Morbidity and mortality profile of children admitted in pediatric department – A single center study

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ABSTRACT

Background: Child morbidity and mortality is an issue of great concern for policy makers because in spite of good efforts still less than 5 years mortality rate is very high and many babies could not survive beyond infancy. Majority of pediatric deaths occurred due to preventable and treatable causes. An emphasis needed on early diagnosis and timely interventions in pediatric patients associated with high risk factors. Aims and Objectives: To study clinical spectrum, morbidity and mortality profile in hospitalized children and to evaluate association of clinicodemographic variable with outcome. Materials and Methods: A cross sectional study was conducted among 2315 patients admitted during study period to evaluate morbidity and mortality profile of patients in pediatric department. Data was collected between January to December 2018 and analyzed for demography, clinical profile including diagnosis, hospital and pediatric intensive care stay, management and outcome. Results: Mean age (mean ± SD) reported was 42.35 ± 35.85 months. Under 5 years children were admitted in majority (62.5%). Respiratory system (21.9%) and nervous system diseases (21.7%) were leading reasons for admission followed by gastrointestinal (11.2%) and hematological disorders (10.8%). Based on etiology infection was leading cause, most common infection in hospitalized children lower respiratory tract infections (19.5%). Vaccine preventable diseases were present in 3.7% patients. 2.5% children admitted due to severe acute malnutrition (SAM). Nervous system diseases (18.2%) associated with highest mortality followed by cardiac (11.7%) and respiratory diseases (11.2%) Mortality rate was 8.07%. Significant association was found between gender, duration of PICU stay, condition at admission, under nutrition and severe anemia to outcome (p <0.01). Conclusion: Early diagnosis and timely interventions can improve outcome in patients with co morbidities and high risk factors. Social awareness is very important to prevent gender discrimination. Emphasis on simple hygiene measures, vaccination and nutrition improvement can decrease the disease burden in pediatric population. Vaccine preventable diseases still occurring and needed hospitalization so strengthening of awareness program for vaccination required, especially in remote rural areas.

Key words: Morbidity; Mortality; Vaccination; Under nutrition; Infection; Outcome

INTRODUCTION

Pediatric population is most important population for policy makers because it affects nation’s future. According to WHO fact sheet in 2018 estimated 6.2 million children died below 15 years of age and underlying etiologies were preventable in majority of the cases. Under 5 years mortality was 5.3 million and causes were prematurity related complications, pneumonia, diarrhea, malaria, birth asphyxia and congenital anomalies.¹

As per Census 2011, India, with a population of 121.1 crore, has 16.45 crore children in the age group 0-6 years and 37.24 crore in the age group 0-14 years which constitute
MATERIAL AND METHODS

A cross sectional study was conducted among 2315 patients admitted in pediatric department of a tertiary care hospital in Central India. Study center had a large draining area and majority of patients are referred patients from peripheries and in critical condition. 10 bedded fully equipped PICU and 24 hour pediatric care facility is available where patients received from outpatient department, emergencies, referred from other hospital and post operative patients required PICU care.

Results

Present study found 2315 patients admitted in PICU and pediatric ward aged 1 month to 14 years during study period. Among these 2315 patients 187 patients expired, mortality rate was 8.07%. 26 patients were transferred in and 11 patients transferred out from department. Thirty four percent were referred patients, 78% were emergency admission (Table 1). 8.3% patients received mechanical ventilation.

During study period majority of children admitted in pediatric department were under 5 years of age (62.5%), out of them 30.06% were infants and 32.48% were 1 to 5 years of age. 37.45% patients were above 5 year of age. Mean (mean ± SD) age for hospitalization was 42.35 ± 35.85 months. Males (58.13%) were in majority in comparison to females. Male: Female ratio (M : F ratio) was 1.39 :1 in hospitalized children.

As shown in Table 2 maximum patients were admitted due to respiratory diseases (21.9%). Most common cause for hospitalization was lower respiratory tract infections.
(19.7%). Respiratory diseases were prominent reason for hospitalization but case fatality rate found to be low (4.1%).

Nervous system diseases (21.7%) were second leading cause, seizures (9.3%) was most frequent reason for hospitalization followed by meningoencephalitis (8%). CNS diseases found to be leading cause for mortality (18.7%). Case fatality rate was 6.9%.

