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EVALUATION OF DISABILITY DUE TO B AND/OR C VIRAL HEPATITIS AMONG HEALTH CARE WORKERS IN CAIRO UNIVERSITY HOSPITALS

By
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ABSTRACT

This study was conducted on 958 workers in Cairo University Hospitals where hepatitis markers (Hepatitis C virus antibodies and Hepatitis B surface antigen) were investigated for all of them. The seropositivity of HCVantibodies and HBsAg were found to be 10% and 0.93% respectively of the total studied patients. All positive cases were called for further evaluation but only 66 patients agreed to continue such an evaluation. All patients were assessed clinically, and with biochemical tests (ALT, AST, bilirubin and alkaline phosphatase) as well as with abdominal ultrasonography then an impairment rating was calculated for each subject using The American Medical Association (AMA) Guides for Evaluation of Permanent Impairment and the Australian Commonwealth Employees' Rehabilitation and Compensation Act.

Of the 66 patients, about 40.9% were asymptomatic and 71.21% were apparently normal on clinical examination whereas 40.91% of patients had elevated serum ALT and 76% showed abnormal hepatic echo pattern that could be attributed to chronic viral hepatitis. The sonographic changes were found to be insignificantly related to job duration, type of job or type of hepatitis. Also, no statistically significant differences

could be detected when the frequency of ALT elevation was compared to the type of job, job duration or job place.

Rating patients for permanent impairment showed that most of them were evaluated as having mild permanent impairment (56.06% of patients classified as Class I according to AMA guides). The AMA and the Australian evaluation systems proved to be significantly correlated ($r=0.56$, $P<0.0001$) concluding that any one of them could be adopted and applied in Egypt.

The study recommended revision and modification of the Egyptian system used for hepatic permanent impairment evaluation to be considered with the guidance of the AMA, Australian and European systems. Pre-employment examination of health care workers [HCWs] should include tests to rule out cases of viral hepatitis and distinguish them from those occupationally related. Also, periodic medical examination of HCWs is needed for early detection of viral hepatitis and cases must be followed up, treated and compensated for their impairment.

Introduction

Infections caused by hepatitis B virus (HBV) and hepatitis C virus (HCV) are important health problems worldwide with a high morbidity and mortality (Di Bisceglie, 1998).

The WHO estimates that about 170 million people, or about 3% of world's population, are infected with HCV and that three quarters of the world's population live in areas where there are high levels of HBV infection and that more than 2 thousand million people alive today have been infected with such virus at some time in their lives. Of these, about 350 million remain chronically infected (WHO, 1999).

Recent investigations in Egypt have reported a strikingly high prevalence of antibodies to hepatitis C virus (anti-HCV) among blood donors ranging from 6% to 38% and averaging approximately 15% (Nafeh et al., 2000) whereas Egypt is considered an intermediate area of endemicity of HBV. The prevalence rate of HBsAg in Cairo Governorate was found to be 4% (Kabil et al., 1990).

Hepatitis B and C viruses are both blood borne viruses transmitted by the parenteral route. Thus, Healthcare workers, who perform exposure-prone procedures, where injury of the worker may result in exposure to the patient's open tissues or

blood, are theoretically at increased risk of infection with such viruses however it is controversial whether healthcare workers have an increased prevalence of hepatitis B or C virus infection as a result of exposure to patient's blood and body fluids (Thorburn et al., 2001).

Chronic viral hepatitis may result in permanent impairment or disability of the infected person. Impairment is defined as, "a deviation from normal in a body part or organ system and its functioning". Also, Impairment is considered as, "an alteration of an individual's health status" and Disability may be defined as "an alteration of an individual's capacity to meet personal, social, or occupational demands, or statutory or regulatory requirements, because of an impairment", whereas Evaluation of permanent impairment is defined as "acquisition and analysis of information, including clinical evaluation, that is carried out relating to an impairment that has become static or well stabilized with or without medical treatment and is not likely to remit despite medical treatment" (AMA, 2000).

Several systems of evaluating permanent impairment resultant from hepatic disease are applied worldwide e.g. The American Medical Association (AMA) Guides to evaluation of Permanent impairment, The Australian Commonwealth Employees' Rehabilitation and Compensation Act and The European Parliament recommendations on a European disability rating scale.

In Egypt, evaluation of permanent impairment and disability that results from liver diseases (of which viral hepatitis represents one of the most important causes) is mainly dependant on subjective factors and the experience of the evaluating physician. This is due to the fact that the articles concerned with liver disease in the Egyptian law are very deficient and do not provide definite criteria to be used for such evaluation. Modification of the Egyptian system for evaluating permanent impairment (especially liver impairment), possibly taking evaluation systems of other countries as a model, is considered an urgent topic.

The main objective of this work is to perform an evaluation of the degree of permanent impairment or disability that may result from viral hepatitis B and/or C in health care workers. Also, this work discusses several systems used worldwide for evaluation of impairment resultant from such diseases.

Subjects and Methods

In the present study, hepatitis markers (Hepatitis C virus antibodies and Hepatitis

B surface antigen) were investigated for all 958 workers in four of Cairo University Hospitals (393 workers in El-Manial Specialized Hospital, 218 workers in the Internal Medicine Hospital, 245 workers in El Monira Pediatric Hospital and 102 workers in The Gynecology and Obstetrics Hospital). The investigation showed that: 94 workers were only HCV positive, 7 were only HBV positive and 2 were positive for both HCV and HBV. The positive cases were called for further evaluation but only 66 patients approved to continue such an evaluation. Out of the 66 patients, 41 were males and 25 were females. Their ages ranged from 24 - 64 years with a mean age of 42.27±9.83 years. These 66 patients were pooled from the various hospitals related to Cairo University; out of the 66 patients, 32 patients out of a total of 393 working in El Manial Specialized Hospital, 12 the in internal medicine out of 218 working in Internal Medicine Hospital, 14 out of 245 working in El Monira Pediatric Hospital and 8 out of 102 in the Gynecology and Obstetrics Hospital. Twelve patients were nurses [2 from El Manial Specialized Hospital, 4 from the Internal Medicine Hospital, and 6 from the El MoniraPediatric Hospital], 44 were service workers [28 from the El Manial Specialized Hospital, 8 from the Internal Medicine Hospital, and 8 from the Gynaecoloy and Obstetric Hospital]. These Service workers were involved in the cleaning wards, carrying waste (including hazardous waste), and moving patients in and out of the wards, etc. Ten were working in other different jobs within the hospitals including: nutrition specialists, plumbers, tailors, electricians, mechanics and secretaries [2 were from El Manial Specialized Hospital and 8 were from El Monira Pediatric Hospital].

