

Wireless cystoscope the future of cystoscopy

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Abstract

Cystoscopy during a hysterectomy may decrease the rate of lower urinary tract injury. Our department has developed a new wireless endoscopic setup that couples a rigid 30 degree , 4-mm cystoscope with a wireless camera modified with a special adapter. We used a portable and rechargeable light source. Two cases performed with the new setup are presented in the videos. This report presents the use of a wireless, low-cost and portable camera throughout the course of cystoscopy and the results are promising. The new technique is feasible and easy reproducible and could contribute to making cystoscopy during gynecologic surgery cost-effective.

Introduction

Urinary tract injury, although rare, is a significant complication in women undergoing laparoscopic, vaginal, or abdominal gynecologic surgery. Cystoscopy at the time of hysterectomy has been proposed to be a valuable tool for recognizing the ureteral and bladder injury, permitting immediate repair, and minimize this way long term complication, re-operation, or litigation issues. (1) Moreover, in 2012, the American Association of Gynecologic Laparoscopists recommended that routine cystoscopy be performed after all laparoscopic hysterectomies, whereas the American College of Obstetricians and Gynecologists limited the endorsement to prolapse and incontinence procedures. (2, 3) Nevertheless, universal cystoscopy's cost-effectiveness and the availability of endoscopic equipment are unsolved problems in countries with low and high resources. (4, 5)

Surgical technique

Portable setup

After the experience of the application of portable wireless cameras during laparoscopic surgery, our team developed a new cystoscopic setup. (6, 7) The new setup was created by coupling a rigid 30°, 4-mm cystoscope with a GoPro HERO5 camera (wireless camera) using a Back-Bone Ribcage H5PRO adaptor (special adaptor). The light source used was a portable and rechargeable LED cold light source (Figure 1). A modified plastic bag was used to ensure sterile conditions, with the camera contained inside.

The specific camera we used has the ability to transmit the signal wirelessly to a tablet computer, mirroring this way, the camera image to a secondary monitor (tablet computer). This is very important for the surgeon as the large tablet screen may project in detail the anatomical structures. This way, it is easier to conclude a correct diagnosis, and performed cystoscopy is more convenient.

Cystoscopy technique

Initially, the patient is in the dorsal lithotomy position, and the vaginal introitus is prepared with normal saline. Lidocaine hydrochloride 1% gel can be used as a local anesthetic and lubricant. A rigid, 30° narrow caliber cystoscope is introduced into the urethra. We infuse normal saline at a 150 mmHg pressure and visualize the urethral wall and direct the cystoscope into the bladder. On entering the urinary bladder, the cystoscope should be tilted downwards to enable the operator to initially visualize the neck and then the urinary bladder's trigone. In case of intraoperative performance, the patient is already under general or epidural anesthesia. In the case of diagnostic cystoscopy, there is no need for anesthesia, except that a pigtail catheter must be introduced or replaced that the patient must be anesthetized.

Our Department performs diagnostic cystoscopy in selected vaginal and abdominal operations, mostly TVT vaginal tapes for urine incontinence, vaginal hysterectomies, and cancer staging (cervical). We applied the new setup in more than 50 diagnostic cystoscopies and pigtail catheter replacement so far effectively and without complications. As demonstrated in video 1, image quality is excellent for the surgeon to complete the cystoscopy without any problems.

Discussion

Intra-operative cystoscopy for detecting surgical trauma in the bladder or the ureter is a useful gynecologist procedure. Rates of Urinary tract injuries during gynecologic procedures have varied by type of surgery and type of injury. Therefore, hysterectomy has a risk of ureteric injury from 1,7% for a benign indication to 4 % for malignancies (8). Bladder injury is prevalent in terms of perforation or trauma when Tension-free vaginal tapes are inserted (4,4%-71%) (9). The routine use of cystoscopy in gynecologic operations may induce intra-operative urinary trauma detection rate. Vakilli et al. have shown that universal cystoscopy after hysterectomy may detect up to 96% of urinary tract injuries intra-operatively. Before cystoscopy, only 12,5% of ureteral injuries and 35,3% of bladder injuries were detected (10). Moreover, in a systematic review, Teeluckdharry et al. tried to determine the urinary tract injury rates with and without the routine use of cystoscopy for patients who underwent any hysterectomy and concluded that routine cystoscopy clearly increases the intra-operative detection rate of urinary tract injuries(11).

