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Intravesical Explosion During TURP: A Rare Complication of a Common Procedure – What We Should Know

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ABSTRACT

A case of bladder rupture due to intravesical explosion during transurethral resection of prostate (TURP) is presented. Exploratory laparotomy done on clinical suspicion revealed a large inverted "V" shaped bladder tear that was sutured in 2 layers. An incidence of intravesical explosion during TURP is extremely rare. It occurs due to a mixture of explosive gases produced during TURP, with the air introduced into the bladder while activating the electrosurgical instrument. The presentation aims to bring attention to this rare complication once again with a literature review and emphasis on the necessary precautions needed to prevent it.

INTRODUCTION

TURP is considered the gold standard surgical procedure for benign hyperplasia of the prostate [1]. Being regularly performed, we are aware of its common complications like hematuria, perforation, and so forth. Intravesical explosion is a very rare complication with only 20 such cases reported so far. This preventable complication occurs due to a mixture of explosive gases with the air once they come in contact with sparks from electrocautery. Along with the case, we will discuss the mechanism and preventable strategies.

CASE HISTORY

A 70-year-old male presented with a 5-year history of lower urinary tract symptoms (AUA score = 13/35). He was on a combination of dutasteride and tamsolusin for 6 months without resolution. On the digital rectal exam (DRE), a grade III gland with firm consistency was felt. On ultrasound, the prostate volume was 96 cc with a high residual volume of 150 cc. His serum PSA was 10.8 ng/ml. A prostate biopsy revealed benign enlargement with prostatitis. TURP was advised and performed with a Storz 26 Fr continuous-flow resectoscope with 1.5% glycine as our irrigant. A thin cutting loop and a Valleylab cautery was used with cutting settings of 100 W and coagulation at 60 W. A cautery pad was placed on the posterior aspect of the right thigh. At the end of the procedure, when haemostasis was achieved at the 12-o'clock position, a loud sound was heard with vibrations on the abdomen and a sudden decrease in endoscopic vision. There was no return of the irrigation fluid and abdominal distension started, confirming the probable diagnosis of bladder rupture due to intravesical explosion. We decided to perform an exploratory laparotomy. There was a sudden gush of air upon opening the peritoneum and 400 cc of hemorrhagic fluid was drained. A large inverted "V" shaped tear extending from the dome of

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the bladder close to both the ureteric orifices was seen, margins of which were ragged and bleeding. Though hemostasis was achieved, margins were not freshened. The bladder rupture was repaired in 2 layers using 2-0 vicryl with an omental patch. A suprapubic catheter and abdominal drain were placed. On post-operative day 12, the patient developed a right perivesical abscess that required repeat exploration and drainage. Finally, the patient was discharged after 3 weeks. A histopathological report showed benign prostatic hyperplasia with prostatitis. On follow-up at 18 months, the patient was healthy, passing urine with a good stream and minimal residual volume.

DISCUSSION

Intravesical explosion during TURP is a rare complication [2]; around 20 cases reported [3] to date. It has also been reported with a transurethral resection of a bladder tumor (TURBT) [2]. A case of renal pelvic explosion during ureteroscopic fulguration of renal papillary transitional cell carcinoma was reported in 1991 [4]. Three cases have been reported from the same institute over 15 years [5]. Despite the large number of TURP performed all over, complications are kept at a low 18% [1]. The most frequent complications are closed and open perforation of the prostatic capsule (2%) [1], mechanical trauma of the prostate and urethra (0.3 and 0.15%) [6], TUR syndrome (2%) [1], and intraoperative bleeding compensated by hemotransfusion (3.9%) [1]. Rare complications include injury of the ureteral ostia (0.09%) [6] and rupture of the urinary bladder (0.02%) [6]. Adherence to precision and technique minimizes serious complications. This complication, though rare but serious, always entails immediate surgical correction. All in all, the explosion occurred toward the end of the procedure during resection or achieving haemostasis of the apical lobe at the 12-o'clock position. In all cases, external air had already been introduced in the bladder prior to explosion while removing TURP chips.

It has been postulated that carbonization of the prostatic tissue during contact with the electric loop while resecting produces inflammable gases like hydrogen (30%), carbon monoxide, and oxygen (3%) [7]. The most important constituent is hydrogen. Intracellular fluid, electrolysis, and pyrolysis of prostatic tissue result in the release of these explosive gases during resection due to the high temperature of the resectoscope [7]; therefore, the greater the temperature, the larger the gas accumulation. It is well known that not pure hydrogen but the addition of oxygen makes it potentially explosive. The amount of the oxygen produced is not sufficient to cause explosion. Therefore, the introduction of air during TURP is crucial in the production of a bladder explosion. These gases accumulate at the bladder dome, represented by the air bubble. An inflammable mixture of these gases and air explodes when the resectoscope loop comes in contact with the gases present at the bladder dome [8].

Hableton et al. [9] analyzed the gases produced during electrocoagulation of dog prostates as early as 1935. They concluded that hydrogen is the explosive component when mixed with air. Similarly, Ning et al. [10] analyzed the gases produced during transurethral surgery and hypothesized that hydrogen is derived from electrolysis of intracellular water.

Air can be introduced into the bladder through a leak in the manual irrigation tubing whenever the resectoscope is opened during surgery and the fluid bottle replaced. As a personal thought, the more common error is an incomplete evacuation of air introduced into the bladder during washes through an Ellik evacuator. This occurs when either it's almost finishing time but more resection is needed, or due to inadequate haemostasis, which compels the surgeon to reintroduce the resectoscope, resulting in incomplete evacuation of the bladder. Among the risk factors mentioned in the literature, the use of a high-power current during coagulation by increasing carbonization and the duration of resection increases the hazard. It has been suggested that the irrigation liquid (1.5% glycine or distilled water) does not seem to play any role, while the type of tissue resected (necrotic, for example) could be significant. Moreover, it is suggested in literature that a continuous-flow resectoscope, in comparison to intermittent ones, could be more dangerous because it allows the slow, continuous accumulation of gas under the bladder vault. Some surgeons have suggested cystography as a prerequisite for evaluation of this mishap, but I feel that it is unnecessary in the presence of endoscopic finding. In case of clinical suspicion, the patient should be explored.

From the point of preventive measures, ureteral catheter evacuation of the gas and positioning of the patient to displace the bubble have been suggested. Suprapubic cystostomy, if done, would also allow these gases to escape and, should an explosion occur, the pressure is vented and the bladder is spared. Careful attention should be given to the size of the air bubble present at the bladder dome. It is here all the explosive gases formed during resection accumulate. Frequent bladder evacuation with the beak of the resectoscope angled toward the bladder dome to decrease the size of air bubble should be done. Among the many practical rules that should always be taken into consideration while performing TURP, the following

appear particularly suited in order to further minimize these rare complications [3]:

1. The use of current of moderate power during coagulation and decreasing the tissue resection time.
2. Minimize the entry of air into the bladder by keeping all connections and joints leak proof, and timely and careful replacement of irrigation fluid.
3. Carefully evacuate the bladder either frequently or continuously to keep the size of the air bubble as small as possible.
4. The bladder should be allowed to evacuate completely by angling the beak of the resectoscope toward the bladder dome.

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