicine, CMC Vellore, TN
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## **Review Article**

### **Heat Stroke in Children**

Dr. Asha Jyothi Penugonda, Assistant Professor, Pediatric Emergency Medicine, Department of Pediatrics, Christian Medical College, Vellore.

#### **Introduction**

Heat Stroke is the most hazardous condition in the spectrum of heat related illnesses. Heat stroke is defined as a core temperature greater than 104°F (>40°C) accompanied by CNS dysfunction in the setting of known heat exposure and/or strenuous exercise(1).

#### **Types of Heat Stroke**

Classic heat stroke which is more common in children, arises from environmental exposure to heat. Exertional heat stroke occurs in healthy children who engage in heavy exercise during periods of high ambient temperature and humidity(2).

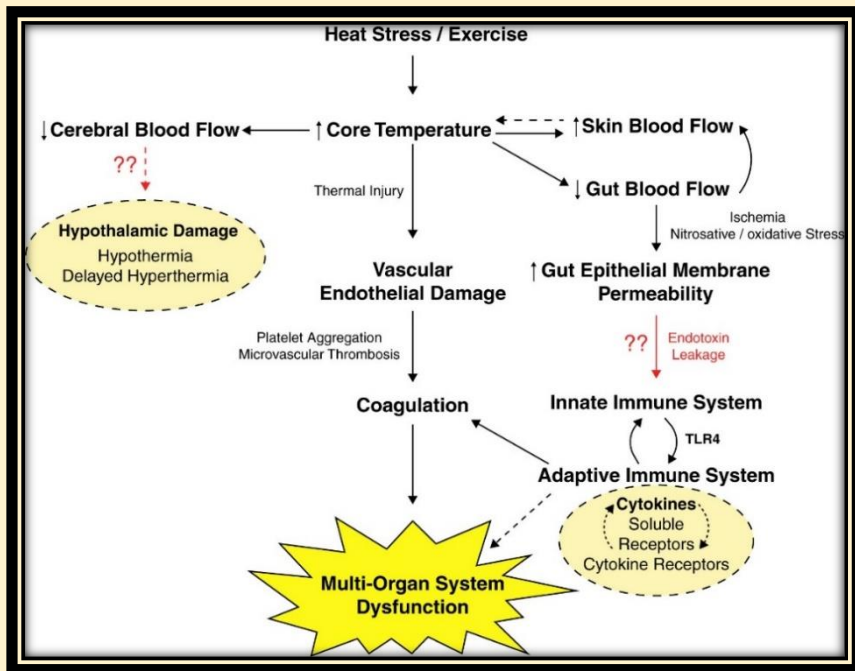
#### **Risk factors**

Extremes of age, lack of acclimatization, chronic illness, medications(sympathomimetics, anticholinergics, barbiturates, diuretics, or beta blockers) predispose to heat stroke(3). Infants covered with excessive bedding, infants and young children who are left unattended in an automobile exposed directly to the sun, disabled children and adolescents who are unable to leave their dwellings during hot weather are prone for non-exertional heat stroke(4).

#### **Pathogenesis and Pathophysiology of Heat Stroke(5).**

In children classic heatstroke is attributed to

- High surface area to mass ratio(increases heat-absorption rate),
- Underdeveloped thermoregulatory system (impairs effective heat dissipation),
- Small blood volume relative to body size (limits heat conductance and results in greater heat accumulation), and
- Low sweating rate (reduces heat dissipation)(6).



**Fig. 1:** Pathophysiology of Heat Stroke

### **Clinical features**

Children can present with high fever with absence of sweating and dry skin, encephalopathy /seizures, diarrhoea/dehydration, metabolic acidosis, unexplained shock and coagulopathy.

### **Laboratory abnormalities expected**

Progressive anemia, thrombocytopenia, coagulopathy, prerenal azotemia, metabolic acidosis, rhabdomyolysis and elevated alanine aminotransferase/aspartate aminotransferase(4). Malarial parasites, sepsis screen and CSF analysis (once the child is stable) should be done to rule out cerebral malaria, sepsis and meningitis respectively.

