Study the concentration of blood sugar and electrolytes in gallstone patients' pre- and post- cholecystectomy

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Abstract

This study was conducted to find the change in blood sugar and electrolytes for the gallstone patients who undergo cholecystectomy (both type's laparoscopy and open laparotomy). Serum electrolytes included: sodium, potassium, and calcium. This study included 120 patients (92 female and 28 male), aged between (16-65).Two samples were taken from the patients (first sample pre cholecystectomy, and the second sample after 2 weeks of it.

The result showed Fasting blood sugar increased significantly ($p \leq 0.05$) in females group pre cholecystectomy comparing to after it, while there was no significant difference in males group. For serum electrolytes Results showed a high significant increase ($p \leq 0.01$) in sodium and potassium concentrations pre cholecystectomy comparing with their concentrations after it, while there was a high significant decrease in calcium concentrations ($p \leq 0.01$) before operative comparing to after it.

The aim of this study: is to study the concentration of serum glucose and electrolytes in gallstone patients and their effect pre and post cholecystectomy.

Key words: blood sugar, electrolytes, gallstone, and cholecystectomy.

Introduction

Gallstones (GS) are one of the most common biliary disease. The gallstone's disease is the most common medical conditions in the United States and in developed counties in general (Everhart *et al*., 1999). Gallstone disease is a worldwide disease and it remains to be one of the most common health problems leading to surgical intervention.[1][2]. Gallstones (GS) are abnormal masses of a solid mixture of cholesterol crystals, mucin, calcium bilirubinate, and proteins that have affected people for centuries, Presence of stones in the gallbladder is referred to as cholelithiasis (from the Greek: chol-, "bile" + lith-, "stone" + iasis-, "process").[3] Gallstone disease is a chronic recurrent hepatobiliary disease, the basis for which is the impaired metabolism of cholesterol, bilirubin and bile acids, which is characterized by the formation of gallstones in the hepatic bile duct, common bile duct, or gallbladder. [4]

Materials and Methods

The population of this study for both gender factors [male (M) & female (F)] patients age range from 16 to 65 years whom are selected by depending on this study questionnaire. 10 ml of venous blood was drawn from each group subjects after (8-12) hour fasting, the blood allowed to clot in plain tube at room temperature. The serum was aspirated and stored at (-20 C°) until the time of estimation. We take two samples from the patients before the surgery and after 15 days of it.

Fasting blood sugar (FBS) was estimated by using enzymatic method and we measured the concentration of glucose using spectrophotometer. Serum Calcium was measured by using serum Calcium kit which depending on colorimetric reaction, serum potassium was estimated by using (photometric Turbidimetric test) and Serum Sodium was estimated by using (photometric determination of serum sodium-Mg-Uranylacetate method, color test).

Results and discussion

Blood sugar

The results of our present study in figure (1) and Table (1) showed a significant decrease ($p \leq 0.05$) in glucose concentrations in male group A (113.80 ∓ 15.73mg/dl) pre cholecystectomy when compared with groups B&C, and also, this group decreases significantly ($p \leq 0.05$) post cholecystectomy when compared to the other two group. There was no significant difference in male groups before and post cholecystectomy.

In female groups the result showed a significant increase ($p \leq 0.05$) in group C (126.18 ± 23.14mg/dl) pre cholecystectomy comparing to group A&B, there was a significant increase ($p \leq 0.05$) in the same group (115.42 ± 18.84mg/dl) post cholecystectomy when compared with other groups.The results in figure (1) showed a significant increase in female groups ($p \leq 0.05$) pre cholecystectomy A (108.08 ± 16.08mg/dl), B (107.10 ± 15.58mg/dl), and C (126.18± 23.14mg/dl), respectively when compared to the concentrations of S. glucose after it.

Table (1): Concentration of blood sugar (mg/dl) according to sex and age.

