Breakage and detachment of the rigid cystoscope's distal tip: an unusual case of urological instrument malfunction

Evangelos N. Symeonidis[1*], Asterios Symeonidis[1], Anastasios Anastasiadis[1], Aris Kaltsas[2], Georgios Tsampoukas[3], Ioannis Mykoniatis[1], Dimitrios Memmos[1], Chrysovalantis Toutziaris[1], Fotios Dimitriadis[1], Ioannis Vakalopoulos[1], Georgios Dimitriadis[1]

[1]*1st Department of Urology, Aristotle University of Thessaloniki, School of Medicine, "G. Gennimatas" General Hospital, Thessaloniki, Greece*
[2]*3rd Department of Urology, Attikon University Hospital, School of Medicine, National and Kapodistrian University of Athens, Athens, Greece*
[3]*Department of Urology, Homerton University Hospital, NHS, London, United Kingdom*

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Corresponding author
Evangelos N. Symeonidis
School of Medicine,
"G.Gennimatas"
General Hospital
Aristotle University
of Thessaloniki
1st Department of Urology I
41 Ethnikis Aminis,
54124 Thessaloniki, Greece
evansimeonidis@gmail.com

Herein, we describe an unusual case of cystoscope damage during a planned laser cystolithotripsy in a 65-year-old male with a previous history of radical prostatectomy for prostate cancer and subsequent serial urethral dilations for bladder neck contracture. Upon crossing the penile urethra without exerting significant pressure, we noticed the cystoscope's distal metallic tip detachment. Therefore, we re-introduced another 22Fr cystoscope and removed the broken part with alligator forceps. Fortunately, no urethral injury or associated complications were noticed on gently re-entering the bladder. Hence, we managed to complete the endoscopic laser cystolithotripsy shortly thereafter. Review of the relevant literature revealed three similar cases. All related to the same manufacturer. Urologists should not lose sight of the fact that such an unexpected instance may tremendously impact the procedure's success, requiring vigilance and adherence to safety protocols.

Key Words: cystoscope breakage ‹› distal detachment ‹› cystoscope malfunction ‹› device-related failure ‹› cystolithotripsy

INTRODUCTION

Cystoscopy is one of the most common urological procedures performed for various diagnostic and therapeutic reasons. While a relatively straightforward procedure, it can result in unpredictable consequences [1, 2]. Equipment failure can pose a threat to patients, instigating further interventions [3, 4]. Herein, we report a rare case, and one of the few in the literature, of cystoscope's distal part breakage and detachment while reviewing the available evidence on the subject.

CASE PRESENTATION

A 65-year-old male underwent an elective transurethral cystolitholapaxy of a 2 cm vesical calculus. Blood tests, urinalysis, and plain chest radiographs were normal on admission. His past medical history was unremarkable, with no reported drug intake. His surgical history included an open retropubic radical prostatectomy for localized prostate cancer and male urethral stricture dilation via serial S-shaped coaxial dilators over a guidewire. Upon investigation, the ultrasound revealed a normal upper urinary tract.

After adequate antibiotic coverage, under general anesthesia and lithotomy position, the procedure began with slowly inserting a 22Fr Karl Storz cystoscope (Karl Storz, Tuttlingen, Germany) into the urethra. Upon crossing the penile urethra without exerting significant pressure, we noticed the cystoscope's distal metallic tip detachment. Therefore, we proceeded to re-introduce another 22Fr cystoscope and remove the broken part with the aid of alligator forceps. The detached distal end was storaged and communicated to the manufacturer (Figures 1, 2, 3).

