

Kidney functions and electrolyte disturbance among Iraqi patients with bladder cancer

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Abstract:

Background: Bladder cancer is among the most prevalent cancers worldwide, with 549,393 new cases reported in 2018. Approximately 3% of all new cancer diagnoses and 2.1% of all cancer deaths are due to urinary bladder cancer.

Objectives: This study aims to explore the efficiency of renal system functions as indicated by renal function tests and electrolyte levels among bladder cancer patients.

Methods: All patients in this case-control study were recruited from Ghazi Al-Hariri Hospital for surgical specialties in Baghdad during the period from December 2021 to June 2022. A total of 100 individuals were enrolled in this study and divided into two groups. The first group included 50 patients with an age range of (16-79) years. All patients were first diagnosed and investigated with a bladder mass by transurethral resection of bladder tumor (TURBT) and sent to the histopathological examination for biopsy of bladder lesion. The second group included 50 healthy individuals.

Results: The results of the present study showed that all renal function tests and serum electrolyte levels were in the upper limit or within the normal range, although some of these levels were significantly different between patients and controls.

Conclusion: All renal function tests were within the upper limits of the normal range as most of the bladder tumors were low-grade small-sized masses.

Keywords: Superficial bladder cancer, renal function tests, electrolyte disturbance.

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Introduction:

Urinary bladder cancer (UBC) is the cause of about 3% of all new cancer diagnoses and 2.1% of all cancer deaths¹. It includes a spectrum of illnesses, from chronically recurrent and non-invasive tumors that can be controlled, to aggressive and advanced-stage illnesses that need invasive and multimodal treatment². Serum urea is the end product of protein metabolism, filtered through the glomeruli and finally excreted from the human body. Studies to evaluate the influence of serum urea on carcinogenic occurrence have been extremely scarce and inconclusive³. Serum creatinine level is one of the routine serum biomarkers commonly used in clinical practice associated with renal function. In advanced bladder cancer, the bladder orifices of the ureters are often infiltrated, causing hydronephrosis. The obstructed outflow of urine from the kidney leads to a reduction in the filtering capacity of the organ, which results in an increased concentration of creatinine⁴. Due to increased cancer cells' cycle activity, it is expected that changes in the purine and pyrimidine metabolic pathways would be seen.

Hypoxanthine is synthesized and transformed into uric acid during the typical degradation of purine nucleotides. This process is dysregulated in cancer cells because purine synthesis is stimulated which will affect uric acid levels in cancer patients⁵. Electrolyte disorders are very common conditions in cancer patients. In most cases, these alterations are asymptomatic and therefore are not always taken into consideration in clinical practice. However, they can sometimes be associated with clinical manifestations that can worsen a patient's clinical condition to more serious life-threatening events. And they seem to correlate with the worsening quality of life and performance status, reduced probability of tumor response to anti-cancer treatment and treatment delays, cause poorer outcomes, and reduced survival. Electrolyte disorders in cancer patients may depend on several causes: cancer physiopathology, anti-tumor treatments, concomitant clinical conditions, or therapies⁶. It is uncommon for bladder cancer patients to have hypercalcemia without bone metastases or a large tumor, and most cases with this condition have been described in individual case reports⁷. Hypercalcemia in cancer patients can have a variety of causes, develop gradually and present with a wide range of symptoms. It might also reflect how the underlying tumor behaves and how it is treated⁸.

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Materials and Methods:

From December 2021 to June 2022, all the individuals from Ghazi Al-Hariri Hospital for Surgical Specialties in Baghdad were enrolled in this case-control study. One hundred individuals were divided in two study groups. The first group included 50 patients (46 men and 4 women), with an age range of 16 to 79 years. All patients had transurethral resection of bladder tumor (TURBT) after receiving a diagnosis of a bladder mass, and samples of the bladder lesions were sent for histologic examination. The second group consisted of 50 healthy individuals (4 females and 46 males), with an age range of 16 to 79 years. All of whom had no prior history of any bladder lesion.

- Inclusion criteria: Patients who presented with a bladder mass.
- Exclusion criteria: Patients with other health disorders that make them unfit for general anesthesia.

Results:

There was a statistically significant difference between the cases and the controls in the mean values of blood urea, serum uric acid, serum calcium, and serum sodium, while serum creatinine and serum potassium did not show such differences, (Table 1). The patients did not receive any anticancer agents. Thirty-five patients had a history of smoking for more than five years.

Table 1: Mean±SD values for biochemical tests of the study groups

Variables	groups	N	Mean ± Std. Deviation	P value
Bl. Urea (20-45) mg/dl	cases	50	33.14 ± 5.226	0.001*
	controls	50	20.88 ± 2.256	
S. Uric acid (3.6-7.0) mg/dl	cases	50	7.16 ± 0.659	<0.001*
	controls	50	5.03 ± 0.626	
S. Potassium (3.4-4.5) mmol/L	cases	50	4.408 ± 0.5717	0.126
	controls	50	4.244 ± 0.4883	
S. Creatinine (0.72-1.18) mg/dl	cases	50	0.94 ± 0.425	0.463
	controls	50	1.10 ± 1.432	
S. Calcium (1.15-1.29) mmol/L	cases	50	1.21 ± 0.036	<0.001*
	controls	50	2.45 ± 0.115	
S. Sodium (136-146) mmol/L	cases	49	140.14 ± 3.075	0.002*
	controls	50	137.56 ± 3.471	

* Significant difference between means using Students-test at (P=0.05) level.

