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Do Urologists Adhere to Antibiotic Prophylaxis Guidelines prior to Cystoscopy?

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Antibiotic prophylaxis · Cystoscopy · Adherence

Abstract
Introduction: Flexible cystoscopy is a common urological procedure with a low infectious risk. Current guidelines recommend selective rather than routine antibiotic prophylaxis (AP), reserving its use for patients with well-defined risk factors. However, real-world adherence to these recommendations remains uncertain. The objective was to assess adherence of urologists to guideline-directed AP use before flexible cystoscopy and to identify physician-related predictors of non-compliance. ***Methods:*** A nationwide anonymous questionnaire was distributed to all urology specialists practicing in Israel. The survey consisted of 18 structured items examining demographic, academic, and clinical characteristics, as well as AP prescribing patterns and risk-factor considerations. Descriptive statistics, chi-square tests, and multivariate logistic regression were used to evaluate associations between physician characteristics and prophylactic antibiotic use. ***Results:*** Of 300 urologists, 75 responded (25%). Overall, 20% routinely prescribed AP for all patients undergoing cystoscopy, regardless of risk stratification. Academic rank was significantly associated with non-compliance; 41% of associate and full professors prescribed AP routinely ($p = 0.012$), and academic rank remained the only independent predictor on multivariate analysis ($p = 0.009$). Older age showed a trend toward increased non-adherence ($p = 0.07$), while gender, subspecialty, fellowship status, workplace, and procedure volume were not associated with prescribing practices. Guideline-based risk factors most frequently prompting AP use included immunosuppression (51%), chronic catheterization (48%), and recurrent urinary tract infections (37%). ***Conclusion:*** A significant number of urologists continue to prescribe AP prior to flexible cystoscopy, contrary to guideline recommendations. Academic rank was the strongest predictor of non-adherence, potentially reflecting workflow pressures and habitual practice patterns. Improved awareness, stewardship initiatives, and standardized protocols may enhance evidence-based AP utilization and reduce unnecessary antibiotic exposure.

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Introduction

Prophylactic antibiotic use emerged to minimize postoperative morbidity, particularly in procedures where transient bacteremia is common. Antibiotic prophylaxis (AP) has traditionally been applied in invasive urologic procedures that involve disruption of mucosal barriers, with the purpose of reducing the risk of post-procedural bacteriuria, urinary tract infections (UTIs), and sepsis [1, 2]. However, the global rise in antimicrobial resistance has become a major concern in clinical practice. The unnecessary use of antibiotics accelerates resistance patterns, increases healthcare costs, and alters local microbial profiles, ultimately limiting treatment options for both urologic and non-urologic infections [3]. Consequently, current clinical decision-making must balance the marginal benefit of prophylaxis with the broader public health implications associated with excessive antibiotic exposure.

Over several decades, multiple studies evaluated the incidence of post-cystoscopy infections and consistently demonstrated that the overall risk of significant infection is low in the general population [4]. In addition, most post-cystoscopy bacteriuria is transient and self-limiting, occurring without clinical sequelae in the majority of patients. Both American Urological Association (AUA) and European Association of Urology (EAU) guidelines currently recommend AP only for a defined subset of high-risk patients, such as those with a history of recurrent UTIs, immunosuppression, urinary tract reconstruction, recent instrumentation, neurogenic bladder, prolonged catheterization etc. [5, 6].

Despite clear recommendations, real-world implementation has been inconsistent. Several studies have demonstrated that compliance with antibiotic stewardship recommendations in urologic practice remains low, with many urologists continuing to administer prophylactic antibiotics routinely, even when not indicated [7–9]. The aim of our study was to assess the level of adherence among practicing urologists to AUA and EAU recommendations regarding AP before cystoscopy and to identify factors influencing compliance or non-compliance.