Methods

I. The 66 workers were subjected to full clinical assessment including:

(A) Thorough History taking and full Clinical examination using a Questionnaire, specially prepared with modifications from Bates et al., 1995.

- Criteria of nutritional state and strength : we ask about appetite, undigestion, ability to work and fitness during work.

(B) Laboratory investigations including:

(1) Biochemical tests:

a. Serum alanine aminotransferase (ALT) with normal value of 10-40 U/L.

b. Serum aspartate aminotransferase (AST) with normal value of 10-40 U/L.

c. Serum Alkaline Phosphatase (ALP) with normal value up to 270 U/L.

d. Serum total Bilirubin with normal value 0.3 - 1.2 mg/dl.

e. Serum direct Bilirubin with normal value less than 0.3 mg/dl (Mc Clatchey, 2002).

(2) Virological tests:

a. Anti-HCV Enzyme linked immunoassay (EIA): The third generation Abbott HCV EIA 3.0 was used. It qualitatively determines the presence of total antibodies to four recombinant HCV proteins in serum: HC-34, HC-r43 (Core, NS3), c100-3 (NS3, NS4) and NS5. The sensitivity of the assay is between 99 and 100% with a specificity of 99.6%, and the procedure is fully automated in an Abbott machine.

b. HBsAg Enzyme linked immunoassay (EIA): The laboratory utilized the Abbott Autozyme Monoclonal EIA to determine the presence of HBsAg in serum. According to the package insert, the sensitivity and specificity of the assay is between 99 and 100%, and the procedure is fully automated in an Abbott machine.

(C) Abdominal Ultrasonography:

Real time abdominal ultrasonography was done with Toshiba machine using a convex-sector probe (3.5 MHz). Patients were examined after at least 8 hours fasting in the supine, right and left lateral positions. Scanning was done through several longitudinal oblique and transverse Cuts. Measurements were taken during quite respiration. Liver scanning included assessment of the surface echogenicity, hepatic veins, portal tracts, attenuation of sound beams and associated findings. Liver measurements were taken in cm for the span in the midclavicular line (from the liver dome to the lower border), extent below the costal margin, and span in the midline. The liver was considered enlarged if its span in the midclavicular line reached 15 cm or more and considered reduced in size when this span was less than 9 cm. Bright liver is diagnosed when there is increase in echogenicity much more than normal renal echogenicity and the liver appears featureless. The spleen was examined for size, texture and focal lesions. Longitudinal axis of spleen was measured as well as the part seen below costal margin.

The spleen was considered enlarged if seen below the costal margin even in deep inspiration, or if its long axis is greater than 12 cm. Examination was completed by noting any abnormality in the gall bladder, kidneys, urinary bladder and the presence of ascites.

II. Evaluation of Liver Permanent Impairment:

Permanent impairment rating was calculated for each subject according to criteria of both The American Medical Association (AMA) Guides to evaluation of Permanent impairment (AMA, 2000) and Australian Commonwealth Employees' Rehabilitation and Compensation Act (Comcare, 2005).

III. Statistical Analysis:

Numerical data were summarized as means and standard deviations. Data were compared using different tests according to the type of the data to be compared. The statistical analysis was done using a Mackintosh Quadra700 computer and Stat-view statistical package. Statistical analysis was done according to Knapp and Miller (1992). The "$\chi 2$" test was used to compare the qualitative data, two or more groups to be compared qualitatively. The "F" test was used to compare the means of different groups; more than two groups to be compared quantitatively through an analysis of variance (ANOVA). The unpaired student "t" test was used for comparing means of the two groups. In order to study the change of parameters due to exposure we utilized a regression test: to detect if there is a linear increase or decrease in the parameter by increasing the exposure and in case of significant regression, we calculated the regression equation and the coefficient of correlation (r) in the corresponding degree of significance. A "p" value of 0.05 was considered the limit below which the difference of the values would be statistically significant.

Results

In response to the first call, all (958) workers of the selected 4 hospitals from Cairo University Hospitals (CUHs) were tested for hepatitis markers (Anti-Hepatitis C antibodies and Hepatitis B surface antigen). The results showed (Table 1) that:

• Ninety-six patients were HCV positive (2 of them were also HBV positive) representing a prevalence rate of 10% of all workers. Of those 37.5% are worked in El-Manial Specialized Hospital, 32.29% in the Internal Medicine Hospital, 16.67% in El Monira Pediatric Hospital and 13.54% in the Gynecology and Obstetrics Hospital.

• Nine patients were HBV positive (2 of them were also HCV positive) representing a prevalence rate of 0.93% of all workers. Of those 44.45% are worked in El-Manial Specialized Hospital, 22.22% in Internal Medicine Hospital, 22.22% in El Monira Pediatric Hospital and 11.11% in the Gynecology and Obstetrics Hospital.

Table (1): Prevalence of Viral Hepatitis at the CUHs.

Hospital	workers examined	positive Cases				
		Both (HCV & HBV +ve)	HCV+ve		HBV +ve	
			alone	Total	alone	Total
		No. (%)	No. (%)	No. (%)	No. (%)	No. (%)
El-Manial	393	0	36	36 (37.5)	4	4 (44.45)
El-Mounira	245	0	16	16 (16.67)	2	2 (22.22)
Internal Medicine	218	1	30	31 (32.29)	1	2 (22.22)
Gyn. & Obst.	102	1	12	13 (13.54)	0	1 (11.11)
Total	958	2	94	96 (100%)	7	9 (100%)
frequency				10%		0.93%

Only 66 patients of those proved to be Hepatitis C and/or B positive cases agreed to undergo further the evaluation performed throughout this study. The characteristics of those 66 patients and the results of their evaluation are discussed in the following tables.

The studied patients ages ranged from 24-64 years with a mean of 42.27±9.83 years. Male patients represent 62.12 % of the total whereas 37.88 % were females. Of the patients 63.64 % were born in rural areas and 45.45 % of the patients were cigarette smokers. 66.67 % of the patients were service workers, 48.48 % were nurses and 15.15 % worked in other jobs. Patients duration of the present job ranged from 2-42 years with a mean of 13.92 ± 9.39. Job place was in El Manial Specialized Hospital in 48.48 % patients, Internal Medicine Hospital in 21.21 %, El Monira Pediatric Hospital in 18.18 % and the Gynecology and Obstetrics Hospital in 12.12%. The study shows that 48.48 % of the patients previously worked as farmers (Table 2).

In studying the past history of Schistosomiasis, 63.64% of the patients gave positive history of contact with water canals and 43.94% gave history of anti-Schistosomal treatment (15.15% of them took I.V tartar emetic injections that carried high possibility of transmitting hepatitis and other blood-born infections). 34.85% of the patients had a history of previous operations and 7.58% of them

had blood transfusion. About 4.55% of the patients were diabetic and 13.64% were hypertensive. 4.55% of the patients were previously vaccinated with Hepatitis B vaccine (Fig. 1).

