

Clinicopathological Characteristics of Bladder Lesions at Sembiring General Hospital: A Retrospective Study

Suriyany^{1,2}, Ade Indra Mukti³

¹Faculty of Medicine, Institut Kesehatan Medistra, Lubuk Pakam, Indonesia

²Department of Anatomical Pathology, Sembiring General Hospital, Deli Serdang, North Sumatera, Indonesia

³Department of Urology, Sembiring General Hospital, Deli Serdang, North Sumatera, Indonesia

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Abstract- Bladder lesions are categorized into benign and malignant lesions, commonly presenting with clinical manifestations such as hematuria or urinary obstruction. Some cases of benign lesions exhibit growth patterns resembling malignant lesions. Malignant bladder lesions rank sixth globally. This study aims to evaluate the clinicopathological characteristics of patients with bladder lesions at Sembiring General Hospital between 2021 and 2024 using a retrospective descriptive approach. Patient data were obtained from medical records of patients who underwent cystoscopy, biopsy, and histopathological examination. The results showed that the 61-70 age group was the most affected, with males having a higher prevalence (77.78%). Malignant lesions dominated, with urothelial carcinoma being the most common subtype (90%). Tumors were most frequently found on the lateral walls of the bladder and carried a high risk of muscle invasion. Although ultrasonography proved effective as an early detection method, histopathological confirmation through biopsy remains the gold standard for diagnosis. Early detection through a multidisciplinary approach is expected to improve patient prognosis, especially in cases with high malignancy potential.

Index Terms- urinary bladder, cystoscopy, ultrasonography, cystitis, urothelial carcinoma.

I. INTRODUCTION

Bladder diseases are generally classified into benign and malignant lesions, each with distinct clinical and histopathological characteristics. Benign bladder lesions, such as cystitis cystica, cystitis glandularis, nephrogenic adenoma, and inverted papilloma, are often reactive changes with no significant malignant potential¹. Cystitis cystica and cystitis glandularis, two common benign lesions, are characterized by cystic and glandular formations in the bladder wall. While benign, these lesions may cause symptoms such as hematuria or urinary obstruction, occasionally requiring medical intervention². Conversely, nephrogenic adenomas, which are relatively rare, may present as polypoid lesions often associated with a history of bladder surgery³. Their tumor-like growth patterns can pose diagnostic challenges, necessitating careful histological evaluation to distinguish them from malignancies such as urothelial carcinoma⁴.

Malignant bladder lesions represent the most common type of bladder cancer, frequently presenting with painless hematuria as the primary symptom of malignancy^{5,6}. According to the Global Cancer Observatory (GLOBOCAN), bladder cancer ranks as the sixth most common cancer worldwide, with high prevalence in various regions, particularly Europe and North America^{7,8}. Urothelial carcinoma accounts for over 90% of bladder cancer cases, with prognosis varying greatly depending on the degree of histological differentiation⁷. Lesions with low-grade differentiation tend to be more indolent, while high-grade lesions are often more aggressive, leading to a worse prognosis and complications such as upper urinary tract obstruction^{9,10}.

The risk of developing urothelial carcinoma is often linked to smoking, occupational exposure to carcinogenic substances, and chronic irritation due to *Schistosoma haematobium* infection in endemic regions^{11,12}. In addition to these risk factors, chronic inflammation from cystitis may contribute to malignant transformation. Persistent chronic inflammation can lead to metaplastic changes in the urothelium, increasing the risk of malignancy¹³. Therefore, understanding the epidemiological differences between cystitis and urothelial carcinoma is crucial, as each carries distinct clinical implications^{2,14}. Cystitis, particularly chronic cystitis, is more common in women due to anatomical factors that facilitate urinary tract infections². Conversely, urothelial carcinoma is more prevalent in men, driven by risk factors such as smoking and chemical exposure¹².