Methods

All senior urologists in Israel were invited to participate in the study. An online questionnaire, consisting of 18 structured items (see online supplementary material; for all online suppl. material, see https://doi.org/10.1159/000552054) was distributed via a secure internet platform. Participation was voluntary and anonymous, ensuring confidentiality and minimizing reporting bias. Despite its non-validated nature, this customized questionnaire was used because, to our knowledge, no pre-existing validated instrument currently exists that is specifically tailored to our urological community while addressing the unique clinical questions posed in this study. The survey collected demographic, professional, and clinical information. Demographic items included gender, age, academic rank, and years of seniority as a practicing urologist. Professional characteristics included fellowship training (location and completion status), primary workplace, and subspecialty.

Aspects related to clinical practice focused on routine cystoscopy practice and antibiotic utilization patterns. Respondents were asked to report whether they used prophylactic antibiotics prior to cystoscopy and to specify factors influencing their decision, including patient-related and procedure-related risk considerations.

Descriptive statistics were used to summarize demographic and professional variables across the study cohort. Associations between categorical variables and the use of prophylactic antibiotics were assessed using Pearson's chi-square test or Fisher's exact test when appropriate. A multivariate logistic regression model was constructed to identify independent predictors of antibiotic administration practices. Statistical analyses were performed using SPSS version 22 (IBM Corp., Armonk, NY), and statistical significance was defined as $p < 0.05$.

No Helsinki approval or informed consent was required because this study involved an anonymous questionnaire administered to physicians and did not include any patient-level data. This determination was confirmed by the Institutional Helsinki Committee. Ethical approval and consent are not required for this study in accordance with local or national guidelines. This study was conducted and reported in accordance with the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) guidelines (see online supplementary material).

Results

Of 300 senior urologists who were approached, 75 completed the questionnaire. The majority of participants were men (80%), with approximately one-third aged 51–60 years (37%). Most participants (75%) were fellowship trained, with 89% completing their fellowship abroad. Approximately half of the participants (51%) did

Table 1. Demographic characteristics of study participants

Variable		*n*	%
Gender	Male	60	80.0
	Female	15	20.0
Age group	≤40	9	12.0
	41–50	17	22.7
	51–60	28	37.3
	>60	21	28.0
Fellowship graduate	Yes	56	74.7
	No	19	25.3
Fellowship location (*n* = 56)	Abroad	50	89.3
	Israel	6	10.7
Academic rank	Full professor	12	16.0
	Associate professor	10	13.3
	Assistant professor	15	20.0
	No academic rank	38	50.7
Primary workplace	Hospital	56	74.7
	Health Maintenance Org	12	16.0
	Private Practice	7	9.3
Subspecialty (*n* = 72)	Endourology	23	31.9
	Oncology	13	18.1
	Functional urology	11	15.3
	Pediatric urology	6	8.3
	Other	19	26.4
Years as senior physician (*n* = 74)	≤5	9	12.2
	6–10	9	12.2
	>10	56	75.7

N = 75 for all variables except fellowship location (*n* = 56 among fellowship graduates), subspecialty (*n* = 72), and years of experience (*n* = 74).

not hold an academic position, while 16% were professors. The majority of the urologists (75%) worked in academic medical centers. The most common subspecialty was endourology (32%), and most participants (76%) had over 10 years of experience as senior physicians. The full demographic characteristics are presented in Table 1.

Among the urologists who participated in the study, 20% reported prescription of AP to all patients undergoing cystoscopy (Table 2). The most common guideline indications for AP, when present, were immunosuppression (51%), chronic urinary catheter use (48%), and a history of UTIs (37%). Other indications recognized by the AUA and EAU guidelines included older age (4%), smoking (4%), and being overweight (3%).

Notably, physicians with higher academic rank were more likely to prescribe AP regardless of patient infectious risk and contrary to AUA and EAU guideline recommendations (41%, $p = 0.012$, Fig. 1). Moreover, urologists over 50 years of age were also more likely to prescribe AP to all patients regardless of their risk (51.1%, $p = 0.07$, Fig. 2). A multivariate analysis indicated that only academic rank is statistically significant ($p = 0.009$, Table 3).

