

IMPROVING OUTCOME IN PEDIATRIC INTENSIVE CARE UNIT IN ACADEMIC HOSPITAL IN PAKISTAN

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ABSTRACT

Objective: To assess the impact on the clinical outcome of critically ill children before and after introduction of pediatric intensivist in an academic pediatric intensive care unit (PICU) in Pakistan.

Methodology: This is a retrospective audit of children (age from one month to 14 years) admitted in the PICU during two 12-month periods in PICU of Aga Khan University Hospital (AKUH). Patients in Cohort one were managed by pediatric intensivist while in Cohort two were managed by general pediatricians. Patients were compared during the two 12-month cohort period.

Results: During the study, in cohort one, 314 patients were admitted, mean age was 24 months (range, one month -14 year), 37% were less than 1-year old, 66% were male, mean PRISM Score was 13.2(3- 39) while in cohort 2, 99 patients were admitted; mean age was 29 months and 60% were male. There were similar medical diagnostic categories in both cohorts. There were significant differences in two cohort for mortality (35% vs. 14%), length of stay (7.5 days vs. 3.2 days) ($p<0.01$) and number of admissions (314 vs. 99).

Conclusion: Our data showed that implementation of full-time trained pediatric intensivist in a tertiary-care PICU of university hospital was associated with improve outcome of critically ill children.

KEY WORDS: PICU, Children, Outcome.

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INTRODUCTION

The WHO estimates that every year more than 10 million children die, 99% of these deaths occur in developing countries.¹ The

major causes of death in children less than 5 years of age are acute respiratory infections, diarrheal diseases and malaria. By providing basic pediatric intensive care services which include oxygen, intravenous access and fluid resuscitation, antibiotic and non-invasive application of continuous positive airway pressure one can save the lives of million children each year in a developing country like Pakistan. These interventions are low cost and having potential for implementation in developing countries on mass scale to decrease mortality. The establishment of pediatric intensive care unit has significantly reduced the mortality.²⁻⁵

Several studies have shown significant positive impact of dedicated ICU physicians on the

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outcome of both critically ill children and adult.⁶⁻⁸ The objective of this study was to report the clinical profile and outcomes of critically ill children admitted before and after the introduction of pediatric intensivist in PICU of a tertiary-care university hospital in Pakistan.

METHODOLOGY

The medical records of all PICU admission from January to December 2005 and January to December 2007 were reviewed. AKUH is a major teaching and national referral centre for childhood disease. The pediatric department has 75 general pediatric beds with an average annual admission of >5000 patients and admits children up to 14 years old. The number of pediatric admissions to the ICU ranged between 72 to 132 per year and the mortality rate was between 40.25% to 25.2% from 1993 to 2005 (from unpublished data). From 2004, the PICU is five beds (3 multidisciplinary and 2 cardiac surgical ICU). The nurse to patient ratio is 1:1.

In September 2006, PICU was reorganized and all medical and surgical patients were admitted under full-time pediatric intensivist who is formally trained from accredited fellowship program and American Board certified in Pediatric Critical Care Medicine. The hospital has an active pediatric congenital heart surgery from June 2006. The PICU team provides services of procedural sedation and analgesia and Rapid Response Team to children admitted in general pediatric wards at AKUH. The study was approved by the Ethical Committee of AKUH.

During the year 2007, all patients care were directed by pediatric intensivist (Cohort-1, n= 314). During the year 2005, patients were managed by general pediatrician with support of adult anesthesiologist (Cohort -2, n= 99). Data of patients were collected from medical records. Data included demographics (age and gender), primary admitting diagnosis, admission source, ICU days, and in-hospital mortality. During Cohort-2 period, all patients underwent PRISM III score (most abnormal values within 24 hours admission were used)⁹

and prevalence of nosocomial infections as defined by NISS¹⁰ were recorded.

Data were expressed as means with range or percentage as appropriate. Statistical analysis was done on SPSS14. Student's t-test or Chi-square analysis was used to compare the data as appropriate. A *p*-value of <0.05 was considered significant.

RESULTS

Table-I depicts the characteristics of patients of two cohorts. In cohort-1 (2007), three-hundred fourteen children were admitted in PICU. Sixty-six percent (220) were male and male-female ratio was 2:1. The mean age was 24 months (range one month - 14 years) and 37% (123/314) were less than one years old. Emergency medical admissions (46%) were almost equal to surgical admission (54%). There were 112 cases (34%) of cardiac surgery. The major diagnostic categories of medical patients were neurological (10%), respiratory (10%) and cardiac (8%) (Table-II).

