

## Penile Erection during Transurethral Surgery

### – Case report and review of the literature –

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Imbalance between sympathetic and parasympathetic nervous systems is generally considered an underlying mechanism for intraoperative erection, although local stimulation before complete sensory blockade can contribute to the problem. With the onset of erection under regional anesthesia during an operative procedure, general inhalational anesthesia must be quickly initiated to enhance venous drainage of the engorged corpora cavernosa before prolonged venous stasis. Combination therapy including ketamine, glycopyrrolate, terbutaline, and alpha-adrenergics may be available, however, the benefit-risk ratio should be considered especially in the elderly patients with cardiovascular diseases. We present a case of intraoperative erection in an elderly patient, which was resolved by applying inhalational anesthesia with remifentanyl after confirmation ineffectiveness of intravenous glycopyrrolate and ketamine. We also review and discuss the treatment strategies. (Anesth Pain Med 2008; 3: 154~156)

**Key Words:** general anesthesia, intraoperative, penile erection, transurethral procedure.

Penile erection following the initiation of regional or general anesthesia is rare, with incidences 0.1–1%.<sup>1-3)</sup> However, when it occurs in patients undergoing urologic procedures, it may delay or cancel the planned surgery. It is also very troublesome to perform the procedure during penile erection because attempts to do so will lead to complications, such as excessive bleeding and urethral trauma.

Several methods for treating intraoperative penile erection have been introduced. Traditional methods of them include compression of the penis by the surgeon,<sup>4)</sup> deepening or extension of existing anesthesia,<sup>5)</sup> and corporeal aspiration.<sup>6)</sup>

These are time-consuming or invasive methods. The other specific drug therapies include ketamine,<sup>7)</sup> sympathomimetics and anticholinergics.<sup>5)</sup>

We present a case of intraoperative erection which was resolved with inhalational anesthetics and remifentanyl after confirming ineffectiveness of intravenous glycopyrrolate and ketamine in the elderly patient who underwent transurethral surgery with epidural anesthesia. We also review and discuss the treatment strategies for intraoperative erection.

### CASE REPORT

A 72-year-old man (69 kg and 167 cm) was admitted for transurethral resection of a hyperplastic prostate. He had a history of hypertension that was controlled without medication. Results of routine laboratory analysis including routine blood tests, coagulation profile, electrocardiogram, and liver function tests were within normal limits.

The patient's initial baseline blood pressure was 143/84 mmHg and his heart rate was 84 beats/min. The patient was given epidural anesthesia with 16 ml of 2% lidocaine with 50 µg fentanyl via the catheter inserted at L4-5 and advanced 4 cm caudally. Ten minutes after the injection, the T8 sensory blockade was checked by an anesthesiologist using pinprick test. Then, the patient was placed in the lithotomic position, prepared with povidone-iodine solution, and draped. His blood pressure and heart rate were 135/87 mmHg and 87 beats/min, respectively. Penile erection was noted at the time of instrumentation with a resectoscope sheath (17 min after the epidural injection) despite levels of sensory blocks at T8 for pinprick and T6 for cold sensation. The erection, with engorgement and rigidity, prevented complete advancement of the resectoscope beyond the prostatic urethra. The resectoscope was thus removed from the patient. Local application of cold

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saline to the penile shaft was performed, but spontaneous detumescence was not achieved. The patient was then given an intravenous injection of 0.2 mg glycopyrrolate. The erection persisted, and additional 0.2 mg glycopyrrolate was administered again. Intravenous 100 mg Ketamine was given 20 minutes later because the erection persisted. General anesthesia was then implemented because of the increase in blood pressure and heart rate (148/96 mmHg, 126 beats/min) and sustaining erection. General anesthesia was induced with 2 mg/kg propofol, target-controlled infusion of remifentanyl (2–4  $\mu$ g/L), and 0.5 mg/kg rocuronium. After tracheal intubation, anaesthesia was maintained with sevoflurane in 50% oxygen-air and was deepened until his blood pressure decreased to 90/51 mmHg and the heart rate decreased to 66 beats/min. Slow resolution of the erection was noted. Complete penile flaccidity occurred 65 minutes after erection. Transurethral resection of the prostate was completed, and 85 g of benign tissue was removed. The patient had a normal postoperative recovery.