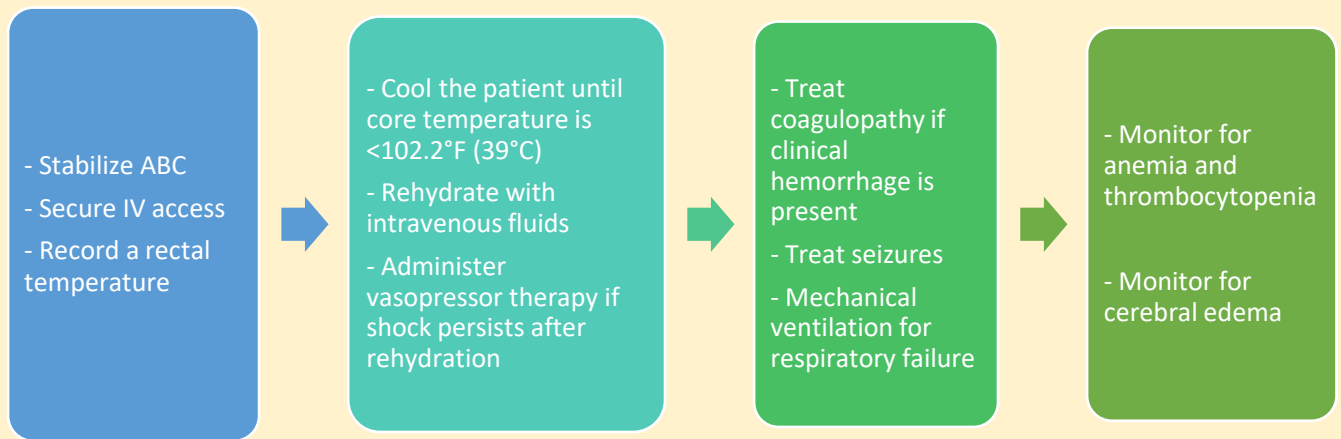
### **Management**

Reduction of heat-wave deaths in India to zero has been the vision adopted by the present Central government. This vision has been followed since 2015. By increasing awareness, rescheduling of working hours for outdoor workers to avoid their exposure to extreme hot weather, creation of drinking water kiosks, supply of water through tankers, erection of special shelter homes, increase in health facilities, stocking of ORS packets at health centres and the nearest anganwadi centres, placement of cooling systems and construction of gaushalas with fodder banks, etc deaths due to heat waves fell from 2,040 in 2015 to 4 in 2020 in India (3).

### **Prehospital care**

Remove the child from the heat source. Start evaporative cooling methods by spraying water or saline along with continuous fanning. Application of ice packs to the neck, axilla, and groin and administration of room-temperature intravenous (IV) normal saline can be done as much possible. These aggressive cooling methods should continue en route to the hospital.

## Hospital management



- Heat stroke should be managed as an emergency as it can cause mortality or irreversible brain damage. Ideal cooling modalities should provide a cooling rate of 0.2°C/min(7). Continue cooling technique till temperature reduces to 38 C (100.40 F).
- Suppression of shivering with IV benzodiazepines can help to prevent increased endogenous heat production. Monitor and treat the end organ complications.
- Antipyretics and Dantrolene are not indicated.
- Children with heat stroke should be admitted to PICU for careful monitoring of end organ dysfunction.

There was no evidence to support the superiority of any one cooling technique in classic heat stroke(8). Active cooling was associated with lower in-hospital mortality among severe cases of heat illness than with rehydration-only therapy(9). Cold-water immersion is associated with significant discomfort, shivering, agitation, and combativeness and there are no trials of hospital-based cooling methods in children(10). Specific pediatric intervention studies for heat-related illness are lacking and hence needs further studies(11).

