RESULTS

This study is a trial to detect NO production and levels in children with liver cirrhosis and their relation to endotoxin levels compared with a healthy control group.

Thirty children patients with liver cirrhosis were selected and stratified into three groups (A, B and C groups) according to modification of Child's scoring system. Group A was 6 cases, group B was 18 cases and group C was 6 cases.

Fifteen normal healthy children were included in the study as controls.

Age of patients varied in the forty five subjects from 2.5 months to 12 years. Results are shown in table 1 and figure 1.

Sex incidence in all groups is shown in table 2 and figure 2.

Table (1): Age incidence in the four groups of our study

	Mean ± SD	Range
Control	6.8 ± 3.379	1 y - 11 years
Group A	4.167 ± 1.571	2 1/2 y - 6 years
Group B	6.417 ± 3.869	2 1/2 m. - 12 ys.
Group C	10.167 ± 1.571	8 1/2 y - 12 years

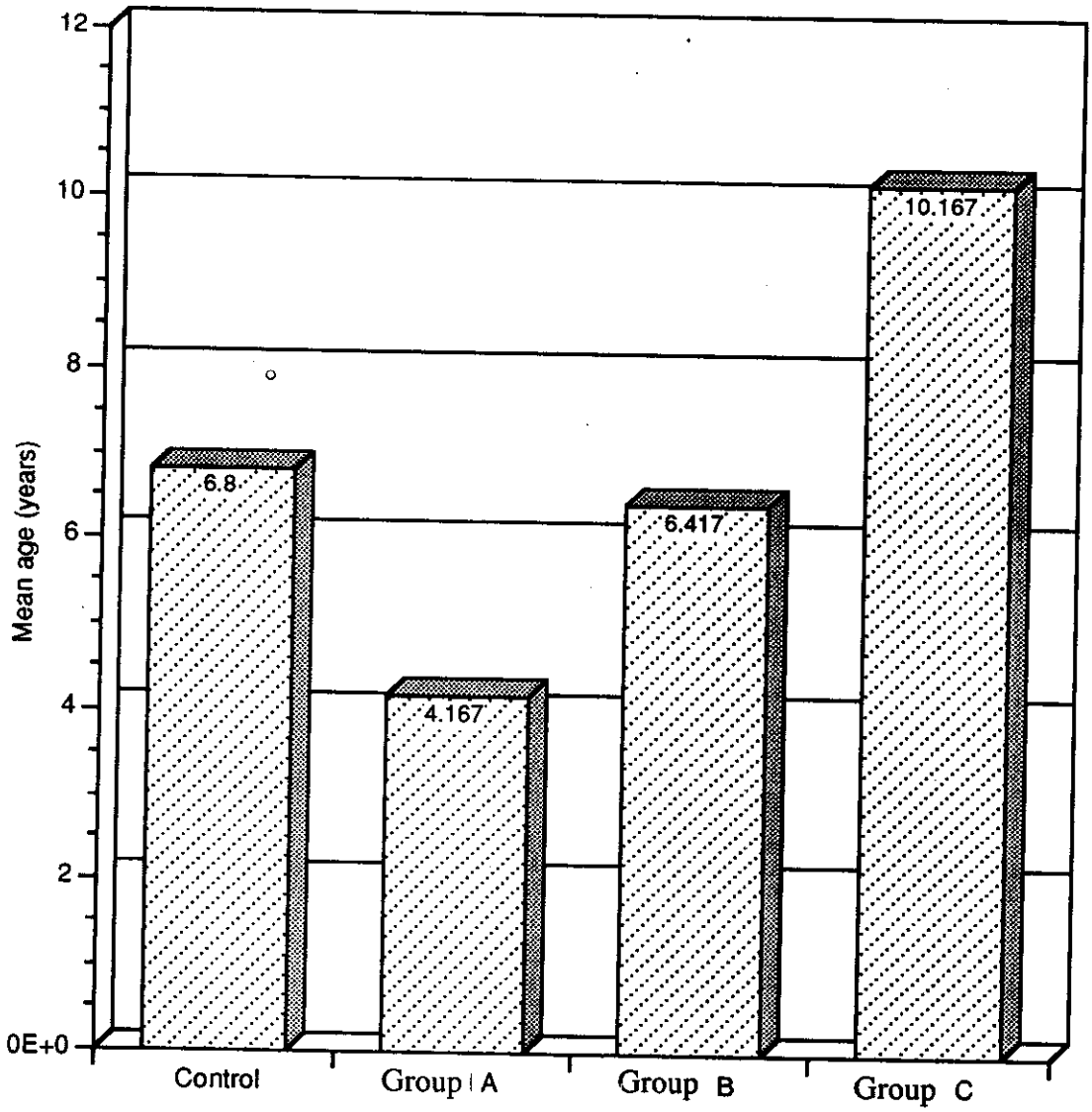


Fig. (1): Age incidence in the four groups of study

Table (2): Male and female incidence in our study

	Male		Female	
	No.	%	No.	%
Control	9	60	6	40
Group A	4	66.67	2	33.33
Group B	10	55.56	8	44.44
Group C	4	66.67	2	33.33