## DISCUSSION

Penile erection is produced by a complex interaction of local factors and cholinergic, noncholinergic, adrenergic, and nonadrenergic neurons. Priapism usually is defined as a persistent painful erection unaccompanied by sexual excitement. Some etiologies of pathologic priapism are known, including blood disorders causing sludge as may be seen with leukemia, sickle cell disease and polycythemia; obstruction of venous outflow with tumors, pelvic thrombophlebitis or retroperitoneal hemorrhage; drugs or chemicals, such as heparin, phenothiazines, hydralazine, testosterone and carbon monoxide; penile trauma, and neurologic diseases, such as spinal cord injury and tuberculosis.<sup>3)</sup> However, causes of intraoperative erection during anesthesia are not well understood. As reported previously, intraoperative penile erection may be encountered with any mode of anesthesia.<sup>2,8,9)</sup> Although regional anesthesia interrupts sympathetic and parasympathetic innervations of the penis, erection may occur. A possible explanation is the incomplete blockade of sacral segments of nerve roots in the epidural space.<sup>8)</sup> It can be supposed that the parasympathetic innervation from the S2–S4 nerve roots were intact in spite of documented high sensory blockade. Psychogenic and reflex erections may also occur during the early stages of regional anesthesia when the pathways involved are still incompletely blocked.<sup>10)</sup> This is perhaps why there are more intraoperative erections seen with epidural anesthesia than with spinal

anesthesia. In addition, local anesthetic agents may depress cortical centers in the brain that normally inhibit penile erection in the conscious individual, thereby enhance erectile response to tactile stimulation. Anesthesia with fentanyl may also increase the incidence of penile erections because it centrally increases vagal tone. In our case, epidural fentanyl was administered; however, there is no evidence that the small dose of epidural fentanyl is responsible for intraoperative penile erection.

Regardless of etiologies, intraoperative penile erection should be aggressively treated in order to prevent long-term postoperative sequelae, such as thrombosis and fibrosis. An erection sustaining for more than 4 hours may result in edema, increasing risk of abrasion, tissue drying, and necrosis of the penis, with the prognosis generally depending on the amount of time elapsed before therapeutic intervention.<sup>2)</sup> Specific drug therapies for penile erection address the specific neurochemical mechanisms of erection. The most frequently used medication for the treatment of intraoperative priapism is ketamine, although it did not always work.<sup>7,11)</sup> If used, care must be given to ensure that the patient, if breathing spontaneously without endotracheal intubation, can maintain protective airway reflexes. Ketamine is a dissociative anesthetic that has been reported as effective in some cases, but it takes time for flaccidity to develop. In the two cases of Ravindran et al.,<sup>12)</sup> complete penile flaccidity occurred at 90 and 110 min after 0.5 mg/kg ketamine administration. In the cases of Benzon et al.,<sup>10)</sup> the flaccidity occurred at 2 h after 100–150 mg ketamine was given. The possible explanation of unsuccessful but partially effective ketamine in our case is the prolonged period of time it takes ketamine to be fully effective. This delayed onset makes ketamine impractical in the operating room because the operating team can not wait that long. So, ketamine is not the first choice of the treatment for priapism in a geriatric hypertensive patient undergoing surgery anymore. The doses of ketamine in excess of 0.5 to 0.75 mg/kg are required to reverse priapism, and sometimes larger doses given incrementally may be required to ensure prolonged relaxation. In our case, general anesthesia was implemented because of the increase in heart rate and sustained erection. The mechanism of the general anesthesia for detumescence is inhibition of centrally and reflex mediated priapism. In the most of the previous reports, although general anesthesia has not been recommended for detumescence especially in the patient undergoing regional anesthesia, we suggested that the general anesthesia using inhalational agents and opioids may be

a reliable and safe method for the complicated geriatrics.

Often, other medications such as physostigmine or neostigmine are also given.<sup>12)</sup> There is a concern that physostigmine may actually impair the ability of ketamine to reverse tumescence due to its central effect of reversing ketamine-induced anesthesia. Another anticholinergic, glycopyrrolate may be an alternative.<sup>6,8)</sup> Glycopyrrolate potentially may block the effect on the NO system produced by acetylcholine.<sup>13)</sup> Glycopyrrolate, a quaternary amine, has less chance of crossing the blood-brain barrier and is more hemodynamically stable than either atropine or scopolamine. These make glycopyrrolate ideal in elderly patients in whom the central nervous system and cardiovascular effects of atropine may not be tolerated. However, it was unsuccessful in our case. Thus, a possible explanation for the discrepancies may be that cholinergic neurotransmission plays an important, but not exclusive, role in the relaxation of human corpus cavernosus smooth muscle during penile erection.

Terbutaline, a  $\beta_2$ -adrenoreceptor agonist, has been used successfully.<sup>14)</sup> Terbutaline can cause tachycardia, pulmonary edema, and hypokalemia and should be used with caution.