GR.		Blood sugar (mg/dl) Mean ± SD.	
		Pre	Post
Male	A	113.80±15.73bA	109.30±14.73bA
	B	129.38±9.75aA	126.37±13.90aA
	C	136.30±9.03aA	132.80±6.03aA
Female	A	108.08±16.08cA	101.46±11.02dB
	B	107.10±15.58cA	99.93±13.58dB
	C	126.18±23.14aA	115.42±18.84bB

Similar letters mean the absence of significant differences. ($P \leq 0.05$)

In comparing between male and female groups, the result showed a significant increase in male groups B&C which were (129.38 ∓ 9.75mg/dl), (136.30 ∓ 9.03 mg/dl), respectively and female group C which was (126.18 ∓ 23.14mg/dl) pre cholecystectomy, while post cholecystectomy there was a significant increase ($p \leq 0.05$) in male group B (126.37 ∓ 13.90mg/dl) and C (132.80 ∓ 6.03) when compared with the other groups of males and females.

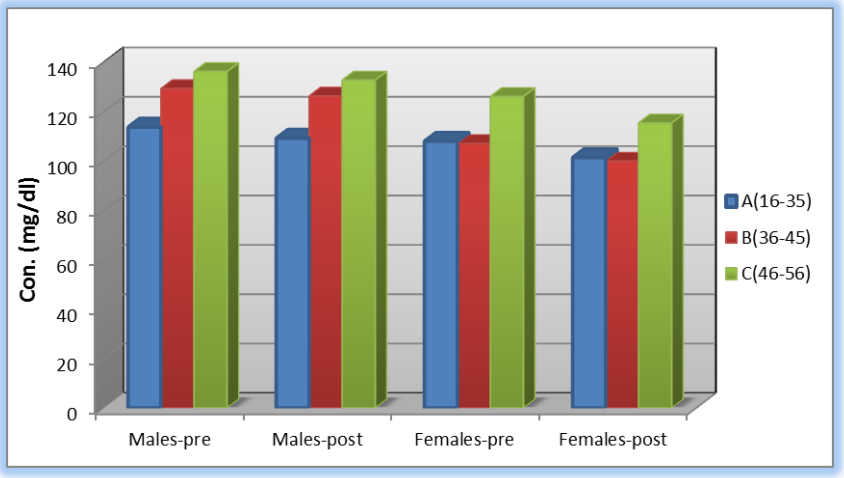

Figure (1) Concentration of blood sugar (mg/dl). pre and post cholecystectomy according to age and sex.

There is a little information on association of abnormal serum glucose concentrations with GSD. [5] In the first stage of GSD the concentrations of blood sugar reduce due to the fact that these patients present for medical intervention due to one of the complications of GS like acute cholecytitis that leads to loss of appetite and vomiting (Sherlock and Dooly, 2002). After that concentrations of blood glucose raised in the period of disease.

In a finding by Neha *et al*. they have been found a significant increase in blood sugar after one week of cholecystectomy. [6] This increase may be caused by the effect of catabolic phase of surgical trauma leading to increase the serum concentration of adrenaline and non-adrenaline, which are insulin antagonists. [7] In addition the increased serum insulin in the blood can lead to increase glycolysis and glucognolysis, therefore, the concentration of blood sugar will be increased.

The results of the present study are in correspondence with finding by Tawfiq which obtained the same results.[8] They reported that fasting glucose concentrations were significantly increased in gallstone patients as compared with the healthy subjects. [9] The increase in fasting gallbladder volume in diabetics with autonomic neuropathy was reported by Shaffer. [10] Our results showed a high (yet within normal range) for fasting blood glucose in gallstone patients. Many studies showed an association between gallstone formation and diabetes mellitus, patients with raised blood glucose concentrations are more prone to develop gallstones. [11] Patients with longer duration of the diabetes mellitus are more likely of developing complication like gallstone formation in gallbladder. [12] Patients with diabetes mellitus have long been assumed to be at an increased risk of gallstones because obesity, high serum concentrations of glucose, insulin, cholesterol, and triglycerides are all associated with poor gallbladder motility. [13] [14]

Previous studies indicated that diabetes mellitus was a risk factor for GSD. [15] GSD appeared strongly associated with fasting glycemia. We noted that there was a positive correlation between prevalence of gallstone and higher FPG. The possible mechanisms for this association may be as follows: hyperglycemia inhibits bile secretion from the liver and disturbs gallbladder contraction hyperglycemia may affect gallbladder motility; or some factors modifying the crystal nucleation and mucous secretion in bile.

Serum electrolytes

The results in figure (2) and Table (2) showed a significant increase ($p \leq 0.01$) in Na^+ concentration in males group C (325.5 ± 48 mmol/l) pre cholecystectomy when compared with the concentration in group A&B, and the concentration of Na^+ in this group (C) increase significantly ($p \leq 0.01$) post cholecystectomy (137.5 ± 6.9 mmol/l) compared with the other two groups.

