Estimation the alkaline phosphatase (ALP) level in partial hepatectomy rabbits

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Abstract

Fifteen local breed rabbits of both sexes were used to evaluate the alkaline phosphatase (ALP) level in the blood before and after partial hepatectomy. Blood samples were collected directly from the heart two times before surgery and consider as control, then one time in a week for eight wks. post-surgery. Partial hepatectomy was employed under general anesthesia, with highly aseptic technique. The results show that, the mean value of (ALP) of the control was (69.00 ± 5.33). During the two weeks after operation the level was seen within the normal. There was elevation of the (ALP) level at the 3rd wk (73.53 ± 4.17) post operation, followed by decrease in the enzyme level through the period from the 4th wk to the 7th wk post operation, and the less (ALP) level reading was in the 7th wk (50.60 ± 4.97). Then the enzyme level was elevated from the 7th wk where reaching near the normal level (57.13 ± 3.07) in the 8th wk. There was no significant change in the ALP values between the control reading and the post operation reading, but there were significant changes at ($P<0.05$) between the readings after operations.

Key words: Alkaline phosphatase, partial hepatectomy, rabbits.

قياس مستوى انزيم الفوسفيت القاعدي في الارانب بعد ازالة جزء من الكبد

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الخلاصة

استخدم في الدراسة (15) خمسة عشر ارنبا محليا من كلا الجنسين لقياس مستوى انزيم (ALP) في الدم قبل وبعد عملية الازالة الجزئية للكبد. تم سحب عينات الدم من القلب مباشرة لمرتين قبل العملية واعتبرت كمجموعة سيطرة ، ثم جمعت عينات الدم مرة واحدة اسبوعيا لمدة (8) اسابيع بعد العملية الجراحية، اجريت عملية ازالة جزء من الكبد تحت التخدير العام وباستخدام شروط التطهير والتعقيم المتعارف عليها. اظهرت النتائج ان معدل مستوى الانزيم في مجموعة السيطرة هو (96.00±5.33) وكان مستوى الانزيم في الاسبوعين الاولين بعد العملية ضمن الحدود الطبيعية ، وسجل ارتفاع في نسبة الانزيم في الاسبوع الثالث وبمستوى (73.53±4.17)، اما في الاسابيع الرابع الى السابع فقد تم تسجيل انخفاض في مستوى الانزيم وبلغت اقل قيمة لمستوى الانزيم في الاسبوع السابع (50.60±4.97)، ثم تلى ذلك ارتفاع تدريجي في مستوى الانزيم ليقترب من الحدود الطبيعية عند الاسبوع الثامن والبالغة (57.13±3.07) ، مع عدم وجود فروقات معنوية بين مجموعة السيطرة والقراءات ما بعد العملية الجراحية بينما وجدت فروقات معنوية بين القراءات بعد العملية الجراحية وعند مستوى احتمال ($P<0.05$).

الكلمات المفتاحية: قطع الكبد الجزئي ، انزيم الفوسفيت القاعدي ، الارانب.

Introduction

Rabbit's liver is divided in to left and right lobes; each of them has anterior and posterior lobules (1). There is a quadrate lobe, which is behind the gallbladder, and a small circular lobe called the caudate lobe next to the right kidney. This lobe has a narrow attachment that makes the caudate lobe prone to displacement and torsion. The gallbladder is deep within the abdominal cavity. There are two separate openings of the bile and pancreatic ducts on the duodenum (2). Rabbits produce a large amount of bile,

approximately 250 ml a day, which is 7 times as much as a dog on a weight basis. It secretes mainly biliverdin in their bile, as opposed to bilirubin (3). The alkaline phosphatase (ALP) is found in many tissues including bone, intestine, gall bladder, kidney, placenta, and liver. The highest levels in the liver are in the cells surrounding the bile ducts. Liver conditions causing bile stasis may cause ALP elevations (1, 3, and 4). ALP is an important enzyme in the liver function test, and indicative for cholestasis, it is done to diagnose liver or bone disease, or to see if treatments for those diseases are working. It may be included as part of a routine liver function test. Partial hepatectomy cause transient disturbance of liver function tests which return to the normal level of biochemical parameters within one week after surgery (4). ALP levels tests in plasma are useful in the evaluation and management of patients with hepatic dysfunction. In serial studies of hepatic function in rats after 70% partial hepatectomy, quantitative changes are found in several of the serum components used clinically to assess liver status. The activities enzymes are found to increase ALP levels in plasma will raise with large bile duct obstruction, intrahepatic cholestasis or infiltrative diseases of the liver (5, 6 and 7). Higher-than-normal ALP levels may be due to obstruction, bone disease, eating a fatty meal if you have blood type O or B, healing fracture, hepatitis, hyperparathyroidism, leukemia, liver disease, lymphoma, osteoblastic bone tumors, osteomalacia disease, rickets, sarcoidosis. Lower-than-normal ALP levels (hypophosphatasemia) may be due to, malnutrition, protein deficiency, Wilson's disease. Normal (ALP) values are varying depending on age, gender, and type of operation; it is high in children and pregnant women (7, 8 and 9). Partial hepatectomy causes a large rise in the activity of liver alkaline phosphatase that takes place exclusively in the plasma membrane. Cortisol, as well as removal of part of the liver, has now been found to cause rises in choline and phosphatidylcholine excretion in the bile and in the specific activity of hepatic alkaline phosphatase (10). The study aim to compare the ALP serum enzymes level in the normal and partial hepetectomized rabbits during the 8 weeks post operation.

