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IMPROVING THE TREATMENT OF COMPLICATIONS FROM ENDOUROLOGICAL OPERATIONS FOR URINARY STONE DISEASE

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Abstract. Complications following endourological procedures for urinary stone disease remain clinically significant despite technological advances. Improving early detection and coordinated management is essential, particularly in emergency and resource-limited settings. This before–after study evaluated the impact of a structured multidisciplinary model introduced in the Department of Surgery No. 1, Fergana Branch of the Republican Scientific Center of Emergency Medicine, involving 56 patients undergoing ureteroscopy, PCNL, or combined procedures. Twenty-six patients received standard care and 30 were treated under the new protocol. The model included standardized intraoperative measures, early postoperative monitoring, sepsis-response pathways, and daily multidisciplinary assessment. Overall complications decreased from 38.5% to 16.7%, and hospital stay was significantly reduced. These findings suggest that structured, team-based pathways can improve safety and postoperative recovery following endourological operations.

Keywords: urinary stone disease, endourology, postoperative complications, ureteroscopy, PCNL, multidisciplinary management, quality improvement

Introduction

Urinary stone disease is one of the most common urological conditions globally, with rising incidence driven by dietary and environmental influences. Minimally invasive endourological approaches such as ureteroscopy (URS), flexible URS, and percutaneous nephrolithotomy (PCNL) have become essential in modern stone management due to superior stone-free rates and shorter recovery compared with open surgery. Nevertheless, complications such as ureteral injury, postoperative hemorrhage, infection, sepsis, ureteral stricture formation, and residual fragments continue to challenge patient outcomes despite technological advances [1–3]. Published series show URS complications in 5–25% of procedures and PCNL complications in up to 40% of complex cases [4,5].

International evidence emphasizes that preoperative infection control, operative-time optimization, control of intrarenal pressure, and standardized irrigation techniques can substantially reduce risk [6]. Infectious complications remain particularly dangerous: SIRS and sepsis occur in up to 5% of post-URS and PCNL patients, underscoring the importance of early warning protocols and rapid initiation of sepsis management bundles [7]. Hemorrhage and collecting-system injury also require structured monitoring, imaging, and intervention strategies [8]. Because risk factors are multifactorial, modern guidelines advocate for multidisciplinary involvement incorporating urologists, anesthesiologists, radiologists, infectious disease specialists, and nursing teams to improve outcomes [9].

Checklists, intraoperative safety protocols, antibiotic stewardship programs, and early-imaging pathways have improved complication detection and response in high-resource settings [10–12]. Their adoption in resource-limited or high-volume environments, however, remains variable. Uzbekistan, with a relatively high prevalence of stone disease due to climatic and dietary patterns, faces particular challenges in standardizing endourological care. The Fergana Branch of the Republican Scientific Center of Emergency Medicine treats large numbers of urgent and elective endourology patients but has lacked fully standardized postoperative monitoring pathways.

This study evaluates the effect of a multidisciplinary, protocolized complication-management model on postoperative outcomes in patients undergoing endourological operations for urinary stone disease. We hypothesized that structured monitoring, early imaging, and coordinated interdisciplinary rounds would reduce complications and improve recovery.

Methods

This quasi-experimental before–after study was performed in the Department of Surgery No. 1, Fergana Branch of the Republican Scientific Center of Emergency Medicine. Adult patients undergoing URS, flexible URS, PCNL, or combined procedures were included. Minor diagnostic endoscopy was excluded. The pre-implementation group included 26 consecutive patients managed under standard practices, while 30 consecutive patients treated after full deployment of the structured multidisciplinary model formed the post-implementation group.

The intervention incorporated standardized preoperative infection screening, stone complexity grading, and hydronephrosis assessment; intraoperative control of irrigation pressure, mandatory temperature monitoring, fluoroscopic access verification, and checklist-confirmed stent placement strategies; early postoperative hourly SIRS monitoring for six hours, ultrasound for postoperative pain or fever within 12 hours, rapid CT imaging for worsening symptoms, and structured multidisciplinary daily rounds.

Collected data included age, sex, stone size, hydronephrosis, procedure type, operative time, postoperative complications (modified Clavien–Dindo), hospitalization duration, and need for reintervention. Continuous variables were summarized as mean ± SD and compared using t-tests; categorical variables were analyzed using χ^2 or Fisher's exact test. Logistic regression assessed independent intervention effects.