Our questionnaire included both guideline-based and non-guideline-based risk factors and indications. Figure 3 illustrates the prevalence of the risk factors that prompted the use of prophylactic antibiotics prior to cystoscopy. The more common reported indicatons were immunosuppression (*n* = 38; 51%), presence of an indwelling catheter (*n* = 36; 48%), and a history of recurrent UTIs (*n* = 28; 37%). Other less common indication are listed in the table below.

Figure 4 presents the frequency of prescription of AP based on specific indications prior to cystoscopy. Table 4 details the specific antibiotic classes utilized by participants. Quinolones were the most frequently selected agents, preferred by 33% of the cohort. Regarding the timing of administration, 53% of participants reported

Table 2. Association between physician characteristics and prophylactic antibiotic administration before cystoscopy

Variable	Antibiotic given	Antibiotic not given	*p* value
	n (%)	*n* (%)	
Gender			0.721
Male	13 (21.7)	47 (78.3)	
Female	2 (13.3)	13 (86.7)	
Age			0.080
≤50	2 (7.7)	24 (92.3)	
51–60	9 (32.1)	19 (67.9)	
>60	4 (19.0)	17 (81.0)	
Fellowship graduate			1.000
Yes	11 (19.6)	45 (80.4)	
No	4 (21.1)	15 (78.9)	
Subspecialty			0.829
Oncology	2 (15.4)	11 (84.6)	
Endourology	4 (17.4)	19 (82.6)	
Other	8 (22.2)	28 (77.8)	
Academic rank			0.012
Assistant professor	1 (6.7)	14 (93.3)	
Associate professor/full professor	9 (40.9)	13 (59.1)	
No academic rank	5 (13.2)	33 (86.8)	
Years as senior physician			0.333
≤10	2 (11.1)	16 (88.9)	
>10	13 (23.2)	43 (76.8)	
Primary workplace			0.747
Hospital	12 (21.4)	44 (78.6)	
Other	3 (15.8)	16 (84.2)	
Cystoscopies per week			0.755
≤5	5 (22.7)	17 (77.3)	
>5	10 (18.9)	43 (81.1)	

administering AP 60 min prior to the procedure, whereas only 1.3% opted for administration 24 h in advance.

Discussion

This study is, to the best of our knowledge, the first to evaluate urologist adherence to guideline recommendations regarding AP prior to cystoscopic examination. The topic is clinically important as unnecessary antibiotic exposure may contribute to antimicrobial resistance and increase the risk of adverse drug events [3, 10, 11].

Over the past decade, a growing body of literature has refined AP principles and emphasized the importance of targeted utilization. Contemporary recommendations advocate restricting prophylaxis to surgical procedures and patient populations in which a clear clinical benefit has been demonstrated, while avoiding routine antibiotic use in low risk or minimally invasive settings. The use of antibiotics is not free of harm, it increases the risk for allergic reactions, secondary infections, microbiome destruction, organ specific damage, and multidrug resistance bacteria. The Infectious Diseases Society of America recommends that AP for surgical procedures be administered within 60 min prior to incision to achieve optimal antimicrobial tissue concentrations at the time of potential intraoperative contamination. The primary intent of these guidelines is to prevent surgical site infections, decrease postoperative morbidity and mortality, and reduce the associated economic burden on healthcare systems. Judicious prophylactic use minimizes adverse drug reactions and mitigates the emergence of

