Case Report

Intravesical Explosion Resulting in Bladder Rupture During Transurethral Resection of Bladder Tumors

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SUMMARY

Explosion in the bladder during transurethral resection of a bladder tumor is an extremely rare complication of urologic surgery. The damage to the bladder can range from small mucosa tears to bladder rupture. A case of intravesical explosion with extensive intraperitoneal bladder rupture during transurethral resection of a bladder tumor is described. The literature is reviewed, and the mechanism of bladder rupture, as well as the possible preventive measures are discussed.

1. Introduction

Transurethral endoscopic resection is one of the most common surgeries in urology. Intravesical explosion during transurethral resection is an extremely rare event. The earliest report of this complication was in 1926. Most explosions occur during transurethral resection of the prostate. Only a few cases associated with resection of bladder tumors have been reported. Bladder injury can range from mucosa tear to bladder rupture. However, a strong explosion causing intraperitoneal shattering of the bladder has never been reported. We report a case of a strong explosion resulting in severe bladder damage during transurethral resection of bladder tumors. We also review the literature to determine the etiology of these explosions and suggest strategies to prevent these explosions.

2. Case report

An 86-year-old male with a history of invasive urothelial carcinoma of the right lower ureter and bladder had previously undergone right laparoscopic nephroureterectomy and transurethral resection of bladder tumor. This time the patient underwent transurethral resection of recurrent bladder tumors under spinal anesthesia. A 24 Fr. continuous flow resectoscope was used with a monopolar wire loop electrode. The electrocautery current was set at 80 W for coagulation and 120 W for cutting. Distilled water was used as the irrigating fluid in a continuous drainage system.

Multiple bladder tumors over the bilateral walls, anterior wall, dome, and trigone area were resected. These resected fragments of the tumor were removed with simple irrigation or Ellick evacuator.

On final inspection, a 3-cm papillary mass on the anterior wall was identified inside an air bubble. On initiation of cutting, a loud pop was heard and a jolt was felt in the lower abdomen by the surgeon and the patient himself. Cystoscopy showed a wide irregular full-thickness laceration into the intraperitoneal space. The intestinal loops were visible.

The operation was converted immediately to laparotomy via a low midline incision. A severely shattered bladder with scattered fragments of the anterior, posterior, bilateral wall, dome, and trigone were found. Fortunately, the large and small intestines were intact. Several bladder wall fragments were removed. The residual intraperitoneal bladder wall was repaired with a double layer of 3-0 Dexon sutures in a running fashion. A 22 Fr. Foley catheter was left in situ. The abdominal cavity was irrigated with copious amounts of sterile water. The patient was discharged with the Foley catheter in situ 5 days later and made an uneventful recovery. The Foley catheter was removed 3 weeks later at the clinic.
3. Discussion

Intravesical explosion is an extremely rare complication during transurethral resection of a prostate and bladder tumor. A case of pelvic explosion during endoscopic pelvic tumor resection was reported in 1991. Explosions have also been described during colonic surgery and large bowel endoscopies when using diathermy. Explosions are more common during resection of prostate tumors than bladder tumors. Only 19 reports related to resection of prostate tumors have been reported since 1926. Only four cases related to resection of bladder tumors have been reported up to now. Most of the cases presented with bladder rupture with small intra- or extraperitoneal perforations. However, a strong explosion causing severe intraperitoneal bladder rupture has never been reported. A mild explosion in the bladder generally does not cause complications. However, if severe enough, a shattered bladder may result in significant morbidity, even mortality, in elderly patients.

The mechanism for the bladder explosion is related to the trapping of volatile gases during resection of human tissue. These volatile gases are an admixture of hydrogen and a lesser quantity of explosive hydrocarbons. Ning et al. and Davis showed in vitro that hydrogen constituted 30–50% of the gases produced by electrocautery, whereas oxygen made up no more than 3%. Hansen and Iversen also demonstrated in vitro and in vivo that hydrogen (30–65%) was the dominant gas produced during transurethral resection of prostate (TURP), and oxygen and several explosive hydrocarbons were produced in small amounts. They theorized that the majority of these gases were produced from pyrolysis of human tissues and electrolysis of intracellular water due to high temperature during cutting and coagulation of tissue. Hydrogen gas alone did not cause explosions even with low amounts of oxygen produced by diathermy. However, when hydrogen mixed with oxygen from the atmosphere, it became flammable and could be ignited by a spark generated by electrocautery.

Air and oxygen may enter the bladder via irrigation tubes and during manipulation of the resectoscope working element or as a result of incorrect use of the Ellick evacuator. The amount of gas formed and the risk of explosion are proportional to the temperature of the resectoscope and operating time. Viville et al. stated that the nature of the bladder infusion liquid did not play an important role.

We suggest several strategies to reduce the possibility of bladder explosion: (1) minimize the amount of air introduced into the bladder via the Ellick evacuator, irrigation tube, or resectoscope during manual irrigation; (2) aspirate the air bubble in the bladder using a suprapubic catheter or ureteral catheter; (3) decrease the time of resection with judicious coagulation of tissues; (4) avoid high-temperature cautery and use a moderate power setting for the coagulation current; (5) use a continuous irrigation system; (6) shift the air bubble away from the tumor in the dome of the bladder by placing the patient in the Trendelenberg position or apply suprapubic pressure during electrocautery; and (7) avoid wire loop exposure in the air bubble during resection.

4. Conclusion

Although rare, intravesical explosions can occur during all forms of transurethral procedures using diathermy. It may cause severe damage to the bladder requiring emergent repair. Urologists must be aware of this potential complication. Careful operative techniques and prevention strategies can reduce the risk of this complication.

References