Discussion:

The absence of a statistically significant difference between the mean values of S. creatinine of the two groups in the present study is in disagreement with the results of the study conducted by Hackemer P. et al, where more than a third of their 143 patients had hydronephrosis which was discovered during the pre-CR ultrasound examination. Advanced bladder

cancer frequently invades the ureters' bladder orifices, leading to hydronephrosis. The kidney's impaired ability to filter urine results in raising the concentration of creatinine with a statistically significant correlation (P=0.003)⁴. In this study, the patients have not had urinary obstruction and did not reach the hydronephrosis state. Accordingly, their serum creatinine results were normal, and with no statistical significant difference from the controls. Although patient's blood urea concentrations were within the normal range, in the study groups, there was a significant difference between the cases and controls. El-Mawla, et al found normal blood urea values in their study, with the exception of patients in advanced stages⁹. Most of the patients in this study had low-grade tumors with a small-sized bladder mass. An earlier investigation examined the relationship between the use of nitrogen products and the risk of bladder cancer. No explanation was provided for urea alone, thus its effects are still unclear. Overall, no study has specifically shown how urea may increase the chance of developing bladder cancer³. Higher levels of hypoxanthine and lower levels of uric acid were found to be associated with increased purine metabolism in bladder cancer⁵. These results disagree with the result of the present study because most of the patients were in a hypermetabolic state and their serum uric acid levels were in the upper limits of the normal range with a significant statical difference. Purine metabolism, which increases during hypermetabolic states, causes an increase in uric acid generation¹⁰. Regarding serum electrolytes, our study found a significant difference between the patients and controls group in serum calcium and serum sodium but not in serum potassium. These concentrations were in the upper limits of the normal range. This is in disagreement with the results of other studies which have shown that electrolyte abnormalities were more prevalent in patients experiencing continent urinary diversion (UD). Hypokalemia with coexisting acidosis is usual and problematic when the ileum is utilized for UD. No patient in that study had hyperchloremic acidosis, clinically symptomatic hypokalemia, acidemia, or hypocalcemia¹¹. Our patients did not undergo UD so their serum electrolytes, in general, were normal. Patients with cancer experience electrolyte abnormalities for many reasons, including cancer physiopathology, anti-tumor therapy, concurrent clinical conditions, or therapies. An analysis of phase I trials conducted between 2011 and 2015 was reported by Ingles Garces et al. In cancer patients receiving new anticancer drugs, they found elevated rates of hypokalemia (40%), hypomagnesemia (17%), hyponatremia (62%), and hypocalcemia (12%). Those who experienced adverse events related to electrolyte disorders during follow-up had a lower median overall survival. These findings highlight how crucial it is to keep an eye on and treat electrolyte imbalances in cancer patients¹²⁻⁶.

Conclusion:

All renal function tests were within the upper limits of the normal range as most of the bladder tumors were low-grade small-sized masses.

Author's Contributions:

Noor I.A. Ibraheem: Data collection and analysing. Rawaa H. Ali: Drafting and scientific proofreading. Mohammed B. Ismail: Drafting and scientific proofreading.

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وظائف الكلى واضطراب الأيونات بين مرضى سرطان المثانة العراقيين

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الخلاصة

المقدمة: يعد سرطان المثانة من بين أكثر أنواع السرطانات انتشاراً في جميع أنحاء العالم، حيث تم الإبلاغ عن 549,393 حالة جديدة في عام 2018 وما يقرب من 3% من جميع تشخيصات السرطان الجديدة و 2.1% من جميع وفيات السرطان ناتجة عن سرطان المثانة البولية. **الاهداف:** تهدف هذه الدراسة إلى استكشاف كفاءة وظائف الجهاز البولي بواسطة اجراء اختبارات وظائف الكلى ومستويات الايونات لمرضى سرطان المثانة.

المنهجية: تم تحديد جميع الافراد المشاركين في هذه الدراسة من مستشفى غازي الحريري للتخصصات الجراحية في بغداد خلال الفترة من كانون الأول (ديسمبر) 2021 إلى حزيران (يونيو) 2022 وقد تم تسجيل مجموعه مكونة من 100 فرد وتقسيمهم إلى مجموعتين. ضمت المجموعة الأولى 50 مريضاً تتراوح أعمارهم بين (16-79) سنة حيث تم تشخيص جميع هؤلاء المرضى وفحصهم مع وجود كتلة في المثانة عن طريق استئصال ورم المثانة عبر الإحليل (TURBT) وإرسالهم إلى الفحص التشريحي لأخذ خزعة من أفة المثانة. وضمت المجموعة الثانية 50 فرداً سليماً. **النتائج:** أظهرت نتائج الدراسة الحالية أن جميع اختبارات وظائف الكلى ومستويات الايونات في الدم كانت في الحد الأعلى ضمن النطاق الطبيعي، على الرغم من أن بعض هذه المستويات كانت مختلفة إحصائياً بين المرضى والأشخاص الأصحاء.

الاستنتاج: وجدت هذه الدراسة أن كل هذه الاختبارات البايوكيميائية كانت ضمن الحدود العليا للنطاق الطبيعي لأن معظم مرضى سرطان المثانة كانوا من ذوي الدرجة المنخفضة مع كتلة صغيرة من الورم في المثانة.

مفتاح الكلمات: سرطان المثانة السطحي، اختبار وظائف الكلى، اضطراب الاملاح