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Assessment of Nutritional Status of Postoperative Patients with Biliary Atresia

Chizuko Shiga[1], Ryoji Ohi[1], Toshio Chiba[1], Masaki Nio[1], Naobumi Endo[1], Setsuko Mito[2] and Miyoko Hino[2]

[1]*Department of Pediatric Surgery and* [2]*Division of Nutrition, Tohoku University School of Medicine, Sendai 980-77*

Shiga, C., Ohi, R., Chiba, T., Nio, M., Endo, N., Mito, S. and Hino, M. *Assessment of Nutritional Status of Postoperative Patients with Biliary Atresia.* Tohoku J. Exp. Med., 1997, **181** (1), 217-223 —— Some patients of biliary atresia (BA) suffer from chronic hepatic dysfunction and/or persistent jaundice. The adverse effects of chronic liver disease on nutrition and growth should be considered on BA patients. We studied 45 BA patients ranging in age from 0.5 to 38 years and divided them into 2 groups. Group A contains the patients whose total bilirubin $\geqq 2$ mg/100 ml, and Group B contains the patients whose total bilirubin <2 mg/100 ml. We measured height, weight, triceps skin fold (TSF), midarm circumference (MAC) and midarm muscle area (MAMA). Visceral protein kinetics was evaluated on the basis of serum albumin and prealbumin levels. Caloric and protein intake was calculated by collecting intake data for 3 days. The results of this study were; 1) The mean TSF in Group A (47th percentile) was not significantly different from that in Group B (53th percentile). 2) The mean MAMA was significantly lower ($p<0.01$) in Group A (16.4th percentile) than in Group B (36.7th percentile) 3) The prealbumin level was significantly lower ($p<0.001$) in Group A (mean 9.9 mg/100 ml) than in Group B (mean18.8 mg/100 ml). The authors conclude that the evaluation of MAMA and prealbumin were very useful to characterize the low metabolic status of protein in the damaged liver. And repeated nutritional assessment was necessary to evaluate liver function and provide adequate nutrition in BA patients. —— nutritional assessment; biliary atresia; liver function

Some patients of biliary atresia are suffering from chronic hepatic dysfunction and persistent jaundice (Roberta et Frederick 1990). The adverse effects of chronic liver disease on nutrition and growth should be considered on BA patients (Sokol and Stall 1990). On some patients who are considered as potentially candidates for liver transplantation, malnutrition will influence their morbidity

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Address for reprints: Ryoji Ohi, M.D., Department of Pediatric Surgery, Tohoku University School of Medicine, 1-1 Seiryomachi, Aoba-ku, Sendai 980-77, Japan.

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and mortality (Lautz et al. 1992). In these patients malnutrition would manifest liver failure as well as the clinical finding, e.g. coagulopathy, encephalopathy and portal hypertension. Consequently nutritional assessment is thought to be very important in BA patients. The purpose of this study is to present detailed data on the nutritional assessment in BA patients following Kasai's operation. And we evaluated malnutrition in BA patients related to hepatic dysfunction.

Patients and Methods

Patients. The nutritional assessment was performed in 49 patients with BA (Table 1). They were medicated to Tohoku University Hospital between June 1990 to April 1996. The 24 patients are male and the 25 patients are female. Mean age of the patients is 9 years old and ranged from 0.5 to 38 years old.

We separate the patients into the two groups presented in Table 2. Group A contains clinically icteric patients whose serum bilirubin is over 2 mg/100 ml. Group B contains clinically jaundice-free patients whose serum bilirubin is less than 2 mg/100 ml.

Assessment of nutritional status. Nutritional assessment was performed 70 times in total. We measured and calculated Height, Weight, Height for Age (H/A), Weight for Age (W/A), Weight for Height (W/H). These data were evaluated in percentile according to Japanese Health and Nutrition Examination Survey of 1990.