Also In male groups the concentration of serum sodium was increase significantly ($p \leq 0.01$) pre cholecystectomy, A (204. ± 17.3 mmol/l), B (192.5 ±18.6 mmol/l), and C (325.5 ± 48 mmol/l), respectively when compared with Na^+ concentration post cholecystectomy.

In females group the results showed a significant increase ($p \leq 0.01$) in Na^+ concentration in group A (201.4 ± 29.8 mmol/l) pre cholecystectomy when compared with the concentration in groups B&C, and the concentration of Na+ in this group is increase significantly ($p \leq 0.01$) post cholecystectomy (155.53 ± 15.1 mmol/l) compared with the other two groups. In all male groups the concentration of serum sodium increased significantly ($p \leq 0.01$) pre

cholecystectomy, A (201.4.± 29.8 mmol/l), B (178.22 ±18.6 mmol/l), and C (164.45 ± 11.04 mmol/l), respectively when compared with Na^+ concentration post cholecystectomy.

In comparing between male and female groups the results in figure (2) showed a significant increase ($p \leq 0.01$) in male group C (325.5 ± 48 mmol/l) and female group A (201.4.±29.8 mmol/l) pre cholecystectomy, when compared with others (M&F) group. There were no significant differences between male and female groups post cholecystectomy.

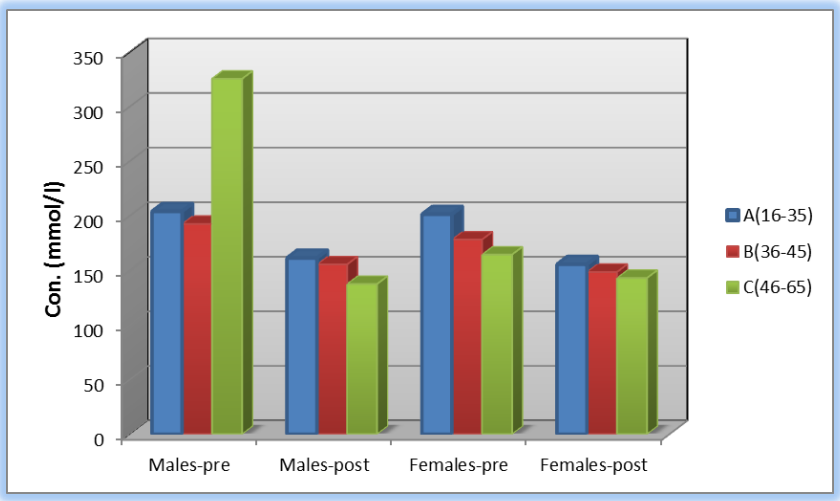

Figure (2) Concentrations of S. Na^+ mmol/l. pre and post cholecystectomy according to age and sex.

For calcium concentration the results in figure (3) and Table (2) showed a significant decrease in Ca^{++} concentration ($p \leq 0.01$) in female and male groups pre cholecystectomy compared with the concentrations after it which was in male groups as flowing A (6.48 ± 1.39 mg/dl), B (6.88 ± 0.80 mg/dl), and C (6.61 ± 0.84 mg/dl), respectively and in female groups A (6.75 ± 0.18 mg/dl), B (7.02 ± 0.89 mg/dl), and C (6.88 ± 0.67 mg/dl), respectively. There was no significant difference between male and female groups before and after cholecystectomy.