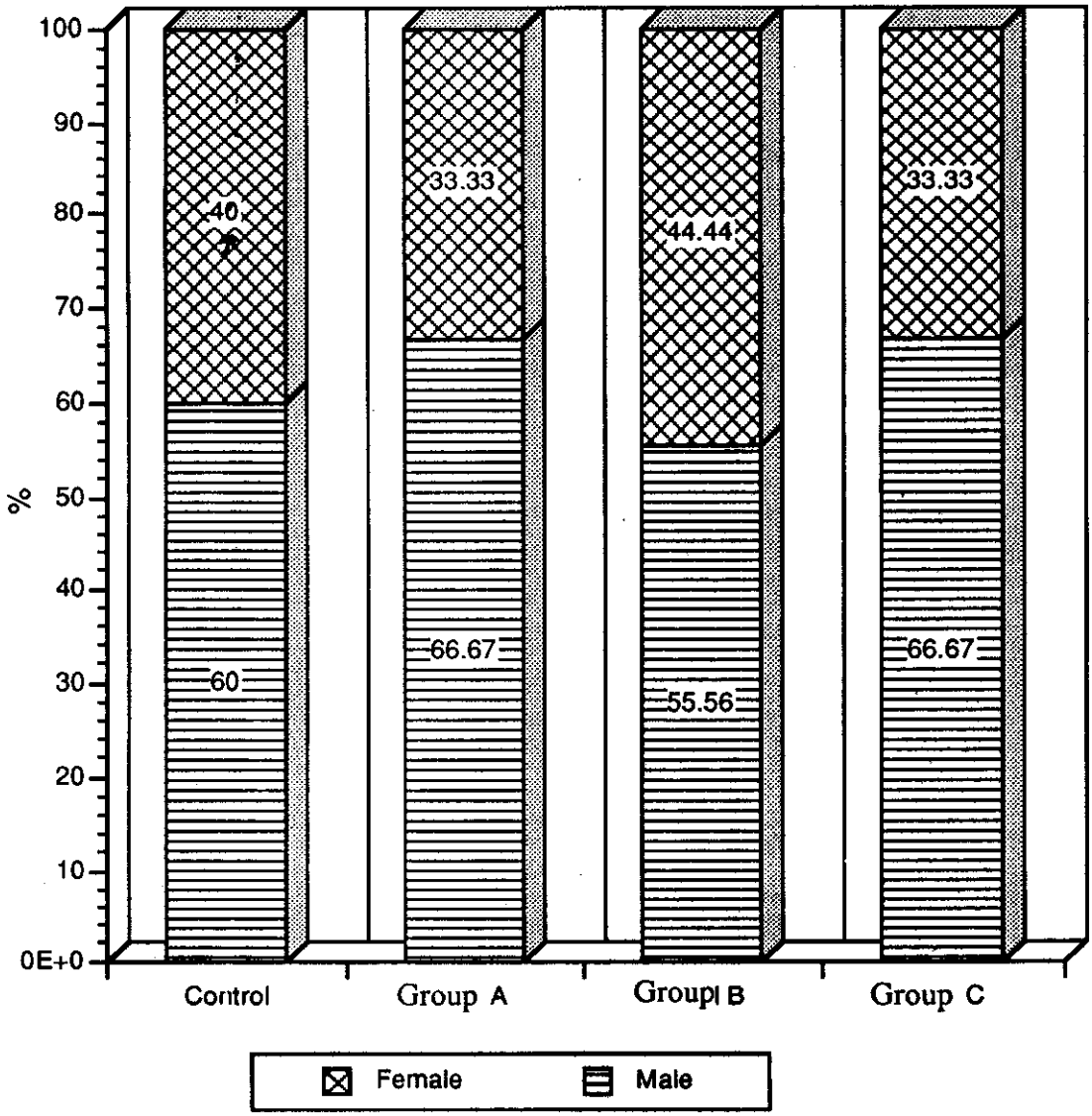


Fig. (2): Male and female incidence in the studied groups

The most evident clinical manifestations in the three groups are shown in table 3.

Table (3): Showing clinical manifestations in the patients of the different groups.

	A		B		C	
	No.	%	No.	%	No.	%
Jaundice	-	-	12	66.67	6	100
Liver: enlarged	4	66.67	10	55.56	-	-
Shrunken	2	33.33	8	44.44	6	100
Spleen: enlarged, firm	6	100	18	100	6	100
Ascites	-	-	6	33.33	6	100
L.L. oedema	-	-	4	22.22	4	66.67
Dil. of Abd. veins	-	-	6	33.33	6	100

* In group A: The most evident clinical manifestation was enlarged spleen.

* In group B: the most evident clinical manifestation was enlarged spleen.

* In group C: the most evident clinical manifestations were jaundice, shrunken liver and enlarged spleen.

Blood picture of the four groups are shown in table 5.

There was a significant difference between the three patient groups and the control group as regard Hb%, RBCs and platelets.

Table (4): Blood picture of the four groups of our study.

	Hb% Mean ± S.D	RBCs Mean ± S.D	WBCs Mean ± S.D	Platelets Mean ± S.D
Control	12.613 ± 0.601	5.058 ± 0.783	7.17 ± 1.107	305.0 ± 30.0
Group A	10.533 ± 0.802 *	3.637 ± 0.385 *	7.70 ± 3.037	94 ± 35.686 *
Group B	9.722 ± 1.356 *	3.397 ± 0.394 *	9.10 ± 5.109	226 ± 146.939 *
Group C	11.033 ± 0.812 *	3.308 ± 0.287 *	11.1 ± 4.831	123 ± 66.775 *

* : Means significant versus control.

