Subcutaneous Fat in Liver Cirrhosis

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Abstract: We have studied the degree of disturbance of fat metabolism represented by the thickness of subcutaneous fat and the degree of liver impairment according to Child Pugh's grading. The mean (+_SD) subcutaneous normal fat in the control, Child A, Child B, and Child C were 16,05+- 0.43;14.25+- 0.21; 11,06 +- 0.51 and 8.18 +- 0.42 respectively. The mean subcutaneous fat was significantly affected especially in patients classified as Child C (P < 0.0001).Same finding was found in considering serum albumin and serum bilirubin. The decreased subcutaneous fat statistically was significantly correlated with elevated serum bilirubin especially in patient classified as Child C and B, (P < 0.0001). This study concludes that the ultrasonographic measurement of subcutaneous fat thickness is a sensitive, reliable and valid method of evaluating the nutritional status and detecting wasting of adipose tissue which occurs in severe liver cirrhosis.

Introduction:

Intermediary metabolism may be profoundly disturbed in liver cirrhosis. Carbohydrate metabolism is disturbed in the form of glucose intolerance and insulin resistance. Both fat mobilization and lipolysis are greater in the fasting state in cirrhosis than in normal subjects. Decrease in protein synthesis with distortion of amino acid metabolism and abnormal carbohydrate storage and release (1).

Accurate measurements of body composition are essential for evaluating nutritional status. The use of hi-technology machinery including computed tomography, total body electrical conductivity, photon absorptiometry, magnetic resonance imaging and infrared interactance is highly innovative but, like hydrostatic weighing, is still restricted to laboratory and clinical use. (2).

A more practical method for both field survey and routine clinical assessment is the measurement of subcutaneous fat thickness (3).

Estimation of body fatness from the thickness of subcutaneous adipose tissue layer has been made by a number of different investigators .The techniques for determining the subcutaneous fatness involve the widely used measurement of skin fold thickness by caliper and soft tissue roentgenogram. A third technique, the use of ultrasound to measure fatness appears to hold some promise in overcoming the limitations of the other techniques mentioned (4).

The finding from a study from Fanelli et Alm, 1984 (3) suggests that the caliper and ultrasonic techniques are equally effective in predicting body density and hence, total body fat of lean men. In addition to its ability to assess subcutaneous fat tissue, the ultrasonic method permits direct measurements of muscle tissue. Furthermore, permanent records of underlying fat and muscle thickness can be obtained with ultrasonic scanners equipped with camera attachments

The ability to monitor and document changes in fat and muscle tissue would enable clinicians to assess, and then if necessary, modify diet and nutritional support of patients (3).

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Aim of Work:

The aim of this work is to study the effect of profoundly disturbed fat metabolism, in patients with liver cirrhosis, on subcutaneous fat thickness. Correlations will be studied between the degree of liver cirrhosis, according to Child's classification and the subcutaneous fat thickness at the waist.

Material and Methods:

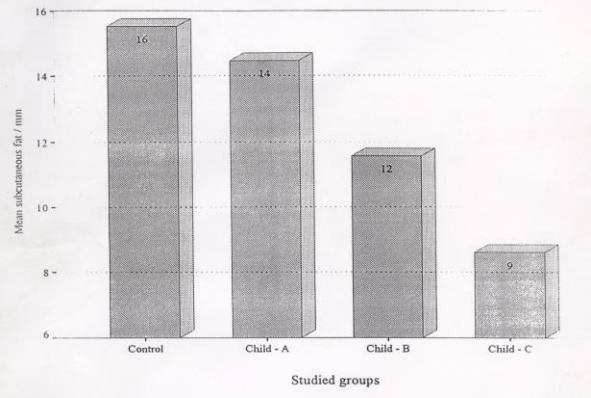
30 patients with liver cirrhosis were chosen ranging from 11 to 20 years old. The patients will be classified according to Child's classification each group will include 10 patients. A control group including 10 average weight subjects was studied. For each patient the following was done: -

*Full medical history and clinical examination.
*Routine laboratory investigations as well as liver function tests and full lipid profile.
*Ultrasonographic measurement of subcutaneous fat at the waist, amid point between the last rib and the iliac crest in the mid-axillary line using linear Transducer 7.5 MHz Siemens apparatus.