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## Case Report

### **Anomalous Origin of the Left Coronary Artery(LCA) from the Pulmonary Artery (ALCAPA)**

Dr. Lakshmi Muthukrishnan, Dr. Radhika Raman, Kanchi Kamakoti CHILDS Trust Hospital, Chennai

#### **INTRODUCTION**

ALCAPA is rare but a common cause of myocardial infarction in children. Due to the fall of pulmonary artery pressure around 4 to 6 weeks of life, perfusion pressure to the Left Coronary Artery reduces and leads to myocardial ischemia. A high index of suspicion is needed for diagnosing this condition which leads to progressive LV dilatation, systolic dysfunction and congestive heart failure if untreated. Mitral insufficiency is a frequent complication secondary to a dilated valve ring or infarction of a papillary muscle. In some cases, inter arterial collateral anastomoses develop between the Right Coronary Artery(RCA) and LCA. Blood flow in the LCA is then reversed, and it empties into the pulmonary artery, a condition known as the “myocardial steal” syndrome.

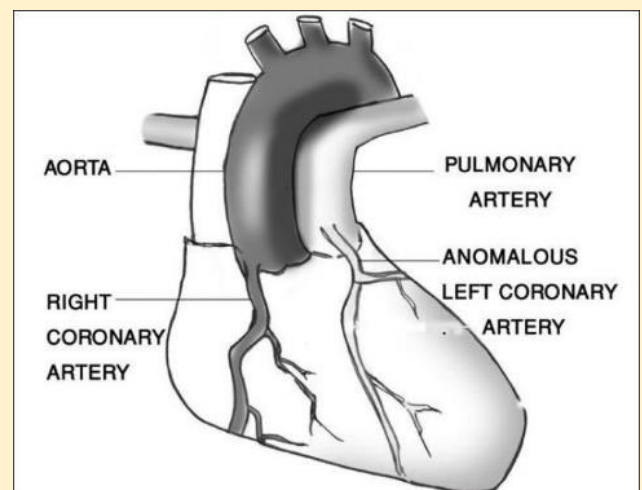
#### **CLINICAL MANIFESTATION**

In neonates and infants, angina may manifest as irritability, pallor, and diaphoresis, with progression to signs and symptoms of shock. With good collateral blood flow, the presentation of this abnormality may be delayed until later childhood. Adolescents may also present with features of dilated cardiomyopathy and sudden death.

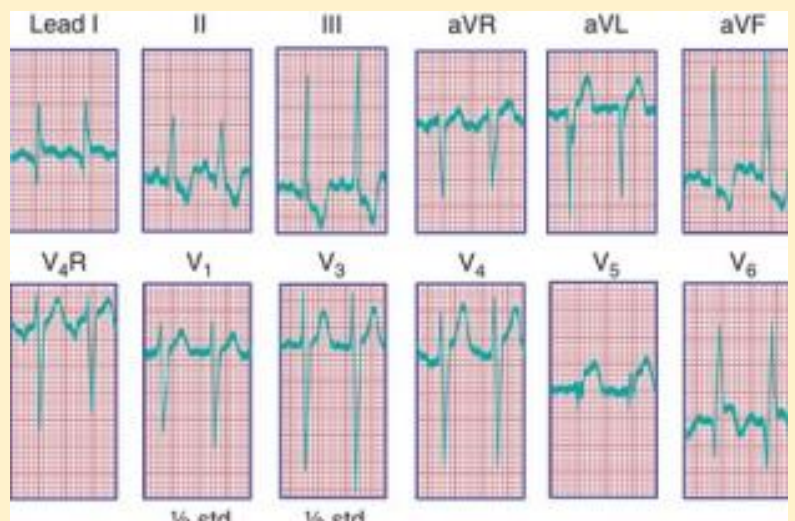
#### **DIAGNOSIS**

CHEST X-RAY (CXR)- CXR may show cardiomegaly and/or pulmonary edema.

ELECTROCARDIOGRAM (ECG)- ECG shows evidence for anterolateral ischemia or infarction, including transient or chronic ST-segment changes in the anterolateral leads or Q waves in leads I, aVL, V5, and V6.



**Fig 1:** Anomalous LCA originating from Pulmonary artery



**Fig 2:** ECG showing ST segment changes <sup>7</sup>



NON INVASIVE IMAGING- 2D ECHOCARDIOGRAM(ECHO) typically demonstrates a dilated heart with global myocardial dysfunction, abnormal coronary artery origins and associated Mitral Regurgitation. Colour Doppler may show the abnormal direction of coronary blood flow.

