



Impact of Pediatric Emergency Team (Pet) on Picu Transfers from Wards and Overall Mortality

Sunit Pathak^{*1}, Gaurav Khandelwal², Rhythmm³, Meenakshi⁴

¹Dept of Pediatrics, S.N. Medical College, Agra, India

²F H Medical college, Tundla, Firozabad, India

³S.N. Medical college, Agra, India

⁴Dhawan diagnostic Pathology, Agra, India

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ABSTRACT

A high index of suspicion is needed in pediatric patients with neurological symptoms being the sole presenting manifestation, to diagnose infection with the Human Immunodeficiency Virus (HIV). This is a write up of two such cases who were admitted to the pediatric intensive care unit with neurological manifestations. A 6 year old previously healthy child, who initially presented with intermittent drowsiness and fluctuation in blood pressure, later during hospital stay, developed progressive motor, cognitive, visual and language difficulties. Investigations revealed the child to be HIV positive and magnetic resonance imaging (MRI) findings were consistent with progressive multifocal leucoencephalopathy. A 12 yr old child had stroke initially (for which extensive work up had been done) and later, after 8 months presented with the same complaints along with severe pneumonia. He succumbed to severe opportunistic infections. That he was HIV positive, had not been detected during the first admission as left sided weakness was the only presenting manifestation.

***Corresponding author:**

Dr Sunit Pathak, Dept of Pediatrics, S.N. Medical College, Agra, India

Phone: +91 8979834496

E-mail: drsunitpathak@gmail.com

Introduction

Cardiac arrest is the cessation of cardiac mechanical activity resulting in the absence of circulating blood flow. Cardiac arrest stops blood from flowing to vital organs, depriving them of oxygen, and, if left untreated, results in death. Despite the use of CPR, mortality rates for cardiac arrest are 80 to 97% for infants and children[1]. Cardiopulmonary arrest is often preceded by a critical period of physiologic instability, during which life saving interventions can decrease the mortality and improve outcomes in sick children[2-4]. Sick children have warning signs and symptoms prior to cardiopulmonary arrest and if these symptoms and signs are recognised on time, many lives can be saved. The introduction of Rapid Response Teams (RRT) and Medical Emergency Teams (MET) in western countries has been advocated. They are meant to be called before a patient has a cardiopulmonary arrest, so that life saving intervention can be carried out in hopes of improving outcomes. Studies in Western countries have shown reduction in cardiopulmonary arrests and hospital mortality after introduction of medical emergency teams (in adults) [5]. There are very few studies on the implementation of such Rapid Response Teams in children and there are no standard criteria available to recognize sick children, as different age groups have different physiologic variables. In our study, we are reporting successful implementation of a Pediatric emergency team (PET) concept and its effectiveness in reducing overall mortality.

Methods

This study was conducted at Department of Pediatrics, Sarojini Naidu Medical college, Agra which is a 100 bedded tertiary care unit with approximately 400 Pediatric admissions per month. Pediatric patients are admitted across pediatric ward, from the 1st to 2nd floor. The hospital has a 6 bedded Pediatric Intensive Care Unit with close to 500 admissions annually. Along with general Pediatric services, we have surgical subspecialties (general pediatric surgery, pediatric neurosurgery, orthopaedics and urology) services available in our hospital.

We conducted a retrospective study, all children admitted to Pediatric wards were considered participants. Observations were made before and after implementation of the Pediatric Emergency Team (PET) concept in Pediatric wards. It was hypothesized that implementation of the PET concept would prevent subsequent cardio pulmonary arrests in the wards, reduce the number of admissions to the PICU from the wards and the overall mortality. The pre-intervention period was between November 2013 and October 2014 (phase-1) and post-implementation period was between November 2014 and October 2015 (phase-2).

There are no standard Pediatric Emergency Team (PET) criteria available to recognize deterioration in children admitted to the wards. A Pediatric Emergency Team Chart highlighting the warning signs and symptoms of various illnesses was prepared. (Annexure 1).

PLACARDS indicating these warning signs and symptoms were made and displayed in every ward, doctor and nurses duty room. A pocket sized Pediatric Ready Reckoner card was also prepared for nurses, highlighting the normal values of vital parameters and what needs to be done in an emergency.

