



## Multiple organ dysfunction in children admitted at pediatric intensive care unit of the Children Hospital, Multan.

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**ABSTRACT... Objectives:** This study was done to find out the frequency of MODS in children admitted at PICU. **Study Design:** Case series. **Setting:** Department of Pediatrics Medicine, The Children's hospital and the Institute of Child Health, Multan. **Period:** From May to November 2019. **Material & Methods:** Variables recorded for each case included age, gender, residential status, maternal education, height, weight and BMI. Venous blood sample was sent to the hospital pathology laboratory for baseline investigations to diagnose MODS. **Results:** Of these 101 study cases, majority, 61 (60.4 %) were male, 51 (50.5 %) belonged to rural areas, 74 (73.3%) from middle income families and 72 (71.3%) mothers of admitted children were illiterate. Overall mean age was  $3.62 \pm 1.95$  years while mean body mass index was  $24.85 \pm 2.20$  kg/m.<sup>2</sup> Mean duration of PICU stay was  $4.31 \pm 3.39$  day and 69 (68.3 %) had duration of PICU stay up to 5 days. Of these 101 study cases, multiple organ dysfunction was noted in 33 (32.7%). **Conclusion:** High Frequency of MOD was observed among children admitted to PICU. MODS was found to have association with male gender, residential status as rural, maternal education status as illiterate, obesity and duration of PICU of more than 5 days.

**Key words:**

Multiple Organ Dysfunction, Maternal Education, Obesity, Pediatric Intensive Care.

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### INTRODUCTION

Earlier described as “multiple system organ failure”, the term “multiple organ dysfunction syndrome (MODS)” was initially explained in the 1960s as bleeding, respiratory failure as well as sepsis.<sup>1,2</sup> MODS is defined as<sup>3</sup> “the development of potentially reversible physiologic derangement involving two or more organ systems not involved in the disorder that resulted in ICU admission, and arising in the wake of a potentially life threatening physiologic insult.” Quite a few predisposing factors are described to be linked with MODS but shock because of any cause, sepsis and tissue hypoperfusion are most commonly witnessed.<sup>4</sup> A substandard immune response or immune paralysis is considered to played a major role in the development of MOD.<sup>1</sup>

MODS is frequently witnessed in the PUCUs, causing significant amount of mortality.<sup>5</sup> Pathophysiology of MODS involves a severe,

systemic as well as uncontrolled inflammatory process that progress in to MODS.<sup>6</sup> Experts advise early diagnosis of MODS when there is dysfunction of at least 2 organs or systems.<sup>7,8</sup> Diagnostic criteria for MODS have been changing over time and no set criteria are endorsed for the diagnosis of organ dysfunction. In 1986, Wilinson JD and Coworkers were the earliest to describe the diagnostic criteria for diagnosing MOD whereas they reported incidence of MOD as 27% in admitted cases in the PICU. In Pakistan, not much work is seen about MODS and its impact among children.<sup>9</sup> A study done by Haque A et al from Karachi<sup>10</sup> noted prevalence of MOD as 25.2% over a span of 2 years A study from Cairo, Egypt<sup>4</sup> noted a high prevalence of MOD as 72% on 1<sup>st</sup> day of admission in the PICU.

The aim of this study was to document the proportion of multiple organ dysfunction in children admitted to PICU. There is scarcity of data at national as well as international level

while not much work is seen in Pakistan on this. The results of this study will generate baseline database of our local population and ascertain current magnitude of the problem.

### MATERIAL & METHODS

A Case series, conducted at the department of Pediatric Medicine, The Children's hospital and the Institute of Child Health, Multan, from May to November 2019. Approval from Institutional Ethical Committee was taken for this study. Informed consent was sought from parents/guardians of all study participants.

A sample size of 101 was calculated by WHO calculator for sample size, by taking 21.4 %<sup>11</sup> of multiple organ dysfunction in PICU, with level of confidence as 95% and margin of error as 8%. Non probability consecutive sampling technique was employed. A total of 101 children of both genders, aged 1 month to 15 years, who were critically ill and admitted to PICU irrespective of presenting complaint, with duration of hospitalization more than 24 hours. All cases admitted to PICU following surgical procedures and trauma or patients whose parents did not give consent for participation were excluded.