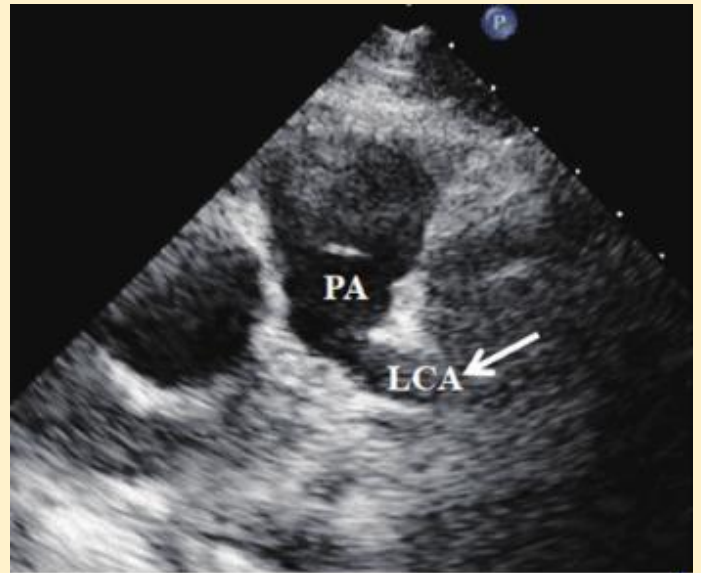
Cardiac Computed Tomography Angiography (CCTA) or Cardiac Magnetic Resonance Angiography (CMRA) may be diagnostic. Cardiac catheterization may provide information about the hemodynamic status.

### TREATMENT

Medical management includes standard therapy for cardiac failure (diuretics, angiotensin-converting enzyme inhibitors) and for controlling ischemia (nitrates,  $\beta$ -blocking agents). Surgical treatment consists of reimplantation of the coronary artery to the aorta. In patients who have already sustained a significant myocardial infarction, cardiac transplantation may be needed.

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1. Nelson Text Book of Pediatrics, 21st Edition.
2. UpToDate-online Evidence-Based Clinical Resource.
3. Park's Pediatric Cardiology for Practitioners, 7th Edition.



**Fig 3:** 2D Echocardiography showing the Left Coronary Artery originating from the posterior wall of the pulmonary trunk (arrow);

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## **Journal Watch**

### **Pediatric trauma- The next reason to worry**

Dr. Neha Thakur (Rai), Associate Professor, Dept of Pediatrics, Dr. RML institute of Medical Sciences, Lucknow

#### **Pediatric trauma mortality in India and the United States: A comparison and risk-adjusted analysis**

**Synopsis:** In this retrospective study 126,678 pediatric patients of road traffic injury from apex trauma centres in north south east and west India was compared with USA. Indian Data was collected from Towards Improved Trauma Care Outcomes (TITCO) and compared with National Trauma Data Bank (NTDB) in USA. The study results are alarming. The researchers found that risk adjusted odds of pediatric trauma related mortality is 22 times higher in India as compared to US. The odds of mortality were highest in children with lower injury scores and physiologic severity. The study recommended early intervention, training, development of standard protocols and timely imaging would help India to reduce pediatric injury related mortality.

**Ref:** Amato S, Culbreath K, Dunne E, Sarathy A, Siroonian O, Sartorelli K, Roy N, Malhotra A. Pediatric trauma mortality in India and the United States: A comparison and risk-adjusted analysis. *J Pediatr Surg.* 2023 Jan;58(1):99-105. doi: 10.1016/j.jpedsurg.2022.09.036

#### **Pediatric trauma-A Silent Epidemic**

**Synopsis:** This was a review article on prevalence and the epidemiology, pattern of injury, road safety measures, and global health initiatives for the prevention of accident-related injury in children. They highlighted the lack of standard treatment protocols, dedicated pediatric trauma facilities and lack of trained staff in developing countries like India. They emphasised the need of dedicated trauma registry for children for better understanding the physiology, epidemiology and pattern of injury.