The diagnostic approach for bladder lesions involves various imaging techniques and histopathological examinations. Cystoscopy and ultrasonography have proven effective for visualizing bladder lesions, especially when contrast-enhanced imaging is employed^{7,15}. Nevertheless, histopathological examination remains the gold standard for definitive diagnosis, particularly in assessing cellular morphology and atypia indicative of malignancy¹⁶. Detailed histopathological evaluations, supported with comprehensive clinical histories, can also help rule out primary adenocarcinoma or metastases from other primary cancers¹⁷⁻¹⁹.

Numerous studies have focused on the clinicopathology of bladder lesions, primarily in developed countries where immunohistochemical analyses are common. Some studies have also been conducted in African nations. However, in-depth

research on the clinicopathology of bladder lesions within the local population of Indonesia, particularly in North Sumatra and Deli Serdang Regency, remains few. To address this data gap, this study will be conducted at Sembiring General Hospital, a referral hospital in North Sumatra Province. The practical contribution of this research lies in generating local data that can serve as a reference for diagnostic protocols and clinical management. The findings of this study are expected to assist physicians in distinguishing between benign and malignant bladder lesions at an earlier stage, optimizing initial treatment, streamlining patient referral systems, and improving patient prognosis.

II. METHODOLOGY

This study employed a descriptive retrospective design to describe the clinicopathological characteristics of patients with bladder lesions at Sembiring General Hospital during the period of July 2021 to June 2024. This design was chosen because the study focuses on analyzing existing data without intervening in the variables under investigation. The study population consisted of all patients who underwent cystoscopy accompanied by histopathological examination of biopsy tissue during the specified period. The sample was selected using a total sampling method, where all patients fulfilled the inclusion criteria were included as study participants. The inclusion criteria included patients who underwent cystoscopy and biopsy with complete histopathological examination results. Patients with inadequate biopsy results or incomplete clinical data were excluded from the study.

Data were collected retrospectively from patient medical records and histopathological examination results obtained from the hospital's anatomic pathology laboratory. The research instruments included variables such as gender, age, imaging examination results, cystoscopy findings, and histopathological outcomes. Data validity was ensured through standard operating procedures in the anatomic pathology laboratory and re-verified using a double-blind approach by two anatomical pathology experts. Histopathological results were categorized based on lesion type and histopathological subtypes.

The study data were presented in tables depicting frequency distributions and percentages of various types of bladder lesions, as well as clinical characteristics of the patients, including age, gender, imaging findings, and cystoscopy results. The study received approval from the Health Research Ethics Committee at Sembiring General Hospital. All patient data were anonymized to maintain confidentiality. As the data used were secondary, direct patient consent was not required.

III. RESULT

A total of 18 patients at Sembiring General Hospital underwent ultrasonography, cystoscopy, and tissue biopsy from July 2021 to June 2024 to evaluate clinical symptoms of dysuria and hematuria. The examination results are presented in the following five tables, which include demographic data, ultrasonographic features of benign and malignant bladder lesions, various ultrasonographic findings of the urogenital system associated with bladder cancer, the most common locations of bladder cancer, and

histopathological results of bladder lesions at Sembiring General Hospital for the period of July 2021 to June 2024.

Table 1. Demographic distribution of bladder lesion at Sembiring General Hospital from July 2021 until June 2024

Variable	Total (n)	Percentage (%)
Number of cases		
2021	2	11.11
2022	14	22.22
2023	5	27.78
2024	7	38.89
Gender		
Male	14	77.78
Female	4	22.22
Age		
41 – 50	2	11.11
51 – 60	5	27.78
61 – 70	7	38.89
71 – 80	2	11.11
> 81	2	11.11
Lesion behaviour		
Benign		
Male	3	16.66
Female	1	5.56
Malignant		
Male	10	55.56
Female	4	22.22
Total	18	

Table 2. Bladder ultrasound findings on benign and malignant lesion at Sembiring General Hospital from July 2021 until June 2024

