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A Study of Malnutrition among Chronic Liver Disease Patients

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Abstract: Malnutrition is as an important complication of chronic liver disease with prognostic implications. This study was carried out with the objectives to identify the frequency and severity of malnutrition among patients suffering from chronic liver disease and to assess relationship between malnutrition and dietary intake in these patients. A total of 231 patients (175 cirrhosis, 56 chronic hepatitis) were studied. Nutritional status was assessed by record of average daily food intake, anthropometery and serum albumin. Mean age of patients with cirrhosis and chronic hepatitis was 57 and 40 years respectively. Ninety-four percent patients had hepatitis B and/or C viral aetiology for chronic liver disease. Based on MAMC values overall 82.6% patients had mild to moderate degree of malnutrition, while 41.6% had moderate to severe malnutrition. Among patients with cirrhosis these values were 86.6% and 45.1% respectively. Corresponding values for chronic hepatitis were 69.6% and 30.3%. Record of average daily food intake showed overall daily energy intake 1102 Kcal/day. Patients with cirrhosis of liver had daily energy intake of 821 Kcal/day compared with 1980 Kcal/day for chronic hepatitis. There was statistically significant correlation (p = 0.000) between BMI and MAMC values and average daily food intake. In conclusion malnutrition is common in patients with chronic liver disease of viral aetiology and the degree of malnutrition varies according to disease severity. Careful record of average daily food intake combined with MAMC and simple laboratory parameters like serum albumin provides a reliable clinical measure of nutritional status in patients with chronic liver disease.

Key words: Malnutrition, chronic liver disease, hepatitis

INTRODUCTION

Malnutrition is frequently seen as a part of acute and chronic illness and is found in about 50% of all hospitalized adults. It is responsible for increased morbidity and mortality in both medical and surgical patients and leads to more frequent hospital admissions among the elderly. It results from combinations of various factors like starvation, abnormal assimilation of the diet, the stress response of illness, and abnormal nutrient metabolism (Halsted, 2005). Patients with chronic liver disease develop malnutrition since liver plays key role in carbohydrate, protein, lipid, vitamin and mineral metabolism. It is also the largest and most complex organ in the body and plays an essential role in many body functions (AIOU Islamabad Publications, 1998).

Malnutrition is an increasingly recognized complication of chronic liver disease and has important prognostic implications. Malnourished patients with chronic liver disease have a higher rate of complications and overall, an increased mortality (Thuluvath and Triger, 1994; Moller *et al*., 1994; Caregaro *et al*., 1996; Alberino *et al*., 2001). Malnutrition greatly affects the outcome of the patients by determining both their quality of life and their survival (Alberino *et al*., 2001; Tajika *et al*., 2002).

Malnutrition in patients with liver disease has been reported to vary from 10-100% in different studies (DiCecco *et al*., 1989; Lautz *et al*., 1992; Roongpisuthipong *et al*., 2001; Nakaya *et al*., 2002; Matos *et al*., 2002). It has been considered one of the most important prognostic factors (Gundling *et al*., 2007; Tsiaousi *et al*., 2008) and an independent risk factor of mortality in liver cirrhosis (Henkel and Buchman, 2006). In view of high prevalence and increased complications resulting from malnutrition it is important to assess the nutritional status and initiate timely intervention in patient suffering from chronic liver disease (Henkel and Buchman, 2006).

There is direct correlation between the progression of the liver disease and the severity of malnutrition (Prijatmoko *et al*., 1993; Merli *et al*., 1996). Malnutrition develops in patients with cirrhosis irrespective of etiology of the disease (McCullough and Bugianesi, 1997) and occurs with roughly equal incidence in patients with alcoholic and non-alcoholic liver disease (Thuluvath and Triger, 1994). Patients with cholestatic liver disease develop calorie depletion, whereas patients with non-cholestatic disease predominantly experience protein depletion (Zaina *et al*., 2004). Additionally, cholestatic disease is more frequently associated with a deficiency in fat-soluble vitamins (Feranchak *et al*., 2005).