Materials and methods

Fifteen adult local breed rabbits of both sexes were used to evaluate the normal serum (ALP) enzymes level, twice times, the first collection is at the zero time and the second one is in the day before the operation. Then all the animals were induced for partial hepatectomy, and measurement for serum ALP one time weekly for 8 weeks post operation.

Surgical operation:

After prepare the site of operation (midline region) by routine manner. Anesthesia was done by using the combination of ketamine hydrochloride (50 mg/kg. B.W), and xylazine (5 mg/kg. BW). Surgical incision was done from the xyphoid caudally to the umbilical region, the linea-

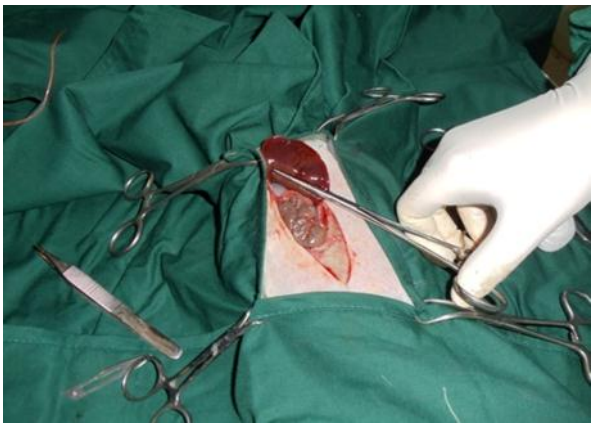

Fig. (1): Part of the right lobe of liver exteriorized out of the abdominal cavity

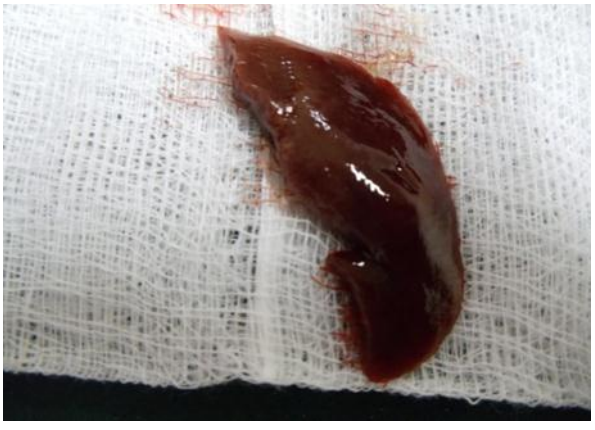

Fig. (2): Part of liver cut and removed (partial hepatectomy)

-alba and the peritoneum was sharply incised, then the abdominal organ were exposed, more than half of the posterior part of the right loop of the liver was removed, figure (1 and 2). Horizontal matters suture technique was done using 3/0 catgut at the remaining part of the liver, the peritoneum and the linea-alba were sutured by continuous suture pattern using 3/0 catgut suture materials, the skin was closed by simple interrupted using 2/0 silk. Single dose of penicillin streptomycin was administration for three days.

Measurement of Serum ALP

2-3 ml of the blood were collected directly from heart two time before the operation for the measurement of the normal serum level of (ALP), then the same amount of blood was collected from each rabbits after the operation one time weekly until the 8thwk. The blood sample was collected in sterile tube without anticoagulant, and left in room temperature obliquely for at least half an hour, the serum was separated by centrifugation for 10 minutes, and kept in the refrigerators until the (ALP) measurement were done in the laboratories of the college of veterinary medicine /Al-Anbar university, and in the Al-Raheebat hospital.

Statistical analysis

Data were expressed as mean ± SE. The results were analyzed and graphed by statistical analysis system (SAS). The statistical evaluation was done using the software package SAS 9.3 (SAS Institute Inc., Cary, North Carolina, USA). Significant difference among the readings were done using (LSD) at P<0.05.

