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The Study of Effect of Static Magnetic Field on The Liver Function Pre- and Post Partial Hepatectomy In Rabbits

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1. Abstract

The static magnetic field SMF was applied on the abdominal area, above the liver region to know the effect of SMF on the liver function. Twenty four rabbits were used in present study. The experimental study was designed to divide the animals to two groups, each one also divided to two subgroups based on the application of SMF and partial hepatectomy. 2nd subgroup of 1st group and 2nd subgroup of 2nd group subjected to SMF (400 Gauss or 0.04 T), and the 1st and 2nd subgroup of 2nd group were performed partial hepatectomy at caudate lobe of liver, whereas 1st subgroup of 1st group left as control group. Dose of SMF, blood parameters and biochemical GPT and GOT were estimated. The results of blood and biochemical parameters showed significant values at $P \leq 0.05$. except GPT value of 2nd subgroup of 2nd group showed highly significant at $P \leq 0.001$. **In conclusion** the magnetic field has ability to change liver physiology to better condition with low SMF, but combination of SMF and partial hepatectomy was undesirable.

Key words : Static magnetic field, Blood parameters, GOT, GPT, Hepatectomy, Rabbits

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1.Introduction

The liver is the largest organ of the body, it has large functions and most important in body physiology [1], it is highly vascularized structure, and receive blood from hepatic artery (a branch of celiac artery) and the portal vein [2]. The functional units of liver is classic hepatic lobule, the hepatic lobule consists of hepatocytes radiating concentrically around a central hepatic vein [3]. There are three major cells in liver; fibrous capsule which is consist of dense collagenous tissue, hepatic lobules are morphological and functional liver units , and hepatic sinusoid are intralobular vascular supply [2]. The main functions of the liver is to produce bile salts, bile pigments, lipid inorganic salts, water, synthesis of plasma proteins and blood storage [4], other function of liver is to produce enzymes, toxin inactivation, vitamins metabolism and production immunoglobulin [5,6, 7]*. There are some problems in liver needs to surgical entrance such as liver abscess, liver fibrosis, lobular liver cirrhosis, trauma, and tumors [8]. The liver has ability of regeneration of its tissue due to several factors : epidermal growth factor, hepatocytes growth factor, fibroblast growth factor and tumor necrosis α factor are activated immediately after partial hepatoctomy [9]. Liver enzymes and other parameters are change post partial hepatoctomy [10].

The studies of the effect of magnetic field on the liver are widely diffused in recent years, and people are frequently

exposed to it [11]. SMF were observe to influence enzymes action, protein synthesis and blood parameters [11]. The low magnetic field and low frequency (0-300 Hz) are non-ionized radiation have energy to break the atomic bond, this termed is low frequency magnetic field (LFMF) [12]. The magnetic field affect blood parameters in rabbits based on magnetic field tension and frequencies [3], some studies on the static magnetic field with tension cause thrombosis at 3000 Gauss[3], other studies with low tension caused increase some parameters to normal values [14].

while the high frequencies as mobile wave (900-1800) MHz caused ionization of haemobiotic cells in rat [15]. SMF effect on the liver function, some studies who were used vary dose of SMF (0.2mT, 0.6mT, 1.4mT) were showed to reduce glutathione enzyme level, and increase lipid peroxidase in rat [16], other study on the steelworkers who were exposed to EMF 1.3mT in their location, the results were showed increase serum glutamic pyruvic transaminase (GPT) ,glutamic oxaloacetic transaminase (GOT) and other biochemical parameters were decrease such as serum lipid, cholesterol, triglyceride, β -globulin, γ -globulin and total protein [17].

The aim of study this to is understand the effect of static magnetic field in blood parameters and function liver test (GPT, GOT) pre and post partial hepatoctomy (liver surgery).

*more details in : Hepatobiliary Disorders and its Diagnostic Methods in Dogs and Cats (Alrashid, Ibrahim MH, 2005)

2. Materials and Methods

Twenty four free females rabbits were used in present study, under same condition(cage, area, temperature(25C°- 29C°), same food and water), they were

weighted 1.9±0.2 Kg. the animals were divided into two main groups, each one was divided into two subgroups as shown in table (1)

Tab (1) experimental design

Total number of animals (24)			
A (without Ph) (12)		B (with Ph) (12)	
control group (6) Without Ph Without SMF	T1 (6) Without Ph With SMF	T2 (6) With Ph Without SMF	T3 (6) With Ph With SMF

Ph : partial hepatoctomy

SMF : static magnetic field

The main apparatus used in present study are the magnetic field apparatus , hematology analyzer, surgical instruments.