On cautiously re-entering the bladder, we examined the urethral lining and fortunately found no associated injury. Hence, we managed to complete the endoscopic laser cystolithotripsy shortly thereafter. For stone fragmentation, we used the Medilas® H Solvo, 30-Watt, Holmium: Yttrium–Aluminium–Garnet (Ho: YAG) laser manufactured by Dornier (Dornier MedTech Laser GmbH, Wessling, Germany). We initiated the procedure using a 600 μm Dornier SingleFlex® Single-Use laser fiber into a 7Fr straight open tip ureteral catheter for better controlling and accurately aiming the stone. The laser settings were set to 0.8 J and 6 Hz while raised in increments to 1.2 J and 8 Hz. The total operation time lasted 20 minutes, with no intraoperative or postoperative complications encountered. We placed a 20-French two-way Foley catheter to drain residual stone fragments maximally. After an uneventful hospitalization, the patient was discharged the next day without a catheter.

DISCUSSION

Cystoscopy is the cornerstone for the diagnosis of several urological conditions. It can be performed either as an office-based procedure or in the operating room under anesthesia [1, 2]. Traditionally, rigid and flexible cystoscopes were used, while nowadays, technological advancements have led to the introduction of novel single-use disposable flexible cystoscopes, offering numerous advantages. On the other hand, the durability of cystoscopes is still debatable to date [2, 5, 6]. Although significant literature exists on ureteroscope damage, there is relatively little information regarding cystoscope breakage and malfunction [7].

Of particular importance, instrument failure is not a urological privilege. Besides, it is equally reported in other specialties, namely general surgery, gynecology, and otolaryngology, considerably impacting the success of a procedure and adversely affecting patient outcomes [3]. Considering that this condition affects almost every surgical discipline, previously, in orthopedic surgery, in a total of 11,856 procedures, the breakage rate was reported to be 0.35% [4].

Despite the lack of data on rigid cystoscope damage, over the past few years, much attention has been fo-