We tried to develop an easy to use, a low-cost, portable endoscopic system to make cystoscopy friendly to the gynecologist. The whole system, including the light source, has no cables and may be contained in the same carrying case as the cystoscope for transportation. The system's portability (total weight <1000gr) allows for easy transfer among the operating room, outpatient office, or emergency room, contrasting with the standard cumbersome endoscopic tower. The system's cost is another major advantage as the modified camera, light source, and tablet cost \$2,047 in sum, considerably lower than \$50,000, which is the average cost of a standard tower.

Surgeons may use the wireless setup to perform cystoscopy simultaneously with laparoscopic surgery, without occupying the endoscopic tower (Figure 2). There is no need to stop the ongoing operation from performing cystoscopy and either stand by an endoscopic tower for the same reason in vaginal or abdominal hysterectomy cases. This may induce the producibility of a health care facility and allow for more conservative use of the valuable and costly standard endoscopic equipment.

The new system may have multiple applications as cystoscopy may even be performed at facilities that do not possess endoscopic equipment other than a rigid cystoscope. Therefore, in vaginal surgery (vaginal hysterectomy with suspension, urethral sling placement), abdominal hysterectomy, laparoscopic hysterectomy, or deep endometriosis surgery, the new setup may contribute to cost reduction of intra-operative cystoscopy markedly. Moreover, it may be utilized for pigtail catheter replacement, which is an often procedure, especially in gynecologic oncology departments, mainly for patients with advanced cervical cancer. Finally, the new setup is useful beyond gynecology limits as it may be used for urologic indications.

We now have a new cost-effective and easily reproducible cystoscopic setup that combines all the benefits already analyzed. The reduction in cystoscopy cost could result in a more wide implementation, eliminating patient risk for undiagnosed urinary tract injuries.

Figure 1, Wireless Cystoscope set-up

Figure 2, Intra-operative wireless cystoscopy

Disclosure of interests

None declared

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References

1. Ibeanu OA, Chesson RR, Echols KT, Nieves M, Busangu F, Nolan TE. Urinary tract injury during hysterectomy based on universal cystoscopy. *Obstet Gynecol.* 2009;113(1):6-10.
2. Worldwide AAMIG. AAGL Practice Report: Practice guidelines for intraoperative cystoscopy in laparoscopic hysterectomy. *J Minim Invasive Gynecol.* 2012;19(4):407-11.
3. American College of O, Gynecologists. ACOG Committee Opinion. Number 372. July 2007. The Role of cystourethroscopy in the generalist obstetrician- gynecologist practice. *Obstet Gynecol.* 2007;110(1):221-4.
4. Peacock LM, Young A, Rogers RG. Universal cystoscopy at the time of benign hysterectomy: a debate. *Am J Obstet Gynecol.* 2018;219(1):75-7.
5. Luchristt D, Geynisman-Tan J, Mueller MG, Kenton K. Cost-effectiveness analysis of universal cystoscopy at the time of benign laparoscopic hysterectomy. *J Minim Invasive Gynecol.* 2020.
6. Chatzipapas I, Kathopoulos N, Protopapas A, Loutradis D. Using a Mobile Smartphone to Perform Laparoscopy. *J Minim Invasive Gynecol.* 2018;25(5):912-5.
7. Chatzipapas I, Kathopoulos N, Siemou P, Protopapas A. Wireless Laparoscopy in the 2020s: State-of-the-Art Technology in Surgery. *Obstet Gynecol.* 2020;136(5):908-11.
8. Kiran A, Hilton P, Cromwell DA. The risk of ureteric injury associated with hysterectomy: a 10-year retrospective cohort study. *BJOG.* 2016;123(7):1184- 91.
9. Atherton MJ, Stanton SL. The tension-free vaginal tape reviewed: an evidence-based review from inception to current status. *BJOG.* 2005;112(5):534-46.
10. Vakili B, Chesson RR, Kyle BL, Shobeiri SA, Echols KT, Gist R, et al. The incidence of urinary tract injury during hysterectomy: a prospective analysis based on universal cystoscopy. *Am J Obstet Gynecol.* 2005;192(5):1599-604.
11. Teeluckdharry B, Gilmour D, Flowerdew G. Urinary Tract Injury at Benign Gynecologic Surgery and the Role of Cystoscopy: A Systematic Review and Meta-analysis. *Obstet Gynecol.* 2015;126(6):1161-9.