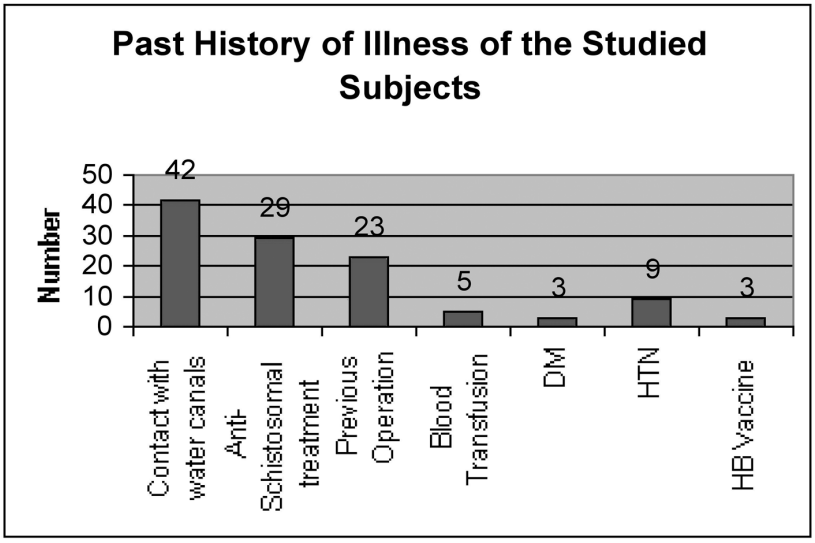
Only 7.58% of the studied patients had history suggestive of acute hepatitis. 3.03% had history of developing jaundice, 1.52% of developing ascitis in the last 3 years whereas none of them developed haematemsis from bleeding esophageal varices during the same period. The nutri-

Table (2): Characteristic Features of the Studied Patients.

Parameters	Range	Mean ± SD
Age (years)	24-64	42.27±9.83
Duration of present job (years)	2-42	13.92 ± 9.39

Parameters		No.	%
Sex	Male	41	62.12
	Female	25	37.88
Born in	Rural	42	63.64
	Urban	24	36.36
Live in	Rural	13	19.7
	Urban	53	80.3
Smoking	No	36	54.55
	Yes	30	45.45
Alcohol intake	Yes	0	0.00
	No	66	100
Job in past	No	25	37.88
	Farmer	32	48.48
	Irrelevant	9	13.62
Job place now	Al-Manial	32	48.48
	Al-Mounira	14	21.21
	Int. Medicine	12	18.18
	Gyn. & Obstet.	8	12.12
Job now	Service	44	66.67
	Nurse	12	18.18
	Other	10	15.15

Figure (1)



DM= Diabetes mellitus

HIN= hypertensive

tional status was affected in 6.06% of patients whereas patients strength and stamina were affected in 30.30% of cases. None of the patients had neurological manifestations or encephalopathy of hepatic disease.

Abdominal pain (right or left hypochondrial pain) was reported by 22.75% of patients. Lower limb swelling occurred in 6.06% of patients and bleeding tendency (manifested by bleeding from several body orifices and easily bruising) occurred in 1.52% of patients.

Upper abdominal discomfort (in form of dyspepsia, heart burn, nausea and vomiting) was experienced by 34.85% whereas lower abdominal discomfort (in form of change of bowel habits and flatulence) was experienced by 39.39% of patients.

The clinical examination of the patients revealed that none of them was jaundiced whereas 6.06% of them had bilateral lower limb edema. On abdominal examination of the patients 27.27% of them had hepatomegaly, 4.55% had splenomegaly and none of them was ascitic.

More than [90.90%] of patients were positive for hepatitis C virus antibodies alone, 7.57% were positive for hepatitis B alone and only 1.51% were positive for both markers. Laboratory tests done for

Table (3): Clinical features of the Studied Patients

Parameters		No.	%
(A) Complaints			
History of acute hepatitis		5	7.58
Bleeding from esophageal Varices (in last 3ys)		0	0.00
Jaundice (in last 3ys)		2	3.03
Ascites (in last 3ys)		1	1.52
Nutritional status	Good	62	93.94
	Affected	4	6.06
Strength	Good	46	69.70
	Affected	20	30.30
Encephalopathy		0	0.00
Abdominal pain		15	22.73
LL Swelling		4	6.06
Bleeding tendency		1	1.52
UA discomfort		23	34.85
LA discomfort		26	39.39
Asymptomatic		27	40.90
(B) Signs (through clinical examination)			
Jaundice		0	0.00
Lower Limb Edema		4	6.06
Hepatomegaly		18	27.27
Splenomegaly		3	4.55
Ascites		0	0.00
Apparently normal		47	71.21

*UA: Upper Abdominal *LA: Lower Abdominal *LL: Lower Limb

Table (4): Hepatitis Markers and Biochemical Tests

Parameters		No.		%	
Hepatitis markers					
HCV Ab +ve (alone)		60		90.90	
HBs Ag +ve (alone)		5		7.57	
+ve for both markers		1		1.51	
Biochemical Tests					
AST Level	**Normal**	52		78.79	
	Elevated<2folds	14	14	21.21	21.21
	Elevated2-4 folds	0		0	
ALT Level	**Normal**	39		59.09	
	Elevated<2 folds	23	27	34.84	40.91
	Elevated2-4 folds	4		6.07	
Alkaline Phosphatase Level	**Normal**	53		80.30	
	Elevated<2 folds	12	13	18.18	19.70
	Elevated2-4 folds	1		1.52	
Bilirubin Level	**Normal**	61		92.42	
	Elevated	5		7.58	

studied patients showed that 21.21% of them had elevated AST levels, 40.91% had elevated ALT levels (with 6.07% have more than 2-fold elevation), 19.70% had elevated alkaline phosphatase levels (with 1.52% have more than 2-fold elevation) and 7.58% had elevated bilirubin levels (Table 4).