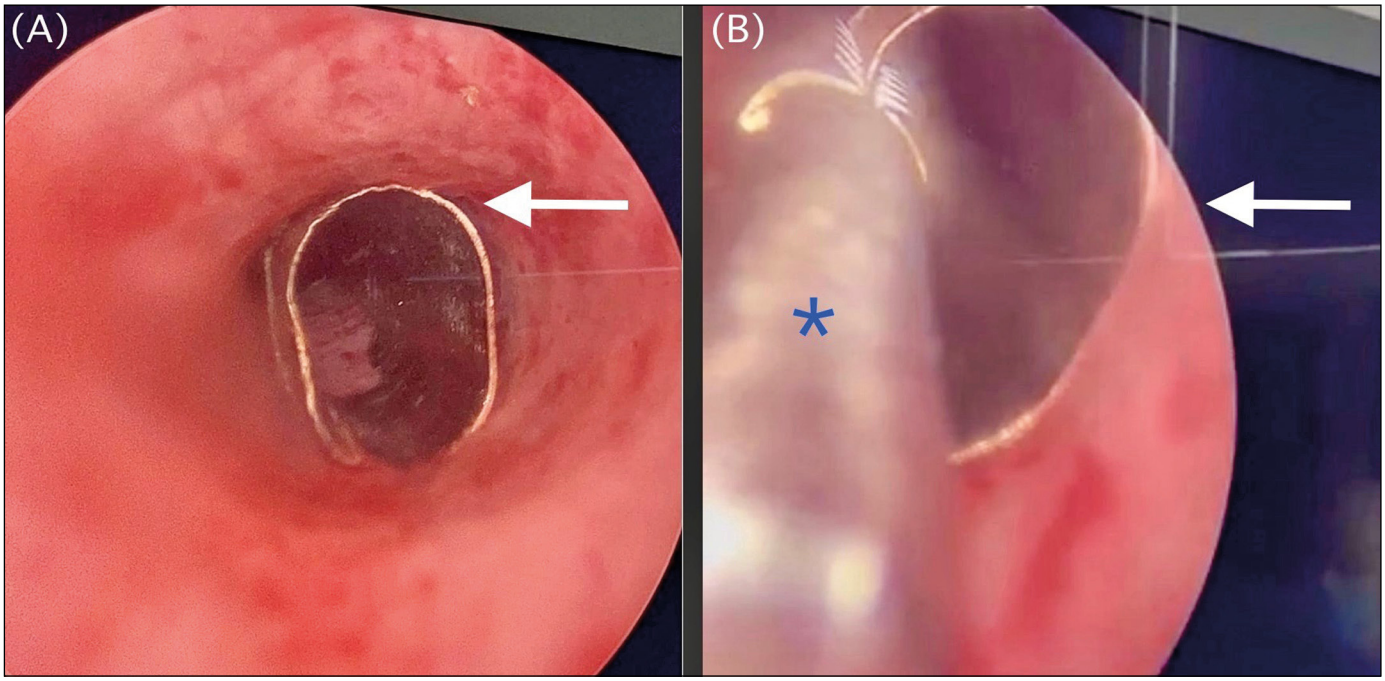

Figure 1. (A) *Cystoscopy image demonstrating the distal metallic part of the cystoscope sheath inside the penile urethral lumen* **(B)** *Alligator grasper forceps used for distal tip retrieval. White straight arrow: distal metallic tip of the cystoscope, Blue asterisk: alligator grasper forceps.*

cused on complications arising from the detachment of the insulating distal resectoscope beak. Many retrieval techniques have been proposed: embolectomy balloon, flexible cystoscope, artery forceps and roller ball-aided removal [8–11]. Other authors reported their experience with laser fragmentation of the ceramic beak, which evenly proved to be safe and effective [12–14]. Hence, we conducted a comprehensive literature review through January 2024 in the electronic databases of PubMed/MEDLINE, Google Scholar, ResearchGate, and Scopus to identify studies reporting the breakage and detachment of rigid cystoscopes' distal parts. A combination of the following keywords was performed: "cystoscope breakage," "cystoscope detachment," "cystoscope rupture," "cystoscope malfunction," and "cystoscope damage." The search was limited to English human studies of any design. Additionally, the reference lists of the included studies were hand-searched and checked for relevancy to expand the field of interest. After retrieving all pertinent articles, we summarized the available critical information in a table to better synthesize all the extractable data. With our case, three studies were included, and characteristics such as the number of cases, surgical procedure, type of cystoscope, detached part, and removal technique were subsequently analyzed (Table 1) [2, 15]. Contrary to our case, in 2011, Fernandez et al. faced a major cystoscope malfunction during a bladder neck incision, where the distal part of a 17 French cystoscope broke and had to be retrieved with alligator forceps from the bladder [2]. Of note, a few years later, Patankar et al. had to deal with the same unexpected complication in 2 pediatric patients. Fortunately, in one case, the instrument failure was pre-operatively recognized, and the procedure was deferred. In the other case, though, the metallic piece was extracted through a suprapubic cystostomy, significantly increasing morbidity and hospital stay [15]. Luckily, in our case, we retrieved the distal metallic tip relatively easily as it was not found in the bladder. Strikingly enough, Alhaider et al. noticed a missing distal metallic jaw from the cystoscope's integrated grasper during a procedure of JJ stent removal. They eventually inserted another reusable cystoscope to complete the procedure and remove the broken, missing jaw [1]. It seems clear that urologists must be aware that any detached part of the cystoscope should be promptly removed as it may serve as a foreign body, further acting as a nidus promoting local adverse sequelae, ultimately affecting patient outcomes [16]. When it comes to the retrieval methods, we defend that each patient should be treated individually depending on the conditions and resources available at the time. Borrowing knowledge from flexible cystoscope analyses, where the distal deflection tip, particularly the outer bending rubber, was the most vulnerable, we equally advocate the breached integrity of the rigid scope's distal metallic part [5]. We believe one of the main reasons for this dramatic occurrence might have been microscopic damage to the cystoscope's weld line between the sheath and distal metallic part. It becomes evident that the frequency of instrument use may trigger such an event. Our clinic's yearly heavy workload for various endou-