Table (5): Laboratory data of the four groups of our study

Group	Bilirubin		AST (n= 42)	ALT (n= 42)	ALP (n= 91)	GGT (n= 50)	Total Protein	Albumin (3.5 - 5)	Prothrombin Time	Prothrombin Concentration
	Total	Direct								
	Mean ± S.D	Mean ± S.D	Mean ± S.D	Mean ± S.D	Mean ± S.D	Mean ± S.D	Mean ± S.D	Mean ± S.D	Mean ± S.D	Mean ± S.D
Control	0.59± 0.103	0.03± 0.05	16.13± 3.97	14.5± 4.121	62.26± 18.37	17.13± 9.37	6.94 ± 0.34	4.80± 0.26	12.0 ± 0	100 ± 0
Group A	0.5 ± 0.15	0.1 ± 0.09	78 ±36.7 *	64.3± 32.2 *	276 ±186.04*	95.33±87.95 *	6.43 ±1.22 *	3.53± 0.78 *	14.96 ±2.26 *	72.46± 22.58*
Group B	10.75± 7.75 *	8.5 ± 6.49 *	211.8±100.3*	99.8± 58.4 *	531.88±354.37*	257.8±282.8 *	6.21 ±1.36 *	2.93± 0.73 *	15.16 ±1.74 *	69.82± 14.54*
Group C	4.46± 2.53 *	2.2 ± 1.33 *	126 ±27.2 *	63 ± 31.4 *	228 ±143.38*	80.66±75.47 *	6.13 ±1.13 *	2.42± 0.05 *	24.1 ±7.35 *	42.06± 21.81*

• Prothrombin time measured in seconds with control = 12 seconds.

* Means significant versus control.

Liver function tests including bilirubin (total and direct), alanine transaminase, aspartate transaminase, alkaline phosphatase, albumin, the prothrombin time and concentration in the four groups are shown in table 5. There was a significant difference between the three patient groups and the control group in all the tests except total and direct bilirubin in Child A group.

Hepatitis C antibody and hepatitis B surface antigen were detected as markers of viral hepatitis shown in table 6.

Table (6): Hepatitis viral markers in the four groups of our study.

	HBs Ag		HCVAb		Both		None	
	No.	%	No.	%	No.	%	No.	%
Control	0	0	0	0	0	0	15	100
Group A	0	0	4	66.67	0	0	2	33.33
Group B	0	0	6	33.33	0	0	12	66.67
Group C	0	0	0	0	0	0	6	100

HBs Ag: Hepatitis B surface antigen detected by ELISA.
HCV Ab: Hepatitis C virus antibody detected by ELISA.

Abdominal ultrasound data done to all subjects of our study, as regards liver size and texture, splenic size, absence or presence of ascites.

Table (7): Data of abdominal ultrasound examination to all subjects of our study.

	Liver				Spleen		Ascites							
	Enlarged cirrhotic		Shrunken cirrhotic		Enlarged		Non-acitic		Minimal		Mild to Moderate		Massive	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Control	Normal Abdominal Ultrasonography													
Group A	4	66.67	2	33.33	6	100	6	100						
Group B	10	55.56	8	44.44	18	100	12	66.67	4	22.22	2	11.11		
Group C	0	0	6	100	6	100					6	100		

Portal vein diameters measured by abdominal ultrasound in all groups are shown in table 8.

Table (8): Portal vein diameter (in cm) in all subjects (measured by abdominal ultrasound).

	< 1.2	1.2	1.3	1.4	1.5	1.6	1.7
Control	15	-	-	-	-	-	-
Group A	6	-	-	-	-	-	-
Group B	12	2	2	-	-	-	2
Group C	-	2	2	-	2	-	-

* A sonographic portal vein caliber more than 1.2 cm can be considered as a sign of portal hypertension.

* All cases of group A are below 1.2 cm.

* Most cases of group B are below 1.2 cm.

* All cases of group C are above 1.2 cm.

NO Level:

Serum nitrite was measured both in patients and control groups and NO concentrations were determined relative to a standard curve using sodium nitrite.

The results are shown in table (9) and figure (3).

NO were found to be significantly elevated in group B and C of liver cirrhosis.

- Table 10 compares NO between group A and group B with a significant P value < 0.05.
- Table 11 compares NO between group B and group C with a significant P value < 0.05.
- Table 12 compares NO between group A and group C with a significant P value < 0.05.
- Table 13 shows the correlation between NO level and serum albumin among the studied groups.

Table (9): Mean and S.D of plasma nitric oxide (μmol/ml) among the studied groups.

	$\overline{X}$	S.D	Sig. * Control	
			t	P
Control	0.993	± 0.427	–	–
Group A	1.1	± 0.404	0.535	> 0.05
Group B	1.522	± 0.833	1.730	< 0.05
Group C	1.633	± 1.303	2.349	< 0.05