Anthropometric measurements were performed by the same skilled investigator. Triceps skin hold (TSF) were measured with Herpenden skinfold caliper (British Indicators Ltd., Liverpool, UK). Midarm muscle area (MAMA) were calculated with midarm muscle circumference (MAC) and TSF[MAMA(mm^2)= (MAC-πTAF)2/4π]. These measurements evaluated in percentile matched reference data (Frisancho 1981; Sann 1988).

The visceral protein status is evaluated by serum albumin and prealbumin level.

Energy and Protein intakes was calculated by collecting intakes over 3 days

Table 1. *Clinical features of 49 patients following Kasai's operation for biliary atresia*

Age (year)	9.0 (range 0.5-38 years)
Sex (M/F)	24/25

Table 2. *The classification of 49 biliary atresia patients*

Group A	Serum bilirubin $\geqq$ 2.0 mg/100 ml	$n=25$[a]
Group B	Serum bilirubin $<$ 2.0 mg/100 ml	$n=49$[a]

[a]frequency of the nutritional assessment.

recorded by nutritionist and related to recommended daily intakes for age and sex.

Statistical analysis. All data are means±S.D. The Mann-Whitney's U-test was used for comparison of the different groups considering $p<0.05$ as significant. The regression analysis curve was made with StatView system using a personal computer (Macintosh).

Results

Table 3 indicates height and weight of the BA patients. Height lower than 50 percentile and 15 percentile are appeared in 63% and 30% of all patients examined. Height lower than 50 percentile and 15 percentile are appeared in 73% and 54% of patients in Group A. There is a tendency that on the patients in Group A the growth is suppressed.

Height for Age and Weight for Height are used as indicators of chronic and acute malnutrition, respectively. In Table 4, H/A, W/A and W/H were evaluated. Each data of Table 4 shows the mean value with standard deviation.

There is the tendency that the patients in Group A are stunted because of low H/A and W/H level. On the other hand, the patients in Group B are seemed to grow normal.

Fig. 1 shows the mean±S.D. of TSF and MAMA in BA patients. And Fig. 2a and 2b showed the histogram of TSF and MAMA of BA patients, respectively. Energy malnutrition, indicated by low TSF in most BA patients was variant. Protein malnutrition, indicated by low MAMA, is significantly pronounced in the patients of Group A compared with the patients of Group B.

The nutritional status of visceral protein is evaluated by serum albumin and prealbumin level. The albumin and prealbumin level is significantly lower in the patients of Group A than of Group B as showed in Table 5. Mean serum albumin

Table 3. *Distribution of growth of biliary atresia patients*

	Group A	All
Height under 50 percentile	16/22 (73%)	44/69 (63%)
15 percentile	12/22 (55%)	22/69 (32%)
Weight under 50 percentile	20/22 (91%)	38/70 (54%)
15 percentile	11/22 (50%)	20/70 (29%)

Table 4. *Height for age, weight for age and weight for height of biliary atresia patients*

	H/A	W/A	W/H
Total	97.3±4.2	95.5±17.5	99.6±14
Group A	95.2±4.2	87.3±16	93.3±12
Group B	98.3±5.8	100±16	102±10

All data are given as mean (percentile)±S.D.

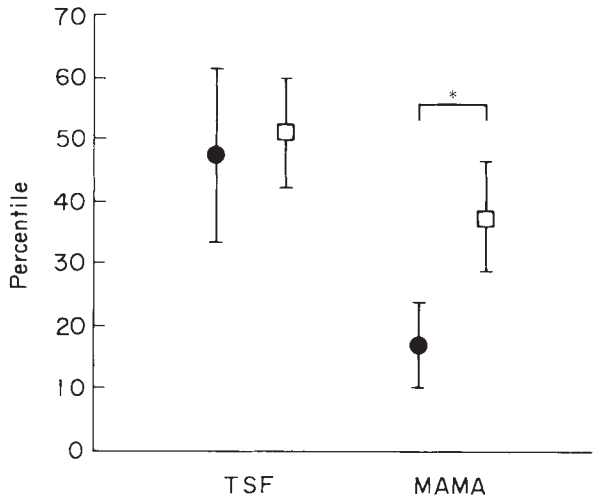

Fig. 1. Mean±S.D. of TSF and MAMA in BA patients of Group A (●) and Group B (□). *Significant $p<0.001$. The axis of ordinates shows percentile.

