

## EXPLOSIVE GAS FORMATION DURING TRANSURETHRAL RESECTION OF THE PROSTATE (TURP)

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### Abstract

Intravesical explosion during transurethral resection of the prostate (TURP) is an extremely rare event. It might be associated with various degrees of bladder injury ranging from simple mucosal tear to rupture of the bladder. It is believed that intravesical explosion occurs due to formation of explosive gases in the bladder during TURP and its admixture with air. One case of intravesical explosion during TURP resulting in complete intra- and extraperitoneal bladder rupture at our institution is described. The management of this dreaded complication involves open surgery. Although rare, this complication is preventable by taking precautions.

### INTRODUCTION

Intravesical explosion during transurethral resection of the prostate (TURP) is a rare complication of TURP and was reported as early as 1926 [1]. This dreaded event is associated with various degrees of bladder injury ranging from simple mucosal tear to bladder rupture [2-5]. Bladder rupture can be either extraperitoneal or/and intraperitoneal requiring laparotomy and open bladder repair. The underlying mechanism for intravesical explosion is the generation and trapping of explosive gases under the dome of the bladder which eventually detonates by sparks from the cutting electrode during TURP. We report one case of an intraperitoneal rupture due to an explosion during TURP in a patient with benign prostatic enlargement as we felt it was important to remind the urologic community of this rare complication, especially those that perform TUR in daily practice. Its mechanism and the possible preventive measures are discussed.

### CASE PRESENTATION

A 73-year-old patient with bladder outlet obstruction due to benign prostate enlargement underwent TURP. The procedure was performed using a 26-French continuous flow resectoscope (Karl Storz, Tuttingen, Germany) with 1.5% glycine as irrigant. The electrocautery current (Erbe, Tuebingen, Germany) was set at 50 W for coagulation and 120 W for cutting. The TURP was straightforward having resected 34 g of prostatic tissue in 45 min. During the last phase of the procedure while resecting at the 12 o'clock position a

loud thud explosion occurred. Endoscopically, a wide laceration with an intraperitoneal full-thickness tear was noticed and intestinal loops were seen. The patient was immediately referred to the open operating theatre. At laparotomy exploration a completely lacerated bladder with irregular margins was found. Both lateral walls, the posterior and anterior wall as well as the peritoneum were torn apart. Fortunately, small and large intestine and big vessels were intact. The remaining adenoma (22 g) was enucleated. Subsequently, the bladder wall was reconstructed with a double layer 3-0 polyglycolic suture in a running fashion after both ureters were stented by a Double-J catheter 7 Charrière. A 3 cm x 2 cm metering piece of full-thickness bladder had to be removed due to insufficient blood supply. Urinary drainage was guaranteed postoperatively by both urethral three-way catheter (Charriere 24) and a subpubic cystostomy (Charriere 12). The patient made an uneventful recovery. On day 7 after surgery retrograde cystography revealed normal intravesical wound healing and both catheters were removed. Peak urinary flow increased from baseline 8.9 mL/s to 23.1 mL/s postoperatively, postvoid residual urine decreased from 125 mL to 35 mL after surgery. No dysuria, incontinence or urgency occurred, although bladder capacity had been reduced. Histopathological examination of the retrieved prostate tissue (56 g) confirmed benign prostatic hyperplasia.

### DISCUSSION

Although bladder injury due to intravesical explosion during TURP is a recognized complication only 17 reports are available since 1926 in the literature. Kretschmer [4] for the first time described two cases of a bladder rupture following TURP as early as 1934. Another single report was published by Bobbitt [2] in 1950, until in 1975 [5] two cases, in 1979 [3] and 1984 [6] each another case of bladder explosion with intraperitoneal rupture were reported. Since then no further case was published until 2001 when Dublin et al. presented a new case, followed by 8 cases through 2007 [7-15].

Almost thirty years ago Hansen et al. [3] described in vitro and in vivo gas formation during TURP which were analysed by means of an oxygen electrode and gas chromatographs. Hydrogen is dominant (30-65%) but also oxygen and several explosive hydrocarbons

are demonstrated. Hydrogen is formed by pyrolysis of prostate tissue and by hydrolysis of intracellular water. The gas formed *in vitro* is highly explosive in contrast to the gas mixture produced *in vivo*. In latter, oxygen is not generated in sufficient quantity and the mere accumulation of hydrogen itself does not cause explosion. Therefore, oxygen from the atmosphere must enter the bladder to form a highly explosive gaseous mixture [5, 16, 17]. The intravesical accumulation of explosive gas can be ignited when the electrosurgical electrode loop comes into contact with gaseous formation.