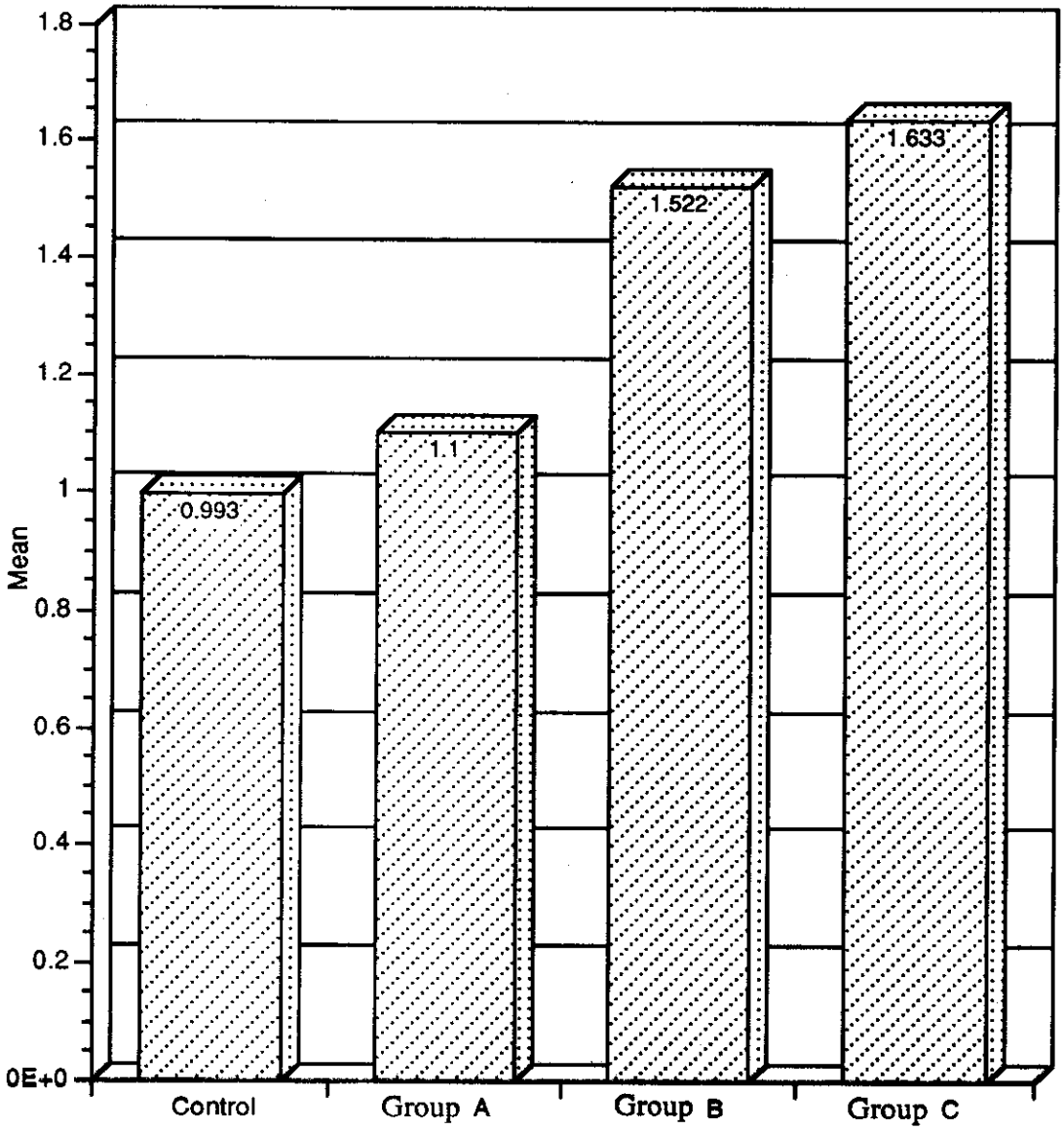


Fig. (3): Mean of plasma nitric oxide among the studied groups

Table (10): Comparison between NO level in groups A and B.

Groups	Mean	S.D	P value
Group A	1.1	0.404	< 0.05
Group B	1.522	0.833	

Table (11): Comparison between NO level in groups B and C.

Groups	Mean	S.D	P value
Group B	1.522	0.833	< 0.05
Group C	1.633	1.303	

Table (12): Comparison between NO level in group A and C.

Groups	Mean	S.D	P value
Group A	1.1	0.404	< 0.05
Group C	1.633	1.303	

Table (13): Correlation between NO level and serum albumin among the studied groups.

	NO Level Mean ± SD	Albumin Mean ± SD	r	P
Group A	1.1 ± 0.404	3.53 ± 0.78	0.462	> 0.05
Group B	1.522 ± 0.833	2.93 ± 0.73	0.593	< 0.05
Group C	1.633 ± 1.303	2.42 ± 0.05	0.614	< 0.05

From table (13) we found a significant relation between NO levels and synthetic function of the liver (albumin) especially in group B and group C of liver cirrhosis.

Table (14): Correlation between PVD and NO.

PVD (in cm)	NO (mean)
1.3	0.6
1.5	1.0
1.7	1.6

As portal vein diameter more than 1.2 cm can be considered a fairly characteristic sign of portal hypertension. So a correlation matrix was done between NO levels and portal vein diameter more than 1.2 cm.

- Table 14 and figure 4, state that there is a significant correlation between NO levels and portal vein diameter.

