

Influence of the grade and invasiveness of bladder cancer on disease course severity in patients with bladder tamponade resulting from a bleeding bladder cancer

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Abstract

Introduction and Objectives: Urinary bladder tamponade is a common urological emergency, but it has so far been insufficiently researched. The aim of our study was to show the association between the characteristics of bladder cancer (grade and invasiveness) and disease course severity based on blood hemoglobin (Hgb) count at admission, the need for red blood cell transfusion (RBCT), and the length of hospitalization in patients suffering from bladder tamponade.

Materials and Methods: A retrospective, cross-sectional study was conducted, namely, including 25 adult patients surgically treated for bladder tamponade resulting from a bleeding bladder cancer.

Results: Patients with low-grade cancer had statistically significantly higher mean Hgb values at admission (101.14 ± 8.26 vs. $87.22 \text{ g/L} \pm 10.64 \text{ g/L}$, $P = 0.005$), as well as a lower mean number of received units of RBCT (0.71 ± 0.76 vs. 2.39 ± 1.46 , $P < 0.001$) and a shorter hospitalization (2.43 ± 0.55 vs. 4.36 ± 1.04 days, $P = 0.009$) than those with high-grade cancer. Patients suffering from nonmuscle-invasive bladder cancer (NMIBC) had statistically significantly higher mean Hgb values at admission ($96.69 \pm 9.86 \text{ g/L}$ vs. $81.22 \pm 7.23 \text{ g/L}$, $P = 0.001$), as well as a lower mean number of received units of RBCT (1.31 ± 1.2 vs. 3 ± 1.41 , $P = 0.004$) and a shorter hospitalization (3.31 ± 1.14 vs. 4.78 ± 0.97 days, $P = 0.004$) than those with muscle-invasive bladder cancer.

Conclusion: Low-grade bladder cancer and NMIBC are associated with a milder clinical course of bladder tamponade.

Keywords: Bladder tamponade, bladder cancer, hematuria

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INTRODUCTION

Urinary bladder tamponade is a life-threatening emergency in urological practice. One of the most common underlying causes is a bleeding bladder cancer.^[1,2] Untimely evaluation and treatment may result in significant morbidity. A common complication is an

anemia resulting from heavy bleeding and requiring the transfusion of blood products.^[3]

Despite the frequency and importance of this urgent urological condition, its underlying pathophysiology is

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poorly understood. There is little original research on bladder tamponade in the literature, and the research is mostly about individual case reports. No study so far has examined the factors influencing the severity of the disease course in patients with bladder tamponade. The aim of our study was to show the association between the characteristics of bladder cancer (its grade and invasiveness) and the severity of the disease course in patients surgically treated for bladder tamponade.

MATERIALS AND METHODS

A retrospective, cross-sectional study was carried out. The study was approved by the Research Ethics Committee of our institution (Class: 500-03/21-01/109; Ref. No. 2181-147/01/06/M.S.-21-02) on June 24, 2021. The study included 25 adult patients surgically treated for bladder tamponade resulting from a bleeding bladder cancer at our institution from January 01, 2019, to June 01, 2021. Data were taken from the hospital's electronic medical records. Patients with incomplete medical records were not included in the study. The patients' identities remained secret, and they were identified with an identification number. The following data were taken: age, sex, smoking history, anticoagulant use, comorbidities, grade, and invasiveness of bladder cancer based on histopathological findings, length of hospitalization, hemoglobin count (Hgb) at admission (before surgery and before transfusion), the need for red blood cell transfusion (RBCT), and the number of administered units of RBCT. The severity of the disease course was determined based on one's blood Hgb count at admission, the need for RBCT, the number of received units of RBCT, and the length of hospitalization.

Statistical analysis

The statistical analysis was performed using the SPSS statistical package (IBM, Armonk, NY, USA).

As for the difference between groups with respect to categorical values, a Chi-square test was used. As for the difference between groups with respect to continuous variables, student's t-test for independent samples was used. For this analysis, values were reported as mean \pm standard deviation. The level of statistical significance was set at $P < 0.05$.

RESULTS

Of the 25 patients included in the study, 18 (72%) were male, and 7 (28%) were female. The mean age of the participants amounted to 81.16 ± 8.53 years, and 11 (44%) of participants had a history of smoking. The average number of associated comorbidities amounted to 2.64. The

most common comorbidities were hypertension, diabetes mellitus, atrial fibrillation, and other cardiovascular diseases. A total of 11 (44%) of patients were taking anticoagulants as part of their chronic therapy.

Eighteen (72%) patients had high-grade bladder cancer (HGBC), whereas 7 (28%) had low-grade bladder cancer (LGBC). Sixteen (64%) patients had nonmuscle-invasive bladder cancer (NMIBC), whereas 9 (36%) had muscle-invasive bladder cancer (MIBC).

The parameters used to determine the severity of the disease course were calculated for the total population of patients. The mean Hgb value in the total population was below the lower limit for normal values (91.12 ± 11.75 g/L), 20 (80%) patients required RBCT, the mean number of administered RBCT units was 1.92 ± 1.5 , and the mean length of hospitalization amounted to 3.84 ± 1.28 days.

An analysis of the difference in disease course severity parameters between patients with different bladder cancer characteristics was performed.