Variable	Lesion behaviour based on histopathological diagnosis	
	Benign	Malignant
Bladder mass	-	10
Thickening wall of bladder	3	1
Suspicious lesion of the surrounding organs	1	1

Table 3. Upper and lower abdominal ultrasound findings on bladder cancer at Sembiring General Hospital from July 2021 until June 2024

Variable	Findings		
	Present	Absent	No Data
Hydronephrosis	8	4	3
Ureteral dilation	8	0	5

Bladder mass	11	3	1
Vesicolithiasis	1	0	0

Table 4. Bladder cancer location based on ultrasound and cystoscopy findings at Sembiring General Hospital from July 2021 to June 2024

Location	Total cases
Lateral	7
Dome	2
Lateroinferior	2
Inferior	2
No Data	1

Table 5. Histopathological diagnosis of bladder lesion at Sembiring General Hospital from July 2021 to June 2024

Histopathological Diagnosis	Number of cases (n)
Benign	
Chronic non specific cystitis	4
Malignant	
Low grade non invasive papillary urothelial carcinoma	4
Low grade invasive papillary urothelial carcinoma	1
High grade infiltrating urothelial carcinoma	3
With squamous differentiation	3
With glandular differentiation	1
Metastasis squamous cell carcinoma	1
Metastasis adenocarcinoma	1
Total	18

IV. DISCUSSION

Based on the findings in Table 1, there is an observed increase in diagnosed cases of bladder lesions at Sembiring General Hospital from July 2021 to June 2024, with a peak in 2024 (38.89%). The majority of patients were in the 61–70 age group (38.89%). This aligns with studies indicating that bladder cancer is most commonly found in older individuals, particularly in the sixth and seventh decades of life^{10,17}. The risk of bladder cancer increases with age, primarily due to prolonged exposure to carcinogens such as smoking²⁰.

The gender distribution in Table 1 shows that bladder lesions are more prevalent in males (77.78%) compared to females (22.22%). This is consistent with studies reporting that bladder cancer is more common in males, with a male-to-female ratio of approximately 3.5:1 to 7.2:1^{21,22}. Risk factors like smoking, which

are more prevalent among males, significantly contribute to the incidence of bladder cancer⁷.

The majority of lesions identified were malignant, with 77.78% being malignancies, while only 22.22% were benign (Table 1). Malignant lesions were predominantly urothelial carcinoma, the most common type of bladder cancer, accounting for more than 90% of malignancy cases^{7,23}. The aggressive nature of urothelial carcinoma necessitates intensive management, including surgical resection and adjuvant therapy, due to its high recurrence risk^{10,24}. Conversely, benign lesions such as cystitis cystica and nephrogenic adenoma, although rare, still pose diagnostic challenges due to their histopathological resemblance to malignant lesions^{25,26}.

A routinely used diagnostic modality for bladder lesion screening is ultrasonography, valued for its non-invasive, affordable, and real-time imaging capabilities. This modality is a standard procedure at Sembiring General Hospital. Most data in Table 2 are derived from ultrasonography findings, with only one case diagnosed using plain abdominal radiography to evaluate radio-opaque stones. This highlights ultrasonography's effectiveness in detecting bladder masses. Among 10 cases identified as malignant on ultrasonography, all were confirmed via histopathological examination. Ultrasonography also identified bladder wall thickening, mostly benign, with only one confirmed malignant case (Table 2). These findings underscore ultrasonography's critical role in the early diagnosis of suspicious bladder conditions.

Previous studies also support ultrasonography's central role in bladder lesion diagnosis. As an initial imaging method, ultrasonography is highly effective in detecting bladder masses and assessing wall thickness. Ultrasonography can detect bladder masses larger than 0.5 cm, with specific echogenic characteristics, such as soft tissue protruding from the bladder mucosa, serving as strong malignancy indicators. Doppler ultrasonography can further enhance accuracy by revealing internal blood flow within lesions, often associated with malignancy^{27,28}.