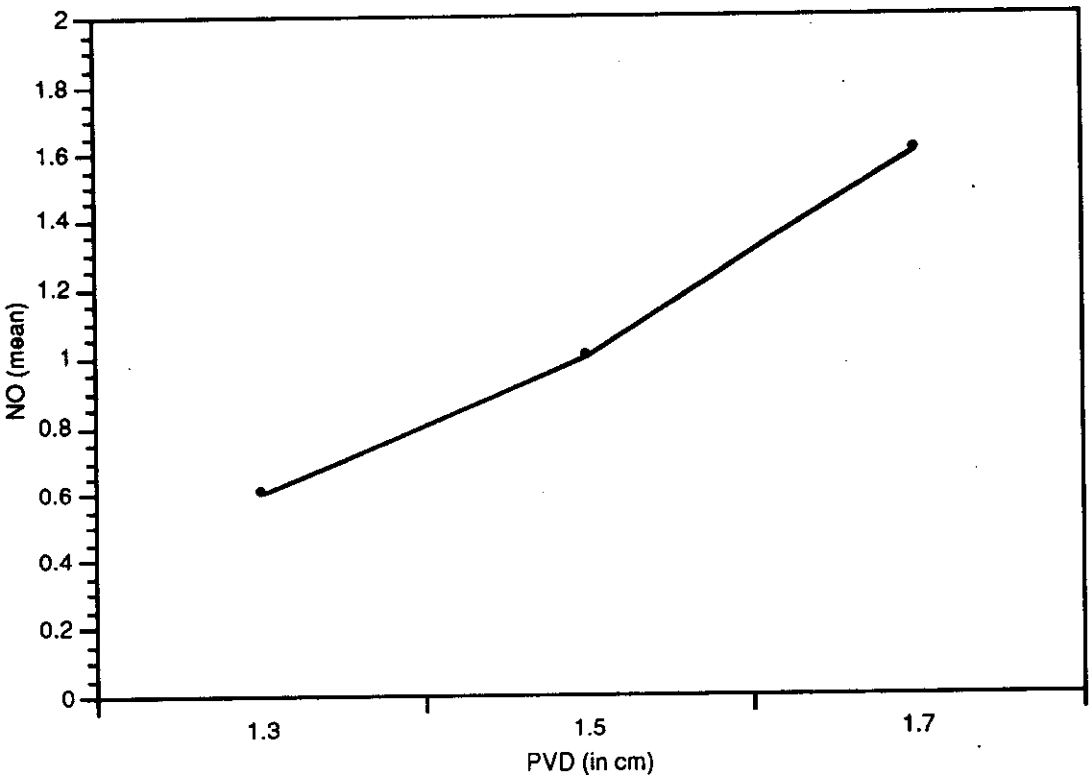


Fig. (4): Correlation between PVD and NO

- Comparison between NO levels in patients with hematemesis and those without hematemesis proved to be statistically significant (Table 15).

- A comparison between NO levels in patients with ascites and those without ascites proved to be statistically significant (Table 16).

Table (15) & Fig. (5): NO levels in patients with and without hematemesis.

	Mean	S.D	P value
Without hematemesis	0.9	± 0.346	< 0.05
With hematemesis	1.546	± 0.902	

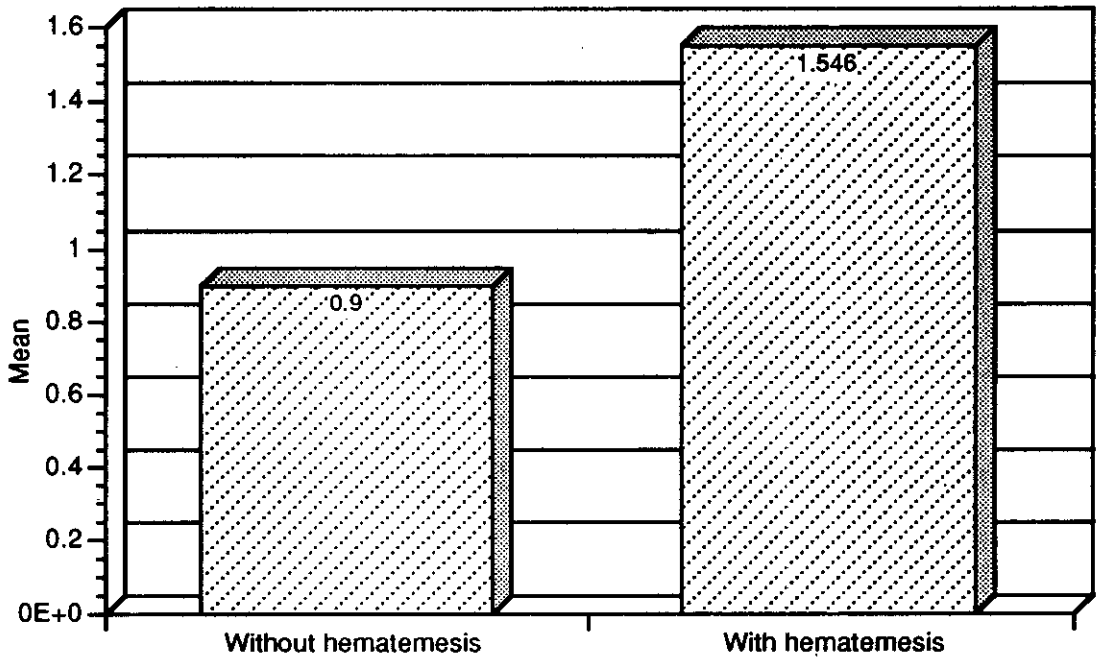
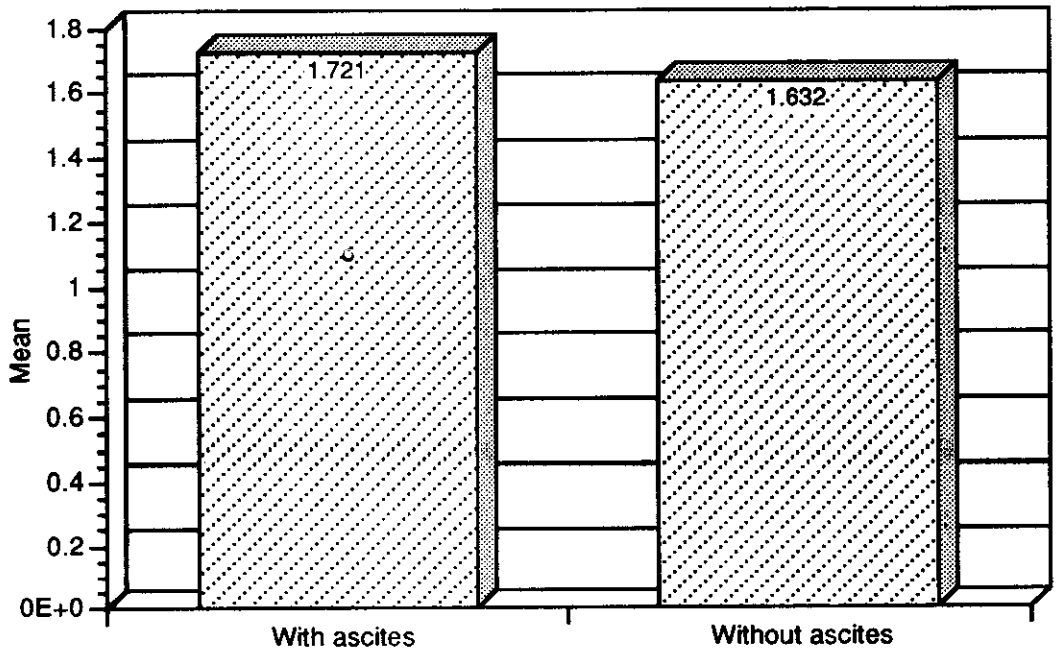


