

Mini Review

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Benchtop Assessment of a Single-Use Cystoscope and a Brief Review of Disposable Cystoscopy

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Abstract

Background

Little data exists on the use of disposable or single-use cystoscopy in the outpatient setting. This study aims to evaluate the specs of a single-use cystoscope and review available literature on disposable cystoscopy.

Materials and Methods

The Ambu a Scope 4 (Columbia, MD, USA) is a single-use system that underwent through benchtop evaluation as part of this study. The primary endpoint of the study included prospective benchtop evaluation to establish cystoscope specs, maneuverability, and deflection. Additionally, a PubMed, Google Scholar, MEDLINE, and Embase search was performed using keywords 'cystoscopy AND disposable'; 'cystoscope AND disposable'; 'scope AND disposable'; 'single-use AND cystoscope'.

Results

Benchtop testing was performed on 10 single-use cystoscopes and revealed the Ambu a Scope 4 to have consistent deflection capability in all 10 scopes 210 up/120 down. Additionally, the visualization was rated on a scale of 1-5 based on user impression with all 10 scopes having similar visualization levels of 5.0. The average cord length was 389.9mm, average outer diameter of the scope was 16.2 French and average working channel diameter 6.6 French. Additionally, ten articles were reviewed and included in this study as part of the review on disposable cystoscopy.

Conclusion

This paper has described disposable cystoscopy with particular attention to the Ambu a Scope 4. Disposable cystoscopes are becoming more and more available and could become particularly useful in the COVID-19 era. Disposable cystoscopes are a viable option for office-based cystoscopy. These disposable cystoscopes warrant future prospective studies to evaluate their cost, safety, clinician interpretation, patient satisfaction and clinical efficacy.

Key words: Cystoscopy; Cystoscope; Disposable; Outpatient

Introduction

Current endoscopic technology, particularly in the field of cystoscopy, is evolving, especially in the COVID-19 era. Lately, there has been an increased demand for disposable medical equipment across all fields, including urology. There is some evidence, particularly in pulmonology and gastroenterology literature, that the use of disposable scopes could provide a cost-benefit compared to their reusable counterparts. However, single-use cystoscopy is

relatively new, and there is a lack of scientific literature available in the field.

Given the paucity of data available on single-use cystoscopy in the outpatient setting, this study aimed to establish the benchtop specs of the Ambu a Scope 4 (Figure 1) while also reviewing available literature on disposable cystoscopy. Specifically, it was hypothesized that there would be no significant differences

between the Ambu-provided specs of a Scope 4 and the benchtop specs obtained in this study. Furthermore, the literature was reviewed for pertinent studies on disposable cystoscopy.

Materials and Methods

This investigation was a prospective benchtop evaluation of a single-use cystoscope system at a single, tertiary-care center in the United States of America. After Institutional Review Board approval, data was logged in a spreadsheet system. Data was obtained on 10 cystoscopes. The primary outcomes evaluated were the specs of the Ambu a Scope 4 which included deflection, diameter measurements and other objective measurements of

the cystoscopy system. Additionally, a diagram was rendered to establish the technical set-up of the Ambu system (Figure 2). Finally, a PubMed, Google Scholar, MEDLINE, and Embase search was performed using keywords 'cystoscopy AND disposable'; 'cystoscope AND disposable'; 'scope AND disposable'; 'single-use AND cystoscope'. Data regarding cystoscope specs was gathered via measurement of various values of the single-use cystoscope system used at this institution. All data was then analyzed using descriptive statistics. Comparisons were made with a two-sample t-test to evaluate for significant differences between the Ambu-provided specs and benchtop specs obtained during the study. A p-value of <0.05 denoted statistical significance.



Figure 1: Ambu Single-Use Cystoscope.

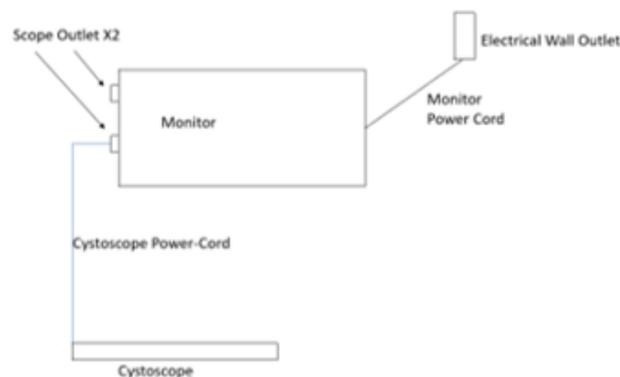


Figure 2: Single-Use Ambu a Scope 4 Diagram.

Results

As part of the study, 10 single-use cystoscopes were evaluated for deflection angle, field of view, outer diameter, working channel diameter, and power cord length. Ambu has information on certain specs of their single-use scope [1]. According to their available information, the scope can deflect 210 degrees upward and 120 degrees downward. Additionally, the cystoscope has a 16.2 French outer diameter with a 6.6 French working channel. The field of view spans 120 degrees. The depth of the visual field ranges from 3-100mm. The insertion cord or power cord length is 390mm in length. Based on the benchtop measurements, the mean scope deflection was 210 degrees upward and 120 degrees downward. No statistical analysis was performed as the benchtop numbers matched the manufacturer numbers. Benchtop testing revealed an average 16.2 French outer diameter and 6.6 French working channel as well. The insertion cord average length was 389.9mm

which resulted in no statistical difference from the manufacturer's number ($p = 1.0$). The visualization was rated 5.0/5.0 for all 10 scopes.