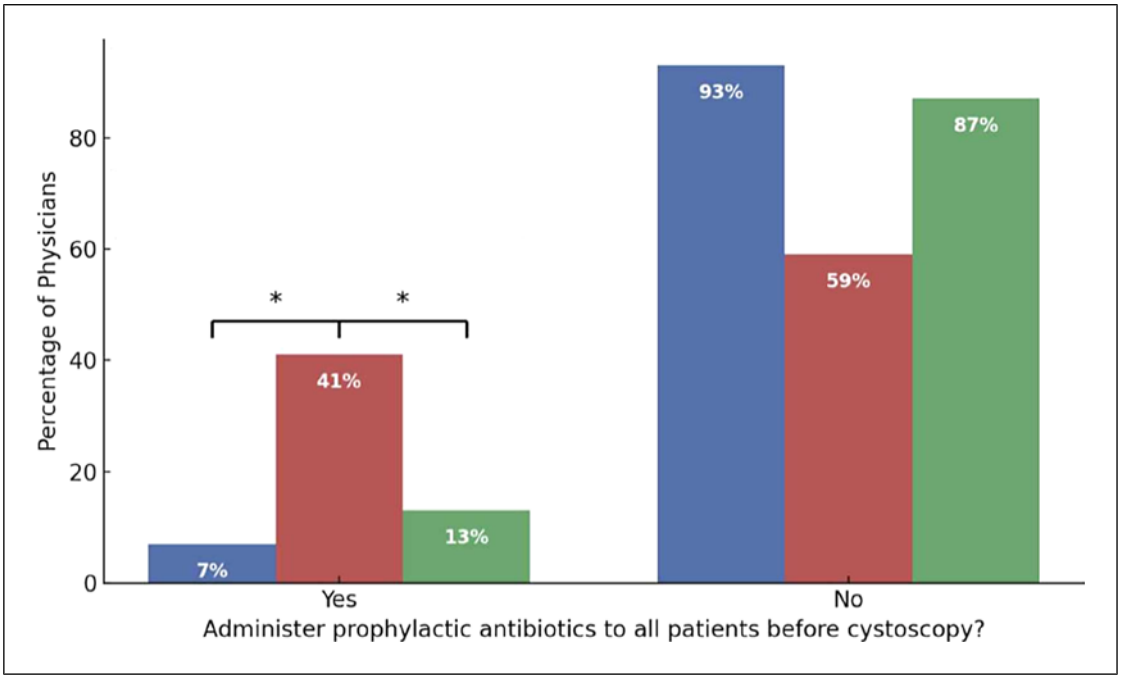

Fig. 1. Rate of prophylactic antibiotic administration by academic rank. Blue – assistant professor. Red – associate and full professors. Green – no academic rank.