Table (16) & Fig. (6): NO levels in patients with and without ascites.

	Mean	S.D	P value
With ascites	1.721	± 0.361	< 0.05
No ascites	1.632	± 0.851	



Endotoxin levels in patients and control groups are stated in table 17 and figure 7.

Endotoxin levels were found to be significantly elevated in group B and C of liver cirrhosis.

Table (17): Mean and standard deviation of plasma endotoxins (μg/ml) among the studied groups.

	X	S.D	Sig. * Control	
			t	P
Control	0.673	± 0.194	–	–
Group A	0.7	± 0.089	0.381	> 0.05
Group B	0.877	± 0.281	0.591	< 0.05
Group C	1.08	± 0.533	0.981	< 0.05

Table (18): Comparison between endotoxin level in groups A and B.

Groups	Mean	S.D	P value
Group A	0.7	0.089	< 0.05
Group B	0.877	0.281	

Table (19): Comparison between endotoxin level in groups B and C.

Groups	Mean	S.D	P value
Group B	0.877	0.281	< 0.05
Group C	1.08	0.533	

Table (20): Comparison between endotoxin level in groups A and C.

Groups	Mean	S.D	P value
Group A	0.7	0.089	< 0.05
Group C	1.08	0.533	

- Tables 18, 19, 20 show comparison of endotoxin levels in different groups of liver cirrhosis which show statistically significant P value.

Table (21): Correlation between PVD and endotoxins.

PVD (in cm)	Endotoxin (mean)
1.3	0.670
1.5	0.700
1.7	1.500

- A correlation matrix between endotoxin levels and portal vein diameters more than 1.2 cm proved to be present (Table 21 and Figure 8).

