Air Cystoscopy is Superior to Water Cystoscopy for the Diagnosis of Active Hematuria

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Purpose: We evaluated the clinical use of air cystoscopy, including its possible advantages and disadvantages over water cystoscopy.

Materials and Methods: Two independent observers prospectively studied consecutive patients who underwent water cystoscopy first and then air cystoscopy at our center from May to September 2012. The indication for rigid cystoscopy in the operating room was noted independently by either observer. Findings after rigid cystoscopy were correlated with the results of flexible water and air cystoscopy using the Pearson correlation and Student t-test.

Results: Included in the study were 57 patients with active hematuria, of whom 36 had bladder cancer, and 257 with a history of bladder tumor. The cause of bleeding was clearly identified on water cystoscopy in 22 patients (38%), including tumors in 17 and prostate bleeding in 5, and by air cystoscopy in 49 (86%), including tumors in 32 and prostate bleeding in 17. For diagnosing bladder tumors air cystoscopy had higher sensitivity than water cystoscopy (88% vs 47%, $p = 0.003$) and similar specificity (97% vs 100%, $p = 0.93$). In the 295 patients without hematuria there was no difference in the indication compared to that identified on rigid cystoscopy (43 vs 43, $p = 1.0$). Water cystoscopy revealed more small papillary tumors than air cystoscopy but the number was not significantly different (76 vs 67, $p = 0.26$). All such implants identified on water cystoscopy alone were less than 2 mm. No complication specifically related to air cystoscopy was noted.

Conclusions: We found no statistical difference between water and air cystoscopy in patients without hematuria. Air cystoscopy had higher sensitivity and specificity for diagnosing active hematuria while adding almost no specific complications to the procedure.

Key Words: urinary bladder, urinary bladder neoplasms, cystoscopy, diagnosis, hematuria

Abbreviations and Acronyms

AH = active hematuria
CIS = carcinoma in situ
CT = computerized tomography
NH = no hematuria

Accepted for publication June 17, 2013.
Study received institutional review board approval.

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FLEXIBLE cystoscopy is currently considered the gold standard for endovesical diagnosis. The latest edition of the European Association of Urology guidelines considers outpatient flexible cystoscopy as paramount in the diagnosis of hematuria, and as an important pillar of followup for nonmuscle invasive bladder tumors.[1,2]

In the late 19th century air cystoscopy was developed and improved by pioneers such as Pawlik,[3,4] and Kelly and Burnam.[5] It first gained wide acceptance for cystoscopy in women.[6–8] Nonetheless, technical limitations made urologists prefer the Nitze water cystoscope to evaluate the bladder in men.[9,10] The improvement

0022-5347/13/1906-2097/0
THE JOURNAL OF UROLOGY®

http://dx.doi.org/10.1016/j.juro.2013.06.040
Vol. 190, 2097-2101, December 2013
Printed in U.S.A.

in water rigid cystoscopes with the possibility of circulating liquid in the bladder and the fear of air embolism made air cystoscopes obsolete in the second decade of the 20th century.[11]

The introduction of flexible cystoscopes revived the idea of air cystoscopy.[11–14] Investigators claimed that visualization was better through air[15] and a few groups assessed the tolerability of the 2 techniques, concluding that that air cystoscopy was better tolerated.[16] The simplicity of the technique and its low costs made Rana et al recommend it as an outpatient diagnosis technique.[16]

To our knowledge there has been is no comparative evaluation of air and water cystoscopy in terms of diagnostic efficacy. Although there is no study to support it, air cystoscopy is done at diagnostic centers,[17–19] especially in patients with hematuria in whom vision through water is poor due to active bleeding.[19]

Virtual or CT cystoscopy is a recent application of bladder air insufflation with the same idea of filling the bladder with air, similar to air cystoscopy.[20,21] Using the attenuation contrast of air and bladder mucosa, the scan shows increased sensitivity for detecting superficial bladder lesions, similar to traditional cystoscopy, with excellent tolerance and virtually no side effects.[22,23]

We evaluated the clinical use of flexible air cystoscopy, including its possible advantages and disadvantages over flexible water cystoscopy.