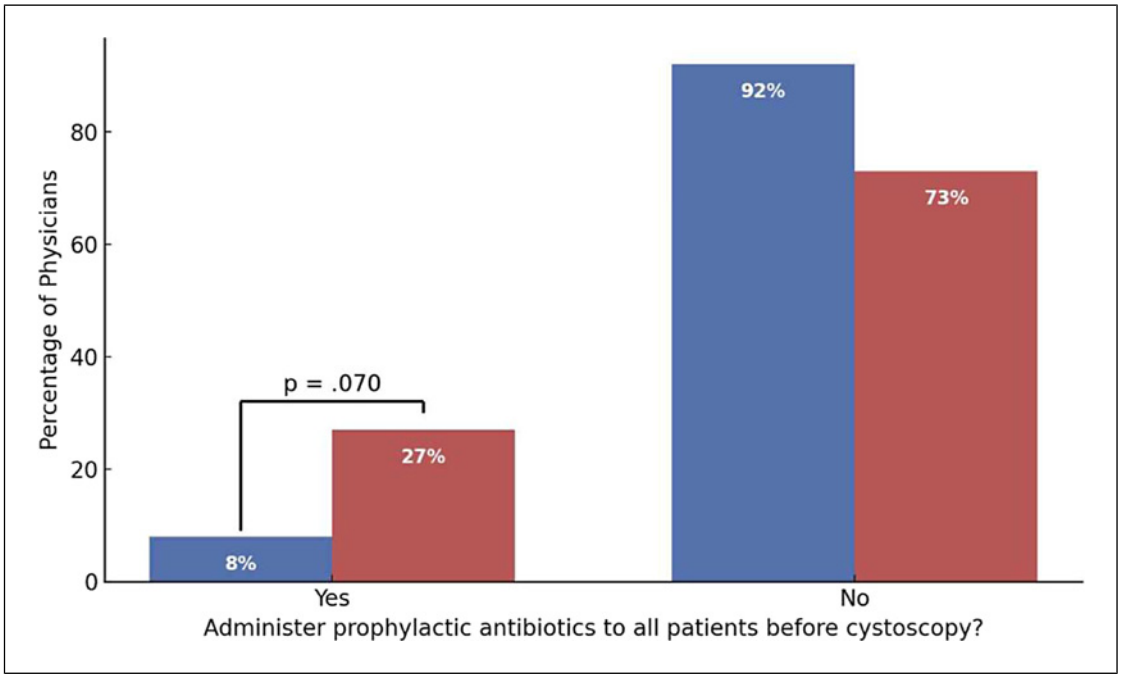

Fig. 2. Rate of prophylactic antibiotic administration by age. Blue – equal or less than 50. Red >50.

Table 3. Logistic regression predicting prophylactic antibiotic administration

Variable	B	SE	Wald	OR	95% CI	*p* value
Gender (male)	−0.58	1.16	0.25	0.56	[0.06–5.44]	0.615
Fellowship (yes)	1.51	1.18	1.64	4.51	[0.45–45.15]	0.200
Age 51–60	−2.50	1.78	1.99	0.08	[0.01–2.66]	0.159
Age >60	−1.05	1.89	0.31	0.35	[0.01–14.31]	0.579
Subspecialty (oncology)	1.82	1.17	2.42	6.18	[0.62–61.26]	0.120
Subspecialty (endourology)	0.99	1.04	0.91	2.70	[0.35–20.85]	0.341
Academic rank (assistant professor)	1.10	1.43	0.59	3.00	[0.18–49.45]	0.443
Academic rank (associate and full professor)	−2.92	1.11	6.87	0.05	[0.01–0.48]	0.009
Experience ≤10 years	−1.59	1.80	0.79	0.20	[0.01–6.86]	0.375
Workplace (hospital)	−1.04	1.10	0.88	0.36	[0.04–3.09]	0.348
≤5 cystoscopies/week	−0.88	0.94	0.87	0.42	[0.07–2.62]	0.350
Constant	4.18	2.23	3.51	65.13		0.061

$N = 72$, $\chi^2(11) = 18.59$, $p = 0.069$, Nagelkerke $R^2 = 0.363$. The model correctly classified 80.6% of cases (sensitivity 21.4%; specificity 94.8%).