The main group **A** (without partial hepatoctomy) comprised two subgroups 1st subgroup was a control, 2nd subgroup was applied (400 Gauss) of magnetic field, direct to the abdomen at right side. The main group **B** (with partial hepatoctomy), both subgroups were made partial hepatoctomy, but 1st subgroup was leaved without SMF treatment for 15 minutes/twice/day daily, while 2nd subgroup was treated with (400 Gauss), static magnetic field was calculated by arithmetic equation [18].

Partial hepatoctomy was done in rabbits after animals anesthetized by (3mg

xylazine + 10 mg ketamine combination) [19]. Procaine penicillin 400 IU were used to prevent infection post operation [20]. Caudate lobe was incised 1 cm in partial hepatoctomy and suture by two arrows were 1st arrow simple continuous suture and 2nd arrow interrupted horizontal matters suture [8].

Blood parameters (Hb, RBCs, WBCs, DWBCs, PCV) and liver enzymes (GPT, GOT) were analyzed at 10 days post surgery[22].

Liver biopsy were taken after 10 days of surgery and slices were prepared histological examination and stained with hematoxilin and eosin stain [20].

3. Results and Discussion

All animal subgroups were showed normal gait, appetite, and water consumption. Because of the liver function wherever small size was removed, will replaced the part removed physiologically and histologically. The result of hematological and biochemical parameters listed in table (2). The treated subgroups T1

and T3 which were treated with static magnetic field showed significant values at ($P \geq 0.05$) in some parameters those revealed that SMF have the ability to increase liver function. The RBCs in groups T1 and T3 which have significantly values as compared with control and T2, those reveals SMF that had affected on RBCs

combined with significant values of GPT and GOT in the same group. The increase RBCs in groups T1 and T3 due to increase hepatocytes activity and reticuloendothelial system, in spite of T3 less than are significantly increase compared with control and T2, these results agree with Cetin et. al.[21].

The increase GPT and GOT resulted from the active process such as detoxification, inflammation, or other systemic illness, therefore the increase GOT and GPT in groups T1, T2 and T3 evident to active process of hepatocytes because of SMF effect but the values in T1,T2 are significant $P \leq 0.05$ within normal values of GPT and GOT in the body, these results agreed with Bair et. al.[9], while T3 was a highly increase and significant with other groups, also combined with increased neutrophils that evident to inflammatory phase, therefore the combination of increase of GOT, GPT and neutrophils were

undesirable and indicated abnormal physiology of liver, wherefore not advise to treated patient of animals with partial hepatoctomy by SMF directly, they should be leaved the patient several days even to decrease of neutrophils (inflammatory phase) to normal level and treated with SMF. Other WBCs parameters showed no significant increase $P > 0.05$ in T2 that reveals activity of reticuloendothelial system without other problems. The significant values of Hb and PCV of group T1 and T3 due to attractive phenomenon of magnetic field to increase blood circulation, these values agreed with Alrashid [14].

The figure (1) showed histopathology of liver of each subgroups, those reveal no significant change in hepatocytes ultrastructure, there are no report we can relay on with present finding histologically. However the SMF therapy able to treat anemia or liver insufficiency.

Table(2) Hematological and biochemical values of control and treated groups after 10 days

Parameter s	Hematological (M+SD)†									Biochemical	
	RBCs *10 ¹²	WBCs *10 ⁹	DWBCs					Hb g/l	PCV	GOT IU/l	GOT IU/l
			Neutr.%	Lymph.%	Mono.%	Esino.%	Baso.%				
Control	5.5±1.3	7.0±2.1	3.6±1.5	29±0.15	1.0±0.4	0.01±0.1	0.3±0.1	10.4±0.8	56±1.2	63±0.2	39±9.1
T1	8.1±0.3 *	6.0±0.6	2.1±0.3	20±1.6	0.6±0.4	0.0±0.0	0.0±0.0	12.1±0.9 *	70±1.9 *	117±11.5 *	55±0.8 *
T2	4.7±3.8	9.6±8.1	7.2±0.1 *	44.1±1.8 *	0.0±0.0	0.0±0.0	0.0±0.0	8.1±0.8	53±1.7	214±2.1 *	83±1.5
T3	7.7±0.1 *	7.8±3.3	3.5±0.01	25±0.5	1.2±0.01	0.2±0.01	0.2±0.01	11.3±0.1	64±1.9 *	360±0.8 **	95±0.7 *