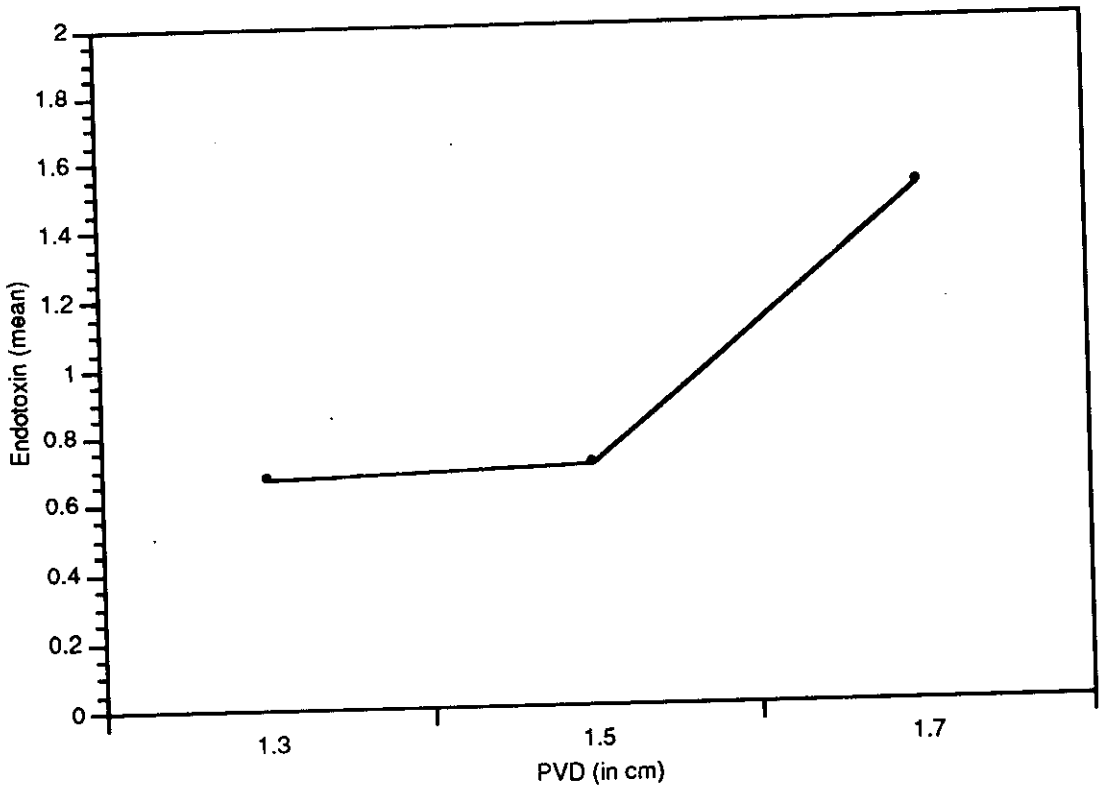
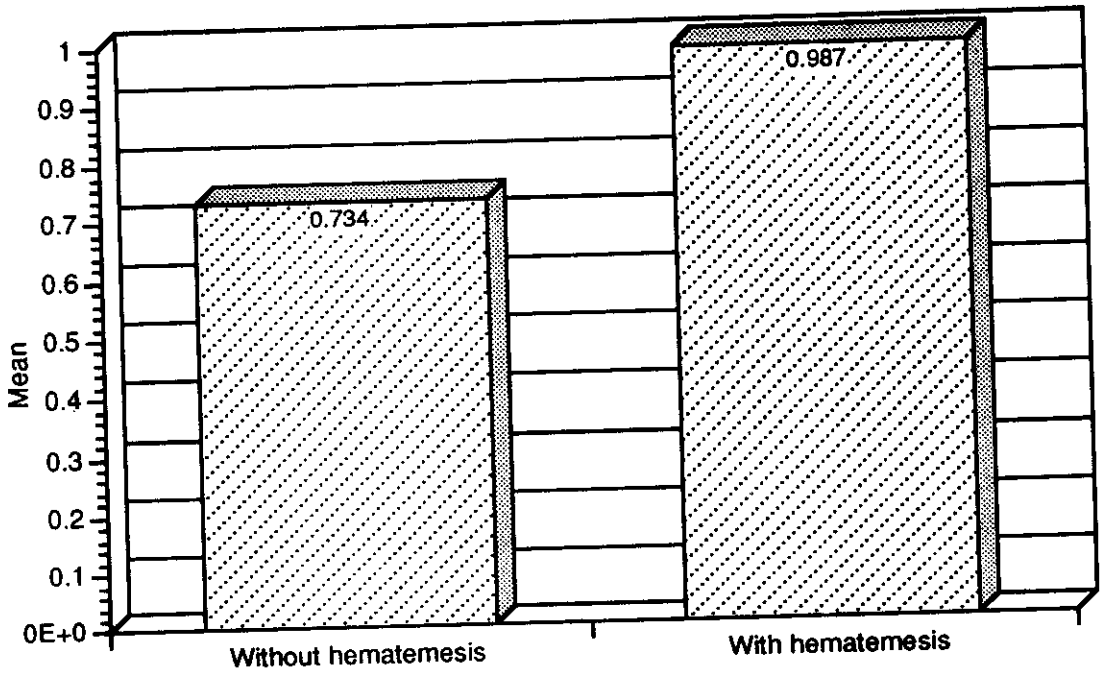


Fig. (8): Correlation between PVD and endotoxin

Table (22) & Fig. (9): Endotoxin level in patients with and without hematemesis.

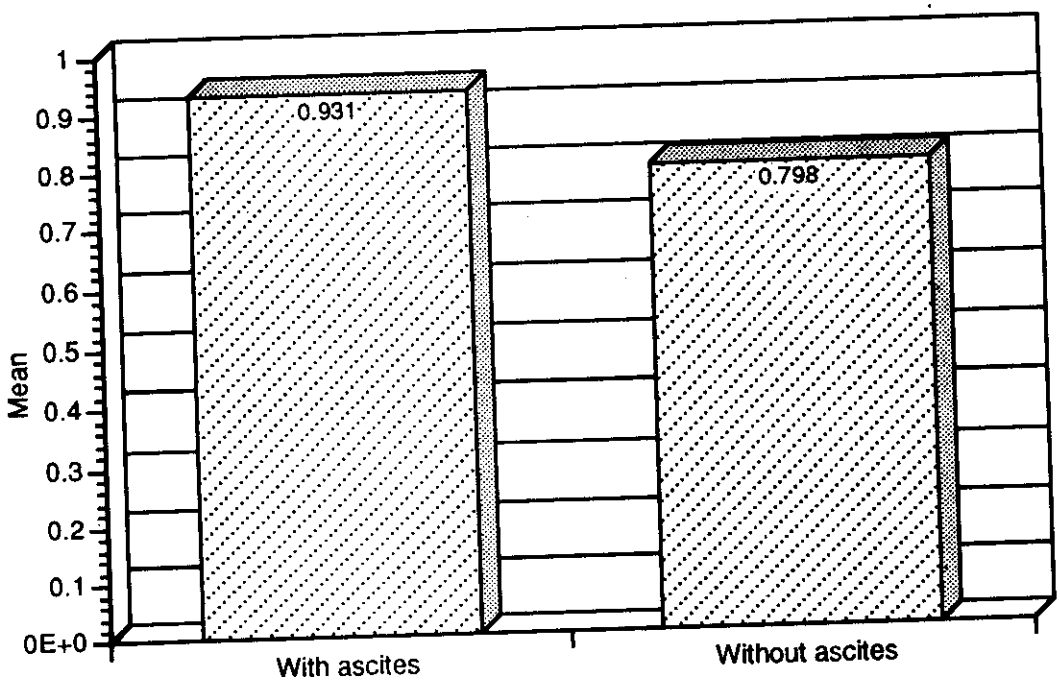
	Mean	S.D	P value
Without hematemesis	0.734	± 0.105	< 0.05
With hematemesis	0.987	± 0.721	



- Endotoxin levels in patients with hematemesis and those without proved to be statistically significant (Table 22).

