Bladder Explosion, A Rare Complication of Transurethral Resection of the Prostate: Two Case Reports

Prostatın Transüretral Rezeksiyonunda Nadir Bir Komplikasyon Olan Mesane Patlaması: İki Olgu Sunumu

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Introduction

Transurethral procedures are common urologic procedures performed in daily clinical practice (1). Electrocautery is widely used in endoscopic urological surgery, and although regarded safe, explosions related to electricity have been reported. Bladder explosion during transurethral resection is very rare (2). The earliest reported case was in 1926 (3). In 1934, Kretschmer (4) reported two intravesical explosions with rupture of the bladder during transurethral resection of the prostate (TURP). We report two patients who suffered bladder explosion during TURP as well as a review of the literature and a summary of the mechanism of explosion, and a discussion how to prevent this complication.

Case 1

A 75-year-old male was admitted to our clinic with the complaints of lower urinary tract symptoms for 10 months. Physical examination revealed grade two enlargement of the prostate. Abdominal ultrasonography showed bilateral hydroureteronephrosis and a prostate size of 55 cc. Serum creatinine level was 3.0 mg/dL and after catheterization, it was reduced to 1.4 mg/dL four weeks later. The patient was operated under spinal anesthesia. Cystoscopy was performed and multiple bladder diverticulae were observed with the largest being in the dome of the bladder. Resection was done using 24 French (Fr) discontinuous flow resectoscope (Karlz Storz). Electrocautery (Force FX;
Covidien) was used with a monopolar cutting current of 140 W and coagulation current of 100 W. 1.5% glycine was used as the irrigation solution. The total resection time was 45 minutes. While hemostasis was achieved near to the bladder neck, there was a sudden loud pop sound, and the bowel loops were become visible through the bladder. Intraperitoneal bladder explosion was suspected. The patient underwent an urgent laparotomy under general anesthesia. Following laparotomy, the abdomen was explored and it was seen that the rupture involved the diverticulum in the bladder dome. No additional injuries were seen in the internal organs. The bladder was repaired by double layer continuous stitching with synthetic absorbable suture. Suprapubic catheter and drain were placed along with 22 Fr urethral catheter, and the operation was completed. Postoperative recovery was uneventful. The drain was removed on the third day and patient was discharged on the fourth postoperative day. The urethral catheter was removed 10 days later. The patient voided with good flow after catheter removal. The biopsy specimen was reported as benign. Informed consent was obtained from the patient for publishing this case.

**Case 2**

A 72-year-old male was admitted to our clinic with refractory urinary retention for six months. Physical examination revealed grade two enlargement of the prostate. Ultrasound evaluation showed a prostate size of 60 cc and normal bladder. All other preoperative parameters were within the normal limits. Following spinal anesthesia cystoscopy was performed and the bladder was found to be normal. TURP was performed using 24 Fr discontinuous flow resectoscope (Karlz Storz). Electrocautery (Force FX; Covidien) was used with a monopolar cutting current of 140 W and coagulation current of 100 W. 1.5% glycine was used as the irrigation solution. Initial 55 minutes of the procedure were uneventful, while resecting the lateral lobes of the prostate, a loud snap was heard. Subsequently, intestinal loops were seen in the bladder. TURP was immediately aborted. The patient underwent an urgent laparotomy under general anesthesia. Following laparotomy, the abdomen was explored and intraperitoneal rupture was observed in the bladder dome. No additional injuries were seen in the internal organs. The bladder was repaired by double layer continuous stitching with synthetic absorbable suture. A suprapubic catheter was introduced intraoperatively to secure the bladder drainage postoperatively. Drains were placed along with 22 Fr urethral catheter and the operation was completed. Postoperative recovery was uneventful. Three days after the operation, the drain was removed and suprapubic catheter was removed five days after the operation. The urethral catheter was removed 10 days later. The patient had a successful trial of void. Biopsy specimen was reported as benign. Informed consent was obtained from the patient for publishing this case.

**Discussion**

Bladder explosion, a rare and frightful complication of TURP, is estimated to occur in approximately 0.02% of transurethral procedures (5). The degree of bladder injury due to an explosion varies from a loud “pop” sound to only a ruptured bladder requiring surgical repair (6). One of the most common causes of bladder perforation during transurethral surgery is hyper distension of the bladder wall when the amount of fluid infused is in excess, when the patient has a low vesical compliance or when excessive pressure is applied during evacuation of prostatic fragments (7). Although there are some cases of bladder explosion when the continuous drainage system is used (8), it occurs most commonly when a continuous drainage system is not used. We think that bladder explosion could be caused by discontinuous drainage system, a probable mechanism for intravesical explosion that has been previously described (9), used in our both cases. The other etiology of intravesical explosions may be related to the formation of hydrogen gas during resection of tissue. Ning et al. (10) performed in vitro experiments showing that hydrogen constituted approximately 30-50% of the gases produced by electrocauterity, while oxygen made up no more than 3%. Gases containing hydrogen are produced by electrolysis of intracellular water. In vitro experiments performed by Davis (11) confirmed at least 30% hydrogen formation in diathermy gases. Whereas hydrogen gas alone is not explosive, when mixed with atmospheric oxygen, it may become combustible. Air from the room can enter the bladder while changing the irrigation bag, or inappropriate handling of the evacuator bulb. 21% oxygen of the room air is sufficient for explosion. In the presence of explosive hydrogen gas with a sufficient amount of oxygen, heated resectoscope may trigger an explosion (12). Air can be introduced into the bladder through the irrigation tubing during manual irrigation whenever the resectoscope is opened for any reason (10). Due to the fact that discontinuous drainage system was used in our cases, we had to remove the resectoscope for the bladder drainage. Therefore, we think that oxygen entrance into the bladder was provided. Other risk factors are the use of high-power current during coagulation and prolonged surgery time (9). We think that bladder explosion could be caused by high-power current used in our cases. The amount of gas formed and the risk of explosion are proportional to the operating time (11). The nature of the bladder irrigation fluid does not appear to play an important role (12).
presence of diverticulum might be an additional risk factor for explosion owing to the thinned bladder as well as a possible trapping of air within it (13). There have been various suggestions for prevention of this untoward complication: use of moderate power current during coagulation and resection, decreasing the tissue resection time, minimizing the entry of air into bladder by keeping all connections and evacuating bladder either frequently or continuously to reduce the size of air bubble as small as possible (2). Ureteral catheter evacuation of the gas and positioning the patient to displace the bubble have been suggested (10). Suprapubic cystostomy in the dome would also allow these gases to escape (14). In conclusion, although bladder explosion is a rare complication, it can occur during TURP. All urologists should be aware of this complication and its management. The risk of bladder explosion is increased in discontinued drainage systems but this risk can be reduced by taking simple precautions.

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References