Some studies have referred to the safe and successful use of intracorporeal injections of  $\alpha$ -adrenergic agonists, such as phenylephrine, metaraminol, and etilephrine.<sup>15-18)</sup> However, the risk of systemic uptake of these medications, with the possibility of hypertension and myocardial or cerebrovascular incidents, suggests that their administration be limited to young patients without risk of vascular compromise. Phenylephrine may be used safely in elderly patients with myocardial disease because that phenylephrine is a pure  $\alpha$ -adrenergic agonist. In the present case, this drug was not administered although we prepared this drug for intracavernous injection. Because that a slow detumescence was noted after inducing inhalational general anesthesia. Most authors recommend injection of 100–250  $\mu$ g phenylephrine with 100% efficacy.<sup>2,9)</sup> However, it should be noted that fewer significant cardiovascular effects are seen when decreasing the dose from 200 to 50  $\mu$ g.<sup>2)</sup>

In conclusion, we presented a case of intraoperative erection due to an autonomic imbalance during the epidural anesthesia. It was resolved with the inhalational anesthetics and remifentanyl after confirmation ineffectiveness of intravenous glycopyrrolate and ketamine. Combination therapy including glycopyrrolate and ketamine may be available for the first choice, however, general anesthesia using inhalational agent

and opioid should be considered especially in the cardiovascular compromised elderly patients when the treatment is insufficient.

## REFERENCES

1. Banos JE, Bosch F, Farre M: Drug-induced priapism. Its aetiology, incidence and treatment. *Med Toxicol Adverse Drug Exp* 1989; 4: 46-58.
2. Baltogiannis DM, Charalabopoulos AK, Giannakopoulos XK, Giannakis DJ, Sofikitis NV, Charalabopoulos KA: Penile erection during transurethral surgery. *J Androl* 2006; 27: 376-80.
3. Van Arsdalen KN, Chen JW, Smith MJ: Penile erections complicating transurethral surgery. *J Urol* 1983; 129: 374-6.
4. Weiss JM, Ferguson D: Priapism: the danger of treatment with compression. *J Urol* 1974; 112: 616-7.
5. Darwish ME, Atassi B, Clark SS: Priapism: evaluation of treatment regimens. *J Urol* 1974; 112: 92-4.
6. Go JE, Sohn JT, Kim HJ, Shin IW, Lee HK: Anesthetic management of the patient penile erection developed after spinal anesthesia - a case report. *Korean J Anesthesiol* 2004; 47: 446-8.
7. Villalonga A, Beltran J, Gomar C, Nalda MA: Ketamine for treatment of priapism. *Anesth Analg* 1985; 64: 1033-4.
8. Valley MA, Sang CN: Use of glycopyrrolate to treat intraoperative penile erection. *Reg Anesth* 1994; 19: 423-8.
9. Staerman F, Nouri M, Coeurdacier P, Cipolla B, Guille F, Lobel B: Treatment of the intraoperative penile erection with intracavernous phenylephrine. *J Urol* 1995; 153: 1478-81.
10. Benzon HT, Leventhal JB, Ovassapian A: Ketamine treatment of penile erection in the operating room. *Anesth Analg* 1983; 62: 457-8.
11. Appadu B, Calder I: Ketamine does not always work in treatment of priapism. *Anaesthesia* 1991; 46: 426-7.
12. Ravindran RS, Dryden GE, Somerville GM: Treatment of priapism with ketamine and physostigmine. *Anesth Analg* 1982; 61: 705-7.
13. Lue TF, Tanagho EA: Physiology of erection and pharmacological management of impotence. *J Urol* 1987; 137: 829-36.
14. Shantha TR: Intraoperative management of penile erection by using terbutaline. *Anesthesiology* 1989; 70: 707-9.
15. Walther PJ, Meyer AF, Woodworth BE: Intraoperative management of penile erection with intracorporeal phenylephrine during endoscopic surgery. *J Urol* 1987; 137: 738-9.
16. Dittich A, Albrecht K, Bar-Moshe O, Vandendris M: Treatment of pharmacological priapism with phenylephrine. *J Urol* 1991; 146: 323-4.
17. Tsai SK, Hong CY: Intracavernosal metaraminol for treatment of intraoperative penile erection. *Postgrad Med J* 1990; 66: 831-3.
18. Serrate RG, Prats J, Regue R, Rius G: The usefulness of ethylephrine (Efortil-R) in the treatment of priapism and intraoperative penile erections. *Int Urol Nephrol* 1992; 24: 389-92.