Bladder injury due to intravesical explosion during transurethral resection of bladder tumor: a case report

Abstract  A 79-year-old man having non-muscle-invasive bladder cancer received a second transurethral resection of bladder tumor (TURBT). An intravesical explosion occurred during the surgery. Although resection was performed at the anterior wall of the bladder, the posterior wall of the bladder was injured. Fat tissue from the bladder was observed. No obvious leakage to the peritoneum was seen in postoperative cystography. An intravesical catheter was indwelled for 14 days and his condition finally improved without additional surgery. Although bladder explosion is a rare complication, it may lead to a serious condition. Oxygen alone from the atmosphere is not detonatable. However, when mixed with hydrogen, it may become oxyhydrogen, a highly explosive gas, and detonation may occur during TURBT. All urologists should be aware of this complication and air bubbles must be removed during resection of tumors in the bladder dome or anterior wall.

Key words: intravesical explosion, bladder injury, TURBT

Introduction  Transurethral resection of bladder tumor (TURBT) is essential for non-muscle-invasive bladder cancer treatment. Although it is rare, bladder perforation is a serious complication1. Perforation by deep resection or obturator nerve reflex is widely recognized. However, bladder injury due to intravesical explosion is rare and urologists may not be aware of the risk.

Discussion  Transurethral resection of bladder tumor has an essential role in the treatment of bladder cancer. The quality of resection is important and deep resection of the bladder wall is necessary, especially when the patient is likely to have muscle-invasive bladder cancer. On the other hand, deep resection may lead to bladder perforation, a complication widely recognized by urologists. Patients also have a risk of complications preoperatively. However, bladder injury due to intravesical explosion is rarely reported and the risk is not widely recognized1,3.

It is clear that oxygen alone from the atmosphere is not flammable. Horger et al. reported1 a case of intravesical explosion during TURBT. However, there are few reports of the complication. It is considered to result from the following phenomenon. A mixture of hydrogen
and oxygen in appropriate proportions may lead to the formation of an explosive gas: \[ 2 \text{H}_2 + \text{O}_2 \rightarrow 2 \text{H}_2\text{O} \]. When this occurs, heat energy will be released and finally lead to injury of the bladder. Hydrogen is thought to supplied by resection of bladder tissue. Ning et al\(^3\) reported that hydrogen was supplied by electrocautery in an in vitro experiment. It is common that air bubbles exist in the bladder dome during TUR. When bubbles get in the way of tumors, most urologists will remove them. However, the risk of explosion is not commonly known.

This patient had a low compliance bladder, and resection of the anterior wall had to be supported manually with suprapubic pressure by the operator. This compression may have transferred bubbles from the bladder dome to the anterior wall. As previously noted, bipolar resection system was used in this case. Same complication was reported using monopolar resection system\(^3\). Because the phenomenon is induced by heat energy and mixture of hydrogen and oxygen, the type of resection system have no relation with explosion. A practical matter, the surgeon should not perform resection when bubbles are present. This patient did not need further surgical treatment; however, Horger et al\(^1\) reported that they needed to repair a bladder rupture into the peritoneum. Although the phenomenon rarely occurs, the impact is large and may cause a serious problem. There are several techniques to prevent explosions. Realistically, evacuating air bubbles during resection of the dome and anterior part of the bladder is the most practical one. Even if surgeons do not resect into air bubbles, they must recognize the risk that bubbles may be transferred into the cautery loop by manual compression, especially in the case of a low compliance bladder.

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**References**