Since malnourished patients with chronic liver disease have a higher rate of complications and overall, an

increased mortality a study was planned to identify the frequency and severity of malnutrition among patients suffering from chronic liver disease and to assess relationship between malnutrition and dietary intake in chronic liver disease patients. To the best of our knowledge no study of malnutrition among patients of chronic liver disease has been carried out in Pakistan and this study was useful to see extent and severity of malnutrition in chronic liver disease patients in our population and to establish correlation between malnutrition and chronic liver disease.

MATERIALS AND METHODS

It was institution based observational study and was performed on patients admitted with diagnosis of chronic liver disease and liver cirrhosis in Combined Military Hospital Kharian. Consecutive 231 patients suffering from chronic liver disease (175 cirrhosis, 56 chronic hepatitis) arising from different aetiologies and admitted in Combined Military Hospital Kharian were included. Two hundred and eight had hepatitis B and/or hepatitis C viral aetiology, 2 were alcoholic while in the remaining 21 cases the aetiology remained unknown.

The patients included serving soldiers, their families and civilian non-entitled. The study was carried out from April 2007 to July 2008. Inclusion criteria of the study were adult patients of chronic liver disease arising from all aetiologies, aged 18-65 years. Patients aged <18 and >65 years and those who were very ill with tense ascites, moribund state and having marked edema extending to the upper extremities were excluded from the study.

Study protocol: The research instruments used for conducting this study were three days diet record, anthropometric measurements, clinical evaluation and biochemical data. Patient's particulars and demographic data were recorded. Relevant information from the history like availability of food, regularity of food intake, history of surgical operations, any other associated illness, loss of weight, anorexia and pain abdomen was taken. Presence or absence of oedema, ascites and hepatic encephalopathy were noted.

The diagnosis of chronic liver disease and cirrhosis was confirmed on clinical, laboratory and ultrasonographic criteria. Liver biopsy was done to diagnose all patients with chronic hepatitis. For cirrhosis of liver, biopsy was done in only selected cases. Assessment of nutritional status was carried out as per standard procedures (AIOU Islamabad Publications, 1998; 2000a; 2000b).

Anthropometric measurements

Patient's nutritional status was evaluated by following measurements: Mid Upper Arm Circumference (MUC), Triceps Skin-old Thickness (TST), Mid Arm Muscle Circumference (MAMC). MAMC was calculated by using the equation:

Mid-upper circumference (cm) - π x triceps skin-fold thickness (mm)

Body weight in Kg and height in cm were measured at admission using accurate scales. Mid Upper Circumference (MUC) and Triceps Skin Fold Thickness (TST) were measured to the nearest millimeter at the non-dominant arm by the same operator. (Halsted, 2005; Campillo *et al*., 2003). Body Mass Index (BMI) was calculated by following formula:

$$BMI = Weight\ (Kg)/Height\ (m)^2$$

All measurements were performed with the patient in supine position. The triceps skin fold thickness was calculated as the mean of three measurements using the vernier caliper midway between the acromion and olecranon with the patient in the upright position and the arm flexed at 90^{o}.

Laboratory investigations: Serum albumin was used as biochemical parameter to asses nutritional status of the patients.

Dietary record: Food intake was retrospectively evaluated using three days dietary record data reported by the patients themselves or by the accompanying persons. The calories of food were calculated with the help of nutrition tables (Food Composition Table For Pakistan, 2001; Aslam, 2005). Consecutive three days dietary record was interviewed from the patient or from the attendant.

Statistical analysis: Statistical Package for Social Sciences (SPSS) was used to analyze data. Values of mean, median and SD for different variables were calculated. Patients presenting with diagnosis of cirrhosis were compared with those having chronic hepatitis. Crosstabs and Chi-Square test was used to compare nominal and categorical variables between these two groups while T-test was used to compare values of numerical variables. A p value of <0.05 was taken as significant. Patients with cirrhosis of liver were stratified according to Child-Pugh class and values of different variable among three Child-Pugh classes were compared using one-way ANOVA. Crosstabs and Chi-Square test was used to compare non-numerical data between Child-Pugh class A, B and C.