Gastrointestinal system (11.2%) was third system involved, mostly patients admitted due to acute gastroenteritis (6.7%). Liver diseases were responsible for admission in 3.9% cases including viral hepatitis, liver failure, chronic liver disease and cholestasis. Case fatality rate was 5.3%.

Cardiac diseases were responsible for 5.7% cases, most common cause was congenital heart disease (CHD) and others were rheumatic heart disease and cardiomyopathy. Most common CHD was ventricular septal defect followed by tetralogy of fallot and patent ductus arteriousus. Case fatality rate was highest (16.6%) in cardiac patients.

In hematological disorders (10.8%), most common cause for hospitalization was anemia. Iron deficiency anemia was the leading anemia followed by sickle cell anemia and thalassemia. Other hematological diseases were idiopathic thrombocytopenic purpura, leukemia and hemophilia. Case fatality rate was 6%.

In renal system involved in 3.8% cases, patients admitted with chronic kidney disease (1.1%), nephrotic syndrome (0.9%) and others. Nutritional problems were found in 5.9% patients. Mostly patients admitted with primary diagnosis of severe acute malnutrition (SAM), others reasons were infantile tremor syndrome (ITS), pre ITS and rickets. Case fatality rate was high in patients with nutritional problems (13%).

Poisoning was found in 4.5% cases, exposure route was ingestion (100%), mostly accidental in nature. Case fatality rate due to poisoning was 5.7%. Miscellaneous causes were diabetic ketoacidosis (0.8%), foreign body inhalation (0.7%), collagen vascular disorder (0.4%), snake bite (0.5%), scorpion sting and others.

Vaccines preventable diseases (3.7%) reported during study period were tetanus, TBM, diphtheria, measles, rabies, hepatitis B and pertussis (Figure 1).

Table 3 shows that most common cause of admission in pediatric intensive care and pediatric ward was infections based on etiology. Lower respiratory tract infections (LRTI) were most common cause for hospitalization (19.5%). Pneumonia (12%) was prevalent LRTI. Other infections were acute gastroenteritis (6.7%), septicemia (4.1%), meningitis, malaria, dengue and others. Seizure (9.3%) was second leading cause including epilepsy, febrile seizure and others. Anemia (8.2%) was third reason and iron deficiency anemia, sickle cell anemia, thalassemia were common underlying etiologies. Meningoencephalitis (8%) was fourth cause included bacterial, tubercular and viral meningencephalitis. Congenital heart disease was fifth reason for admission (5.2%) and also associated with high mortality rate. Other causes were poisoning (4.5%), liver diseases (3.9%), SAM (2.6%), cerebral palsy (1.9%) and others (25.6%), mortality rate was very high (30%) in SAM patients.

| Table 1: Admission and outcome details of hospitalized patients during study period |
|---|---|---|
| S. No. | Variable | Number (%) |
| 1. | Total Admission | 2315 |
| 2. | Improved | 1849 (79.9) |
| 3. | Death | 187 (8.0) |
| 4. | Left against medical advise | 279 (13.1) |
| 5. | Referred patient | Yes 791 (34.1) No 1524 (65.8) |
| 6. | Transfer | In 26 (1.1) Out 11 (0.47) |
| 7. | Admission | Emergency 1817 (78.4) Elective 498 (21.5) |

| Table 2: Patient morbidity pattern based on system involved and disease |
|---|---|---|
| System involved and disease | Admission Number (%) (N=2315) | Death Number (%) (n=187) | Case fatality rate (%) |
| Respiratory | 507 (21.9) | 21 (11.2) | 4.1 |
| CNS | 503 (21.7) | 35 (18.7) | 6.9 |
| GIT | 260 (11.2) | 14 (7.4) | 5.3 |
| Hematology | 250 (10.8) | 15 (8.02) | 6.0 |
| Infection | 240 (10.3) | 23 (12.2) | 9.5 |
| Nutrition | 138 (5.9) | 18 (9.6) | 13.0 |
| CVS | 132 (5.7) | 22 (11.7) | 16.6 |
| Poisoning | 104 (4.5) | 6 (3.2) | 5.7 |
| Renal | 89 (3.9) | 7 (3.7) | 7.8 |
| Miscellaneous | 92 (3.9) | 26 (13.9) | 28.2 |
In Table 4, monthly distribution of admissions and deaths. Admission rate was high in January, February, September and October months at time of season change while minimum admission was in August. Maximum deaths were noted in September (11.7%) and minimum in April (5.8%). Monthly mortality rate was highest in December (12.2%) and lowest in April (6.0%). Mean for hospitalization was 177 and for death mean was 15.58. Mean mortality rate was 8.4%.