While ultrasonography excels in detecting larger masses, its sensitivity for smaller lesions is lower compared to advanced imaging modalities like computed tomography (CT) and magnetic resonance imaging (MRI). Ultrasonography struggles to detect bladder lesions smaller than 1 cm or superficial ones. In such cases, additional evaluation with CT or MRI is necessary for more comprehensive and detailed diagnosis²⁹.

Clinically, ultrasonography is frequently used to evaluate patients presenting with hematuria or urinary obstruction symptoms, which could signal early-stage bladder lesions. This imaging technique can identify solid bladder masses, guiding further evaluation. Previous studies revealed that while ultrasonography is an excellent initial method, advanced imaging techniques such as CT or MRI may be required to assess mass size in greater detail, its relationship with surrounding structures, and potential muscle or adjacent organ involvement⁶.

Despite its limitations, ultrasonography offers rapid, non-invasive access, particularly beneficial for children or older patients who may face higher risks from invasive diagnostic methods. Ultrasonography is effective in pediatric populations for initial diagnosis and monitoring of bladder tumors. This method is also useful for tracking changes in bladder wall thickness and the

emergence of new masses after initial interventions, such as transurethral resection³⁰.

In this study, all bladder mass cases detected through ultrasonography were malignant, underscoring the high positive predictive value of this modality in malignancy detection. However, findings such as benign bladder wall thickening emphasize that final diagnosis must rely on histopathological confirmation, particularly in cases with atypical structural changes identified via ultrasonography. Hence, combining ultrasonography with histopathological biopsy remains the diagnostic standard for definitively characterizing bladder lesions.

The research findings presented in the table focus on various observations related to malignant bladder lesions, specifically urothelial cell carcinoma. Of the 14 cases confirmed as malignant through histopathological examination, 11 cases (73.33%) exhibited masses in the bladder. This finding underscores the critical role of ultrasonography in detecting masses as an early indicator of malignancy. Consistent with the literature, masses visualized on ultrasonography in the bladder are often correlated with urothelial carcinoma, one of the most common types of bladder cancer^{7,31}. Detection of masses through ultrasonographic imaging typically serves as an initial signal for clinicians to plan further evaluation via cystoscopy and histopathological biopsy, which are essential for determining the type and degree of tumor invasion^{10,32}.

In addition to bladder masses, Table 3 also evaluates the presence of hydronephrosis, observed in 8 cases (53.33%). Hydronephrosis indicates urinary tract obstruction caused by invasive bladder tumors. It often occurs due to blockage of urine flow from the kidneys to the bladder, resulting from tumor pressure or spread. Furthermore, ureteral dilation was identified in 8 patients (53.33%), also indicating urinary tract obstruction. This finding aligns with the literature, which states that bladder tumors can cause ureteral obstruction due to their growth and spread³³. The presence of ureteral dilation and hydronephrosis is an indicator of more severe complications, requiring immediate intervention to prevent the risk of kidney failure^{7,34}.

Meanwhile, vesicolithiasis, or bladder stones, was detected in only one case, indicating that the presence of bladder stones is not directly associated with malignant lesions. This finding aligns with the literature, which states that bladder stones are often incidental findings and rarely associated with malignant processes³⁵.

The findings presented in Table 4 combine data from ultrasonographic findings and cystoscopy results. Based on the data in Table 4, the majority of tumors in the urinary bladder were located on the lateral wall, with 7 out of 14 cases (50%) localized in this area. This location is significantly more commonly involved in the development of bladder cancer, as shown in several studies. Previous study conducted by Khadhoury found that tumors on the lateral wall account for approximately 30–40% of all cases³⁶. This position is often more accessible during cystoscopy, enhancing detection. Additionally, tumors on the lateral wall are frequently associated with detrusor muscle invasion, which increases the potential for aggressiveness and the likelihood of metastatic spread³³. Tumors in this area often require more aggressive interventions, such as partial or radical cystectomy, especially if muscle involvement or spread to surrounding tissues is present³².