The nature of the bladder irrigation liquid does not appear to play an important role [6]. The amount of gas formed and the risk of explosion are proportional to the operating time which means that decreasing the time of resection decreases also the risk of explosion. Furthermore, prevention implies the reduction in the use of a cutting and coagulation current of moderate power, since the higher the temperature of the resectoscope loop the more gas is accumulated in the bladder [17]. Prevention also implies the avoidance of air entering the bladder accidentally. This may occur as a result of a leaking irrigation tube or an improper use of the Ellick evacuator bulb. Oxygen may also enter the bladder cavity during replacement of irrigation fluid bottles and whenever the resectoscope is opened for any reason during surgery. Air in the dome of the bladder may be aspirated using a ureteral catheter if necessary. Suprapubic pressure may be used to reposition the location of the air bubble away from the area of interest, while placing the patient in the Trendelenburg or anti-Trendelenburg position may shift the air bubble [12]. Others have recommended to evacuate air bubbles under the bladder vault continuously (by percutaneous cystostomy/trocar) or simply by angling the beak of the resectoscope sheath ventrally while emptying the bladder [7].

### CONCLUSION

Bladder explosion, although rare, is a complication which should be kept in mind for those that perform transurethral resections in daily practice. It is preventable by taking precautions.

*Consent:* Written informed consent was obtained from the patient for publication of this case report and any accompanying images.

### REFERENCES

1. Cassuto A: Explosion dans la vessie au cours d'une électro-coagulation. *J Urol* 1926, 22:263.
2. Bobbitt RM: Intravesical rupture of bladder during transurethral prostatic resection. *J Urol* 1950, 64:338-340.
3. Hansen RI, Iversen P: Bladder explosion during uninterrupted transurethral resection of the prostate. A case report and an experimental model. *Scand J Urol Nephrol* 1979, 13:211-212.
4. Kretschmer HL: Intravesical explosions as a complication of transurethral electroresection: Report of two cases. *JAMA* 1934, 103:1144.

5. Ning TC, Jr., Atkins DM, Murphy RC: Bladder explosions during transurethral surgery. *J Urol* 1975, 114:536-539.
6. Viville C, de Petriconi R, Bietho L: [Intravesical explosion during endoscopic resection. Apropos of a case]. *J Urol (Paris)* 1984, 90:361-363.
7. Khan A, Masood J, Ghei M, Kasmani Z, Ball AJ, Miller R: Intravesical explosions during transurethral endoscopic procedures. *Int Urol Nephrol* 2007, 39:179-183.
8. Srivastava A, Sandhu AS, Sinha T, Madhusoodanan P, Karan SC, Sethi GS, Talwar R, Narang V: Intravesical Explosion during Transurethral Resection of Prostate - a reminder. *Urol Int* 2006, 77:92-93.
9. Ribeiro da Silva MN, Lopes Neto AC, Zambon JP, Verotti MJ, Wroclawski ER: Vesical explosion during transurethral resection of the prostate: report of a case. *Arch Esp Urol* 2006, 59:651-652.
10. Rezaee MM: Intravesical Explosion during Endoscopic Transurethral Resection of prostate. *Urology Journal (Printed in IRAN)* 2006, 3:109-110.
11. Martov AG, Kornienko SI, Gushchin BL, Ergakov DV, Sazonov OA: [Intraoperative urological complications in transurethral surgical interventions on the prostate for benign hyperplasia]. *Urologiia* 2005:3-8.
12. Horger DC, Babanoury A: Intravesical explosion during transurethral resection of bladder tumors. *J Urol* 2004, 172:1813.
13. Morin G, Vincendeau S, Manunta A, Guille F, Lobel B, Patard J-J: Rupture intra-péritonéale de vessie au cours d'une résection trans-urétrale de prostate. *Progrès en Urologie* 2003, 13:303-305.
14. Di Tonno F, Fusaro V, Bertoldin R, Lavelli D: Bladder explosion during transurethral resection of the prostate. *Urol Int* 2003, 71:108-109.
15. Dublin N, Razack AH, Loh CS: Intravesical explosion during transurethral resection of the prostate. *ANZ J Surg* 2001, 71:384-385.
16. Hambleton BF, Lackey RW, van Duzen RE: Explosive gases formed during electrotransurethral resection. *JAMA* 1935, 103:1144.
17. Davis TR: The composition and origin of the gas produced during urological endoscopic resections. *Br J Urol* 1983, 55:294-297.

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