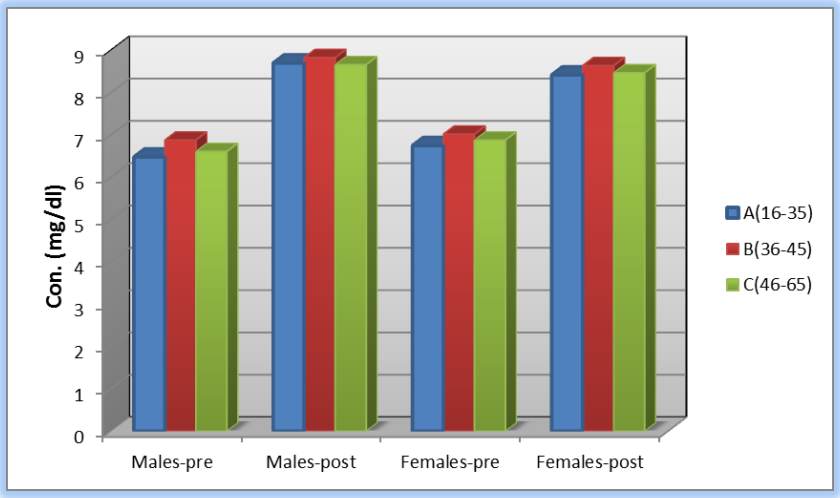

Figure (3) Concentrations of S. Ca^{++} (mg/dl). pre and post cholecystectomy according to age and sex.

For potassium concentration the results in figure (4) and Table (2) showed a significant increase in K^+ concentration ($p \leq 0.01$) in female and male groups pre cholecystectomy compared with the concentrations after it which was in male groups as flowing A (6.89 ± 1.17 mmol/l), B (6.33 ± 0.90 mmol/l), and C (6.70 ± 1.29 mmol/l), respectively and in female groups A (6.47 ± 0.60 mmol/l), B (6.54 ± 1.36 mmol/l), and C (5.81 ± 1.33 mmol/l), respectively. In comparing between males and females pre cholecystectomy the result showed a significant decrease ($p \leq 0.01$) in female group C (5.81 ± 1.33) when compared with other group, while post cholecystectomy there was a significant increase ($p \leq 0.01$) in males group A (5.51 ± 0.66) comparing with others patients group.

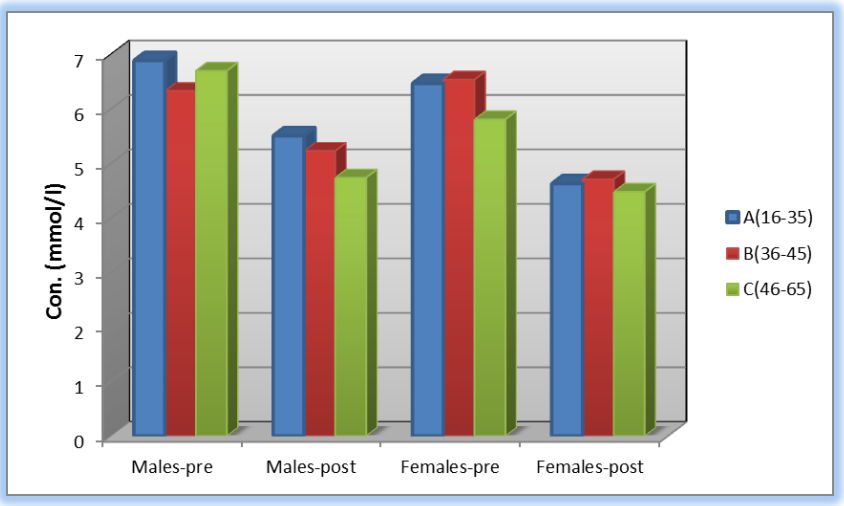

Figure (4) Concentrations of S.K $^{+}$ (mmol/l). pre and post cholecystectomy according to age and sex.

Table (2): Concentration of S. electrolytes (mmol/l, mg/dl) according to sex and age.

	Na^{+} (mmol/l) Mean ±SD.		Ca^{+2} (mg/dl) Mean ±SD.		K^{+} (mmol/l) Mean ±SD.	
M	Pre	Post	Pre	Post	Pre	Post
A	**204.1±17.3bA**	**161.4±10.5cB**	**6.48±1.39bA**	**8.70±0.76aB**	**6.89±1.17aA**	**5.51±0.66bB**
B	**192.5±18.6bA**	**155.4±11.9cB**	**6.88±0.80bA**	**8.83±0.56aB**	**6.33±0.90aA**	**5.23±0.36bcB**
C	**325.5±48.2aA**	**137.5±6.9dB**	**6.61±0.84bA**	**8.66±0.63aB**	**6.70±1.29aA**	**4.74±0.76cB**
F	Pre	Post	Pre	Post	Pre	Post
A	**201.4±29.8aA**	**155.53±15.1dB**	**6.75±0.18bA**	**8.42±0.60aB**	**6.47±1.19aA**	**4.63±0.18cB**
B	**178.22±18.65bA**	**148.5±10.08eB**	**7.02±0.89bA**	**8.64±0.61aB**	**6.54±1.36aA**	**4.71±0.90cB**
C	**164.45±11.04cA**	**143.02±7.37eB**	**6.88±1.03bA**	**8.47±0.67aB**	**5.81±1.33bA**	**4.48±0.93cB**