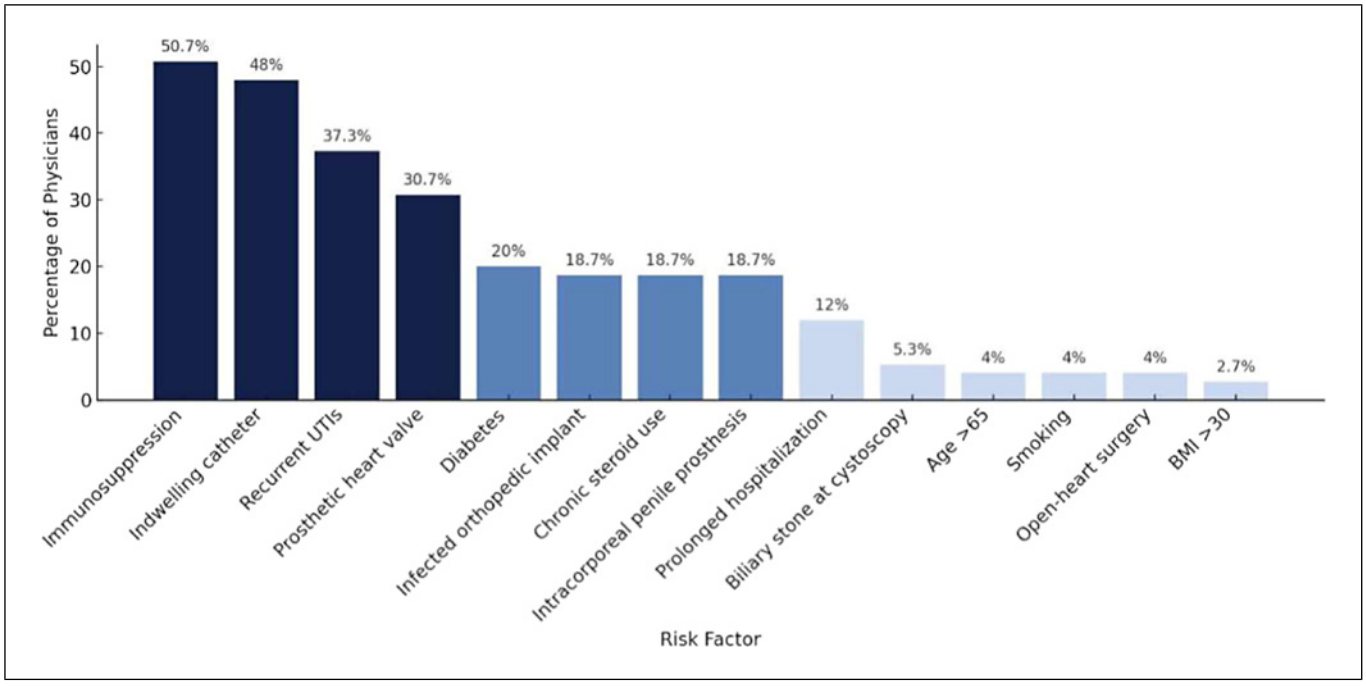

Fig. 3. Prevalence of risk factors for prophylactic antibiotics. X axis – risk factors. Y axis – percentage of physicians.

antimicrobial resistance [12]. A recent review [13] demonstrates that across a wide range of surgical fields, including dermatology, ophthalmology, dentistry, and many ambulatory or minimally invasive general surgery procedures, routine AP confers no significant benefit and should not be administered. Recent urological research indicated that patients undergoing diagnostic cystoscopy, urodynamics, and extracorporeal shock