Abdominal ultrasonography revealed that hepatomegaly was present in 39.39% of patients whereas normal echo pattern was present in 18.18%, bright echo pattern in 46.96%, echo pattern with generalized increased speckling in 25.75%, cirrhotic echo pattern in 3.03% and coarsened peri-portal fibrosis of Bilharziasis in 6.06% of patients. Splenomegaly was present in

Table (5): Findings of Abdominal Ultrasonography in the Studied Patients

Sonographic finding		No.		%	
Hepatomegaly			26		39.39
Hepatic Echo pattern	Normal		12		18.18
	Bright	31	54	46.96	81.82
	Generalized Increased speckling	17		25.75	
	cirrhotic	2		3.03	
	Bilharzial (coarsened peri-portal fibrosis)	4		6.06	
Portal vein dilatation			12		18.18
Splenomegaly			11		16.67
Kidney	Gravel alone	7	19	10.60	28.79
	Stone alone	6		9.09	
	Gravel & Stone	3		4.54	
	Pathological kidney & stones	1		1.51	
	Ectopic one kidney	1		1.51	
	Absent one kidney	1		1.51	
Gall Bladder stones			4		6.06

Table (6): Sonographic Findings in Relation to Job Duration

Parameter	present job duration (Years)			Statistical Significance	
	(<10) (n=30)	(10-20) (n=18)	(≥ 20) (n=18)	χ^2	p
Hepatomegaly	13 (43.33)	7 (38.88)	6 (33.33)	0.47	>0.05 (n.s.)
Abnormal liver echo pattern	21 (70)	17 (94.44)	6 (33.33)	5.35	>0.05 (n.s.)
Portal Vein dilatation	5 (6.66)	6 (33.33)	1 (5.55)	4.75	>0.05 (n.s.)
Splenomegaly	4 (13.33)	4 (22.22)	3 (16.66)	0.64	>0.05 (n.s.)
Abnormal Renal findings	10 (33.33)	3 (16.66)	6 (33.33)	1.77	>0.05 (n.s.)
Abnormal GB findings	1 (3.33)	1 (5.55)	2 (11.11)	1.21	>0.05 (n.s.)

Table (7): Type of Hepatitis in Relation to Various Sonographic Findings

Parameter	Hepatitis B/B&C (n=6)	Hepatitis C (n=60)	Statistical Significance	
			χ^2	p
Hepatomegaly	3 (50)	23 (38.88)	0.31	>0.05 (n.s.)
Abnormal liver echo pattern	5 (83.33)	49 (81.66)	0.01	>0.05 (n.s.)
Portal Vein dilation	1 (16.66)	11 (18.33)	0.01	>0.05 (n.s.)
Splenomegaly	1 (16.66)	10 (16.66)	0	>0.05 (n.s.)
Abnormal Renal findings	1 (16.66)	18 (30)	0.47	>0.05 (n.s.)
Abnormal GB findings	0 (0)	4 (6.66)	0.43	>0.05 (n.s.)

patients who were infected with hepatitis B virus were named "group 1" and patients who were infected with hepatitis C were named "group 2"

16.67% and portal vein dilatation in 18.18% of patients. Associated renal abnormal patterns were detected in 28.79% where as gall bladder stones were present in 6.06 of patients Table (5).

Hepatomegaly is present in 43.33% of those who worked less than 10 years, 38.88% of those who worked 10-20 years and 33.33% of those who worked more than 20 years, while a higher prevalence of abnormal echo pattern is detected in 70%, 94.44% and 33.33% of group 1, 2, and 3, respectively.

The percentage of those with splenomegaly ranged from 13.33% in those who worked less than 10 years, to 22.22 % in those who worked 10- 20 years to 16.66% in those who worked more than 20 years. Portal vein dilatation was sonographically detected in 6.66% of the first group, 33.33% of the second group and 5.55% of the third group.

Abnormal renal findings and abnormal gall bladder findings are present in (33.33% and 3.33% of those who worked less than 10 years, (16.66% and 5.55%) of those who worked 10 - 20 years and 33.33% and11.11% of those who worked more than 20 years. No statistically significant difference could be detected on comparing the present job duration with any of the sonographic findings detected in the studied patients (Table 6).

Laboratory tests showed (Table 8) that 80% of group 1, 83.33% of group 2 and 94.44% of group 3 were positive for HCV

Table (8): Laboratory Findings in Relation to Job Duration

Parameter	present job duration (Years)			Statistical Significance	
	Gp 1 (<10) (n=30)	Gp 2 (10-20) (n=18)	Gp 3 (≥ 20) (n=18)	χ^2	p
HCV Ab.	24 (80)	15 (83.33)	17 (94.44)	3	>0.05 (n.s.)
HBsAg	2 (6.66)	3 (16.66)	1 (5.55)	1.74	>0.05 (n.s.)
AST elevation	3 (10)	5 (27.77)	6 (33.33)	4.3	>0.05 (n.s.)
ALT elevation	17 (56.66)	5 (27.77)	5 (27.77)	5.65	>0.05 (n.s.)
Alkaline phosphatase elevation	2 (6.66)	5 (27.77)	6 (33.33)	6.08	<0.05
Increased bilirubin	3 (10)	0 (0)	2 (11.11)	2.05	>0.05 (n.s.)

Patients with work duration <10 yrs, 10-20 yrs, ≥ 20 yrs are named Gp1, Gp 2 and Gp 3 respectively.

Abs whereas a lower prevalence of HBs Ag was detected 6.66% of group 1, 16.66% of group 2 and 5.55% of group 3. AST elevation was present in 10% of group 1, 27.77% of group 2 and 33.33% of group 3 whereas ALT elevation and Alkaline phosphatase elevation were present in 56.66% and 6.66% in group 1, 27.77% and 27.77% of group 2 and 27.77% and 33.33% of group 3, respectively. Increased bilirubin was detected in 10% of group 1, 0% of group 2 and 11.11% of group 3. Statistically significant relationship was detected on comparing the present job duration and alkaline phosphatase elevation. (χ^2=6.08, P <0.05) (Table 8).

Hepatomegaly was detected in 50 % of group 1 and in 38.88% of group 2 whereas a higher frequency of abnormal echo pattern was detected (83.33% of group 1 and 81.66% of group 2). Splenomegaly was detected in 16.66% of either group. Portal vein dilation was sonographically detected in 16.66% of group 1 and in 18.33% of group 2. Abnormal renal findings and abnormal gall bladder findings were present in group 1 (16.66% and 0%) and group 2 (30% and 6.66%). No statistically significant difference could be detected on comparing the type of hepatitis and any of the sonographic findings detected in the studied patients (Table 7).

AST elevation was detected in 16.66% of group 1 and in 21.66% of group 2 whereas ALT elevation and alkaline phosphatase elevation were detected in 33.33% and 16.66% of group 1 and in 41.66% and 20% of group 2, respectively. Increased bilirubin is not detected in any of patients of group 1 but was detected in 8.33% of

Table (9): Relationship between Type of Hepatitis and Various Laboratory Findings

Parameter	Hepatitis B/B&C (n=6)	Hepatitis C (n=60)	Statistical Significance	
			χ^2	p
AST elevation	1 (16.66)	13 (21.66)	0.08	>0.05 (n.s.)
ALT elevation	2 (33.33)	25 (41.66)	0.16	>0.05 (n.s.)
Alkaline phosphatase elevation	1 (16.66)	12 (20)	0.04	>0.05 (n.s.)
Increased bilirubin	0 (0)	5 (8.33)	0.54	>0.05 (n.s.)