In addition to the lateral wall, two cases were found in the dome of the bladder. Although the incidence of tumors in the dome area is lower, accounting for approximately 15–20% of total cases³⁷, this location often presents challenges in diagnosis and intervention. Tumors in the dome of the bladder are typically detected at more advanced stages due to their less accessible location during cystoscopy and the absence of clinical symptoms in the early stages until the tumor grows larger or begins to invade surrounding tissues³⁸. The proximity of tumors in the dome to important nerve and vascular structures also complicates surgical procedures, particularly during transurethral resection (TURBT), increasing the risk of incomplete resection and potential tumor recurrence.

Additionally, two cases were found in the latero-inferior region of the urinary bladder. Although less common, this location is also significant in clinical management due to its proximity to the pelvic floor. Tumors in the latero-inferior region can cause urinary tract obstruction, symptoms of urinary retention, or recurrent infections. Their close proximity to vital tissues in the pelvic floor also poses challenges for surgical intervention, especially when radical cystectomy is required. Tumors in this location often demand more cautious surgical strategies to ensure complete resection and minimize the risk of complications³⁹.

Tumors located at the base of the urinary bladder accounted for two additional cases in this study, with a prevalence of approximately 10–15% of all bladder cancer cases⁴⁰. This location, particularly in the trigone area, holds significant clinical importance due to its association with urinary function. Tumors in the trigone or bladder base are more challenging to completely remove because of their proximity to the urethra and prostate, increasing the risk of complications such as postoperative incontinence. Additionally, tumors in this area often require more aggressive treatment approaches to prevent local spread or involvement of adjacent organs³⁸.

The location of bladder tumors has significant clinical implications for treatment planning. For example, tumors on the lateral wall are generally more accessible for resection via transurethral resection of bladder tumor (TURBT). However, if there is muscle invasion or spread to surrounding tissues, more aggressive interventions, such as radical cystectomy, may be necessary³³. Conversely, tumors in the dome or latero-inferior region of the bladder often require special attention due to their more challenging anatomical locations, which can affect the completeness of resection and increase the risk of recurrence. Tumors in the dome are also more difficult to access during cystoscopy, making early detection a challenge.

Tumors located at the base of the bladder, particularly in the trigone area, pose a higher risk of surgical complications because of their proximity to the urethra and prostate. Tumors in this location often require more invasive and complex treatment approaches to minimize risks such as urinary tract obstruction or postoperative incontinence. Additionally, tumors near these vital areas can complicate radiotherapy or other adjuvant therapies due to the need to minimize damage to surrounding critical tissues¹⁰.

Histopathological examination of biopsy and tumor resection tissue remains the gold standard for diagnosing bladder lesions. Table 5 of the study findings shows the histopathological results of bladder lesions, with significant variation between benign and malignant lesions. Among benign lesions, chronic non-specific

cystitis was the most common diagnosis, with four recorded cases. This condition is a form of chronic inflammation in the bladder often caused by recurrent irritation, such as infections or chemical exposure. Although this lesion is not malignant, chronic cystitis can lead to significant symptoms like dysuria or increased urinary frequency, which can reduce the patient's quality of life³⁴. Nonetheless, it is crucial to distinguish these benign lesions from malignant tumors through histopathological biopsy to avoid diagnostic errors that could impact patient care.

Malignant lesions dominated the findings in Table 5, with urothelial carcinoma being the most common type of bladder cancer, consistent with literature stating that over 90% of bladder cancer cases are urothelial carcinoma, previously known as transitional cell carcinoma³¹. Among the subtypes of urothelial carcinoma, low-grade non-invasive papillary urothelial carcinoma was the most prevalent, with four cases identified. Papillary carcinoma often represents a form of bladder cancer with lower malignancy, typically manageable with transurethral resection of bladder tumor (TURBT). Patients with this type of cancer generally have a better prognosis and a lower risk of recurrence if the tumor is adequately removed and routine follow-ups are conducted³².