In present study outcome was evaluated in 2036 patients among these 90.81% patients improved and 9.1% patients expired. 278 patients left against medical advice (LAMA) so outcome could not be evaluated in them. Majority of hospitalized children were under 5 year of age contributed to 62.5% of pediatric mortality during study period while mortality rate was 8.08%. Number of deaths was more in under 5 children due to their high number of hospitalization but no statistical significant difference (p=0.53) was found in both age groups (above and below 5 years) in outcome as shown in table 5. Male: female ratio (M: F ratio) was 1.39:1 in hospitalized children while 0.8: 1 in expired children. Admission rate was high for males but mortality rate was high for females (10.4%) than males (6.4%). Statistical significant gender difference (p= 0.001) was found in outcome (Table 5).

Severe anemia (as per WHO classification of anemia) correlated with poor outcome of patients. Serious condition of patients (hemodynamically unstable, altered sensorium, respiratory distress, cyanosis,) also associated with poor outcome. Association of co morbidities (malnutrition, severe anemia), condition on admission and duration of PICU stay with outcome was found to be strongly significant (p < 0.01) as shown in Table 5.

**DISCUSSION**

In the study admission rate in hospital was more for boys than girls. This was also shown in other studies – Adhikari et al. from Nepal and Saho B et al. (61.3%). Majority of males in admission also present in Shah and Mirdha’s study. It may be due to still preference of boys over girls for care which also reflected in difference in mortality rate where females outnumbered. Mean age in present study was 3.5 ± 2.9 years while 4.3 years ± 5 years were reported by Falludin et al.

A total of 30.06% infants admitted in present study while 47.4% infants admitted in study by Haqu et al, and 50% reported by Earen SK. In present study although under 5 children contributed to 62.5% of total mortality but no significant difference was found between both age groups (under and above 5 years) for admission and mortality. Number of deaths was more in under 5 years children due to their high number of hospitalization. Mortality rate for both groups were showing no statistical significant difference.
In this study respiratory system predominantly involved followed by CNS system for hospitalization. Most common cause based on etiology was infections followed by seizure and anemia. Study by Saho B et al also showed same results most common causes for admission were respiratory diseases and infections in their study, study by Shukla also showed infection as most common cause for admission and mortality. Roy RN reported respiratory infections (22.2%), seizures (12.68%), poisoning and accidents (6.07%) were leading causes for hospitalization. In present study pneumonia, seizures and anemia were leading causes based on etiology for admission. Earen SK et al also found respiratory diseases, infections and CNS diseases as most common cause for admission.

Pattern of diseases changed over time. In current study congenital heart disease (CHD) was predominant cardiac cause for hospitalization. Cases of CHD were increased may be due to easy availability of echocardiography and improved survival with better treatment facilities. Number of rheumatic heart disease patients decreased significantly over time due to changing life styles and increased use of antibiotics.

Pneumonia, diarrhea and malaria are predominant reason for high morbidity and mortality in children according to WHO fact sheet. In this study causes were different, neurological diseases was leading reason for mortality followed by cardiac diseases and infections. Reason may be it was a hospital based study where referred patients treated so morbidity and mortality pattern may be different.

According to WHO fact sheet in 2019, 5.2 million children under 5 year of age died due to preventable and treatable causes. Mortality decreased in older children and most common cause is trauma and accidents. Neurological diseases were leading reason for mortality in present study followed by infections and cardiovascular diseases while infection was most common cause in Shukla’s study. Falludin et al reported that sepsis, pneumonia, CHF and hepatic encephalopathy were leading causes for mortality while sepsis, cardiac diseases and neurological diseases were reported by Sankar et al. LRTI, CNS infections and malnutrition were three leading causes of mortality according to Bucens et al. Mortality rate was 8.06% in this study, other studies with similar results were Reshma R P (mortality rate - 10.58%), Mridha D (20%) and Khilani (mortality rate - 6.7%). Low mortality rate was reported by Saho (4.7%) and Fallahudin (1.35%). Diarrhea, malnutrition and malaria were reported as common cause by Okechukwu AA. High mortality rate in present study was due to hospitalization of patients in critical condition, majority were referred patients and co morbidities (e.g. – under nutrition and anemia) were present.