Patients who were infected with hepatitis B virus were named "group 1" and patients who were infected with hepatitis C were named "group 2"

group 2. No statistically significant difference could be detected on comparing the type of Hepatitis and any of the laboratory findings detected in the studied patients (Table 9).

On classifying patients according to the degree of permanent impairment using The American Medical Association (AMA) Guides to evaluation of Permanent impairment we finded that 56.06% of patients were considered to be of class I (0%-14% impairment of whole body), 36.36% of class II (15%-29% impairment of whole body), 7.58% of class III (30%-49% impairment of whole body) and none were of class IV (50%-95% impairment of whole body). On using The Australian Commonwealth Employees' Rehabilitation and Compensation Act we find that 62.12% had (0%) impairment of whole body, 30.30% had (10%) impairment of whole body, 3.03% had (20%) impairment of whole body and 4.55% had (40%) impairment of whole body. It appears that both systems are significantly correlated (r=0.56, P<.0001).

Most of patients classified as class I or II are males (64.68% and 62.5%, respectively) whereas 60% of patients classified as class III were females. The mean age of patients classified as class I was 41.27±10.12 years whereas it was 43.11±9.35 years for patients classified as class II and 45±10.97 years for those classified as class III. The mean of present work duration of patients classified as class I was 12.84±9.66 years whereas it was 14.79±8.9 years for patients classified as class II and 17.8±1026 years for those classified as class III. No statistically sig-

Table (10) : Impairment Evaluation of the studied patients and a comparison between AMA and Australian systems.

AMA			Australian		
Class	No.	%	Evaluation %	No.	%
I	37	56.06	0 %	41	62.12
II	24	36.36	10 %	20	30.30
III	5	7.58	20 %	2	3.03
IV	0	0	40 %	3	4.54

r= 0.56, p<0.0001

Table (11): AMA Impairment evaluation in relation to various parameters of the patients personal history.

Parameter		Impairment evaluation (AMA)			Statistical Significance	
		I (n=37)	II (n=24)	III (n=5)	χ^2	p
Sex	Males	24 (64.68)	15 (62.50)	2 (40)	1.16	>0.05 (n.s.)
	Females	13 (35.13)	9 (37.50)	3 (60)		

Parameter	Impairment evaluation (AMA)			Statistical Significance	
	I (n=37)	II (n=24)	III (n=5)	F	p
Age	41.27±10.12	43.11±9.35	45±10.97	0.54	>0.05 (n.s.)
Work duration	12.84±9.66	14.79±8.9	17.8±1026	0.77	>0.05 (n.s.)

nificant relationships were detected between the class of AMA evaluation and sex (χ^2 =1.16 and P>0.05), age of the patients (F =0.54, P>0.5) or the work duration (F = 0.77, P>0.5).

Discussion

Hepatitis B and C are both blood borne viral diseases transmitted by the parenteral route. Thus, healthcare workers, who perform exposure prone procedures, where injury to the worker may result in exposure of the patient's open tissues or blood, are theoretically at increased risk of infection with such viruses. However, it is controversial whether healthcare workers have an increased prevalence of hepatitis B or C virus infection as a result of exposure to patient's blood and body fluids (Thorburn et al., 2001).

In the present work, the seroprevalence of hepatitis markers (Anti-Hepatitis C antibodies and Hepatitis B surface antigen) was initially studied in all (n=958) workers of four of Cairo University Hospitals. The seropositivity of Anti-HCV was found to be 10% of the total studied patients. This rate is found to be higher than similar studies involving health care workers (HCWs) in Egypt like that performed by Hindy and Colleagues, in 1995) on dentists working or studying at the Cairo University Faculty of Oral and Dental Medicine. Their study detected seropositivity of Anti-HCV in 1.4% of the studied patients. Fahim, in, 1995 reported anti-HCV seroprevalence of 6.7% in nurses working in the Liver Unit of Cairo University Hospitals. Also Metwaly, in, 1997 detected seropositivity rate of 6.3% in nurses working in Cairo Uni-

versity Hospitals (employed in wards with greatest exposure to blood, like blood bank and emergency units). However, the rate of Anti-HCV seropositivity detected in the present study was close to or even lower than that detected in other studies involving the general population of Egypt (varied widely from one study to another) It was 24.8% in blood donors in 24 of Egypt's 26 governorates (Arthur and colleagues, 1997), 24.3% in residents of a rural Egyptian community in the Nile Delta (Abdel-Aziz et al., 2000), 19% in healthy, HIV-negative, pregnant women who delivered spontaneously at the Alexandria University Hospital (Kassem et al., 2000, 14.5% of urban blood donors and 15.5% of residents in a rural area in Sinai (El-Gohary et al., 1999) and 10% in people living in Gaza strip (Shemer et al., 1999).

The seropositivity of HBsAg was found to be 0.93% of the total studied patients. The rate of HBsAg seropositivity detected in the present study was close to that detected by Metwaly, in , 1997 in Cairo University Hospitals' nurses which was 3.3% and the difference between the two may be explained by the fact that a higher number of personnel were involved in the present study ("958 patients") as compared to Metwaly's (367 nurse). Our figure is also close to the figures detected by studies involving some groups of the general population e.g. HBsAg seropositivity was 1.6% in 740 Egyptian Nationals working in the tourism industry (El-Sayed et al., 1996) and was 2.2% of 500 non-vaccinated children in Alexandria (Reda et al., 2003). This also can be explained by the fact that HCWs are more educated about exposure prone procedures. However; it is expected to be lower than that detected in patients with chronic liver disease as reported by Abdel-Baset et al., in 1999, how funded HBsAg seropositivity of 12% in individuals with chronic liver disease. Also Zakaria et al. (1993) reported that 43% of patients with non-schistosomal chronic liver disease and 36% of patients with hepatocellular carcinoma were HBsAg carriers in their series.

In the present study, it is noticed that males represented about two-thirds of the patients which is in agreement with the results of the National Health and Nutrition Evaluation Surveys conducted in the USA between 1991 and 1994 that demonstrated higher incidence of Hepatitis C (Alter et al., 1999) in males than in females.

On studying the past history of illness of the studied patients, it was observed that 63.64% of patients were of rural origin, 48.48% previously worked as farmers, 63.64% had history of contact with water

canals and 43.94% had history of receiving anti-schistosomal treatment (tartar emetic injections in 15.15% of patients and oral therapy in 28.78%).