This study also identified one case of low-grade invasive papillary urothelial carcinoma and four cases of high-grade infiltrating urothelial carcinoma, reflecting the more aggressive variants of urothelial carcinoma. High-grade tumors are more likely to invade the bladder muscle layer and spread to surrounding tissues, thereby worsening the patient's prognosis. The findings of cellular differentiation, such as squamous differentiation in three cases and glandular differentiation in one case, also indicate a poorer prognosis. These cellular differentiations are often associated with more aggressive tumor behavior and a higher risk of recurrence⁷. Lesions with squamous or glandular differentiation often respond poorly to standard therapies for urothelial carcinoma and require more aggressive treatment approaches, including the possibility of radical cystectomy along with adjuvant chemotherapy or radiotherapy²⁰.

One significant finding in this study was the presence of metastatic squamous cell carcinoma and adenocarcinoma in two cases. The metastatic squamous cell carcinoma originated from the cervix, while the metastatic adenocarcinoma originated from colon adenocarcinoma. Primary tumors of these histopathological types are relatively rare in the bladder. Squamous cell carcinoma accounts for approximately 2% to 7% of all bladder cancer cases and is more commonly found in endemic regions for schistosomiasis, where chronic irritation caused by parasitic infection plays a role in cancer development²⁰. Primary squamous cell carcinoma of the bladder has a poorer prognosis than urothelial carcinoma due to its tendency to be more invasive at diagnosis. Primary adenocarcinoma, which accounts for approximately 0.5% to 2% of bladder cancers, also has a poorer prognosis because it is usually detected at an advanced stage⁴¹. These two metastatic subtypes demonstrate that bladder cancer can develop from the spread of primary cancers in other organs, such as the colon, prostate (in males), and gynecological organs (in females), adding complexity to clinical management.

The histopathological findings presented in Table 5 have significant clinical implications for determining treatment strategies and patient prognosis. Patients with low-grade non-

invasive papillary urothelial carcinoma can generally be treated with local resection via transurethral resection of bladder tumor (TURBT), followed by close monitoring through routine cystoscopy to prevent recurrence³³. The prognosis for such cases is typically better compared to high-grade lesions. However, for patients with high-grade infiltrating urothelial carcinoma or cancers with squamous or glandular differentiation, a more aggressive approach is required, such as partial or radical cystectomy combined with adjuvant therapy. These tumor types tend to be more invasive and carry a higher risk of recurrence⁴². Lesions with complex histological differentiation often require more intensive management to improve clinical outcomes.

The presence of metastatic squamous cell carcinoma and adenocarcinoma in the bladder indicates involvement of other organs, necessitating a multidisciplinary treatment approach. Metastatic cancers often have a poor prognosis, and identifying the source of metastasis is crucial to ensure appropriate management. A collaborative approach involving oncologic surgeons and radiologists is required to plan suitable treatments, including systemic therapies that can improve long-term patient outcomes⁴³.

Overall, these histopathological findings provide critical insights into the types of lesions found in patients with suspected bladder cancer. Early detection and determination of histological subtypes are essential for designing optimal treatment strategies and improving long-term prognosis. Advanced-stage cases or those involving metastasis require more aggressive care and a multidisciplinary approach to achieve the best outcomes.

