ASSOCIATION BETWEEN WEIGHT FOR AGE AND CLINICAL OUTCOMES IN CHILDREN UNDERGONE CARDIAC SURGERY

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ABSTRACT

Objective: To find out the frequency of underweight children with CHD and find out the association between weight for age and clinical outcomes in children undergone cardiac surgery.

Study Design: Descriptive cross sectional study.

Place and Duration of Study: Armed Forces Institute of Cardiology & National Institute of Heart Diseases Rawalpindi, from Jan 2018 to Aug 2019.

Methodology: Retrospective analysis was performed on all patients of age one month to five years undergoing cardiac surgery. A total of 575 patients satisfied the inclusion criteria for the study. Data regarding age, gender, ethnicity, height, disease, procedure, RACHS score, co morbidity was collected. Mortality was marked as the primary outcome. Secondary outcomes included length of stay, clamp time, duration of ventilation, bypass time in intensive care, ionotropic support, infection, reventilation, neurological complication, renal complication, fever, reopening, and pulmonary edema. The data was analyzed using the statistical package for social sciences version 23.

Results: Mean weight for age 14.7 percentile ± 26.8 and mean z score was 2.3 ± 2.98 whereas mean age was 27 months ± 17.8, mean weight was 10 ± 3.68. Mortality in normal weight babies (Z<−2) was 3.4%, but increased to 47% in underweight, and 49% in severely underweight patients. Significant association was seen between total ventilation time, X-Clamp time in minutes, total hospital stay in days and CPB time in minutes with weight for age Z score (WAZ score).

Conclusion: This study exhibits the effect of underweight, indicated by weight for age z score, on mortality and adverse outcomes after pediatric cardiac surgery in a wide range of patient ages. There is no data on specific nutritional interventions that will improve weight in this high-risk population but addition of a dietitian to the medical team for infants with congenital heart disease has been shown to improve weight in the first few months of life.

Keywords: Clinical outcomes, Weight for age.

INTRODUCTION

To repair the defect in Children with Congenital Heart Diseaseopen heart surgery is commonly performed. However, few studies have been conducted in developing countries discussing effects of underweight on the post-surgical outcomes in children who undergo congenital heart surgery with cardiopulmonary by pass. Polat and colleagues 1 found that a lower body mass index (BMI) affected post-operative hemodynamic status in children undergone cardiac surgery.

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Due to increased metabolic demands and reduced energy intake in children with Congenital Heart Disease there is increased risk for both acute and chronic malnutrition[2-5]. Apart from often having a normal birth weight children with CHD fail to gain height and weight because of, muscle wasting, growth retardation and reduction of subcutaneous fat[6-7]. A cohort study was conducted on hospitalized children with CHD in USA, the results demonstrated that 64% had chronic malnutrition while 33% had acute malnutrition[8]. The incidence of malnourishment may be even higher in developing countries[9]. In children with pulmonary hypertension, malnutrition is

most prevalent particularly when associated with congestive heart failure and cyanosis[7,8,10].

METHODOLGOY

Retrospective analysis was performed on patients of age one month to five years under-going cardiac surgery at Armed Forces Institute of cardiology and National Institute of Heart Disease from the initiation of data collection in January 2018 August 2019. We excluded patients with preexisting pulmonary disease, multiple congenital abnormalities, surgeries without an RACHS score, and those who died after the procedure. Surgeries within first and second class of RACHES score 11 were included in the study. 575 patients were enrolled in study after satisfying the inclusion criteria for the study.

Preoperative anthropometric indices including weight for ageand z scores was calculated for each patient using the CDC/NCHS infant weight for age percentiles and CDC weight for age percentiles for girls and boys (2-20 years). WHO recommends the use of Z (standard) score to describe weight for age. Thus, a Z score of-2, indicates weight for age which is 2 standard deviations below the reference mean and corresponds to 2.3rd percentile[12].