Results: -

Table (1):- Present the mean +- S.D. of serum bilirubin ,serum albumin and subcutaneous fat among the different Pugh classification of liver diseases together with the normal control, and triglyceride, liver size and prothrombin time for the 3 grades of liver disease .

Table (2):- Present the correlation coefficient" between serum bilirubin, serum albumin, subcutaneous fat and cholesterol in parameter in different studied groups where subcutaneous fat in correlation with cholesterol in Group B and with Triglyceride in Group A



Discussion:

Liver cirrhosis is a major medical problem in Egypt. Malnutrition accompanies liver cirrhosis. Alterations in the nutritional state may result from changes in energy intake, intestinal assimilation of nutrients, energy expenditure, metabolic efficiency and storage of nutrients (3).

The potential for hepatic regeneration and the increasing tendency for liver transplantation have made nutritional support in patients with liver failure very important (6). Therefore an early and detailed nutritional assessment is mandatory in all patients with liver cirrhosis (5). Accurate measurements of body composition are essential for evaluating nutritional status. Simply, the body composition is divided into fatness and fat free (lean) body mass (7)

Body fat can be estimated by complex laboratory methods e.g. CT, bioelectrical impedance, photon absorptiometry magnetic resonance imaging and infrared interactance (2).

Amore practical method for both field surveys and routine clinical assessment is the measurement of subcutaneous fat (3). The most widely used methods of estimation of the subcutaneous fat thickness are skin fold caliper and ultrasound (3). The skin fold caliper suffers from many known limitations.

Kuczmarski (2) reported a major advantage of ultrasound over caliper because there is no or little compression of ultrasound. Furthermore, US are more portable and less invasive than either radiation or high technology methods.

This study was done on 40 subjects, 10 healthy and 30 cirrhotic patients.

The patients were divided according to Pugh's modification of Child-Turcotte grading into 3 groups, A, B, C, reflecting the degree of liver impairment .Child and Turcotte, introduced a system of grading to assess the risk of surgery in patients with liver disease, it was based on five variables, serum albumin concentrations, serum bilirubin concentrations, presence and severity of ascites, presence and severity of encephalopathy, and the state of nutrition.

Pugh and his colleagues (8) published a modification of Child's grading. Prolongation of prothrombin time was added too and nutritional assessment omitted from the grading of Child.Subcutaneous fat thickness proved to have a statistically significant correlation with albumin concentration, and S. bilirubin. Subcutaneous fat thickness was significantly lower in group C, than in group B, A, and the control group.

This is in agreement with Merli (9). He found that distribution of triceps skin fold and arm muscle circumference was below the median, and in most patients, was below the Cutoff points of malnutrition. Also Lolli (10) . In study assessing the nutritional status of patients with liver cirrhosis in Italian population anthropometrically, concluded that, 5-45% of males and 10-30% of females with cirrhosis had signs of malnutrition. He found that male patients showed a larger reduction in muscle mass (30-45% of patients mainly in the presence of moderate to severe liver failure) whereas females showed a more remarkable reduction in fat stores (15-30% of cases) with advancing liver failure ,and less severe reduction in muscle mass .

Leutz (5) had studied protein energy malnutrition in liver cirrhosis, he concluded that at clinical presentation, malnutrition was not correlated with the histological and biochemical parameters of liver cirrhosis and can occur at all stages of the disease.

The liver volume was not correlated with liver function it had no correlation with serum albumin concentration or with prothrombin time .Also, no correlation had been found between liver volume and subcutaneous fat. The explanation for this is that the liver volume has a wide range of measure Went in normal subjects.