RESULTS

Out of a total of 231 patients, 142 (61.5%) were males and 89 (38.5%) females. Age of the patients ranged from 36-65 years. Mean ages of male and female patients were 52.4 years (SD 10.3) and 54 years (SD 7.2) respectively. One hundred seventy five patients had cirrhosis of liver while 56 had chronic hepatitis without

progression to cirrhosis. Male to female ratio was 55.4% versus 44.6% among patients with cirrhosis of liver and 80.4% versus 19.6% among patient with chronic hepatitis. Table 1, 2, 3 and 4 show patient's demographic characteristics, presenting features, anthropometric and biochemical parameters. Patients with cirrhosis were assigned three groups according to severity of disease as assessed by Child-Pugh classification, which is scored according to values of serum albumin, bilirubin, prothrombin activity, presence of ascites and encephalopathy. Out of 175 patients suffering from liver cirrhosis, cases falling in Child-Pugh class A, B and C were 60 (34%), 58 (33%) and 58 (33%) respectively. Range of values for BMI, Triceps Skin Fold Thickness (TST) and mid Arm Muscle Circumference (MAMC) were 15-31 Kg/m^2, 5-30 mm and 17-38 cm respectively. History of irregular food intake was seen in 74.3% patients with cirrhosis of liver and 17.9% with chronic hepatitis. Common symptoms seen in patients with cirrhosis of liver and chronic hepatitis were anorexia: 95.4 and 58.9%; sleeplessness: 94.3 and 58.9% and pain abdomen: 90.9 and 53.6% respectively. Thirty eight percent of the patients (50% with cirrhosis) had hepatic encephalopathy. Oedema and ascites were present in 26.3 and 33.1%; 7.1% and 5.4% respectively among patients with cirrhosis of liver and chronic hepatitis respectively.

Seventy-four (32%) patients had BMI values <18.5 Kg/m^2. Fifty percent males and 57% females had serum albumin levels <35 g/l. Triceps skin fold thickness below the normal values (12.5 mm) was seen in 97 (68.3%) males, while 6 (4.2%) had values 6 mm or less. The corresponding values in females were 74 (83.1%) and 19 (21.3%) with triceps skin fold thickness values <16.5 mm and 8 mm respectively.

Among 97 males out of 175 patients with cirrhosis 44.3% had BMI <18.5 Kg/m^2, 82.5% triceps skin fold thickness values <12.5 mm and 93.8% MAMC values <25.5 cm. In 78 females with cirrhosis 33.3% had BMI value <18.5 Kg/m^2, 87.2% triceps skin fold thickness <16.5 mm and 78.2% MAMC value <23 cm.

Among 45 males out of 56 patients with chronic hepatitis 6.7% had BMI <18.5 Kg/m^2, 37.8% triceps skin fold thickness values <12.5 mm and 77.8% MAMC values <25.5 cm. In 11 females with chronic hepatitis 18.2% had BMI value <18.5 Kg/m^2, 54.5% triceps skin fold thickness <16.5 mm and 36.4% MAMC value <23 cm.

Based on MAMC values overall 82.6% (191/231) patients had mild to moderate degree of malnutrition, while 41.6% (96/231) had moderate to severe malnutrition. Among patients suffering from cirrhosis these values were 86.6% (152/175) and 45.1% (79/175) respectively. Corresponding values for degree of malnutrition in patients of chronic hepatitis were 69.6% (39/56) and 30.3% (17/56). These findings reveal that both frequency and degree of malnutrition is more among patients with cirrhosis than chronic hepatitis.

