Research Article

Spectrum of Paediatric Emergency at a Tertiary Care Public Hospital in Northern India: Application of WHO-ETAT Triage Guidelines and Predictors of 24 hour Mortality

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Introduction

Epidemiological data comprising paediatric emergency attendance and admission profile of a tertiary care hospital in developing countries are scarcely available [1-3]. This data is necessary for health planners for cost effective allocation of scarce health resources according to the need of changing times. Large numbers of patients, inadequate drugs and equipment’s and non-availability of trained staff are some of the deficiencies commonly encountered especially in a developing country.

Uttar Pradesh or the ‘northern’ state is the most populous state in India and also one of the poorest, with low human development indices. Lucknow is the capital city of Uttar Pradesh. The King George’s Medical University is a historic institution situated in the heart of Lucknow. Being a state run tertiary care centre, it caters to the poorest and sickest patients in Lucknow and surrounding districts as far as Nepal. Since 2004, it has a New Emergency and Trauma Centre. All paediatric emergencies are seen here. Child patients beyond one month of age are assessed in the main emergency room, after which almost all the medical emergencies are referred to the paediatric emergency room and ward.

Pediatric medical emergencies can be categorised according to the system involved (eg. central nervous system, respiratory system, gastrointestinal system etc.), the type of pathology (inflammatory, neoplastic, traumatic etc.) and severity both of the primary diagnosis and co-morbidity. All these along with demographic profile and management given would have a bearing on outcome.

Abstract

Spectrum of pediatric emergencies - both types and severity are scarcely reported from India and there is little literature on factors associated with early mortality.

Methods: Consecutive patients presenting to the pediatric emergency in one 24 hour period every week for 40 weeks were enrolled for study. Record was made of: i) Demographic details ii) Chief complaints and main system involved iii) Presence of variables in WHO ETAT system. Standard definitions for variables were used. Four other variables were also recorded. Association between WHO ETAT and additional variables and mortality within 24 hours was looked for by univariate and logistic regression analysis using standard methods.

Results: Of total 1014 patients enrolled (mean age 45 (44.6) months; 61% males), the commonest illnesses were respiratory (29.8%), gastro-intestinal/hepatic (16.3%) and neuroinfectious (15.6%). A fourth of patients fell into Level 1 or 2 and 47.1% fell into level 3 of WHO ETAT. Presence of shock, Glasgow coma score (GCS) <=8, severe respiratory distress, SpO2 < 90, continuously restless, irritable or lethargic and severe pallor were significantly associated with mortality within 24 hours with p < 0.05. On logistic regression analysis, shock, GCS <= 8, SpO2 < 90 and continuously restless, irritable or lethargic remained in the final model.

Conclusion: Respiratory illnesses, gastrointestinal/ hepatic and neuroinfectious disorders constituted the commonest illnesses seen. Apart from shock and low Glasgow Coma score (<8), SpO2 < 90 and continuously restless, irritable or lethargic predicted mortality at 24 hours and could be used to possibly improve the triage system.

Keywords: Pediatric Emergency, WHO-ETAT, Triage, Mortality at 24 hours, Spectrum
The concept of 'triage' is an important one in emergency management. Large number of patients visit the emergency department. Consulting in the order of attending will, in a crowded emergency department, lead to long waiting times for some seriously ill patients who need immediate resuscitation. It is important to prioritize patients who are seriously ill or would be at increased risk of morbidity and mortality due to delay in the initiation of treatment. The word “triage” means sorting. Triage can be instituted by any health care personnel such as nursing staff. Many scoring systems have been developed for triage purposes [4-8]. Especially for resource poor settings such systems need to be simple and quick. However, most of the existing triage scores developed from western countries are exhaustive and include multiple physical and laboratory variables making them cost and labor intensive and difficult to implement in the emergency department. Some of the existing triage systems for pediatric emergencies are Canadian Triage and Acuity Scale (CTAS) [4], Manchester Triage Scale [5], Emergency Severity Index [6], Australasian Triage Scale [7] and WHO Emergency Triage and Treatment Scale (ETAT) [8] etc.