This study has several limitations that need to be acknowledged. First, the retrospective design used results in constraints on the availability and quality of data, particularly related to incomplete medical records or variability in the documentation of histopathological findings. This may affect the consistency of data analysis and the accuracy of conclusions. Additionally, while ultrasonography (USG) serves as a non-invasive initial detection tool, its sensitivity for small or superficial lesions is lower compared to more advanced imaging modalities such as CT scans or MRI, potentially leaving some lesions undetected at early stages. The lack of integration of local environmental and genetic risk factors also limits a deeper understanding of the causes of bladder cancer in this population. Beyond these limitations, there are other aspects to consider. Variations in biopsy techniques or cystoscopy procedures among patients may not have been fully standardized, potentially impacting diagnostic outcomes and the quality of histopathological data. Moreover, the study did not account for the time differences between early detection and intervention, which could influence disease progression and patient prognosis. Further research is needed to address these limitations. Prospective studies could provide more comprehensive and structured data, ensuring consistency in data collection and analysis. The use of advanced imaging modalities such as CT and MRI should be more integrated into clinical practice to enhance early detection, especially for smaller and harder-to-detect lesions. Additionally, epidemiological studies focusing on local risk factors are needed to expand understanding of bladder cancer etiology in this region. Key variables such as smoking status and a history of exposure to hazardous chemicals should be included, given the strong association of these factors with bladder cancer risk.

Socioeconomic status and access to healthcare should also be assessed, as they can influence early detection and treatment choices. Genetic factors that may contribute to cancer predisposition are also crucial, particularly in the context of the local population in North Sumatra.

Finally, monitoring the duration and response to treatment in prospective studies is essential to evaluate the long-term effects of implemented treatment strategies. Such research can help design more effective prevention strategies and personalized interventions.

V. CONCLUSION

This study provides clinicopathological data on patients with bladder lesions at Sembiring General Hospital for the period of July 2021 to June 2024. The research indicates that the majority of bladder lesions identified at Sembiring General Hospital were urothelial carcinoma, the most common and aggressive type of bladder cancer. The highest incidence occurred in patients aged 61–70 years, with a higher prevalence in males compared to females, consistent with risk factors such as smoking and exposure to carcinogens. Ultrasonography proved beneficial as an initial diagnostic tool; however, its limitations in detecting small or superficial lesions underscore the importance of histopathological biopsy for definitive diagnosis. The most common tumor location was the lateral wall of the bladder, which has a higher potential for invasiveness and, in some cases, requires more aggressive surgical intervention. Although benign lesions such as chronic cystitis were also identified, the primary focus remained on malignancy, which demands prompt and appropriate management to improve patient prognosis. From the retrospective studies, we suggest that :

1. **Early Detection and Diagnosis:** Routine cystoscopy and histopathological biopsy examinations should be strengthened, especially for high-risk patients such as older males with known risk factors. This approach will aid in detecting cancer at an early stage and improving survival rates.
2. **Optimization of Imaging Modalities:** Ultrasonography should be used as an initial screening tool but needs to be supplemented with CT scans or MRI for a more comprehensive evaluation, particularly in cases involving small or anatomically challenging lesions.
3. **Integrated Approach for Invasive Tumors and Complex Cases:** Tumors located in areas such as the dome or latero-inferior bladder require collaboration between urologists, oncologic surgeons, and radiologists. This multidisciplinary approach is crucial to achieving better clinical outcomes.
4. **Further Research:** Prospective studies focusing on local risk factors, such as environmental chemical exposure and genetic predisposition, are needed to deepen the understanding of bladder cancer epidemiology in North Sumatra, particularly in Deli Serdang Regency, and to validate the findings of this study.
5. **Prevention and Education:** Community education and awareness programs about the dangers of smoking and exposure to carcinogenic substances should be enhanced. These health campaigns can reduce the prevalence of bladder cancer, especially among high-risk populations.

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AUTHORS

First Author – dr. Suriany, M.Ked (PA), Sp.PA Faculty of Medicine, Institute Kesehatan Medistra, Lubuk Pakam, Indonesia. Department of Anatomical Pathology, Sembiring General Hospital, Deli Serdang, North Sumatera, Indonesia, **email ID:** suriany.ppds.pa@gmail.com

Second Author – Dr. dr. Ade Indra Mukti, Sp.U, Department of Urology, Sembiring General Hospital, Deli Serdang, North Sumatera, Indonesia

Correspondence Author – dr. Suriany, Faculty of Medicine, Institut Kesehatan Medistra, Lubuk Pakam, Indonesia, **email ID:** suriany.ppds.pa@gmail.com