Table 1: Demographic characteristic and presenting features of patients with chronic liver disease (chronic hepatitis and cirrhosis both inclusive, n = 231)

Characteristic		Number of cases (percentage)
Sex:		
	Male	142 (61.5%)
	Female	89 (38.5%)
Diagnosis:		
	Cirrhosis of liver	175 (75.8%)
	Chronic liver disease (Compensated)	56 (24.2%)
Socioeconomic status:		
	Low	115 (49.8%)
	Middle	82 (35.5%)
	High	34 (14.7%)
Education:		
	Illiterate	98 (42.4%)
	Primary	17 (7.4%)
	Middle	26 (11.3%)
	Secondary	57 (24.7%)
	Higher secondary	19 (8.2%)
	University	14 (6.0%)
Other co-existing disease:		
	Present	110 (47.6%)
	Not present	121 (52.4%)
History:		
	Surgical operation	42 (18.2%)
	Anorexia	200 (86.6%)
	Pain abdomen	189 (81.8%)
	Loss of sleep	198 (85.7%)
Physical examination:		
	Oedema	50 (21.6%)
	Ascites	61 (26.4%)
	Encephalopathy	88 (38.0%)

Table 2: Anthropometric and biochemical parameters in patients suffering from chronic liver disease (chronic hepatitis and cirrhosis both inclusive, n = 231)

Characteristic	Mean value (Median, SD)
Age (years)	53.0 (55, 9.29)
Disease duration (years)	6.9 (6.0, 4.2)
BMI	20.6 (20.0, 3.49)
Triceps skin fold thickness (mm)	12.0 (12.0, 4.7)
Males (n = 142)	12.3 (12.0, 4.6)
Females (n = 89)	11.9 (12.0, 4.8)
MUC (cm)	24.9 (24.0, 4.29)
MAMC	21.0 (20.5, 3.27)
Males (n = 142)	20.7 (20.0,3.16)
Females (n = 89)	21.4 (21.0, 3.41)
Average food intake (Kcal) (Based on 3 days food intake)	1102 (893, 809)
Serum albumin (g/l)	33.2 (33.0, 5.66)

Record of average daily food intake showed overall daily energy intake was 1102 Kcal/day. Patients having mild to moderate malnutrition had daily energy intake of 960 Kcal/day, those with moderate to severe malnutrition had 835 Kcal/day. Patients with cirrhosis of liver had daily energy intake of 821 Kcal/day. The values for mild to moderate and moderate to severe malnutrition among this class were 784 and 712 respectively. Similarly patients with chronic hepatitis had daily food intake of 1980 Kcal/day while corresponding values for mild to

Table 3: Anthropometric and biochemical parameters in patients suffering from cirrhosis of liver (n = 175)

Characteristic	Mean value (Median, SD)
Age (years)	57.0 (59, 6.0)
Disease duration (years)	7.9 (8.0, 4.03)
BMI	19.6 (19.0, 2.75)
Triceps skin fold thickness (mm)	11.0 (12.0, 3.9)
Males (n = 97)	10.7 (11.0, 3.2)
Females (n = 78)	11.5 (12.0, 4.6)
MUC (cm)	24.1 (24.0, 3.75)
MAMC	20.5 (20.0, 2.98)
Males (n = 97)	20.0 (20.0, 2.79)
Females (n = 78)	21.1 (21.0, 3.11)
Average food intake (Kcal) (Based on 3 days food intake)	821 (731, 393)
Serum albumin (g/l)	31.8, (32.0, 4.9)

Table 4: Anthropometric and biochemical parameters in patients suffering from chronic hepatitis (n = 56)

Characteristic	Mean value (Median, SD)
Age (years)	40.1 (38, 4.58)
Disease duration (years)	3.6
BMI	23.5 (22.0, 3.9)
Triceps skin fold thickness (mm)	16.0 (16.0, 5.2)
Males (n = 45)	15.9 (16.0, 5.1)
Females (n = 11)	15.0 (14.0, 5.6)
MUC (cm)	27.7 (28.2, 4.77)
MAMC	22.7 (22.2, 3.59)
Males (n = 45)	22.4 (22.0, 3.2)
Females (n = 11)	23.5 (24.5, 4.7)
Average food intake (Kcal) (Based on 3 days food intake)	1980 (1571, 1101)
Serum albumin (g/l)	37.8, (38.0, 5.4)

moderate and moderate to severe malnutrition cases were 1467 and 1423 Kcal/day respectively. This means that patients with chronic hepatitis had much better food intake compared with cirrhosis. Statistical analysis revealed a significant correlation ($p = 0.000$) between BMI and MAMC values and average daily food intake.