**Ref:** Thakur N, Rai N, Misra S, Misra M. Pediatric Trauma - A Silent Epidemic. *Curr Pediatr Rev.* 2023 Apr 7. doi: 10.2174/1573396320666230407092601. Epub ahead of print. PMID: 37026497.

## **Advanced Neuromonitoring Modalities on the Horizon: Detection and Management of Acute Brain Injury in Children**

**Synopsis:** This review describes recent technological advancements for patients with acute head injury. Timely detection and monitoring of acute brain injury in children is essential for decreasing long term consequences. Even now traditional neuroimaging modalities, such as computed tomography and magnetic resonance imaging (MRI), are still the frontline diagnostic techniques to detect acute brain injury. However, it is crucial to detect structural and anatomical abnormalities hence nowadays advanced MRI sequences assessing functional alterations in cerebral physiology are used because of their unique diagnostic utility. Portable head ultrasound has also emerged as a point-of-care diagnosis for assessing anatomical and perfusion abnormalities. Also, application of electroencephalography and near-infrared spectroscopy allows for bedside real-time detection of neurological abnormalities.

**Ref:** Ko TS, Catennacio E, Shin SS, Stern J, Massey SL, Kilbaugh TJ, Hwang M. Advanced Neuromonitoring Modalities on the Horizon: Detection and Management of Acute Brain Injury in Children. *Neurocrit Care*. 2023 Mar 22. doi: 10.1007/s12028-023-01690-9.

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## CPR and its Variations- Part- 1

Dr. Gunda Srinivas, Consultant Pediatric Emergency, Aster RV Hospital, Bangalore

**Cardio Pulmonary Resuscitation(CPR)** is one of the most dramatic and life saving interventions very commonly performed in the emergency department, done more usually in the adult population than pediatric ones owing to the differential nature of the illnesses. Early methods of resuscitation began in the 1500s, ranging from whipping the unconscious person to rolling them repeatedly over a barrel. Dr. Friedrich Maass performed the first documented instance of chest compression in 1891. Modern CPR techniques were first introduced in 1950. It has remained largely unchanged except for the finer aspects upon which are the high-quality CPR recommendations by AHA are based upon. According to a study, approximately 11.4% of pediatric OHCA patients survived to hospital discharge, but outcomes varied by age, with survival rates of 17.1% in adolescents, 13.2% in children, and 4.9% in infants. pediatric IHCA incidence was 12.66 events per 1000 infant and child hospital admissions, with an overall survival to hospital discharge rate of 41.1% with favorable neurological outcome in up to 47% of survivors to discharge.

There are various versions/types of CPR explained based on different age groups who receive, based on the skills of those who perform and specific context of the underlying probable conditions etc.

- **2 Finger technique-** Usually done in infants(upto 1 yr) with thumb and middle finger when single rescuer.
- **2 Thumb technique-** 2 thumb encircling technique in infants(upto1 yr) with 2 rescuer.
- **1 Hand technique-** For children 1-8 yrs heel of 1 hand can be used to do CPR and depends upon physical structure of rescuer and size of chest, although 2 hands are recommended for high quality CPR.
- **2 Hand technique(conventional/standard CPR)-** This is the standard 2 hand technique that has been the mainstay of CPR in children above 8 yrs and adults. AHA recommended high quality CPR comprises of Compression fraction >80%, Compression rate of 100-120/min, Compression depth of at least 50 mm (2 inches) in adults and at least 1/3 the AP dimension of the chest in infants and children & No excessive ventilation.
- **Open chest CPR-** In open-chest CPR the heart is accessed through a thoracotomy (typically created through the 5<sup>th</sup> left intercostal space) and compression is performed using the thumb and fingers, or with the palm and extended fingers against the sternum. Use of this technique generates forward blood flow and coronary perfusion pressure that typically exceed those generated by closed chest compressions. However, open-chest CPR can be

useful if cardiac arrest develops during surgery when the chest or abdomen is already open, or in the early postoperative period after cardiothoracic surgery.