Similar letters mean the absence of significant differences. ($P \leq 0.01$)

Comparison for serum sodium, potassium, and calcium concentration between GS patients before and after cholecystectomy of different age group in males and females are shown in figure (2, 3 and 4). In GSP sodium concentration was significantly high ($p \leq 0.01$) in male and female groups pre cholecystectomy, these results agree with a finding by Naseem *et al*., which found similar results. [16] Serum Na^{+} and K^{+} play an important role in the diagnosis of different disease. [17]

The results of present study about serum Na^{+} and K^{+} concentration are agreement with the other study that compare between them concentrations in GSP before and post cholecystectomy. [15]

The base of present study was on the findings of the previously published work on the electrolytes in GSP serum analyzed which indicated the role of these electrolytes in the pathogenesis of human gallstone. Many investigators have suggested that electrolytes especially when present in higher amount in serum and/ or in bile play a significant role in stone formation either in association with structure of conglomerate crystals or in combination with organic molecules[18] [19].

Naseem *et al*., found high concentration of sodium in the bile and serum of females, and this could be attributed to certain factors such as hypomotility (due to pregnancy). [20] Sodium and potassium may be the reason for significant occurrence of gallstone in females as compared to males. [21] In the present study we found a significant decrease of Ca^{++} concentration in GSP pre cholecystectomy, and this finding agrees with a finding by Jalaja and Srihari (2010) which found similar results. Calcium has been hypothesized to protect against gallstone by binding secondary bile acids including deoxycholate in the small intestinal lumen, thus reducing the deoxycholate and cholesterol content of the bile. Few studies have examined the association between calcium intake and GBD and, thus evidence for such an association is extremely limited. Other studies found an increase association between dietary calcium and GBD. Calcium is seemed to be important menials in formation of stones in gallbladder; it is present as calcium carbonate and calcium bilirubinate.[22] Accumulate of calcium in gallstones maybe a reason for lower of its concentration in serum. Many studies showed no association between dietary calcium and GBD. [23]

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دراسة تركيز سكر الدم و الألكتروليتات لدى مرضى حصى المرارة قبل عملية الاستئصال وبعدها

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الملخص

صممت هذه الدراسة لإيجاد التغيرات في تركيز سكر الدم والكهارل لمرضى حصى المرارة والذين خضعوا لعملية استئصالها (بنوعيها المنظارية باستخدام المنظار والمفتوحة عن طريق احداث شق في البطن). ضمت هذه الالكتروليتات كلاً من (الصوديوم Na, البوتاسيوم K و الكالسيوم Ca). شملت الدراسة 120 مريضاً (92 اناث, و28 ذكور) تراوحت اعمارهم مابين (16–65), تم اخذ عينتين من الدم للمرضى (العينة الاولى قبل اجراء العملية والعينة الثانية بعد 15 يوما من اجراء العملية).

اظهرت نتائج الدراسة الحالية ان هناك ارتفاع معنوي في سكر الدم ($P\leq 0.05$) قبل العملية لمجموعة الاناث مقارنة لما بعدها, بينما لم تكن هناك اختلافات معنوية قبل وبعد عملية استئصال المرارة لمجموعة الذكور. كما اظهرت نتائج هذه الدراسة ان هناك ارتفاع معنوي ($P\leq 0.05$) في تركيز كلا من الصوديوم والبوتاسيوم قبل عملية الاستئصال عندما قورن تركيزهما لما بعد العملية وفي كلا الجنسين, بينما كان هناك انخفاض معنوي في تركيز الكالسيوم ($P\leq 0.01$) لمجاميع المرضى قبل عملية استئصال المرارة مقارنتاً لما بعد الاستئصال.

الكلمات الدالة: سكر الدم, الكهارل, حصى المرارة, استئصال المرارة.

الهدف من هذه الدراسة: دراسة تركيز سكر الدم وعدد من الكهارل لمرضى حصى المرارة ودراسة الاختلاف في تراكيزها قبل وبعد عملية استئصال المرارة.