Z scores (in contrast to percentiles) can quantify extreme values, are gender independent, and allows comparison across age-groups and populations[12,13,14]. WHO recommends using 2 Z (2.3 percentile) scores for diagnosis of under-weight and 3 Z (0.1 percentile) for the diagnosis of severe underweight. Data regarding age, gender, ethnicity, height, disease, procedure, RACHS score, co morbidity was collected. Mortality was marked as the primary outcome. Secondary outcomes includedlength of stay, clamp time, duration of ventilation, bypass time in intensive care, ionotropic support, infection, reventilation, neurological complication, renal complication, fever, reopening, and pulmonary edema.

RESULTS

In our study males were 368 (64%) and females were 207 (36%). Weight for age

percentiles were divided into seven groups, ≤ 5 group (severely underweight and underweight group), 5.01-25.0 group (mild underweight group), 25.1-45.0 group, 45.1-55.0 group (normal weight), 55.1-75.0 (mildly overweight), 75.1-90.0 (overweight) and ≥90 (severely overweight and obese), Mean weight for age percentile was 14.7 ± 26.8. 357 (62%) children were present in underweight group i.e. ≤5 percentile group, whereas 100 (17%) were present in mildly underweight group i.e. 5.01-25.0 group. 36 (6.3%)
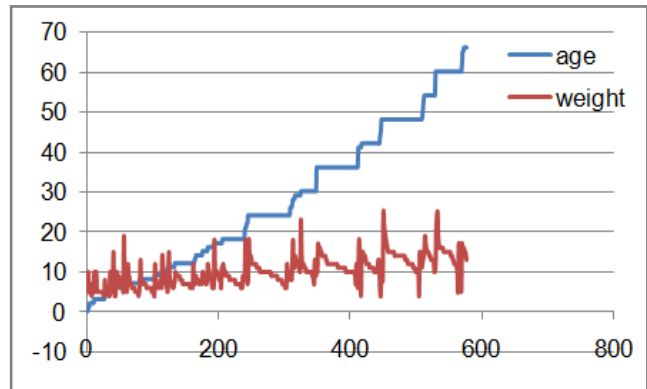
Figure-I: Relationship between z age and weight.
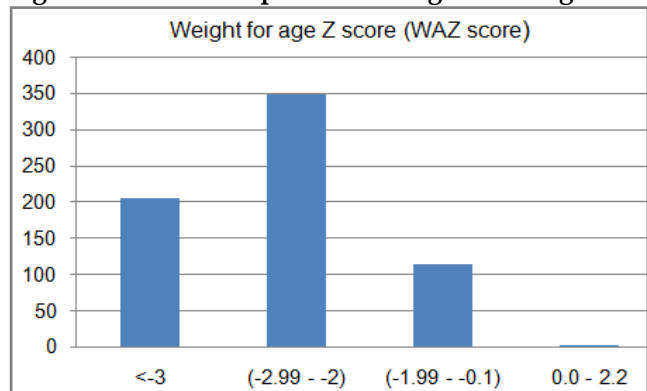
Figure-II: Z score of weight for age.

were present in severely overweight group . Mean age was 27 months ± 17.8, mean weight was 10kg ± 3.68 and mean height was 82.27cm ± 16.8. Most of the patients were Punjabi 380 (68%), Pakhtun 117 (20%) and kashmiri 38 (7%). Most of the children were operated for VSD closure 141 (25%) and total Correction-Trans annular 77 (13.4%). Patients suffering from TOF were 125 (22%) and VSD were 150 (26%).

Z score was divided into four groups and mean z score was 2.3 ± 2.98. Patients with z score

3 and less than 3 were 207 (36%), these patients were extremely underweight. Patients with z score 2.99 to 2 was 349 (61%), theses patients were moderately underweight. Patients with z score 1.99 to 0.10 were 15 (2.6%), these patients

seen between total ventilation time, X-clamp time in minutes, total hospital stay in days and CPB Time in minutes with weight for age Z score (WAZ score).

Table-I(a): Relationship between weight for age z score and outcome (n=575).