Statistical analysis of the data revealed significant differences ($p<0.05$) between cases of chronic hepatitis and cirrhosis of liver for mean values of age, duration of disease, BMI, triceps skin fold thickness, MUC, MAMC and average food intake.

Significant differences were also observed among these two groups for male to female ratio, regularity of food intake, history of jaundice, anorexia, pain abdomen, sleeplessness, oedema, ascites and encephalopathy while there was no significant difference for socioeconomic status. Comparison between Child-Pugh classes A, B and C of hepatic cirrhosis patients was done to see any significant difference among various groups. Cross tabulation and Chi-Square revealed no significant difference between various Child-Pugh classes for sex ratio, socioeconomic status, anorexia, pain abdomen, sleeplessness, oedema and ascites. Significant difference however existed between three classes for regularity of food intake, which was seen in 27/60, 10/57 and 8/58 patients in class A, B and C respectively. Significant differences were also observed among three classes for presence of encephalopathy seen in 13/60, 26/57 and 48/58 cases respectively. ANOVA test revealed significant difference among Child-Pugh class A, B and C for values of age, daily food intake, BMI, triceps skin fold thickness, MUC, MAMC and albumin. The mean values showed significant deterioration in these parameters with disease progression from Child-Pugh class A-C. Table 5 shows mean values, SD and 95% confidence interval among Child-Pugh class A, B and C patients.

DISCUSSION

Malnutrition is common among patients with chronic liver disease and can influence their short and long-term survival. The prevalence of Protein Energy Malnutrition (PEM) ranges from 10-100% in patients with liver diseases, depending on their etiology. It is particularly high in liver cirrhosis (Figueredo *et al*., 2006). Most of the data published on malnutrition among liver disease patients is on alcoholic liver disease with few studies on non-alcoholic liver disease (Roongpisuthipong *et al*., 2001). Our patients with chronic liver disease had wide range of abnormalities. These changes were more marked among patients with cirrhosis than those of chronic hepatitis B or C disease. Overall 74 cases (32%) had BMI <18.5 Kg/m^2, values among patients with cirrhosis and chronic hepatitis were 39.4 and 8.9% respectively. Serum albumin <35 g/l was seen in overall 52.8% cases, 63.4% cases of cirrhosis and 19.6% cases of chronic hepatitis. These findings indicate that protein malnutrition is relatively more common than energy malnutrition if BMI is used as a sole measurement for assessing malnutrition among patients with chronic liver disease. BMI, however is reported to be reliable if its cut-off values are raised depending upon whether the patient has no ascites, mild ascites or tense ascites. (Campillo *et al*., 2006). A study on 60 patients with cirrhosis showed BMI <18.5 Kg/m^2 but protein malnutrition was 45% in the same study population (Roongpisuthipong *et al*., 2001).

Forty-six (32.4%) males had TST thickness value <12.5mm while 74 (83.1%) females had values less than 16.5mm indicating than taken alone this parameter shows more malnutrition among females compared with males. Values of MAMC <25.5 cm were seen in 88.7% males, <23 cm in 73% females which indicate that MAMC is more reliable anthropometic parameter than TST. The corresponding TST values for males and females in patients with chronic hepatitis and cirrhosis were 37.8, 54.5, 82.5 and 87.2% respectively. This shows obvious increase in percentage malnutrition with severity of disease. Similarly MAMC values below the normal range among males and females suffering from chronic hepatitis and cirrhosis were 77.8, 36.4, 93.8 and 78.2% respectively. The MAMC values in females

Table 5: Mean values, standard deviation and 95% confidence interval of various parameters in patients with hepatic cirrhosis according to Child-Pugh Classes