Figure 2. *The detached distal tip of the cystoscope was grasped and extracted with curved forceps at the level of the external urethral meatus.*

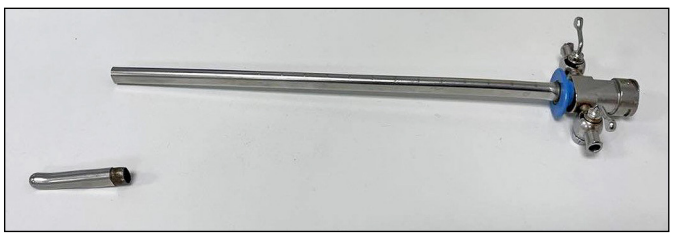

Figure 3. *Cystoscope sheath and the detached distal metallic tip.*

Table 1. *Summary of cases reporting on breakage and detachment of cystoscope's distal metallic tip*

Author, Year [Reference]	Age	Number of cases	Surgical Procedure	Type of Cystoscope	Detached part	Removal Technique
Present case, 2024	65yrs	1	Laser cystolithotripsy	22 Fr Karl-Storz rigid cystoscope	Distal Metallic Tip	Alligator grasper forceps
Patankar et al., 2015 [15]	18mo	1	Cystoscopy and PUV ablation	9.5 Fr Karl-Storz rigid cystoscope	Distal Metallic Tip	Suprapubic Cystostomy and removal
	6mo	1	Cystoscopy and PUV ablation*	9.5 Fr Karl-Storz rigid cystoscope	Distal Metallic Tip	–
Fernandez et al., 2011 [2]	72yrs	1	Laser cystolithotripsy and bladder neck incision	17 Fr Karl-Storz rigid cystoscope	Distal Metallic Tip	Alligator grasper forceps

* Breakage noticed pre-operatively
Fr – French; mo – months; PUV – Posterior Urethral Valve; yrs– years

rological procedures might have directly impacted the cystoscope's durability. Respectively, in a recent case, continuous instrument usage 2-3 times per week for four years was considered capable of causing breakage of 9Fr pediatric rigid cystoscopes [15]. Remarkably, flexible cystoscopes are more prone to damage and may require repairing every 2–3 years, as demonstrated by Canales et al [5].
Another factor to contemplate is the importance of optimization for handling and storage, thus maintaining the cystoscope's durability. In 2013, McGill et al. prospectively evaluated six flexible cystoscopes and concluded that implementing a stringent reprocessing protocol implies strict adherence to manufacturer recommendations, which appears invaluable for reducing mechanical failure and repair costs [6].
Regarding sterilization, data remains conflicting, and the question arises as to which are the optimal processing techniques. Many modes of urologic endoscopic instrument decontamination are currently available. CIDEX®, an activated 2.4% glutaraldehyde solution, is a widely tested and cleared disinfectant providing a broad spectrum of efficacy against viruses, fungi, and bacteria. In the past several years, Fuselier and Mason ascertained the effectiveness of CIDEX® over the Steris® system in significantly reducing the number of repairs [17]. Nevertheless, to date, information regarding the impact of the type of sterilizer and the duration of sterilization on cystoscope damage is yet scanty.
The present case conveys several vital messages. First, staff responsible for cystoscope handling and storage should constantly check and communicate the instrument's integrity and advise equipment replacement in cases of device fatigue. Second, safety protocols expand in reprocessing and sterilization techniques where the staff should strictly adhere to the manufacturer's guidelines. Third, staff training for accurate documentation of failure events in the form of a report appears logical. In that vein, this case further expands upon the importance of analyzing the damage mechanism and improving equipment design limits by industry manufacturers. Future research should provide valuable insights into durability and correlate it with the safety upper limit of specific procedures preceding damage. Finally, the current study serves as a cautionary tale about the potential harm arising from an often disregarded device-related malfunction.

CONFLICTS OF INTEREST

The authors declare no conflicts of interest.

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