All nursing staff across the hospital were trained on recognition of early warning signs and symptoms in children. The Doctor and Nurses were also made to undergo PALS training. We Selected 4 of our senior nurses, with PICU experience of more than 2 years as PET (Pediatric Emergency Team) Nurses. They worked in two shifts- from 8am to 8pm and from 8 pm to 8 am. At any given point of time, there are around 40-50 Pediatric patients admitted to the wards. Out of these admissions, the "AT RISK" patients (around 10-15 on any given day), were identified by the pediatrician. Criteria to include patients in the "AT RISK" Group were: 1) All Patients shifted out of the PICU after recovery. 2) Patients admitted directly from the Emergency Room, who need frequent monitoring, but not sick enough to be admitted to the PICU. 3) All patients admitted through the ER after midnight. 4) Any child in the ward about whom the primary admitting Pediatrician/staff is concerned about. 5) Neurosurgical and post surgical patients in the wards. A key aspect of the system was that, any staff member, irrespective of rank, may call the PET team. A List of these "AT RISK" patients was generated in the morning by the PET nurse. These would include some new patients and some patients carried forward from the previous day's list. Patients who had improved considerably were removed from the list, after being seen by the PICU consultant. Detailed rounds were done three times a day- in the morning, evening and at night, initially by the PET nurse and later by a PICU Consultant. The potentially sick children were seen more often, as required. At any point, if the doctor or nurse felt that the child needed to be shifted to the PICU, the same was done, after keeping the primary treating Pediatrician informed. The PET chart (annexure 1) had to be filled in for every patient on the list. This was done by the nurses in the wards and when warning signs/symptoms were noticed, they would alert the Pediatric Emergency team on the PET mobile number. This ensured monitoring of the child more closely than other patients. The following variables were compared before and after implementation of the PET concept- the number of patients having cardiopulmonary arrest in the

ward, the number of patients transferred to the PICU from the wards, the number needing intubation on Day1 of transfer and the overall mortality of patients transferred in.

Results

130 patients needed to be shifted to the PICU because of worsening clinical status, out of a total of 5,560(2.33%) admissions during phase1(before introduction of PET), as against 96 out of 4,425(2.16%) admissions during phase 2(after introduction of PET).

The mean age of patients transferred to PICU before and after introduction of PET was 3.2years and 5.5 years respectively.

Total admissions in ward varied between two phases of observation. There was not a significant difference in the number of patients transferred to the PICU between the two Phases. There were 2 cardiac arrest before introducing PET and there was no death in ward after introducing PET.

29 patients required intubation and mechanical ventilation within 8 hours after their transfer to PICU during Phase-1 (22.3%) and 7 during Phase-2 (8.1%), p value 0.021. Other interventions like use of boluses were not significantly different between the two groups. Out of all the patients transferred in to the PICU after starting PET, 2 (2.08%) died, whereas 14(10.7%) patients died before starting PET (p value 0.012) in PICU.

Discussion

The concept of applying pediatric emergency team(PET) in our hospital came to our mind when we saw two cardiac arrest cases in our ward and number of patients being transferred to PICU in a critically ill condition, our pediatric team was thinking about the mistakes in managing the patients and at last we reached a conclusion that our nurses and junior residents failed to recognise the early deteriorating vital signs and symptoms. ICU-based Medical Emergency Team (MET) system was first described by Lee and colleagues in 1995[6]. The formation of rapid response teams (RRTs)/medical emergency teams(MET)/'patient-at-risk team' (PART), as these have been variously called was based on the concept of "failure to rescue." [7]. We hypothesised that, early recognition of the warning signs and symptoms of patients admitted to the wards and appropriate intervention reduces their rate of transfer to the PICU and their overall mortality. This is the second study from India on the impact of the Pediatric Rapid response Team (here Pediatric Emergency Team) on pediatric in-patients transfer to the PICU and their mortality. Our source of inspiration for advocating PET team in our hospital is from Original Research Article "Critical Care without Walls"- Impact of a "Pediatric Emergency Team" on Picu

Admissions from the Wards and Overall Mortality. We studied the impact of the Pediatric Emergency Team (PET) on the incidence of cardiopulmonary arrests in the wards, number of patients transferred to the PICU from the wards, the number of mechanical ventilation within 24 hours and the overall mortality of the patients transferred in.