After a literature review, 10 studies were chosen which covered aspects of disposable cystoscopy. The majority of studies covered a single-use, built-in grasper system that is currently available for use. Cost-analyses of disposable cystoscopy were also included in the review. Additionally, a disposable sheath study was included as there are few studies in urology which cover any disposable aspect of cystoscopy.

Discussion

The Ambu a Scope 4 is a relatively new single-use cystoscope which has been implemented in our clinic as part of a response to COVID-19. Overall, benchtop testing revealed solid visualization and maneuverability and similar measurements compared to

manufacturer-provided numbers. Based on office experience, there are two trigger options for deflection. One scope has a trigger which when deflected upward with the thumb, allows upward deflection of the scope; downward trigger deflection leads to downward scope deflection. There is also a reverse trigger available which causes opposite scope deflection compared to trigger deflection. There are technically two power sources for the Ambu a Scope 4 (the rechargeable battery and an option for electrical wall outlet connection). There must be a monitor which is also provided and is non-disposable. This monitor has a kickstand for self-retained positioning. The cystoscope can be plugged into one of two ports on the monitor. As with most cystoscopes, there is a working channel which needs a non-specific adaptor to allow simultaneous flow and manipulation of the working channel.

Based on a 2007 study, a disposable-sheath cystoscopy system was found to decrease the need for sterilization of the cystoscope which decreases cystoscopy time and financial burden [2]. According to the study, patients were overall satisfied with the disposable sheath and the authors concluded that utilization of disposable material could increase the number of scopes performed in a day and thus safely increase the number of patients who can be treated. While this paper does not evaluate a cystoscope per se, it gives some information on the safety and efficacy of disposable materials used for cystoscopy.

There are several studies covering a single-use cystoscope with a built-in grasper. One of the first cases published on this device covered its use in foreign body removal in a 38-year-old male patient [3]. This single-use grasper scope is marketed as a stent-removal device, but it was utilized for the removal of urethral and bladder foreign bodies. There are several cost-analysis studies available covering single-use cystoscopy. A cost-analysis of stent removal with reusable cystoscopy versus disposable cystoscopy stent removal was performed [4]. The single-use cystoscope had built-in graspers for stent removal. Reusable scopes showed predisposition to damage which was considered a source of financial strain. Increased efficiency and decreased cost were noted for the single-use system compared to the reusable systems. Another cost analysis compared single-use cystoscopy to digital reusable cystoscopy [5]. The per-use cost for stent removal with a reusable cystoscope was estimated to be \$161.85. The per-use purchasing price for the single-use device is \$200. After 704 stent pulls, the cost-benefit favored the reusable cystoscope. A study of 150 ureteral stent removals in renal transplant patients, showed significant cost-benefit favoring the single-use system [6]. While the single-use system cost was largely compared to reusable cystoscopy in an operating theater, the success and possible financial benefit of disposable cystoscopy is presented.

One micro-costing analysis favored reusable scopes for cost-benefit [7]. A high-volume practice showed a per-case cost of \$65.98 (reusable cystoscopy) compared to \$227.18 (single-use cystoscopy). Reusable scopes cost significantly less than single-use

scopes according to this study.

Several studies covered maneuverability and scope characteristics. A multi-center study evaluated double-J stent removal with a new single-use digital flexible cystoscope with a built-in grasper system [8]. Image quality, deflection, maneuverability, and grasper functionality were evaluated. All categories were judged 'very good' in over 70% of the surveys taken in the study. Another study compared the grasper-integrated single-use flexible cystoscope to several other scopes [9]. Five scopes were evaluated with the single-use scope rated second in terms of image quality. The single-use cystoscope had the best deflection and water flow when its built-in grasper is activated compared to other scopes with instruments in their working channels. This study shows that the built-in grasper system is a safe and feasibly used alternative to traditional flexible cystoscopy with separate grasper. This same type of scope was studied in patients with bladder cancer. This study compared 608 reusable cystoscopies to 603 disposable cystoscopies. [10]. No differences were observed in positive findings or cancer detection rates (approximately 15% in both groups). A multi-institutional study prospectively evaluated a single-use scope versus a reusable scope clinically and with benchtop evaluation [11]. The single-use cystoscope was found to have superior deflection (230 up/220 down), compared to the reusable scope (195 up/95 down). The single-use scope deflection was impacted more with instrumentation of the working channel compared to reusable cystoscopy. The single-use scopes offered adequate ability to be used in practice, and there was a superior ability for the single-use scope to be portable. The single-use scope could be utilized more efficiently in terms of portability in a hospital setting.

Conclusion

This study has described single-use cystoscopy, with specific attention paid to the Ambu a Scope 4 disposable system. Disposable cystoscopes are becoming increasingly available, particularly in the COVID-19 era. Based on its benchtop assessment, the Ambu a Scope 4 cystoscope is a viable option for office-based cystoscopy. There are a number of other single-use systems reviewed in this study. All disposable cystoscopes warrant future prospective studies to evaluate their cost, safety, clinician interpretation, patient satisfaction and clinical efficacy.

Acknowledgement

None.

Conflict of Interest

None.

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