- **Hands only CPR/Compression only CPR-** It was found that in case of laymen bystanders, mouth to mouth breathing was a barrier in initiating CPR and precious minutes were wasted in starting the more important chest compressions (which provided the crucial blood flow) during the CPR. Hence compressions only CPR where only chest compressions needed to be done without need for any breaths/ventilations was advised. This is also called as bystander CPR which was popularised for the laymen who are the bystanders and the ventilation component was optional based in the skill of the rescuer.
- **Mechanical CPR-** CPR using the automated device which provides the compressions consistently as per AHA recommendations but ventilations has to be performed as per the ratio of 30:2 recommended (adults). The advantage is that CPR can be started and continued even during transport, shifting patient and difficult to perform scenarios. It also relieves the limited number of rescuers for other patient care like IV access, ventilation, medications etc.
- **Extracorporeal CPR-** ECPR (Extracorporeal CPR) combines ECMO with CPR and is used to stabilize patients with cardiac arrest that is unresponsive to conventional CPR and underlying potentially reversible cause. Within about 10 minutes of unsuccessful CPR, starting ECMO can lead to good outcomes by allowing parallel treatment of the underlying cause of the cardiac arrest while maintaining organ perfusion. This complex technique requires specialized equipment and intense resources but has shown promising results in pediatric populations with good neurological outcomes.
- **IAC- CPR-** The IAC-CPR technique involves three rescuers, with one providing manual abdominal compressions midway between the xiphoid and umbilicus during the relaxation phase of chest compressions. The technique combines conventional chest compressions with alternating abdominal compressions, and the force required for abdominal compressions is similar to that used to palpate the abdominal aorta.
- **Prone CPR, Cough CPR, Precordial thump, Percussion pacing** are other techniques explained and tried before.

## References:

1. Part 7: CPR Techniques and Devices, 2010 American Heart Association Guidelines for Cardiopulmonary Resuscitation and Emergency Cardiovascular Care, *Circulation*. 2010;122:S720–S728.
2. Extracorporeal Cardiopulmonary Resuscitation (E-CPR) During Pediatric In-Hospital Cardiopulmonary Arrest Is Associated With Improved Survival to Discharge, *Circulation*. 2016;133:165–176.

## Challenges to Diagnosis & Management in ER

Dr. Sayantan Ghosh Bag, Pediatric Emergency dept, Kanchi, Kamakoti, CHILDS Trust Hospital, Chennai.

17 years old adolescent female was admitted to our emergency thrice with acute abdominal pain, recurrent vomiting, seizures and autonomic instability (hypertension and tachycardia). In view of hypertensive emergency and ongoing seizures, child was started on Labetalol infusion and loaded with anti seizure medication. Clinical examination for acute abdomen was not conclusive of a definite cause and ultrasound abdomen was normal. Her biochemical profile revealed severe hyponatraemia.

This was a challenging situation as she had hypertensive crisis and hypertonic saline was indicated for symptomatic hyponatremia. In view of encephalopathy, we administered a loading dose of 3% NS and serum sodium levels were closely monitored. With BP control and improvement in serum sodium, clinically she improved. Complement levels and autoimmune workup was normal. On her third admission there was doubtful hematuria. Due to recurrent admissions for similar complaints, we evaluated her for Pheochromocytoma, PNET and Acute porphyria. Urinary PBG was raised and ALA levels were normal suggesting AIP. Significant control of symptoms were noticed with carbohydrate loading in ED. Literature review regarding treatment guidelines are limited and specific therapies like haem arginate is not available in India. Later whole exome sequencing was sent which was positive for HMBS gene and a diagnosis of acute porphyria was established.

**Abbreviations:** NS- Normal saline, PNET-Primitive Neuroectodermal tumour, PBGPorphobilinogen, ALA- Aminolevulonic acid, AIP- Acute Intermittent Porphyria, ED- Emergency Department

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# **National Assembly on Pediatric Emergency Medicine(NAPEM)- 2024**

*“High quality PEM for developing countries..”*



**Date: 1<sup>st</sup>- 3<sup>rd</sup> March, 2024**

**Venue: Bangalore**



**Further details shall be shared soon...! Keep following us..!**



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