						95% Confidence Interval for mean	
		N	Mean	Standard Deviation	Standard Error	Lower limit	Upper limit
Age	1	60	55.65	6.62	0.85	53.94	57.36
	2	57	58.40	5.49	0.72	56.95	59.86
	3	58	57.48	5.79	0.76	55.96	59.01
	Total	175	57.15	6.07	0.45	56.25	58.06
Duration of disease	1	60	6.95	3.82	0.49	5.96	7.93
	2	57	8.10	3.58	0.47	7.15	9.05
	3	58	8.79	4.48	0.58	7.61	9.97
	Total	175	7.93	4.03	0.30	7.33	8.53
BMI	1	60	21.11	2.93	0.37	20.36	21.87
	2	57	19.67	2.53	0.33	19.00	20.34
	3	58	18.12	1.83	0.24	17.64	18.61
	Total	175	19.65	2.75	0.20	19.24	20.06
Triceps skin fold thickness	1	60	1.27	0.40	0.05	1.17	1.37
	2	57	1.12	0.34	0.045	1.03	1.22
	3	58	0.91	0.35	0.04	0.81	1.00
	Total	175	1.10	0.39	0.02	1.04	1.16
MUC	1	60	25.48	4.04	0.52	24.43	26.52
	2	57	24.31	3.50	0.46	23.38	25.24
	3	58	22.54	3.07	0.40	21.73	23.35
	Total	175	24.12	3.75	0.28	23.56	24.68
MAMC	1	60	21.38	3.27	0.42	20.54	22.23
	2	57	20.65	2.89	0.38	19.88	21.41
	3	58	19.48	2.43	0.31	18.84	20.12
	Total	175	20.51	2.98	0.22	20.07	20.96
Average daily food intake	1	60	1072.61	486.28	62.77	946.99	1198.23
	2	57	822.00	268.39	35.54	750.78	893.21
	3	58	562.43	147.13	19.32	523.74	601.11
	Total	175	821.89	393.16	29.72	763.23	880.55
Serum Albumin	1	60	34.55	5.00	0.64	33.25	35.84
	2	57	31.57	4.15	0.55	30.47	32.68
	3	58	29.25	4.18	0.54	28.15	30.35
	Total	175	31.82	4.95	0.37	31.08	32.56

with chronic liver disease show low level of malnutrition among this category of patients but since there were only 11 patients in this category the percentage values do not reflect the degree of malnutrition. Values of BMI are reported to be overestimated in cirrhotic patients due to fluid retention (Roongpisuthipong *et al*., 2001) and this has been claimed to be a disadvantage for using BMI to estimate malnutrition. Though we excluded all patients who had marked oedema extending to upper extremities our values of BMI show overall 32% cases had BMI less than the lower limit while if we take the value of MAMC 82.6% show values below normal range for sex. Similarly TST values below the normal values for sex were seen in 74% patients. This further substantiates the fact the assessment of malnutrition among patients with chronic liver disease cannot be done by using BMI alone. Similarly if we take values of serum albumin, 52.8% had values less than 35 g/dl again suggesting that BMI underestimates degree of malnutrition among this category of patients. The reason why values of albumin suggest lesser degree of protein malnutrition than determined by MAMC or TST is that liver has a large reserve and unless most of it is damaged, the synthesis of albumin is not impared markedly. If we use value of albumin among patients who had cirrhosis of liver (n = 175), 63.4% had values < 35 g/l indicating that serum albumin is a reliable indicator of malnutrition in cirrhosis of liver.

Overall average daily caloric intake based on three days record was 1102 Kcal. The value in patients with chronic hepatitis and cirrhosis were 1980 Kcal and 821 Kcal respectively. This indicates that the patients of chronic hepatitis had relatively better food intake compared with cirrhosis. Chronic liver disease without cirrhosis is not usually associated with protein-energy malnutrition, but vitamin and mineral deficiencies are reported to be common, especially with significant cholestasis (Teran, 1999). Malnutrition is reported to be a common finding in liver cirrhosis and protein energy malnutrition may be present in 20% of patients with well-compensated disease and in more than 60% of patients with severe liver insufficiency (Campillo *et al*., 2003). In a study on impact of malnutrition and nutrition practice in 396 patients with liver cirrhosis impaired nutritional status