The WHO ETAT system was developed and recommended for use in developing countries in 2005. It has 4 levels - immediate, urgent, priority and queue as is shown in Table 1. It does not use Oxygen saturation (SPO2) as a criteria for determination of severity. However, hand held pulse oximeters are now easily available. In this study we proposed to i) describe the spectrum, severity and short term outcome of pediatric medical emergencies presenting to a tertiary care public teaching hospital in northern India and ii) examine the factors included in the WHO ETAT system [8] which are related to early mortality (within 24 hours) and some additional factors, including SPO2 to see if they can possibly improve the triage system. Such a study will serve as an audit; help in evidence based allocation of resources and may lead to improved management and triage guidelines.

**Methods**

The study was conducted at the Pediatric Emergency, Trauma Centre, King George’s Medical University (KGMU), Lucknow. Lucknow is the capital city of Uttar Pradesh – KGMU is a tertiary care, public teaching hospital which caters especially to the poor and seriously sick patients from Lucknow and surrounding districts. All children beyond one month of age with pediatric medical problems are seen in the pediatric emergency.

**Sampling**

All pediatric patients presenting to the pediatric emergency in one 24 hour period every week for 40 weeks (approx. 10 months) were enrolled for study. On an average, 25 patients are seen in a 24 hour period. Therefore it was estimated that data of approximately 1000 patients will be generated in 10 months.

**Demographic and clinical presentation data**

Patients presenting to the emergency were managed as usual. However, record was made of the following: i) Demographic details ii) Chief complaints with duration so as to classify the main system involved. Attempt was made to classify the patient’s presenting problems into one of the following clusters: i) Fever/ Septicemia ii) Respiratory & ear, nose, throat (ENT) iii) Cardiac/ Circulatory/ Hypertensive/ peripheral vascular iv) Neurological / neuro-infectious v) Oncological vi) Gastrointestinal/ hepatic vii) Metabolic/diabetic viii) Renal ix) Toxicology and venomous bites x) Skin and soft tissue infections xi) Hematologic xii) Neuropsychiatric xiii) Rheumatological xiv) Trauma/surgical/ burns xv) Allergic/wx) Other

If more than one system was involved, then this was noted along with primary and secondary involvement.

**Classification of severity**

This was done using the WHO ETAT triage system [8].

Condition at presentation was noted - vitals, Glasgow Coma score (GCS), main physical findings, presence or absence of variables included in the WHO ETAT system so as to get WHO severity level.

In addition, following information was collected: i) Oxygen saturation at presentation ii) Hypertension with degree (percentile) iii) Hemorrhage iv) Urine not passed for more than 12 hours Shock was defined as presence of two or more of i) tachycardia ii) cold clammy skin iii) low blood pressure iv) capillary refill time > 3 sec.

Definition of severe respiratory distress (Source – F- IMNCI 2009) [9] was defined as respiratory rate >= 70/minute along with one or more of i) Severe lower chest in-drawing ii) Head nodding (use of accessory muscles) iii) Grunting iv) Apneic spells v) Unable to drink

Normal respiratory rate, pulse rate and lower limit of systolic blood pressure were defined as per New York State’s Emergency Medical Services Pediatric Reference Card [10]. National Institutes of Health Guidelines [11] for hypertension in children were used for defining hypertension. For pain assessment, the FLACC Behavioral Assessment Tool [12] was used in children less than 7 years of age and the Linear Pain Scale [13] was used for pain assessment in children more than 7 years of age. Grades of fever (axillary – in Fareinheight) were defined as i) Mild-99.5 to 100.4 ii) Moderate- 100.4 to 103 and iii) High >103

**Outcome**

Deaths within the first 24 hours was recorded.
Analysis

Descriptive statistics of the demographic, illness type and illness severity data were analyzed. Presence of additional severity indicators – oxygen saturation (sPO2), hypertension, not passing urine for 12 hours or more, and hemorrhaging - were computed in an attempt to improve the triage criteria. All the severity of illness variables were correlated with death within 24 hours. Those having p value of less than 0.05 were entered into an unconditional stepwise logistic regression model. Variables were retained if p value was less than 0.05 or if their addition or removal substantially increased or decreased the likelihood of the model by more than 1.96.