† M+SD mean+ standard deviation

*significant values at $P \leq 0.05$

**highly significant values at $P \leq 0.001$

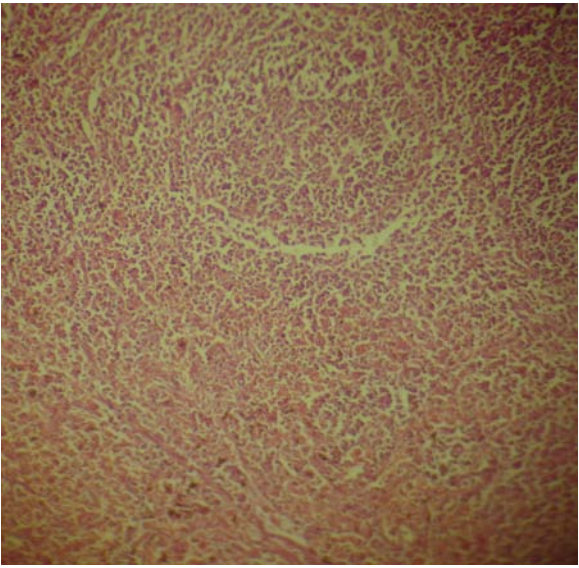
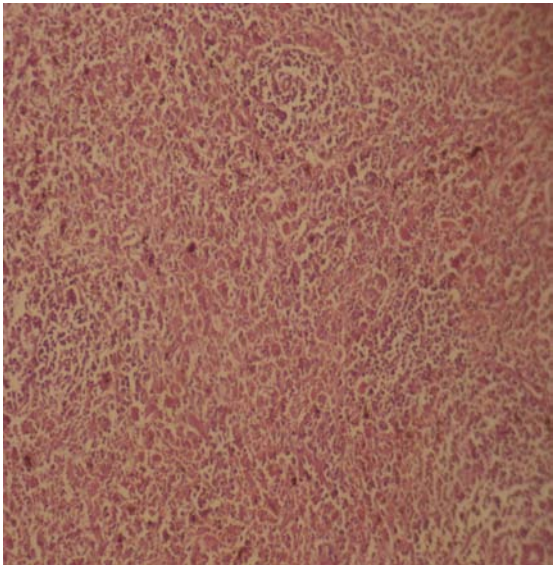
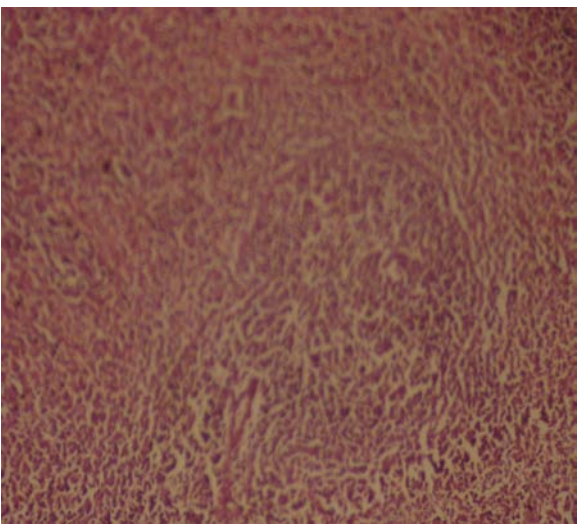
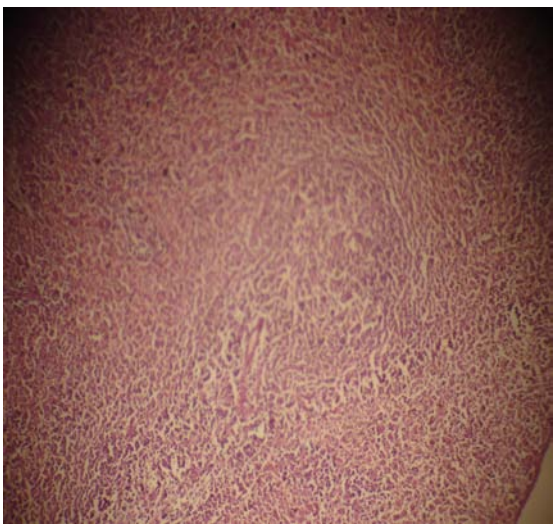
	
(C) Sub-capsular hemorrhage with pericapsular congestion , fibrosis (H&E stain X40)	(T1) Centrally lobular vaculation of hepatocytes (H&E stain X40)
	
(T2) Minimal vaculation of hepatocytes and general congestion (H&E stain X40)	(T3) Portal triad bile duct proliferation (H&E stain X40)

Figure (1) histopathological images of all groups

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