Among our patients the high percentage of patients positive for factors considered as risk factors of acquiring Bilharziasis suggested a high percentage of Bilharziasis and viral hepatitis co-infection. This is in agreement with several studies that pointed out to this relationship Abdel-Baset et al., in 1999, reported association of anti-HCV and schistosomal antibody seropositivity in 60% of patients with chronic liver disease whereas association of HBsAg and schistosomal antibody seropositivity was detected in 10% of patients. El Zayadi et al., in 1997, found that 30% of the patients that were anti-HCV seropositive were anti-schistosomal antibody positive. Khan et al., in 2004, detected that 17.9% of patients positive for bilharzia antibodies were also anti-HCV positive. Gad and Colleagues, 2001 studied the association of hepatitis C virus co-infection in patients with schistosomal liver disease and found a high percentage of co-infection (70% of patients positive for bilharzia antibodies were also anti-HCV positive) which was higher than that detected in control volunteer blood donors. The high prevalence of co-infection could be due to HCV transmission during anti-bilharzial parenteral therapy or due to depressed cell mediated immunity associated with schistosomal infection (El Zayadi et al., 1997).

Established risk factors of acquiring Hepatitis B and C virus infection other than occupational exposure were identified from taking the past history of the studied patients and included; history of previous operations (34.85% of the studied patients), blood transfusion (7.58%) and parentral anti-schistosomal therapy (15.15%). These factors may be confounding in establishing a causal relationship between occupational risk factors (exposure-prone procedures) and acquiring viral hepatitis in HCWs. However, such confounding may be considered of low importance due to the fact that the percentage of patients who were exposed to these risk factors (especially blood transfusion) in the present work was low when compared with results of other researchers who worked on the identifying risk factors of acquiring viral hepatitis such as El-Raziky, in 1995, who identified history of blood transfusion in 32% of anti-HCV seropositive patients and Altman et al., in 1999, who found history of blood transfusion in 70% of patients with chronic liver disease.

On reviewing the clinical features of the studied patients, it appears that 40.9% were asymptomatic and most of the complaints in symptomatic patients were non specific (easy fatigability, upper or lower abdominal discomfort or pain) and on examination only 27.27% had hepatomegaly, 4.55% had splenomegaly whereas 71.21% were apparently normal. These findings agree with Sherolck and Dooley, in 1997, who stated that the majority of cases of chronic viral hepatitis may be asymptomatic and are diagnosed during routine blood screening. Fatigue is a major symptom. Non specific symptoms, such as anorexia and nausea often initially develop and may be experienced frequently. Upper abdominal discomfort and pain may occur with activity. Mild hepatomegaly with or without splenomegaly is present only in one - half of the patients.

On analyzing the results of abdominal ultrasonography performed to the studied patients, it was shown that approximately 82% of the studied patients had abnormal hepatic echo pattern of whom 6% showed echo pattern suggestive of Bilharziasis. This means that about 76% of patients included in this study showed abnormal hepatic echo pattern that could be attributed to chronic viral hepatitis. Thus it could be concluded that ultrasonography could be useful in predicting such disease. This is in agreement with Zheng and colleagues, (2003) who carried out a complex study aiming to identify the value of ultrasonography in the evaluation of liver fibrosis and compensated liver cirrhosis in comparison with serology and histology in 225 patients with chronic viral hepatitis and compensated liver cirrhosis. The results showed that hepatic parenchymal echo pattern, liver surface and the wall thickness of gallbladder were valuable predictors for the fibrosis stage and showed a diagnostic accuracy of 74.5%, 46.8% and 62.5% in diagnosing mild, moderate and severe hepatic fibrosis, respectively. Also Shen et al., (2005), conducted a prospective study on 324 chronic viral hepatitis patients to evaluate the validity of ultrasonography in evaluating the severity of liver fibrosis in these patients. The results showed that changes in the liver surface and liver parenchyma were correlated to the severity of fibrosis and the degree of the inflammation seen in the liver biopsies.

Age, male sex and duration of infection were considered by Zakiem and Boyer, (2003) to correlate well with the progression of chronic viral hepatitis (and hence the appearance of sonographic find-

ings when taking the results of Zheng and colleagues, (2003) and Shen et al., 2005 in consideration). This may explain several findings observed in the present. Statistically significant relationship was detected on comparing the job place with abnormal liver echo pattern (χ^2= 7.38 and P <0.05) in the studied patients with the lowest frequency (68.75%) occurring in patients from El-Manial Specialized Hospital. This may be explained by that the mean age of patients from El-Manial Specialized Hospital (38.75±6.75) was significantly lower than other hospitals included in the study (F =3.14, P <0.05). Thus the presence of less frequent sonographic findings (representative of pathological changes) could be expected. This also is in agreement with Danta et al., (2002) who collected and analyzed demographic and clinical data from 2,986 patients with chronic HCV infection and concluded that age alone is an important predictor of hepatic fibrosis score in patients with chronic hepatitis C and that the risk of more severe hepatic fibrosis increases significantly with increasing age. No statistically significant relation was detected on comparing the type of job with abnormal hepatic echo pattern in the studied patients. This also may be explained by the fact that the mean age of patients working in different job types included in this study was statistically insignificant different (F =0.54, P >0.05). No statistically significant different was detected on comparing the job duration with abnormal hepatic echo pattern in the studied patients. This is somewhat expected because the job duration could not be considered as the duration of disease which is the factor that is actually related to the development of pathological changes of chronic viral hepatitis (and consequently sonographic change) as the onset of infection could be at any point in the course of employment. No statistically significant relation was detected on comparing the type of Hepatitis (HCV or HBV) with abnormal hepatic echo pattern detected in the studied patients which could be explained by the fact that there were no statistically significant differences between those infected with hepatitis C and those infected with hepatitis B when considering the age, male sex and duration of infection.

Liver enzymes are good indicators of liver tissue damage and being found in low concentrations in tissues other than liver, ALT is frequently considered specific for hepatocellular injury (Amr, 1994). However, in the present study, about 59% of the investigated patients had normal serum ALT and the rest (41%) had less than four fold- elevated levels than normal. This

comes in agreement with Villano et al., (1999), who found that 25% to 50% of patients who develop chronic hepatitis C have persistently normal ALT values and also is in agreement with Zakiem and Boyer, (2003) who stated that biochemical tests are usually completely normal in patients with long standing non-replicative Hepatitis B infection.

The main purposes of this work were to evaluate permanent impairment and disability that may result from chronic viral hepatitis in the studied patients and to discuss different systems used worldwide for such evaluation aiming to reach a conclusion about which one of them could fit most to be applied, as a whole at it is or after modification, in Egypt. There are three systems designed for evaluating permanent impairment resultant from hepatic disease which are; the American Medical Association (AMA) Guides to evaluation of Permanent impairment, the Australian Commonwealth Employees' Rehabilitation and Compensation Act and the European Parliament recommendations on a European disability rating scale.