Data was recorded on predesigned Data Collection Forms. Written informed consent was obtained from the parent/guardian. This was a purely observational study and no intervention of any kind was made. Approval from Institutional Ethics Committee was taken.

Results

A total of 1014 patients were enrolled over a period of 10 months. Table 2 gives the demographic characteristics of the enrolled patients. Neonates are not seen here and mean age was 45 months, lowest being 1 month and highest 180 months. About 61% were male and about half were self referred. A fifth of the patients had been admitted elsewhere. Table 3 shows the major systems or genre of diseases in which the patients fell. The most common illness presenting to the pediatric emergency was respiratory and ear, nose and throat (ENT) (29.8%), followed by gastro-intestinal/hepatic and neuroinfectious. Vaccine preventable diseases constituted 2.7 % of total visits, out of which diphtheria (1.6%) was observed most frequently followed by tetanus (0.8%) and measles (0.3%). A total of 41 (4%) patients were observed to have severe protein energy malnutrition (PEM) within 24 hours. The most common of these were congenital heart disease (20, 35%) and cerebral palsy (8, 14%).

Table 3: Category of illness in 1014 patients presenting to Pediatric Emergency.

<table>
<thead>
<tr>
<th>Categories of Illness</th>
<th>Frequency</th>
<th>Percentage (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fever/Septicemia</td>
<td>94</td>
<td>9.3</td>
</tr>
<tr>
<td>Renal</td>
<td>55</td>
<td>5.4</td>
</tr>
<tr>
<td>Gastrointestinal/Hepatic</td>
<td>165</td>
<td>16.3</td>
</tr>
<tr>
<td>Toxicology/Venomous bites</td>
<td>28</td>
<td>2.8</td>
</tr>
<tr>
<td>Neuropsychiatric</td>
<td>10</td>
<td>1.0</td>
</tr>
<tr>
<td>Respiratory/ENT*</td>
<td>295</td>
<td>29.1</td>
</tr>
<tr>
<td>Neurological</td>
<td>94</td>
<td>9.3</td>
</tr>
<tr>
<td>Metabolic/Diabetic</td>
<td>14</td>
<td>1.4</td>
</tr>
<tr>
<td>Skin &amp; Soft tissue infections</td>
<td>16</td>
<td>1.6</td>
</tr>
<tr>
<td>Rheumatology</td>
<td>4</td>
<td>0.4</td>
</tr>
<tr>
<td>Circulatory/Cardiac/Hypertensive/PVD*</td>
<td>49</td>
<td>4.8</td>
</tr>
<tr>
<td>Neuroinfectious</td>
<td>158</td>
<td>15.6</td>
</tr>
<tr>
<td>Hematological</td>
<td>80</td>
<td>7.9</td>
</tr>
<tr>
<td>Oncological</td>
<td>48</td>
<td>4.8</td>
</tr>
<tr>
<td>Allergic</td>
<td>3</td>
<td>0.3</td>
</tr>
<tr>
<td>Infectious diseases $</td>
<td>505</td>
<td>49.8</td>
</tr>
<tr>
<td>Severe protein energy malnutrition (PEM)*</td>
<td>41</td>
<td>4.0</td>
</tr>
<tr>
<td>Trauma/Burns/Surgical</td>
<td>84</td>
<td>8.3</td>
</tr>
<tr>
<td>Vaccine Preventable Diseases’</td>
<td>27</td>
<td>2.7</td>
</tr>
<tr>
<td>Others</td>
<td>37</td>
<td>3.7</td>
</tr>
</tbody>
</table>

Preventable diseases constituted 2.7 % of total visits, out of which diphtheria (1.6%) was observed most frequently followed by tetanus (0.8%) and measles (0.3%). A total of 41 (4%) patients were observed to have severe protein energy malnutrition (PEM) which 57 (5.6%) patients had an underlying chronic disease. The most common of these were congenital heart disease (20, 35%) followed by cerebral palsy (8, 14%) and epilepsy (8, 14%).