was seen in 49% cases with ascites indicating that hospitalized cirrhotic patients have high prevalence of malnutrition. Decrease in caloric intake was independent risk factor for short-term mortality. Enteral nutrition after failure of oral supplementation had no clinical benefit and early tube feeding was recommended (Campillo *et al*., 2003). Various studies have reported that prevalence of malnutrition among non-alcoholic cirrhosis is less compared with alcoholic liver disease (Morgan *et al*., 1976) but the observation in our study shows that it may be equally common in non-alcoholics. Similar observations have been reported in other studies also (Thuluvath and Triger, 1994). In a study on 77 alcohol related cirrhosis and 43 virus related cirrhosis 34% showed malnutrition and there was no difference between alcoholic versus non-alcoholic group (Caregaro *et al*., 1996). Sarin *et al*. have reported similar results while comparing alcoholic liver disease, non-alcoholic liver disease and chronic alcoholics without liver disease (Sarin *et al*., 1997). Above studies indicate that malnutrition depends upon degree of liver injury than its aetiology. Body fat is reported to be more affected in non-alcoholic cirrhosis while muscle mass is more affected in alcoholic cirrhosis (Narayanan *et al*., 1999).

The frequency of malnutrition among patients with chronic liver disease in our study was found to be 82.6% although majority of them had mild to moderate degree of malnutrition. The values for patients suffering from chronic hepatitis and cirrhosis of liver were 69.6% and 86.8% respectively.

Inadequate food intake resulting from anorexia was important factor contributing to malnutrition in our patients. There was significant association ($p<0.05$) between nutritional status and Child-Pugh stage of the hepatic cirrhosis. Class C patients showed significantly lower mean values of BMI, TST, MAMC, serum albumin, average daily food intake and prolongation of prothrombin time. This is obvious from the fact than Child-Pugh class C shows progression of the disease, which adversely affects these parameters.

Fifty percent of the patients with cirrhosis had features of encephalopathy in our study. Patients with cirrhosis are prone to develop cognitive dysfunction like hepatic encephalopathy. In these patients skeletal muscle plays an important role in the temporary detoxification of ammonia to glutamine. A study has reported that patients of chronic liver disease with malnutrition have more hepatic encephalopathy than those without malnutrition. (Kalaitzakis *et al*., 2007).

Sixty two percent of our patients were male compared with 38% females. Reason for this sex difference is probably not increased prevalence of chronic liver disease among male population rather it was due to increased number of soldiers among the study population since the hospital looks after mostly active and retired service personnel. Half of our patients belonged to low socioeconomic class, which obviously reflects the overall majority in our general population. In addition this group is also likely to be more exposed to risk factors for acquiring chronic hepatitis B and C infections which is the leading cause of chronic liver disease in our population. Similarly 42% patients were illiterate and their illiteracy coupled with poverty may become an important factor contributing towards increased exposure to un-necessary parenteral injections. A large number of patients (47.6%) had some co-existing disease like diabetes mellitus, hypertension and ischaemic heart disease which otherwise are prevalent in this age group. Anorexia and pain abdomen were major presenting symptoms seen in >80% cases. This along with anorexia was probably an important contributory factor for malnutrition in our patients.

Mean age of our patients was 53 years the corresponding values for chronic hepatitis and cirrhosis were 40 and 57 years respectively. This reflects the natural history of hepatitis B and C viral infections, which progresses to cirrhosis over 10-15 years.

Mean values of serum albumin were within normal limits in patients with chronic hepatitis, which indicate these patients, have relatively preserved liver function. The corresponding values were deranged in large proportion of patients with cirrhosis indicating hepatic failure. The difference for values of albumin between these two groups was statistically significant. The values also revealed significant differences ($p<0.05$) among Child-Pugh class A, B and C with marked deterioration of the parameters in class C compared with Class A and B.

Conclusion: This study revealed that malnutrition was common in patients with chronic liver disease of viral aetiology and the degree of malnutrition varies according to disease severity. The nutritional parameters showed significant deterioration with the disease progression from chronic hepatitis to cirrhosis. BMI tends to underestimate the degree of malnutrition in these patients. Careful record of average daily food intake combined with MAMC and simple laboratory parameters like serum albumin provides a reliable clinical measure of nutritional status in patients with chronic liver disease.

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