Table (23) & Fig. (10): Endotoxin level in ascitic and non-ascitic patients.

	Mean	S.D	P value
Ascitic	0.931	0.348	< 0.05
Non-ascitic	0.798	0.234	



- Endotoxin levels in patient with ascites and those without proved to be statistically significant (Table 23).

- Table 24 states that there is a statistically significant relation between endotoxin and albumin (as a synthetic liver function), meaning that there is a direct relation between liver failure and endotoxin levels.

- Table 25 and figure 11 states that there is a statistically significant relation between NO and endotoxin levels in the three groups of our patients.

Table (25): Relation between NO level and endotoxin level in the same group of liver disease.

	NO Level Mean ± S.D	Endotoxin Level Mean ± S.D	r	P
Group A	1.1 ± 0.404	0.7 ± 0.089	0.655	< 0.05
Group B	1.522 ± 0.833	0.847 ± 0.281	0.742	< 0.05
Group C	1.633 ± 1.303	1.08 ± 0.533	0.935	< 0.05

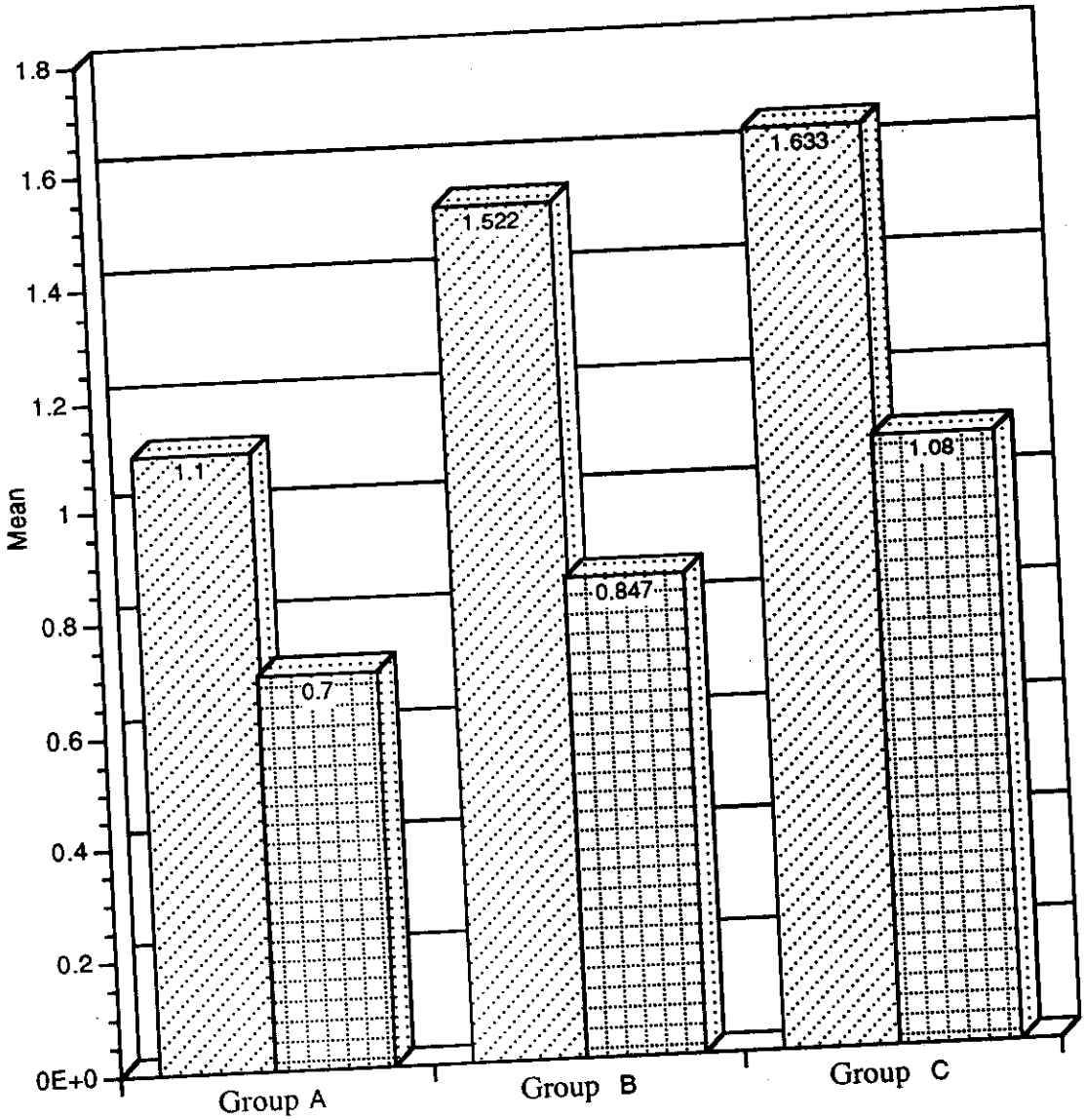


Fig. (11): Relation between NO level and endotoxin level in the same group of liver disease