Table 4 shows the severity according to WHO ETAT triage system. Almost half the patients fell into Level 3 i.e. priority level. However more than a fourth fell into level 1 or 2. Mortality was highest in level 1, followed by levels 2, 3 and 4 and this trend was highly significant.

Table 5 shows the association between the WHO ETAT variables and mortality within 24 hours. Presence of shock, Glasgow coma score of 8 or less, severe respiratory distress, SpO2 less than 90, continuously restless or irritable or lethargic (CRIL) and severe pallor were significantly associated with mortality within 24 hours with p less than 0.05. On multivariate logistic regression analysis, shock, Glasgow coma score of 8 or less, SpO2 less than 90 and CRIL remained in the final model (Table 5).

Discussion

Spectrum of diseases coming to a tertiary care hospital needs to be analysed at regular intervals so as to get an insight into the...
changing pattern of disease frequencies in this modern era. This data would help stakeholders and administrators in planning of resource allocation. This is especially true for developing countries like India where patient volumes and requirements are high and resources are limited. A study of types, severity and outcomes of emergencies would serve as an audit and help in identifying gaps in care.

It is a global phenomenon that emergency rooms and departments are overcrowded. Many seriously sick children who could be saved by immediate or early attention have to wait in long queues often till it is too late. This again is particularly true for hospitals in the developing world, where haphazard lines of management lead to inefficient utilization of our valuable and limited resources and poor outcomes. The problem can be overcome to some extent by ‘triage’. Triage is very relevant to crowded emergency departments (ED) and over the last 2 decades, many scales and algorithms for severity of illness classification and prioritization have been developed in western countries. To date, four reliable ordinal ED triage scales have been researched and published for use in developed countries [4-7]. These include the Manchester Triage System (MTS), the Canadian Triage and Assessment Scale (CTAS), the Australasian Triage System from Australia and the Emergency Severity Index (ESI) from the USA.

In 2005, the World Health Organization (WHO) brought out the Emergency Triage, Assessment and Treatment scale (WHO ETAT). Our study was to evaluate the suitability of WHO ETAT system in our hospital setting. This scale was developed in Malawi – one of the poorest regions of the world, for use in developing countries. While this subjective system has been successfully implemented in Malawi, countries like India, Brazil and South Africa have sought a more objective triage instrument based on physiology. They have either adopted the triage instrument from a developed country or modified it to their own local context and needs.

Limitations of our study were that patients often come to the hospital without any previous records. Information on socioeconomic status of patients and time of reporting is not available. We did not analyse the final outcome in patients i.e. beyond 24 hours and nor did we take into account the management of the patient.

We classified our patients both in terms of system involved and illness severity. The 15 different illness clusters were decided on by peer group discussion and through having an idea of the common illnesses encountered here. Most frequent categories of illnesses were respiratory and ear, nose & throat (ENT) (29.8%), followed by gastrointestinal/hepatic (16.3%). This is not surprising as lower respiratory infections, pneumonias, bronchiolitis and empyema are very common and pneumonia continues to be the leading cause of death in under 5 children. Gastrointestinal illness was most commonly acute diarrhea with dehydration, followed by hepatic coma at various stages, acute hepatitis and infantile cholostasia. Singhi, Jain and Gupta (2003) [14] found that the most common reasons for attending the emergency department were gastrointestinal and illnesses (23 per cent each) but we observed respiratory illnesses as by far the most common (29.1%) group followed by gastrointestinal (16.3%).