Furthermore the relatively statistically small number of patients in each group (10 patients) affects the statistical analysis limiting significant results. Thus the absolute measure of liver volume as an indication of fibrosis process in cirrhosis is not correlated with the degree of liver impairment according to Child grading nor correlated with subcutaneous fat.

It is probably that follow up of liver volume of the same patient for decrease of volume is the best and the valid indication of liver cirrhosis rather than absolute measurement at a time.

Cirrhosis may disturb fasting glucose and fat metabolism both directly and indirectly changes, namely decreased glucose and triglyceride production, are the consequences of defective liver function and/or Porto –systemic shunting (11). Indirect effects of cirrhosis include increased lipolysis resulting increased free fatty acid (FFA) or (NEFA non esterified fatty acids) concentration and fat oxidation whereas glucose oxidation is clearly decreased resulting in the loss of adipose tissue and wasting in subcutaneous fat observed in cirrhotic patients (12) .

Day et al.,(13) have found decreased level of LDL in cirrhotic patients with low LCAT activity and normal LDL level in patients with normal or high LCAT activity.

Table (1): S.bilirubin,S.Albumin and Sub C. Fat were significantly different between the studied groups,where S. bilirubin,was highly increased and the reverse was true in S.Albumin and Sub C.Fat.

Group	S.Bilirubin		S.Albumin		S.C.Fat		Cholesterol		Triglyceride		Liver Size		Proth.Time	
	Mean	S.D.	Mean	S.D.	Mean	S.D.	Mean	S.D.	Mean	S.D.	Mean	S.D.	Mean	S.D.
Control	0.8100	0.1912	4.8400	0.2675	16.0500	0.4303	-	-	-	-	-	-	-	-
Group A	1.7000	0.3266	4.1700	0.3561	14.2560	0.2121	233.5000	46.1346	162.0	23.50	13.2600	1.0069	64.8000	15.9430
Group B	2.6000	0.1764	3.2300	0.1703	11.0600	0.5125	250.5000	41.7965	172.0	22.26	13.400	0.9189	67.1000	13.7635
Group C	3.9400	0.3864	2.2900	0.4630	8.1800	0.4211	265.0000	31.7105	175.50	23.027	13.5200	0.5371	63.0000	10.1456
Significance	P < 0.001		P < 0.001		P < 0.001		P > 0.05		P > 0.05		P > 0.05		P > 0.05	

Table (2): Correlation matrix showing some significant correlation between the studied parameter in different sub groups.

	Cholesterol	Triglyceride	Proth.Time	Sub C. Fat
	Group B	Group A	Group A	All Groups
S.Bilirubin		r =0.8188 n =10 P < 0.004	r =-0.7295 n =10 P < 0.010	r =-0.9165 n = 30 P < 0.000
S.Albumin				r =0.9133 n=30 P=0.000
Sub C.Fat	R=-0.6759 N=10 P < 0.002	R=0.7140 N=10 P < 0.020		

In our study we found significant correlation between fasting level of triglyceride and the subcutaneous fat thickness in group A, Also between subcutaneous fat thickness and cholesterol in group B.

Stefanini et al, (14) have found that the intensity in the decrease of total plasma cholesterol was associated with the degree of malnutrition in cirrhotic patients. McIntyre (15) has found that in patients with severe liver cirrhosis the fasting plasma VLDL concentration is low, probably because the production of VLDL of hepatic origin is impaired; the total plasma triglyceride remains relatively normal because LDL in such patients is triglyceride rich.

Conclusion and Recommendations:

In this study we conclude that the ultrasonographic measurement of subcutaneous fat thickness is a sensitive and reliable valid method for evaluating nutritional status and detecting wasting of adipose tissue which occurs in severe liver cirrhosis and these measurements are correlated well with the degree of liver impairment according to Pugh's modification of Child-Turcotte grading which proved to be a useful reliable and valid prognostic tool in patients with liver cirrhosis.

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