Results

The ALP enzyme reading of the control group (before partial hepatectomy), and the weekly ALP reading during the 8 wks. Post-surgeries (after partial hepatectomy) in all animals were recorded in table 1. The ALP reading of control group before partial hepatectomy was (69.00 ± 5.33). The ALP value at the 2nd wk. after operation was within the normal level, while there was increase in the ALP in the 3rd wk. post operation (73.53 ± 4.25) compare with the reading of others weeks. This reading was not significant compare with control group. From the 4th wk. to 7th wk. post operation there were decrease in ALP reading especially at the 7th wk. post operation (50.60 ± 4.97) which declare a significant reading compare with other weeks, then the reading of the ALP was gradually increased and not returned to normal value at the end of the experiment (Table 1) (Fig. 3).

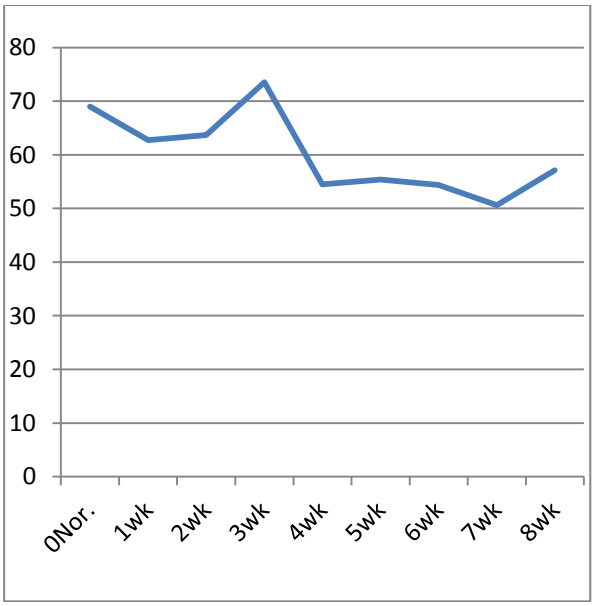

Fig. 3: Liner histogram had shown the different levels of (ALP) enzyme throughout the 8 wks. post operation compared with the normal value.

Table (1): The ALP level in the blood serum of rabbits before and after partial hepatectomy. (throughout 8 wks. post operation). Values are the means ± SE. (n=15). The LSD at (P<0.05).

No. of readings	Time of reading	ALP M ± SE
1	Before operation	69.00 ± 5.33
2	1st wk. after operation	62.73 ± 3.91
3	2nd wk. after operation	63.67± 4.25
4	3rd wk. after operation	73.53± 4.17
5	4th wk. after operation	54.47 ± 4.95
6	5th wk. after operation	55.40 ± 2.70
7	6th wk. after operation	54.40 ± 4.82
8	7th wk. after operation	50.60 ± 4.97
9	8th wk. after operation	57.13 ±3.07
LSD		6.15*

Discussion

The basal reading of the ALP serum level in the control group is (69.00 ± 5.33). This reading is non-corresponding with many authors, due to the methods and techniques are used in laboratory measurements, and also due to the effect of age, nutrition, and physiological condition (8, 9, 11, and 12). The differences (increase or decrease compare with the control group) in readings of the ALP enzyme levels which are seen in this partial hepatectomy experiment, is may be due to the extensive changes in enzymes activity as a part of liver regenerative process which occurred after partial hepatectomy (13and14). During the two weeks after operation the ALP level is remain within the normal level, and the elevation in the ALP started at the 3rdwk which is not significant compared with the values of the normal group. This elevation may be due to the increase production of bile canalicular cells which leading to increase the level of this enzyme in serum (10, and 15). This is agreed with the results of others workers whom referred that the ALP serum level is increased after the liver hepatectomy during the (1 day) post operation and continued until the (28 days) post operation in liver failure, while in the normal and healthy one the level of the ALP is remained with the normal level (16). The decrease value of ALP from the 4^{th}wk to the 7^{th}wk post operation is agreed with (7, 9, and 8) whom attributed to many factors like pregnancy, age, and nutrition or protein deficiency. This decline is transient and soon returns to the normal reading (4). The elevation and decline in the rate of ALP serum in this study is not significant because the animal is healthy, and this is agreed with (16) which declare the gradual increase of the ALP level at post operation (16 and 17). The study demonstrates a significant change within the group especially in the 3^{rd} wk. and 7^{th} wk. The different in the reading of ALP serum enzymes level in partial hepatectomy is still not significant among the groups even if there is little change in the ALP level and this agree with the some authors whom declare that Alkaline phosphates and γ GT showed little change in partially hepatectomized group but in biopsy group noticeable increase occurred in comparison with control and hepatectomized group. Interestingly the change in biopsy group is opposite to Hepatectomy group point by point (18).

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