Variables recorded for each case included name, age, gender, residential status, maternal education, height, weight and BMI. Venous blood sample was taken and sent to the hospital laboratory for baseline investigations to diagnose multiple organ dysfunction after every 24 hours. MOD was defined as > 2 organ dysfunctions as per criteria defined in Table-I.<sup>12</sup>

Data was analyzed using SPSS version 23.0. Frequency and percentage were calculated for gender, multiple organ dysfunction, residential status and mother's educational level. Mean and standard deviations was calculated for numerical data including age of patients, BMI and duration of PICU stay. Stratification was done with respect to age, gender, residential status, duration of PICU stay and mother's educational level. Post stratification chi square test was applied. P value less than 0.05 was considered significant.

### RESULTS

Out of 101 study cases, 61 (60.4 %) were male whereas 40 (39.6 %) were female. Overall, mean age was  $3.62 \pm 1.95$  years while mean age of the male patients was  $3.84 \pm 2.16$  years and  $3.30 \pm 1.57$  years for female ( $p=0.180$ ). Majority, 85 (84.2 %) were < 5 years of age. There were 51 (50.5 %) patients from rural areas and 50 (49.5 %) from urban areas. There were 27 (26.7%) patients who belonged to poor families and 74 (73.3%) were from middle income families. Seventy two (71.3%) mothers were illiterate while 29 (28.7%) were literate.

Overall, mean body mass index (BMI) was  $24.85 \pm 2.20$  kg/m<sup>2</sup> while obesity noted in 12 (11.9%) patients. Mean duration of PICU stay was  $4.31 \pm 3.39$  day and 69 (68.3%) had duration of PICU stay as less than 5 days.

It was observed that MODS was found to be significantly associated with male gender, residential status as rural, maternal education status as illiterate, obesity and duration of PICU as more than 5 days. (Table-II.)

### DISCUSSION

Understanding of the epidemiology as well as outcome of MODS in children is limited because of irregular diagnostic criteria and population's characteristics. Some patients develop additional organ dysfunction during and/or after the first week of PICU admission. These patients might be best categorized as having "progressive MODS," a recently proposed term that will subsequently be discussed later in sections on New and Progressive MODS.<sup>13,14</sup>

In the present study, 61 (60.4%) patients were male. Haque A et al<sup>15</sup> in a local study found 66.5% of their cases admitted to PICU as male. Another local study<sup>10</sup> also documented 66% male cases which is quite similar to what we noted. El Hamshary AA et al from Cairo, Egypt<sup>4</sup> noted 70.1% of the cases with MODS to be male.

Cardiovascular	Reduction in blood pressure (BP), systolic blood pressure (SBP) <90mmHg, mean arterial pressure <70mmHg, < 5 <sup>th</sup> percentile for age, or SBP <2 SD below normal for age, despite administration of isotonic IV fluid bolus or require vasoactive drugs to maintain BP in normal range or any 2 of the these: unexplained metabolic acidosis: base deficit > 5mEq/L, Increased arterial lactate: > 1mmol/L. urine output less than 0.5ml/kg/hour Prolonged capillary refill (more than 5 seconds)
Respiratory	Presence of anyone of these: PaO <sub>2</sub> / FiO <sub>2</sub> ratio <300 without cyanotic heart disease, PaCO <sub>2</sub> >20mmHg, Require >50% FiO <sub>2</sub> to maintain saturation above 92%.
Neurologic	Glasgow Coma Scale (GCS) score <11 or acute change in mental status with a lowering in GCS score of >3 points from abnormal baseline
Hematologic	Presence of anyone of these: Platelets count <100,000/mm <sup>3</sup> , reduction in platelet count as 50% from the highest value recorded in last 72 hours, International normalized ratio (INR) > 1.5 and activated partial thromboplastin time (APTT) > 60 seconds
Renal	Serum Creatinine >0.5mg/dl, >2x upper limit of normal for age
Hepatic	Total bilirubin as more than 4mg/dl and alanine transaminase (ALT) level two times to upper limit of normal for age