We used the criteria of cardiac arrest in ward, intubation and mechanical ventilation within 24 hours of their transfer to the PICU and the mortality in those patients to evaluate the effectiveness of PET. After applying PET we found no cardiac arrest cases in ward, a significant reduction in the number of patients needing intubation and mechanical ventilation within 24 hours after their transfer to PICU from 22.3% to 8.1% (p value 0.021) (Table2). This is similar to the first pediatric report published by Tibballis *et al*, who found reduction in code rate from 0.19 to 0.11 per 1000 admissions after starting MET[8]. In the study by Richard J. Brilli *et al* the code rate per 1,000 admissions decreased from 1.54(baseline) to 0.62 (post-MET) (risk ratio, 0.41; 95% confidence interval, 0–0.86; p value 0.02) [9]. In study conducted by Agarwal *et al* number of patients needing intubation and mechanical ventilation within 24 hours after their transfer to PICU, after starting PET reduced from 17.9% to 5.8% (p value 0.012864, OR 0.2831, 95% CI 0.1120 to 0.7156) [10]. In our study mortality in patients needing intubation and mechanical ventilation within 24 hours after their admission to the PICU in our study decreased from 10.7% to 2.08% (p value 0.012)(Table2).

This was similar to the study by Tibballis *et al* (0.12 to 0.06 per 1000 admissions) after the implementation of MET at Royal Children's Hospital in Melbourne[8]. In the study by Richard J. Brilli *et al* the pre-MET mortality rate was 0.12 per 1,000 days compared with the post-MET rate of 0.06 per 1000 days (risk ratio, 0.48; 95% confidence interval, 0–1.4, p = .13). All the patients needing intubation within 24 hours of shifting to the PICU 5/7 survived (mortality-28.7%) after the implementation of PET, whereas 14/29(48.2%) needing intubation died, before starting PET[9]. In study conducted by Agarwal *et al* study mortality in patients needing intubation and mechanical ventilation within 24 hours after their admission to the PICU decreased from 6.2 % to 0% (p value 0.0366), after the implementation of PET[10]. The number of patients needing interventions fluid boluses and inotropes was more before starting PET, but the difference was not significant. There were 130 patients who needed to be shifted to PICU because of worsening clinical status for a total of 5,560(2.33%) admissions, before introduction of PET against 96 for 4,425(2.16%), after introduction of PET. Goldhill, D.R. *et al* reported decrease in the number of unnecessary transfers to a higher level of care by a mean of 30%[11]. In study

Table 1: Characteristics and Overall Outcome of Patients in Wards before and after Starting PET

Variables	Before PET	After PET
Total Admissions	5,560	4,425
Transfer to PICU	130	96
Cardiac arrest in ward	2	0
No of death in ward	0	0

Table 2: Characteristics of Patients Transferred to PICU before and after Starting PET

Variables	Before PET (n = 130)	After PET (n=96)	p value
Interventions, %			
CPR	2 (1.53%)	0	
Intubation within 24 hr	29(22.3%)	7(8.1%)	0.021
Fluid bolus	52(40%)	35(36%)	0.582
Inotrope	40(30%)	22(22.9%)	0.681
Outcome %			
Died in PICU	14(10.7%)	2(2.08%)	0.012
Survival to discharge	116(89%)	94(97.9%)	0.731

conducted by agarwal et al, 145 patients who needed to be shifted to PICU because of worsening clinical status for a total of 10088(1.43%) admissions, before introduction of PET against 103 for 7737(1.33%) admissions, after introduction of PET. In our study total number of patient monitored by PET was 764, out of total 4,425 admission(17.26%). 87.43% of the patients kept under PET were managed in the wards and did not need transfer to the PICU, because warning signs and symptoms were recognized early and they were appropriately managed in the wards-fluid boluses, administration of oxygen and nebulisations, administration of the first dose of antibiotic, seizure control etc. It may be said that implementation of a Pediatric Emergency Team concept (Pediatric RRT) will reduce the incidence of respiratory and cardiopulmonary arrests or sudden deteriorations outside of the critical care areas, thereby reducing overall mortality. The Institute for Healthcare Improvement's Saving 100,000 Lives Campaign has advocated the deployment of in-hospital medical emergency teams (METs) as a means to rescue patients and reduce hospital mortality rates, and has already been adopted with good results in many hospitals worldwide (for adult patients) [12-13]. We hence recommend implementation of the Pediatric Emergency Team (RRT) concept in all tertiary care hospitals, in an attempt to reduce in-hospital cardiopulmonary arrests and overall mortality in Pediatric patients. We hope that soon the importance of PET team will be realised by every pediatric hospital and it will be implemented to benefit the patients.

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Competing interests

None declared

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