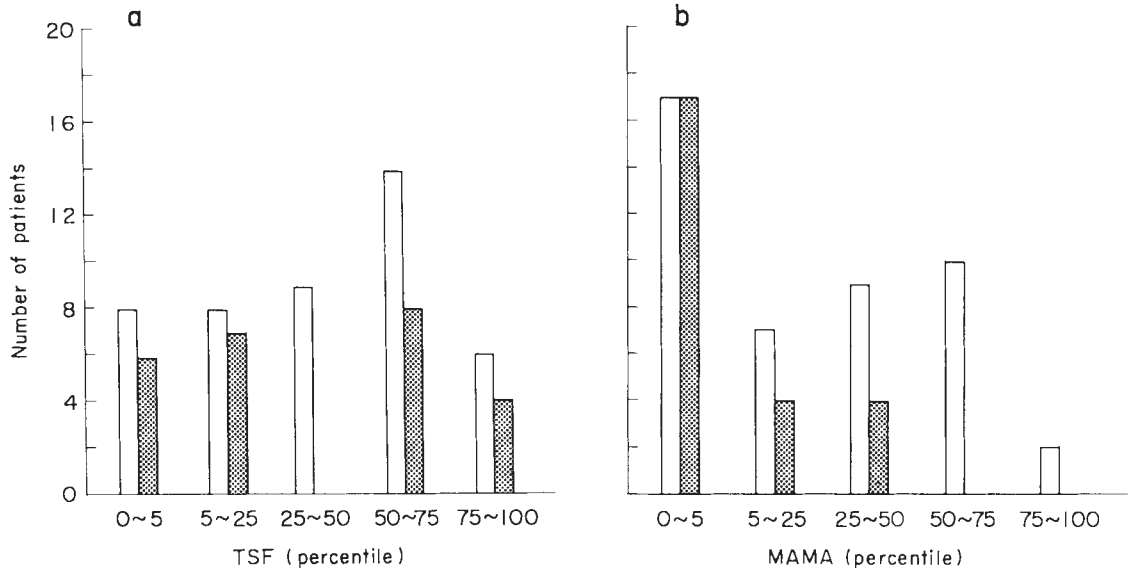

Fig. 2. a) Histogram of TSF in BA patients. Group A (▨); Group B (□).
b) Histogram of MAMA in BA patients. Group A (▨); Group B (□).

and prealbumin level of the patients in Group A are 3.14 and 9.9 mg/100 ml respectively.

Fig. 3 shows Energy or protein intake ratio. The average was calculated after collecting food intake data for 3 days and compared with recommended daily intake. The mean energy and protein intake in BA patients are 84% and 93% of recommended daily intake, respectively. This data indicated that the nutritional therapy must be needed in all BA patients.

Fig. 4 shows the relation between serum prealbumin level and protein intake ratio. In the patients of Group A whose prealbumin level is under the normal range, the increase of protein intake doesn't increase the prealbumin level. We suggest that low prealbumin level indicates the poor metabolic status of protein

TABLE 5. *Mid-arm muscle area and visceral protein status of biliary atresia patients*

	Group A	Group B	*p*Value
MAMA	16.4±3.3	36.7±4.5	0.003
Albumin	3.14±0.55	3.8±0.77	0.007
Prealbumin	9.9±6.0	18.8±8.3	0.0004

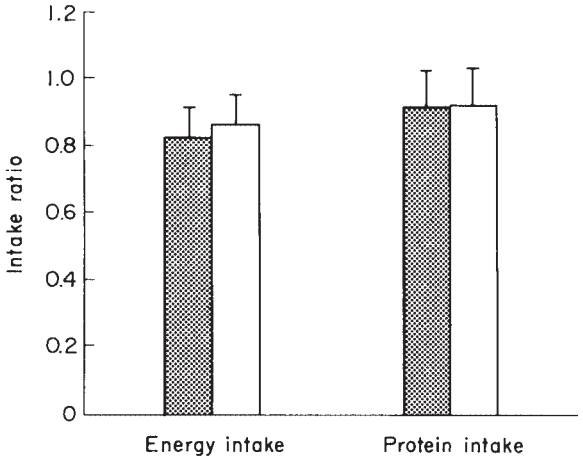

Fig. 3. Energy and protein intake data of BA patients.
The intake ratio was calculated to divide the intake of energy or protein by the recommended daily intake.
Group A (▨); Group B (□).