MATERIALS AND METHODS

In this study 2 independent observers prospectively evaluated consecutive patients who underwent cystoscopy at our center from May to September 2012. All cystoscopies were performed for diagnostic or tumor followup as part of the standard protocol at our center. The study was done according to local regulations and standards, and it was approved by the institutional review board. All patients provided informed consent before study inclusion. No specific inclusion criteria were set and all patients who were to undergo cystoscopy were considered eligible. The exclusion criterion was patient refusal to participate.

We used standard, flexible CYF-VA2 digital cystoscopes (Olympus®). Sodium chloride (0.9%) was used as the optical medium for water cystoscopy. Atmospheric air was used for air cystoscopy. The 2 observers were trained urologists experienced with flexible cystoscopy. Each was blinded to the indication for performing cystoscopy and the diagnosis suggested by the other. Simple randomization was used to assign each urologist to water or air cystoscopy so that each observer performed the same number of water and air procedures.

All patients underwent water and air cystoscopy. To insert the cystoscope and evaluate the urethra we needed a good opening and good vision of the urethra with a low risk of damaging the mucosa. This could have been achieved by continuous water inflow or continuous air insufflation. Since an air insufflator was not available for our study, we evaluated the urethra using continuous water inflow. Thus, water cystoscopy was performed first. The second observer was not present in the room during water cystoscopy.

After performing standard water cystoscopy, the first observer performed a J maneuver to empty the bladder. With the cystoscope at the bladder neck the remaining liquid was removed from the bladder by suction, leaving the bladder completely empty. At this point the second observer entered the room as the first one left. The second observer injected atmospheric air through the flexible cystoscope with a 50 ml Luer-Lock® syringe until correct bladder distention was achieved. Standard cystoscopy was then done. Liquid accumulating at the bladder neck could be evacuated as needed. After performing air cystoscopy, all air was suctioned before removing the cystoscope.

Each urologist evaluated for tumors, CIS suggestive areas and active bleeding, and each was at liberty to wash the bladder. Based on cystoscopy findings, if one urologist considered that the patient should undergo rigid cystoscopy in the operating room for biopsy or transurethral resection, this was scheduled independently of the diagnosis of the other observer. Rigid cystoscopy in the surgical theater was used to clarify diagnostic discrepancies between water and air cystoscopy. The surgeon always performed complete cystoscopy first, confirming the previously diagnosed lesion and searching for new ones not identified on flexible cystoscopy. Findings after rigid cystoscopy were correlated with the results of water and air flexible cystoscopy.

All patients were specifically instructed to report certain complications that are symptoms possibly related to air embolism, including loss of consciousness, vertigo, convulsions, tremors, loss of coordination, loss of control of bodily functions, numbness, paralysis, extreme fatigue, weakness in the extremities, areas of abnormal sensation, visual abnormalities, hearing abnormalities, personality changes, cognitive impairment, nausea or vomiting, bloody sputum or any other symptom occurring in week 1 after air cystoscopy.

The quality of vision was graded by each observer according to a Likert scale of 1—impossible, 2—poor, 3—fair, 4—good and 5—excellent. Patients evaluated procedure tolerability on a Likert scale of 1—no pain to 10—very painful.

For statistical analysis of the results we divided patients into 2 statistical groups, including AH and NH. We used Excel® 2003 and SPSS® 15 with the Pearson correlation and Student t-test. Statistical significance was considered at $p < 0.05$.

RESULTS

The study was proposed to 357 patients, of whom 5 patients refused to participate. Thus, the study included 352 patients, of whom 57 had AH. There were 243 men and 109 women. Up to 257 patients had a history of bladder tumor. No technical problems were identified during water or air cystoscopy. We noted no problem when filling the bladder with