Complications	Z Score								p-value
	≤3		-2.99 to -2		-1.9 to -0.1		0-2		
	Yes	No	Yes	No	Yes	No	Yes	No	
Renal impairment	27	114	35	209	4	10	0	3	0.305
Neurological Impairment	8	133	8	231	1	13	0	3	0.6622
Reventilation	20	122	2	221	4	10	0	3	0.079
Pulmonary edema	16	126	14	2226	1	13	0	4	0.258
Infection	18	124	23	221	2	12	0	3	0.672
Low cardiac output	26	109	38	197	3	9	1	22	0.671
Redo surgery	3	199	3	342	0	15	0	4	0.965
Fever	25	117	29	217	1	13	0	4	0.288
High inotropic support	23		28		1		1		0.421
Reopening	In ITC	In OT	In ITC	In OT	In ITC	In OT	In ITC	In OT	0.640
	3	10	6	19	-	-	-	-	
Inotropic duration	>72hrs	<72hrs	>72hrs	<72hrs	>72hrs	<72hrs	>72hrs	<72hrs	0.716
	21	98	32	177	3	9	0	2	
Final oucome	Dis-charge	Ex-pired	Dis-charged	Ex-pired	Dis-charged	Ex-pired	Dis-charged	Ex-pired	0.045
	113	44	212	42	9	2	2	1	

were with normal weight to mildly underweight and patients with z score 0-2.20 were 4 (0.7%), these patients were overweight as shown in (fig-II).

In our study, 89 (21%) of patients had in-hospital mortality. Mortality in normal weight babies (Z <−2) was 1 (3.4%), but increased to 42

Table-I: (b) Relationship between weight for age score and outcome.

	Mean	p-value
Total ventilation time in hours	36.1 ± 57.9	<0.0001
X-Clamp time in minutes	76.4 ± 44.2	<0.0001
Total hospital stay in days	16.2 ± 10.3	<0.0001
CPB Time in minutes	113.5 ± 50.8	<0.0001

(47%) in underweight, and 44 (49%) in severely underweight patients. Significant association was

DISCUSSION

In our study median Z scorewas[2]. 3.94% had Z score <−2 and 36% of patients had a Z score <−3. In a rural population study, Ramachandran and Gopalan 15 median z score was 0.59 and number of underweight patients were 42.5%. Khadilkar 16 studied Z scores in urban Indian children, the median Z score was 0.59 and number of underweight patients were 8.5%. Thus compared to general Indian population, our study has lower median Z score and higher pro-portion of underweight patient. In a study of patients with CHD undergoing surgery at hospitals in India, median Z score of 2.2, 59% underweight and 27.7% severely underweight patients[17].

In our study, 21% of patients had in-hospital mortality. Mortality in normal weight babies (Z<−2) was 3.4%, but increased to 47% in underweight, and 49% in severely underweight patients. George *et al*. Concluded that 11.5% of

patients had in-hospital mortality. In normal weight babies (Z<−2) mortality was 3.2%, but increased in underweight to 9%, and 16.5% in severely underweight patients[18].

Infection in our study was present in 12% of the patients among which 42% has z score ≤-3 and 89% had ≤-2. De mello and colleagues 19 explained that children with poor nutritional status, defined as a WAZ less than-2, admitted for medical and surgical problems in intensive care unit were more likely to develop culture-positive bloodstream infections.

The adverse effects of malnutrition are depicted in various studies conducted on patients with Congenital Heart Disease. Mortality in neonates undergoing surgery for CHD and an increased duration of mechanical ventilation is associated with a low weight for age z-score. In our study total ventilation time and total hospital time increased with the decrease in WAZ score

CONCLUSION

This study exhibits the effect of under weight, indicated by weight for age z-score, on mortality and adverse outcomes after pediatric cardiac surgery in a wide range of patient ages. There are no data on specific nutritional interventions that will improve weight in this high-risk populations but additionof a dietitian to the medical team for infants with congenital heart disease has been shown to improve weight in the first few months of life[21]. Close monitoring by parents of weight gain with home scales has also been shown to lead to improved weight in patients.

CONFLICT OF INTEREST

This study has no conflict of interest to be declared by any author.

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