There were 45 deaths giving overall mortality of 14%. The patients (n=23) were transferred from ward had highest mortality as compared to other sources of admission because of delay in recognition or plan. There was no mortality related to pediatric major trauma including severe traumatic brain injury in PICU. The mean PRISM III score was 13.2 (3-39). The average length of PICU stay was 3.2 days (1-49 days). The bed occupancy rate was 90%. Ninety percent of patients received mechanical ventilation while more than 50% received vasoactive drugs. The rate of

Table-I: Patients Characteristics

Variables	Cohort -I	Cohort-II
No. of admissions	314	99
Mean age (months)	24	29
Age <1yr	37%	32%
Male (%)	60	66
PICU length of stay (days)	3.2	7.5
Mortality (%)	14	35

Table-II: Diagnostic Category of PICU Admissions

Post Cardiac Surgery	34%
Trauma/ Postop (non cardiac)	20%
CNS	10%
CVS	8%
Respiratory	10%
Sepsis	7%
Misc.	11%

nosocomial infection was 4.7%. Bloodstream infection from central venous catheter (mostly placed in femoral vein) and ventilator associated pneumonias were the main sites of infections in patients with nosocomial infections.

In cohort-2 (2005), total number of admission was 99. Over the last five-year, the admission rate varied from 87 -135. The primary medical diagnostic category were alike in cohort one i.e., infectious causes, respiratory, cardiac (not post-operative) and neurological cases. The mortality rate was 35%.

We compared two-cohort groups for outcomes. There was a significant reduction in mortality from 35% to 14% ($p < 0.001$) and sharply decrease in length of stay from 7.5 days to 3.2 days ($p < 0.001$). There was also a two-fold increase in number of admissions with same bed capacity.

DISCUSSION

Advances in pediatrics sub-specialties including the pediatric critical care medicine have dramatically improved the prognosis for the critically ill children. Numerous conditions that were previously fatal are now treatable. The pediatric intensive care was first established in 1950 in Sweden.¹⁰ During the last two decades PCCM has become a mature medical discipline well recognized for its services in the west and then slowly spread out in other parts of world.¹¹ There are few positive experiences of PICU from neighboring countries have been described including India and Malaysia.^{4,5} The age and gender characteristics of our patients

were similar to that noted in studies done in other PICUs in this region. We have almost equal number of medical and surgical patients as compared to western PICU where majority of admission is from operating room.¹³

Based on our observation, it appears that care of patients in our PICU is somewhat similar to the western PICU. This PICU has relatively privileged position because of medical school affiliation and enjoying better resources availability (technology and supplies etc), 24-hour physician coverage, highly trained-nurse and good nurse-patient ratio.

Few studies have described the characteristics of PICU managed by general pediatricians from Pakistan and the mortality rate was 29%.¹⁴ Pearson et al have suggested that the availability of full-time trained pediatric intensivists can deliver care of high quality and with much higher efficiency than without them in PICUs.¹⁵ To the best of our knowledge, this is the first report about the state of pediatric critical care led by specialized trained pediatric intensivist from Pakistan. We have similar results.

Mortality in our PICU was 14%. The mortality rate in our PICU is comparable to other reported PICU studies, which ranged from 18 -35%.^{16,17}

Our relatively higher mortality was most likely due to late presentation of medical patients to PICU from emergency room or pediatric wards at the height of their illness with maximal physiological derangements. Improved outcomes have been associated with early identification of critically ill child on the wards before physiologic deterioration and need for emergent resuscitation and PICU admission.¹⁸ Since the implementation of pediatric rapid response dramatically reduces the number of blue-codes and unexpected mortality (unpublished data).

Pediatric critical care medicine is in a nascent stage in Pakistan as in other developing countries. Indeed, there is a great need of pediatricians to be trained in the care of critically ill or injured child in order to reduce the mortality rate. The beginning has been made but there is

still long way to go. This field is full of opportunity, challenges and dynamism. Motivation and dedication towards providing care to critically ill children is the most important part in the development of pediatric critical care medicine. Though it is a quite challenging but we know that "Journey of thousands miles start with a single step".

This study has few limitations. Retrospective, single-center, limited-time period, unable to assess the severity scoring and incidence of nosocomial infections in cohort one due to incomplete medical records and unable to quantifying the use of advanced technologies were the few obvious limitations.

CONCLUSIONS

Our data showed that the availability of full-time trained pediatric intensivist made a significant impact on the outcome of critically ill children in our PICU. Availability of these services to the sick children of developing countries like Pakistan should be a priority in health policy to reduce the mortality and improve the child survival.

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