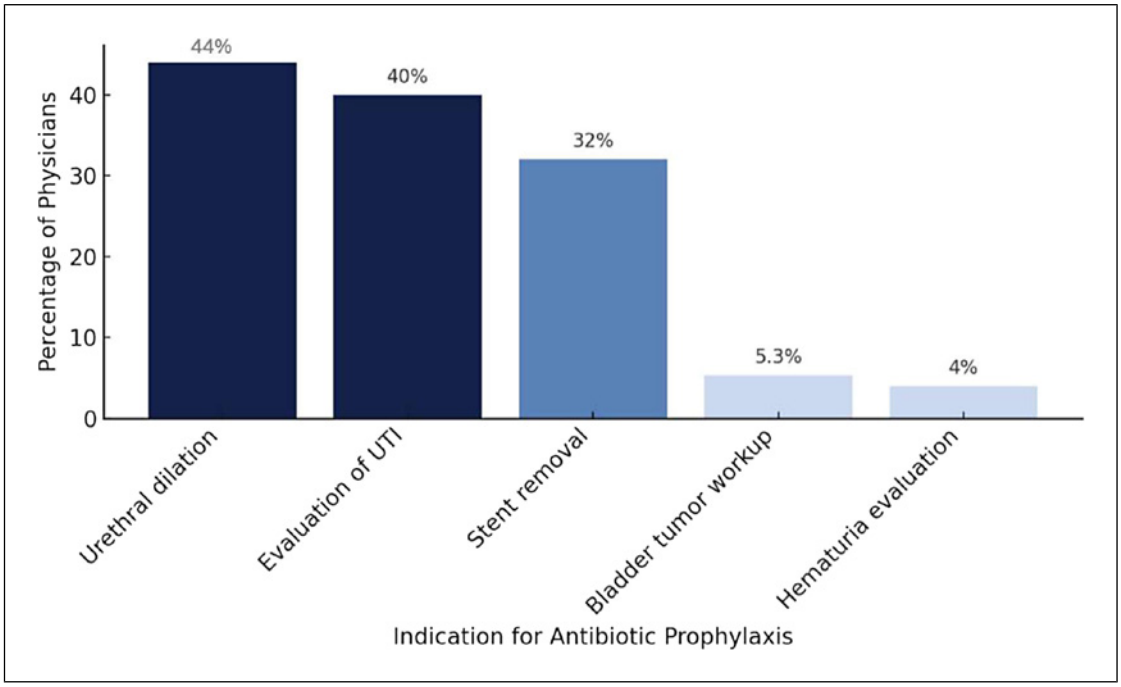

Fig. 4. Frequency of prophylactic antibiotics use by cystoscopy indication. X axis – indication for antibiotic prophylaxis. Y axis – percentage of physicians.

Table 4. Class of antibiotic utilized by participants

Antibiotic type	*n*	%
Quinolones	25	33.3
Cephalosporins	8	10.6
Aminoglycoside	10	13.30
TMP-SMX	3	4.0

wave lithotripsy should not receive AP [14–16]. These observations reinforce antimicrobial stewardship principles, aiming to reduce unnecessary healthcare exposure to antibiotics, thereby limiting toxicity, ecological disruption, and development of resistance. The same stewardship rationale extends to urology, where limiting prophylaxis to carefully selected indications has been shown to reduce resistance patterns and antibiotic overuse [5, 6].

In urological practice, AP prior to invasive diagnostic or therapeutic interventions has historically been common and remains recommended in many contexts due to the recognized risk of post-procedural infectious complications [17]. Nevertheless, it is now well established that not all urological procedures carry sufficiently high infectious risk to justify prophylaxis. Several interventions, particularly those with short instrumentation time and minimal mucosal trauma, are associated with low post-procedural infection rates and do not benefit from routine AP administration [5, 6]. Flexible cystoscopy is a representative example as numerous studies have consistently demonstrated that the procedure carries a very low rate of subsequent UTI or febrile events [18, 19]. Furthermore, multiple randomized and observational studies have failed to show a significant reduction in infectious complications when AP is used prior to diagnostic cystoscopy [7, 16, 20]. These findings have driven a major shift in clinical guidelines. Both the AUA and EAU now recommend selective rather than routine administration of AP for cystoscopy, reserving antibiotic use for patients at increased risk, including those with immunosuppression, recent UTI, urinary stasis, structural abnormalities, or other clinically defined high-risk features [5, 6]. This selective strategy reflects a broader paradigm shift toward evidence-based antibiotic stewardship, ensuring that antimicrobial prophylaxis is provided only when the balance of clinical benefit outweighs potential harms.

We found that 20% of respondents routinely prescribe AP for all patients undergoing flexible cystoscopy, regardless of individual risk factors. This finding is in line

with findings of a review of general AP use in 825 hospitals in the USA, which indicated suboptimal adherence to AP guideline protocols of only 59% [7]. Another study that included 31 hospitals found that only 35.9% of physicians followed AP guidelines for use in surgery [21]. In a large prospective multicenter study done in the UK, over 80% of patients received AP prior to surgery, although urological surgeries represented less than 15% of cases [22]. Several other studies focusing on urological surgeries have demonstrated a similar AP guideline adherence rate ranging between 50 and 60% [23, 24].

The literature suggests that several variables contribute to deviation from best-practice guideline recommendations. These include procedural timing, particularly off-hours or urgent settings, differences in patient race and demographic characteristics, incomplete familiarity with updated guidelines, variations in practice patterns between specialties, and insufficient antimicrobial stewardship support within clinical facilities. Addressing these determinants may help optimize guideline adherence and promote evidence-based antibiotic use [21, 22, 25–29].