Patients visiting ED were also categorized according to the WHO level of severity (Tables 4). WHO ETAT system has 4 levels of severity. Level 1 is cardiac/respiratory arrest or agonal rhythm needing immediate cardiopulmonary resuscitation. Level 2 is ‘urgent’ and includes “ABCCCD” A for airway compromise, B for breathing, C for circulation, coma and convulsions and D for dehydration (severe). These patients need to be attended to within 5-10 minutes. Level 3 is priority signs -T, P, 3 R MOB, who need to be assessed but can wait till the first 2 categories are attended to. The most common category in our ED was Level 3 or Priority accounting for almost half the patients (47.1%). The Level 4 patients who were non serious were the next common group (265 or 26.1%). Level 2 signs were present in 254 or 25%. The least common were Level 1 patients who needed immediate resuscitation (17 or 1.7%). We can therefore say that very severely ill children come to our emergency because more than 1/4th were
in level 1 or 2 severity. Ours being a public tertiary care hospital, most of the very poor and seriously ill patients report here.

When the WHO severity level was correlated with mortality, (Table 5) there was a highly significant correlation between WHO severity levels and mortality within 24 hours, which in a way validates the system. While there has been some focus on the reliability of triage tools [15] not much is published on their validity. In this study we validated the WHO ETAT against mortality within 24 hours. We think this is appropriate because the emergency physician often has to decide whether or not to admit the patient. Any patient in danger of dying within next 24 hours should definitely be hospitalized. All the triage systems so far were developed by inputs and consensus building between experts. Others have tried to predict risk of admission [16]. About half of the ED visits were constituted by attendees falling into levels 1 and 2 of WHO system.

We also examined the risk of mortality with individual WHO parameters – of level 2 and 3, Shock was highly significantly associated with early mortality, as was severe respiratory distress, coma with Glasgow Coma Score of <8, severe pallor and CRIL. Of these, the latter two are level 3 variables. We also recorded some other variables - oxygen saturation by pulse oximeter (SpO2), hemorrhaging child, hypertensive and history of severe respiratory distress, coma with Glasgow Coma Score <8, CRIL and SpO2 <90%. SpO2 can be easily checked in the emergency by a hand held pulse oximeter. Extreme restlessness is often a sign of severe hypoxemia and death can follow within minutes. It is therefore concluded that these signs should be looked out for and management of such a child be prioritized as this could possibly improve the triage system.

### References


### Table 6: Predictors of death at 24 hours of hospitalization.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>OR $^3$</th>
<th>95%CI $^3$</th>
<th>Coeff $^3$</th>
<th>S.E. $^3$</th>
<th>Z Statistics</th>
<th>p-value $^4$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Shock</td>
<td>6.9</td>
<td>2.6-18.4</td>
<td>1.9</td>
<td>0.5</td>
<td>3.8</td>
<td>0.000*</td>
</tr>
<tr>
<td>SpO2 &lt;90</td>
<td>2.6</td>
<td>1.0-6.9</td>
<td>0.97</td>
<td>0.5</td>
<td>1.9</td>
<td>0.048*</td>
</tr>
<tr>
<td>GCS &lt;=8</td>
<td>7.2</td>
<td>3.0-17.4</td>
<td>1.98</td>
<td>0.4</td>
<td>4.4</td>
<td>0.000*</td>
</tr>
<tr>
<td>Resilient or persistently irritable or lethargic (CRIL)</td>
<td>3.0</td>
<td>1.1-7.9</td>
<td>1.1</td>
<td>0.49</td>
<td>2.2</td>
<td>0.026*</td>
</tr>
</tbody>
</table>

$^3$ OR Odds ratio, CI Confidence Interval, Coeff - β Coefficient, S.E.- Standard Error; GCS – Glasgow coma scale; SpO2 – oxygen saturation

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