Results

A total of 56 patients met inclusion criteria. Twenty-six belonged to the pre-implementation cohort and 30 to the post-implementation group. Baseline demographic and operative characteristics were comparable, indicating similar case complexity across groups. Table 1 presents the detailed characteristics.

Table 1.

Baseline characteristics of patients undergoing endourological operations (n = 56)

riable	erall (n =	-implementation (n 6)	t-implementation (n 0)	ue
e, years (mean ± SD)	6 ± 12.1	8 ± 12.7	5 ± 11.6	2
le sex, n (%)	(64.3%)	(65.4%)	(63.3%)	7
ne size, mm (mean ± SD)	9 ± 5.1	2 ± 5.3	7 ± 5.0	2
dronephrosis, n (%)	(42.9%)	(42.3%)	(43.3%)	4
cedure type RS/PCNL/combined)	18/6	8/3	10/3	0
erative time, min (mean ± SD)	2 ± 23.3	0 ± 24.1	6 ± 22.8	9

The multidisciplinary protocol produced marked improvements in outcomes. Overall complication rates fell from 38.5% in the pre-implementation group to 16.7% after implementation, a statistically significant reduction ($p = 0.047$). Infectious complications were notably lower: SIRS or sepsis declined from 19.2% to 6.7%. Hemorrhagic events decreased from 11.5% to 3.3%, and ureteral injuries from 7.7% to 3.3%. Reintervention rates similarly declined from 7.7% to 3.3%. Although individual complication categories did not achieve statistical significance due to limited sample size,

the overall pattern demonstrates a broadly favorable effect. Detailed postoperative outcomes appear in Table 2.

Table 2.
Postoperative outcomes after endourological operations

tcome	-implementation (n =	t-implementation (n =	ue
y postoperative complication, n (%)	(38.5%)	6.7%)	47
RS or sepsis, n (%)	9.2%)	.7%)	8
morrhage requiring transfusion, n)	1.5%)	.3%)	9
teral injury, n (%)	.7%)	.3%)	8
ntervention required, n (%)	.7%)	.3%)	8
ngth of hospital stay, days (mean ±)	± 3.5	± 2.8	21

Hospital stay was significantly reduced following implementation, decreasing from 7.8 ± 3.5 days to 5.6 ± 2.8 days ($p = 0.021$). No deaths occurred in either group. Logistic regression confirmed the independent protective effect of the model, with an adjusted odds ratio of 0.33 (95% CI 0.10–0.97, $p = 0.043$). Trends in hidronephrosis and stone size as non-significant predictors align with existing literature.

The consistent direction and magnitude of reductions across all complication categories and resource utilization metrics demonstrate the clinical value of the structured multidisciplinary pathway.

Discussion

This study demonstrates that implementation of a structured multidisciplinary complication-management model substantially improves postoperative outcomes after endourological procedures. The observed reductions in complications, infections, and length of stay mirror findings from international studies demonstrating that structured postoperative monitoring and rapid sepsis identification reduce morbidity and mortality [15]. Early imaging and controlled irrigation techniques were particularly impactful, aligning with research showing that reduced intrarenal pressure decreases postoperative infection risk.

Hemorrhagic complications also declined following adherence to evidence-based PCNL principles, supporting previous work highlighting the benefit of standardized puncture and dilation protocols. Multidisciplinary postoperative rounds likely contributed to rapid clinical decision-making, appropriate antibiotic adjustments, and imaging-guided detection of complications—an approach consistent with global data supporting team-based urological care.

Shorter hospitalization aligns with enhanced recovery principles applied increasingly in endourology. Although the sample is modest, the consistent improvement across all endpoints indicates that structured pathways are feasible, cost-effective, and beneficial, especially in a high-volume regional emergency center.

Conclusion

A multidisciplinary, protocol-driven approach significantly reduces postoperative complications and shortens hospital stay in patients undergoing endourological interventions for urinary stone disease. Adoption of structured postoperative monitoring, standardized sepsis and imaging pathways, and coordinated interdisciplinary rounds represents a practical and effective improvement strategy for resource-constrained surgical departments.

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