The difference in disease course severity parameters between patients with LGBC and those with HGBC was analyzed. Patients with LGBC had statistically significantly higher mean Hgb values at admission, as well as a lower mean number of received units of RBCT and a shorter hospitalization than those with HGBC. The percentage of patients who required RBCT was lower in the group of patients with LGBC than in the group of patients with HGBC but did not reach statistical significance [Table 1]. The difference in disease course severity parameters between patients with NMIBC and those with MIBC was also analyzed. The patients with NMIBC had statistically significantly higher mean Hgb values at admission, as well as a lower mean number of received units of RBCT and a shorter hospitalization than those with MIBC. The percentage of patients who required RBCT was lower in

Table 1: Comparison of blood hemoglobin values at admission, the number of patients requiring red blood cell transfusion, the number of administered units of red blood cell transfusion, and the length of hospitalization between patients with low-grade bladder cancer and high-grade bladder cancer

	LGBC	HGBC	P
Hgb at admission (g/L), mean \pm SD	101.14 \pm 8.26	87.22 \pm 10.64	0.005*
Patients requiring RBCT (%)	57.1	88.9	0.075#
RBCT units administered, mean \pm SD	0.71 \pm 0.76	2.39 \pm 1.46	<0.001*
Hospital stay (days), mean \pm SD	2.43 \pm 0.55	4.36 \pm 1.04	0.009*

*Student's t-test for independent samples, #Chi-square test.

SD: Standard deviation, RBCT: Red blood cell transfusion, LGBC: Low-grade bladder cancer, HGBC: High-grade bladder cancer, Hgb: Hemoglobin

the group of patients with NMIBC than in the group with MIBC but did not reach statistical significance [Table 2].

DISCUSSION

Urinary bladder tamponade resulting from a bleeding bladder cancer is a condition affecting the elderly, mostly men. The average age of our participants was 81.16, and 72% of participants were male. Previous epidemiological studies involving patients with bladder tumors have shown that the average age of diagnosis was between 70 and 84 years.^[4] Previous studies have also shown male predominance in patients diagnosed with bladder cancer. Men are diagnosed with bladder cancer 3–4 times more frequently than women.^[5,6] In our sample, there was a large share of people with a history of smoking (44%). This is not a surprising result given that smoking is an important risk factor for bladder cancer.^[6] Anticoagulants, drugs that can induce bleeding from a pathological substrate, were taken by 44% of patients. Previous research on hematuria shows that the use of anticoagulants is significantly associated with higher rates of hematuria-related complications.^[7]

At the time of diagnosis, about 30% of all bladder cancers are HGBC. Furthermore, most studies report that of all newly diagnosed cases of bladder cancer, about 30% are MIBC.^[8,9]

We observed that HGBC and MIBC are more frequent in patients suffering from bladder tamponade resulting from a bleeding bladder cancer relative to the aforementioned data from the literature. In fact, 72% of our patients had HGUC, and 64% had MIBC.

There is little original research on bladder tamponade in the literature. To our knowledge, the present study is the first to investigate the influence of the degree and invasiveness of bladder cancer on the severity of the disease course in patients with bladder tamponade resulting from a bleeding

Table 2: Comparison of blood hemoglobin values at admission, the number of patients requiring red blood cell transfusion, the number of administered units of red blood cell transfusion, and the length of hospitalization between patients with nonmuscle-invasive bladder cancer and muscle-invasive bladder cancer

	NMIBC	MIBC	P
Hgb at admission (g/L), mean±SD	96.69±9.86	81.22±7.23	0.001*
Patients requiring RBCT (%)	65.8	100	0.061*
RBCT units administered, mean±SD	1.31±1.2	3±1.41	0.004*
Hospital stay (days), mean±SD	3.31±1.14	4.78±0.97	0.004*

*Student's *t*-test for independent samples, *Chi-square test. SD: Standard deviation, RBCT: Red blood cell transfusion, NMIBC: Nonmuscle-invasive bladder cancer, MIBC: Muscle-invasive bladder cancer, Hgb: Hemoglobin

bladder cancer. Our results showed an association between a more severe clinical course of bladder tamponade with HGBC and MIBC. Patients with HGBC and MIBC had lower mean Hgb values at admission, as well as a higher mean number of received units of RBCT and a shorter hospitalization than those with LGBC and NMIBC. A possible explanation for a more severe anemia and a greater need for transfusion in HGBC and MIBC cases is their potentially greater tendency to bleed. Normal tissues have a highly organized network of blood vessels. In comparison, tumor vasculature consists of a disorganized architecture of immature blood vessels, resulting in a poorly perfused and leaky network.^[10] Sadaf *et al.* found that VEGF expression shows a significant association with bladder cancer grade.^[11] A number of other authors reported that higher microvessel density is significantly associated with the advanced T stage and high histological grade of bladder tumors.^[12-14] Increased vascularization of higher-grade and more invasive tumors could potentially lead to more profuse bleeding, more severe anemia, and a greater need for transfusions, and consequently to a more severe disease course and a longer hospitalization.

The main limitation of our study was the small sample size caused by the low incidence of bladder tamponade in the total population, as well as the fact that our hospital serves a relatively small number of people compared to large world centers.

Our results provide interesting and new insights into the course of bladder tamponade resulting from a bleeding bladder cancer. Given the lack of previous research and existing knowledge, additional studies on larger samples are needed to further elucidate the pathophysiology of hematuria and bladder tamponade.

CONCLUSION

LGBC and NMIBC may be associated with a milder clinical course of urinary bladder tamponade resulting from a bleeding bladder cancer.

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Conflicts of interest

There are no conflicts of interest.

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