Gender, under nutrition, anemia, duration of PICU stay and condition on admission were significantly associated with high mortality in present study. Mortality rate for girls was higher than boys in study by Onyiriuka AN. Similar results were found in this study. Desire B et al reported malnutrition is significantly associated with mortality in less than five years children.

Vaccine preventable diseases are still prevalent in community as reported in current study. It suggests that immunization is still lagging behind expectations. NFHS – 4 surveys showed improvement in immunization rate but still coverage in remote areas is not optimum. The explanation could be lack of awareness in remote areas and

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**Table 5: Association of clinico-demographic variables with outcome**

| Clinico-demographic variables | Total patients Numbers (N= 2036) | Survived Numbers (%) (n= 1849) (90.8%) | Death Numbers (%) (n=187) (9.2%) | P value |
|------------------------------|-----------------------------------|----------------------------------------|----------------------------------|--------|
| **Gender**                  |                                    |                                        |                                  |        |
| M                            | 1150 (56.5%)                      | 1063 (57.5%)                           | 87 (46.5%)                       | 0.001* |
| F                            | 886 (43.5%)                       | 786 (42.5%)                            | 100 (53.5%)                      |        |
| **Age**                     |                                    |                                        |                                  |        |
| ≤5 years                     | 1282 (62.9%)                      | 1171 (63.3%)                           | 117 (62.6%)                      | 0.447**|
| >5 years                     | 754 (37.1%)                       | 678 (36.7%)                            | 70 (37.4%)                       |        |
| **Serious condition on admission** |                        |                                        |                                  |        |
| Yes                          | 853 (41.9%)                       | 759 (40.8%)                            | 155 (82.9%)                      | 0.001* |
| No                           | 1183 (58.1%)                      | 1150 (62.2%)                           | 32 (17.1%)                       |        |
| **PICU stay**               |                                    |                                        |                                  |        |
| ≤72 hours                    | 1361 (66.8%)                      | 1254 (67.8%)                           | 107 (57.2%)                      | 0.003* |
| >72 hours                    | 675 (33.2%)                       | 595 (32.2%)                            | 80 (42.8%)                       |        |
| **Undernourished**          |                                    |                                        |                                  |        |
| Yes                          | 458 (22.5%)                       | 345 (18.7%)                            | 113 (60.4%)                      | 0.001* |
| No                           | 1578 (77.5%)                      | 1504 (81.3%)                           | 74 (39.6%)                       |        |
| **Severe anemia**           |                                    |                                        |                                  |        |
| Yes                          | 326 (16.0%)                       | 264 (14.3%)                            | 62 (33.2%)                       | 0.001* |
| No                           | 1710 (83.9%)                      | 1585 (85.7%)                           | 125 (66.8%)                      |        |

*The association is highly/strongly significant for 1 degree of freedom at the 0.01 level of significance. **The association is not significant for 1 degree of freedom at the 0.05 level of significance.
CONCLUSION

Present study concluded that infection is prevalent reason for hospitalization and associated with high mortality. Early diagnosis and treatment may improve patient outcome especially in patient with co morbidities and risk factors. Female mortality rate is also high, social awareness required to decrease discrimination. Vaccine preventable diseases still prevalent so further emphasis on immunization awareness required specially in remote areas. Simple preventive measures like hand hygiene, nutrition, vaccination and sanitation facility can decrease significant outcome especially in patient with co morbidities and hospitalization including pneumonia and diarrhea.

Emphasis on preventive measures needed including nutrition, immunization, improvement in hygiene and sanitation facilities.

Limitations of the Study

Limitation of present study were single centric and hospital based so it is suggested that future studies should be planned multi centric or community based long term studies to verify findings of current study.

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**Author's contribution:**
PR, NJ - Contributed the complete process of this study, Participate in concept design, review of literature, data collection, interpret results, statistical analysis and interpretation, preparing manuscript, first draft, critical revision of manuscript.

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