**Table-I. Criteria for organ dysfunction<sup>12</sup>.**

Study Variables		Multiple Organ Dysfunction		P-Value
		Yes (n=33)	No (n=68)	
Gender	Male	25 (75.8%)	36 (52.9%)	0.032
	Female	08 (24.2%)	32 (41.1%)	
Age	< 5 Years	31 (93.9%)	54 (79.4%)	0.082
	> 5 Years	02 (6.1%)	14 (20.6%)	
Residential Status	Rural	23 (69.7%)	28 (41.2%)	0.011
	Urban	10 (30.3%)	40 (58.8%)	
Socioeconomic Status	Poor	11 (33.3%)	16 (23.5%)	0.341
	Middle Income	22 (66.7%)	52 (76.5%)	
Maternal Education	Illiterate	18 (54.5%)	54 (79.4%)	0.001
	Literate	15 (45.5%)	14 (20.6%)	
Obesity	Yes	00	12 (17.6%)	0.008
	No	33 (100%)	56 (82.4%)	
Duration of PICU Stay	< 5 days	13 (39.4%)	56 (82.4%)	<0.001
	> 5 days	20 (60.6%)	12 (17.6%)	

**Table-II. Multiple organ dysfunction with respect to study variables (n = 101).**

Overall, mean age was found to be 3.62 ± 1.95 years (ranging from 1 year to 8 years) while we noted that most of the patients, 85 (84.2 %) < 5 years of age. A study from Karachi<sup>15</sup> also observed mean of the children admitted to PICU as 56.3 ± 5.5 months which are pretty similar to what was found in the present research. Another study from Karachi<sup>10</sup> showed that 63% cases were aged below 5 years. A study from Egypt<sup>4</sup> noted 87% of the children in PICU to be of less

than 5 years of age. Giri A and Colleagues from Nepal<sup>5</sup> also found 61.2% of the patients to be less than 5 years of age.

In the present study, 51 (50.5 %) belonged to rural areas and 50 (49.5 %) belonged to urban areas. Of these 101 study cases, 27 (26.7%) belonged to poor families and 74 (73.3%) were from middle income families. Sixty nine (68.3%) mothers were illiterate while 32 (31.7%) were literate. Ramzan

S and Coworkers<sup>16</sup> found 28% poverty rate and 40.7% illiteracy among cases admitted in PICU which is quite similar to us.

Mean duration of PICU stay was  $4.31 \pm 3.39$  day and 69 (68.3 %) had duration less than 5 days. Ahmad K and Colleagues noted a similar finding where mean duration of hospital stay in the PICU was 3.89 days. Volakli E et al<sup>18</sup> found that to be  $8.85 \pm 23.28$  days. Ramzan S et al<sup>16</sup> also reported similar results.

Multiple Organ Dysfunction was noted in 33 (32.7%) patients in the present study. Villeneuve A et al<sup>11</sup> reported 21.4 % multiple organ dysfunction in PICU. Ramzan S and Colleagues<sup>16</sup> also reported 26.7% MOD. A recent study from Nepal<sup>15</sup> found MODS to be presented in 51% of the cases admitted in the PICU.

This is the 1<sup>st</sup> study done in our region to find out the burden and characteristics of pediatric population suffering with MODS. One of the main limitations of this research was that we did not note any kind of short or long-term outcomes of MODS in affected children. Finding outcomes of MODS among pediatric population in the future studies will further enlighten us about identification of prospects for improvement in the handling and recovery plans focusing improvement of these children.

## CONCLUSION

High Frequency of MOD was observed among children admitted to PICU. Multiple organ dysfunction was found to have association with gender, residential status, obesity, maternal education and prolonged duration of PICU stay. All clinicians treating such patients should anticipate MODS in critically ill children for early diagnosis followed by proper treatment to decrease morbidity and mortality.



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**AUTHORSHIP AND CONTRIBUTION DECLARATION**

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2	Asim Khurshid	Study concept, Methodology, Supervision, Proof reading.	
3	Ayesha Fayyaz	Methodology, Literature review, Discussion.	