Liver biopsy is regarded as an important parameter for evaluating the staging of fibrosis and the degree of hepatic inflammation in viral hepatitis and helping to guide management and treatment. However, the value of the liver biopsy has been questioned because of the potential risks of the procedure (being an invasive technique) and the concern of sampling error (AASLD, 2004).

The European rating scale depends exclusively on performing a liver biopsy which could be refused by many patients in our country for the risk formerly mentioned and thus, in this study, we excluded the use of such scale and decided to use The AMA guides and The Australian Commonwealth act for evaluating the degree of permanent impairment in the studied patients being easier to apply and not necessitating a liver biopsy.

On applying the AMA guides, we considered the following:

• Seropositivity of Anti-HCV or Anti-HBV (all patients) is considered to be an objective evidence of persistent liver disease and all patients then (being suffering from chronic viral hepatitis) are categorized as Class I permanent impairment at least.

• The presence of diffusely increased spackling or coarse hepatic echo pattern was considered as an objective evidence of chronic liver disease taking in consideration the study of Zheng and colleagues,

(2003), who concluded that "as the progresses of liver fibrosis reached to a certain degree, the liver pathological changes would become obvious. The acoustic interfaces would increase and the acoustic impedance between fibrotic tissue and other hepatic tissues would become large. On ultrasonography, the echo pattern of liver parenchyma would become coarse and echogenic".

• patients having such sonographic criteria are categorized as Class II permanent impairment.

• The presence of coarse hepatic echo pattern associated with portal vein dilatation or splenomegaly were considered as an objective evidence of chronic progressive liver disease taking in consideration the study of Zheng and colleagues, (2003), who found that portal vein diameter and longitudinal diameter of the spleen were significantly related to the degree of fibrosis.

• patients having such sonographic criteria or having history of jaundice, ascites, or bleeding esophageal or gastric varices within the past year were categorized as Class III permanent impairment.

As regard to permanent impairment evaluation of the studied patients, the results of our study showed that the AMA and the Australian evaluation systems proved to be significantly correlated ($r=0.56$, $P<0.0001$). Most of patients were evaluated as having mild permanent impairment (56.06% of patients classified as Class I (0-14% impairment of the whole person) according to AMA guides and 62.12% as having 0% impairment of the whole person according to Australian Act) and a fewer number of patients were evaluated as having moderate permanent impairment (36.36% of patients classified as Class II (15-29% impairment of the whole person) according to AMA guides and 30.30% as having 10% impairment of the whole person according to Australian Act). This may be explained by the observation that the mean age of all patients was about 42 years which is considered by many authors as an age associated with mild sequelae of chronic viral hepatitis. Zakiem and Boyer, 2003 stated that progression of fibrosis in chronic viral hepatitis is markedly affected by increasing age so that it is minimal or even nil before the age of forty and escalates considerably after the age of sixty. This relationship is supported by the fact of increasing mean age of patients with increasing class of impairment (41.27±10.12 years for class I, 43.11±9.35 years for class II and 45±10.97 years for class III AMA evaluation) in spite of the

absence of statistically significant differences in such relation which could be explained by the fewer number of patients included in this study when compared to that included in other studies which documented such relation.

Another factor that may contribute to the longer number of patients with mild impairment is the mean of the duration of employment which was about 14 years, a figure that (in spite of the lack of correlation between such factor and the duration of the disease) means that the duration from the onset of infection to that of evaluation is maximally 14 years which is considered to be associated with moderate incidence of developing cirrhosis and long term complications of chronic viral hepatitis (especially hepatitis C) by many authors. EASL, (1999), stated that the rate of progression of patients with chronic hepatitis C to cirrhosis is usually slow, with 20 or more years elapsing between infection and the development of serious complications. This relationship is supported by the increasing mean duration of employment of patients with increasing class of impairment (12.84±9.66 years for class I, 14.79±8.9 years for class II and 17.8±1026 years for class III AMA evaluation) in spite of the absence of statistically significant differences in such relation which could be explained by the fewer number of patients included in this study when compared to that included in other studies which documented such relation.

Conclusion and Recommendations

The study concludes:

1. Most of workers involved in this study are rated to have mild permanent impairment possibly due to the low mean age and duration of infection. The AMA and Australian evaluation systems are strongly correlated and any one of them could be applied as it is or after modification in Egypt for evaluation of permanent impairment resultant from liver disease.

2. Ultrasonography is of great importance for screening and diagnosing liver disease in general and viral hepatitis in particular a being non-invasive technique of good accuracy (82% of the patients showed abnormal hepatic echo pattern when 71.21% were apparently normal during physical examination). ALT level elevation alone is not a good indicator of viral hepatitis as it was detected in only 40.91% of patients which is low when compared to the results of abdominal ultrasonography. The prevalence rates of HCV and HBV detected among patients included in this study are similar or close to those detected by other studies involving the general pop-

ulation denoting that, in spite of the theoretical increased risk (being more exposed to needle-stick injuries, blood and other sources of infection), there is no actual higher risk of acquiring such infections among health care workers (HCWs). This may be due to the fact that HCWs are more educated about exposure, prone procedures than the general population.

The study recommends the following:

1. The Egyptian system for evaluating permanent impairment resultant from liver disease (including viral hepatitis) should be modified to include more definite and specific criteria possibly with the use of the AMA system or Australian system guidance and in case of medical arbitration, the European system could be adopted (being dependant on liver biopsy) for accurate objective judgment. Further study of permanent impairment evaluation systems adopted by other countries (especially developing nations like India, South Africa ...etc.) may be needed to come out with a system that will best suit the Egyptian situation.

2. Pre-employment examination of health care workers should be done and should include hepatitis markers so as to distinguish cases of occupational viral hepatitis from other non-occupational cases. All health care workers at CUHs should be examined periodically with the performance of abdominal ultrasonography for early detection of cases of viral hepatitis. Follow-up of patients involved in this study should be done and they should be properly managed and compensated for their impairment.

3. An ambitious plan should be adopted to apply more strict measures to reduce the risk of blood born infections and to educate health care workers at CUHs about routes of transmission, dangers and sequelae of viral hepatitis.

References

1. Abdel- Wahab MF, Zakaria S, Kamal M et al.: High seroprevelence of hepatitis C infection among risk groups in Egypt. Am. J. Trop. Med. HYg 1994; 51 (5) 536-547.