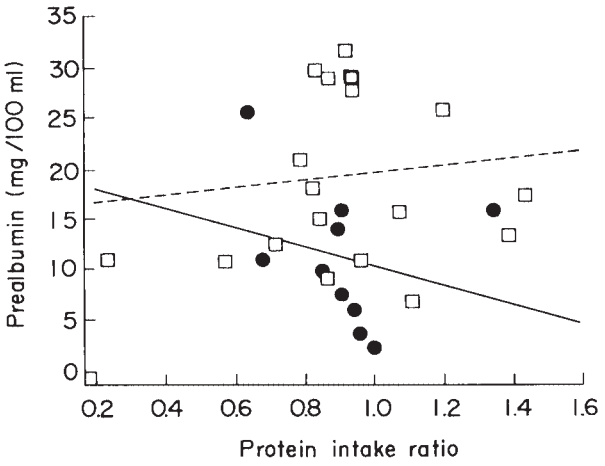

Fig. 4. Relation between serum prealbumin level and protein intake.
The protein intake ratio was calculated to divide the protein intake by the recommended daily intake.
Group A=(●) and (—; $Y=19.811-9.427X$, $R^2=.069$); Group B=(□) and (---; $Y=15.943+3.655X$, $R^2=.014$).

in the damaged liver.

Discussion

In our research, malnutrition with significant growth failure was commonly found in BA patients. Especially, protein malnutrition indicated by low MAMA values, and low serum levels of albumin and prealbumin was striking in Group A, jaundiced patients. In the literature, compromised nutrition is also a common association in patients with BA as well as with other end-stage liver disease (Shepherd et al. 1991; Chin et al. 1992). It is well known that several factors are predisposing to protein-calorie malnutrition in patients with advanced liver dysfunction: 1. decreases in oral intake due to anorexia, 2. malabsorption due to diminished bile excretion, 3. metabolic disturbances of hepatocytes, and 4. portal-systemic shunting associated with cirrhotic changes of the liver, although it is difficult to define which cause is predominantly responsible in each patients. Reduced intakes of energy and protein documented by diet history taking seemed to explain our results partly, but it was also noted that an increase in protein intake did not lead to a rise in serum prealbumin levels in our patients.

Our results also showed that a combination of non-invasive, and non-sophisticated examinations i.e. anthropometry, diet history taking, and ordinary biochemical tests including serum prealbumin was quite useful in pediatric patients. As an anthropometric evaluation suggests only somatic skeletal protein status, assessments of rapid turnover protein synthesis were required for comprehensive investigations including visceral protein status. Of several well-known rapid turnover proteins, we picked out prealbumin for assessing these patients because we believe prealbumin is the best choice in terms of its biological half-life.

One of the goals of nutritional work-up and therapy is to achieve a nutritional replenishment along with prevention of clinical manifestation of hepatic coma in patients scheduled to undergo liver Tx (Akerman et al.1993), because it has been emphasized that the preoperative malnutrition is the most important manageable factor to minimize postoperative mortality and morbidity in children waiting for liver transplantation.

In pediatric patients with underlying advanced liver disease, our research revealed accompanying nutritional problems hard to manage even with increased oral intake. To our knowledge, there are some controversies on how to correct those nutritional deficiencies, and the most annoying problem to be answered is the choice of appropriate planning for nutritional support (Plevak et al. 1994).

Further investigation is required to establish more organized strategy of nutritional management based on full understanding of metabolic disorder in the liver disease.

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