In our cohort, 41% of high academic rank (associate and full professor) urologists prescribe AP in comparison to only 13% of lower academic rank ($p = 0.012$). This finding is counterintuitive as higher academic rank would be expected to correlate with greater guideline familiarity and adherence. A possible explanation is that academic advancement is often accompanied by increased clinical volume, so that prescribing AP to all patients may represent an attempt to streamline workflow and minimize infectious complications in a busy office environment. Other studies indicated a relationship between seniority and antibiotic use, in which junior residents gave more AP in comparison to senior residents [30]; another retrospective study demonstrated that procedures performed by senior urologists in a single center were associated with a higher rate of antibiotic use [27, 31]. Given that clinicians with higher academic seniority may paradoxically exhibit a greater tendency toward prophylactic antibiotic use, there is a critical need for continuous review of established protocols and a rigorous commitment to maintaining awareness of the latest EAU and AUA guidelines. Such adherence is essential not only for ensuring evidence-based practice but also for mitigating the risks associated with antibiotic overuse, including organ-specific toxicities, disruption of the host microbiome, and the escalating threat of antimicrobial resistance. We also observed an age-related trend: older urologists were more likely than younger colleagues to prescribe antibiotics. It seems that this finding correlates to the higher academic rank which was noted to be determinant factor for AP prescription. This is contrary to data reporting that patients treated by younger physicians had a higher rate of prophylaxis administration [30]. Gender-related differences in adherence to prophylactic practices have been reported inconsistently; some studies that assessed this variable found that antibiotic use varied by physician gender [32], whereas others reported no association [33]. We found no difference in AP use between male and female physicians.

A key strength of this study is that it evaluated AP use prior to flexible cystoscopy, across urologists at different stages of their careers, and in both community and academic settings. Nonetheless, several limitations should be acknowledged. Only 25% of approached urologists eventually participated in the study, which may introduce non-response or selection bias. Another limitation of this study is the use of a non-validated questionnaire designed specifically for senior urologists. This may introduce measurement bias. Furthermore, the self-reported nature of the survey could lead to response bias or social desirability bias, potentially causing participants to report clinical practices that align more closely with official guidelines than their actual daily practice. Additionally, certain questions also allowed multiple reasonable interpretations, which may have introduced response variability. Moreover, this study specifically targeted senior urologists and not residents because, in our clinical setting, residents typically perform procedures under the direct supervision and guidance of senior staff, often adhering to the established protocols and preferences of the senior physicians. Therefore, the prescribing patterns of senior urologists are the primary drivers of clinical practice. However, future research is warranted to include residents, specifically stratified by their seniority. Such studies could provide deeper insights into the development of clinical autonomy and the evolution of independent decision-making regarding AP throughout the residency period. Prior studies indicate that implementing standardized peri-procedural protocols can reduce such variability and improve adherence to best practices [9, 34, 35]. In our center, there is currently no written protocol for AP use in flexible cystoscopy and developing one remains an important future objective.

Conclusions

The present study highlights a clinically meaningful gap between AUA and EAU recommendations and real-world practices regarding antibiotic prescription in

flexible cystoscopy. A deeper understanding of the factors contributing to this divergence, including physician knowledge, workload, local culture, and institutional practice norms may guide efforts toward more consistent guideline implementation. Improving adherence has implications beyond individual patient care, contributing to antibiotic stewardship on a national level, reducing healthcare expenditure, and mitigating the growing threat of antimicrobial resistance. Future multicenter studies and consensus-driven protocols may further support uniform and responsible prophylactic strategies in urological practice.

Statement of Ethics

No Helsinki approval or informed consent was required because this study involved an anonymous questionnaire administered to physicians and did not include any patient-level data. This determination was confirmed by the Institutional Helsinki Committee. Ethical approval and consent are not required for this study in accordance with local or national guidelines.

Conflict of Interest Statement

The authors have no conflicts of interest to declare.

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Author Contributions

S.T.: conceptualization, data curation, investigation, methodology, validation, and writing – original draft, review, and editing; J.M., D. Leibovici, and B.B.: writing – original draft, review, and editing; D.R. and D. Lerman: data curation, investigation, methodology, validation, and writing – review and editing; Y.S.: conceptualization, validation, and writing – original draft, review, and editing.

Data Availability Statement

All data generated or analyzed during this study are included in this article. Further enquiries can be directed to the corresponding author.

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