2. Abdel-Aziz F, Habib M, Mohamed MK et al.: Hepatitis C virus (HCV) infection in a community in the Nile Delta: population description and HCV prevalence, Hepatology 2000:32(1):111-115

3. Alter MJ, Kruszon-Moran D, Nainan OV et al.: The prevalence of hepatitis C virus infection in the United States, 1988 through 1994. N Engl Med 1999. 341:556-562.

4. Altman C, Lesiour A, Dunbavand A et al.: Screening of patients at risk for Hepatitis C virus infection in general medicine. Gastroenterol Clin. Biol. 1999:23(3):359-62.

5. American Association for the Study of Liver Diseases (AASLD): Practice guidelines: Diagnosis, management, and treatment of Hepatitis C, 2004. Published online in www.interscience.wiley.com.

6. American Medical Association (AMA): The Guides to the Evaluation of Permanent Impairment. 5th Edition. Publisher: AMA, 2000.

7. Amr MM: Heterocyclic pesticides and its environmental impact. Proceedings of the third world conference on environmental and health hazards of pesticides. December 1994, pp. 753-782.

8. Arthur RR, Hassan NF, Abdallah MY, el-Sharkawy MS et al.: Hepatitis C antibody prevalence in blood donors in different governorates in Egypt, Trans R Soc Trop Med Hyg. 1997:91 (3):271-274.

9. Bates B, Bickley LS and Hoekelman RA: Physical examination and history taking 6th edition. Lippincott Company, 1995.

10. Comcare: Guide to the assessment of the degree of permanent impairment. Cited on www.comcare.gov.au. Last viewed on 31/5/ 2005.

11. Danta M, Dore GJ, Hennessy L et al.: Factors associated with severity of hepatic fibrosis in people with chronic hepatitis C infection, MJA 2002:177 (5): 240-245.

12. Di Bisceglie AM: Hepatitis C. Lancet 1998, 351:351-355.

13. El-Gohary A, Hassan A, Nooman Z et al.: High prevalence of hepatitis C virus among urban and rural population groups in Egypt. Acta Trop 1999; 59:155-161.

14. El-Raziky M: A study of the impact of schistosomiasis and hepatitis C on the response to hepatitis B virus vaccine. MD thesis, 1995.

15. El-Sayed NM, Gomatos PJ, Rodier GR et al.: Seroprevalence survey of Egyptian tourism workers for hepatitis B virus, hepatitis C virus, human immunodeficiency virus, and Treponema pallidum infections: association of hepatitis C virus infections with specific regions of Egypt. Am J Trop Med Hyg 1996:55(2):179-184.

16. El-Zayadi A, Simmonds P, Dabbous H et al.: Response to interferon-alpha of Egyptian patients infected with hepatitis C virus genotype 4. J. viral. Hepatitis 1996: 3 (5): 261-264.

17. European Association for the Study of Liver (EASL): International Consensus Conference on Hepatitis C. Consensus Statement. Journal of Hepatology 1999: 31:3-8.

18. Fahim ML: Prevalence of hepatitis C virus in medical personnel working in liver unit in Kasr-Elaini Hospital, Cairo University. Thesis submitted in partial fulfillment of the M.Sc. Degree in Tropical medicine. Tropical Medicine Department, Faculty of Medicine, Cairo University, Egypt.

19. Gad A, Tanaka E, Orii K et al.: Relationship between hepatitis C virus infection and schistosomal liver disease: not simply an additive effect. J Gastroenterol. 2001:36(11):753-8.

20. Hindy AM, Abdelhaleem ES, Aly RH: Hepatitis B and C viruses among Egyptian dentists. Egypt Dent J. 1995:41(3):1217-26.

21. Kabil S, El-Zayadi A, Kamal M et al.: The true situation of liver disease in Egypt with the beginning of declination of viral hepatitis B.J. Trop. Med. 1990; 1:1-10.

22. Kassem AS, el-Nawawy AA, Massoud MN et al.: Prevalence of hepatitis C virus (HCV) infection and its vertical transmission in Egyptian pregnant women and their newborns, J Trop Pediatr. 2000:46(4):231-233.

23. Khan ZA, Alkhalife IS, Fathalla SE: Prevalence of hepatitis C virus among bilharziasis patients, Saudi Med J. 2004:25(2):204-6.

24. Knapp RG and Miller MC: Clinical epidemiology and Biostatsitics. Horwall Publishing co. Pennsylvania, 1992.

25. McClatchey KD: Clinical Laboratory Medicine, second edition, 2002.

26. Metwaly HG: Occupational health program in Cairo University Hospitals with special reference to viral hepatitis. Thesis submitted in partial fulfilment of the M.D degree in industrial medicine and occupational diseases. Occupational Medicine Department, Cairo University, 1997.

27. Nafeh MA, Medhat A, Shehata M et al.: Hepatitis c in a community in Upper Egypt: I. Cross-Sectional Survey. Am. J. Trop. Med. Hyg. 2000: 63(5, 6): 236–241.

28. Reda AA, Arafa MA, Youssry AA et al.: Epidemiologic evaluation of the immunity against hepatitis B in Alexandria, Egypt, Eur J Epidemiol. 2003:18(10):1007-11.

29. Shemer AY, El-Astal Z, Kemper O et al.: HCv infection and genotypes in southern Israel and Gaza Strip, J.Med.Virol 1999:56(3):230-233.

30. Shen L, Li JQ, Zeng MD et al.: Evaluation of the value of ultrasonography in diagnosis of liver fibrosis in patients with chronic viral hepatitis, Zhonghua Gan Zang Bing Za Zhi 2005:13 (2):117-20.

31. Sherlock S and Dooley J: Diseases of the liver and biliary system. Tenth edition. Blackwell scientific publications, Oxford, Uk, 1997.

32. Thorburn D, Dundas D, McCruden EAB et al.: A study of hepatitis C prevalence in healthcare workers in the West of Scotland. Gut 2001;48:116-120.

33. Villano SA, Vlahov D, Nelson KE et al.: Persistence of viremia and the importance of long-term follow-up after acute hepatitis C infection. Hepatology 1999:29:908.

34. World Health Organization (WHO): Communicable disease surveillance & response, Hepatitis B, 1999.

35. Zakaria S, Mabrouk MA, Zakaria E et al.: Hepatitis delta infection in patients with chronic liver disease and hepatocellular carcinoma. Egypt J. Bilh. 1993; 15(1):111.

36. Zakiem D and Boyer TD: Hepatology, A Textbook of Liver Disease. Fourth ed., Elsevier Science (USA), 2003.

37. Zheng RQ, Wang QH, Lu MD et al.: Liver fibrosis in chronic viral hepatitis: An ultrasonographic study. World Journal of Gastroenterology 2003:9(11):2484-2489