INTRACAVERNOSAL USE OF ADRENALIN TO INTERRUPT ANAESTHETIC PENILE ERECTION DURING TRANSURETHRAL SURGERY

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ABSTRACT

BACKGROUND AND OBJECTIVES

Intraoperative penile erection is uncommon, but troublesome problem associated with anaesthesia in patients undergoing transurethral surgery. Many methods and drugs have been used in past to solve this problem. Our objective was to find the incidence of intraoperative penile erection and to study the use of intracavernosal injection of adrenalin to solve this problem. Adrenalin is a strong sympathomimetic and an essentially present drug in the operation theatre besides being cheaper.

MATERIAL AND METHODS

We studied patients who underwent transurethral procedures from March 2007 to March 2009 at Nepalgunj Medical College and Teaching Hospital, Kohalpur, Nepal. During this period, three patients developed penile erection following anaesthesia. Out of those three patients, use of intracavernosal adrenalin was studied in two patients in whom masterly inactivity did not resolve the problem.

RESULT

In one of the patients, detumescence occurred with masterly inactivity and two patients were administered 5µg intracavernosal adrenalin. Detumescence occurred within two minutes without any cardiovascular side effects and procedures could be completed without any complication.

CONCLUSION

Using intracavernosal adrenalin is safe and effective in treating intraoperative penile erection.

KEYWORDS

Adrenalin, Anaesthesia, Intraoperative Penile Erection.

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INTRODUCTION

Penile engorgement usually occurs following regional anaesthesia due to vasodilation and pooling of blood in the venous sinuses of penis. However, penile erection during transurethral surgery is rare and a troublesome hazard of anaesthesia. Its reported incidence is 0.1% to 2.5%.[1,2,3] It can make the performance of transurethral procedure difficult and fraught with risk of bleeding and iatrogenic trauma. Many methods and drugs have been tried to resolve this problem.[2,4,5] Adrenalin is a readily available drug in the operation theatres being a lifesaving drug. This is a strong sympathomimetic and vasoconstrictor[6]. We studied the use of intracavernosal adrenalin in three cases of intraoperative penile erections during transurethral surgeries at our centre.

MATERIAL AND METHODS

We conducted an observational study in which patients who underwent transurethral procedures from March 2007 to March 2009 at Nepalgunj Medical College and Teaching Hospital were studied. Ethical approval for the study was taken from the ethical committee of the hospital. Female patients were excluded from the study. The other exclusion criteria for the study were patients with any associated diseases like sickle cell disease, polycythaemia, leukaemia, pelvic thrombophlebitis, retroperitoneal haemorrhage, neurologic diseases such as spinal cord injury, which can lead to priapism. Patients on drugs like heparin, testosterone, hydralazine, phenothiazines, papaverine, sildenafil, tadalafil, apomorphine, and prostaglandin, which can induce penile erection were also excluded from the study.

Patients with any kind of erectile dysfunction were excluded from the study. During the study period, 976 patients underwent transurethral procedures in our department. Among these patients, 456 were females and 520 were males. Out of these 520 procedures, which were performed in males, 338 were performed in spinal anaesthesia, 18 under epidural anaesthesia, 21 in general anaesthesia, 2 in combined spinal and epidural anaesthesia, and 141 in topical 2% Xylocaine. In this study, we observed penile erection in 3 (0.57%) patients after giving spinal anaesthesia. We waited for 15 minutes for detumescence to occur on its own after stopping all the stimuli failing which 2.5 mL of diluted adrenalin (1 mL of 1:1000 adrenalin was added to 500 mL of normal saline) was injected intracavernosally. Patients were studied for the anaesthetic technique used, methods used to relieve the erection, haemodynamic changes noted with the treatment

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intraoperatively, and the surgical procedure undertaken. Any surgical or anaesthetic complication during the procedure were also noted. Postoperatively, patients were observed for any discoloration of the penile skin. Any erectile dysfunction was enquired at one month follow up.

OBSERVATIONS AND RESULTS

The patients who developed anaesthetic penile erection were 32 years, 35 years, and 38 years old males. None of the patients was having any disease or drug, which increases their risk for penile erection. All the patients were administered spinal anaesthesia using bupivacaine 0.5% in L3-4 space and we waited for 5-10 min for the drug to have its effect. The level of sensory blockade was noted to be between the level of T8 and T10 in all the patients. Patients were positioned in lithotomy for the transurethral procedure. Penile erection was noted at the time of draping in all the patients. Waiting period of 15 minutes was given for the spontaneous resolution of the erection. In one of the three patients, it resolved to a great extent spontaneously to allow for the transurethral performance of ureterorenoscopic lithotripsy and removal of ureteric calculus. In rest of the two patients, 5μg of adrenalin (1 ampoule of 1 in 1000 strength was diluted in 500 mL of saline and 2.5 mL of that was taken as injectate) was injected intracorporeally and persistent detumescence within 2 minutes was achieved in both. There was no tachycardia or hypertension noted in any of the patients following its administration. The surgical procedure (Ureterorenoscopic removal of ureteral calculus and transurethral cystolithotripsy) could be conducted safely afterwards. No discoloration of penis was noted in any of the patients. On enquiry, all three patients were potent at one month follow up.

DISCUSSION

Penile erection prior to transurethral procedure has been reported in 0.1%-2.5% patients.[1,2,3] In our study, it occurred in 0.57% of transurethral procedures conducted in males. It makes the procedure difficult or even practically impossible. Displacement of anatomical landmarks can result in trauma to the urethra/sphincter complex and excess bleeding will render the procedure difficult or impossible. Its incidence has been reported to be lower for spinal anaesthesia as compared to epidural and general anaesthesia[7], but in our study, this problem came under spinal anaesthesia, which could be because of the preponderance of spinal anaesthesia in our study.

Priapism is the phenomenon of painless penile erection during endourological procedures, but the duration of erection or tumescence is much shorter. Priapism is usually defined as a persistent penile erection unaccompanied by desire or sexual excitement. It can be idiopathic as described by Nelson et al[8], but various diseases like sickle cell anaemia, polycythaemia, blood disorders can cause sluggish blood flow as with leukaemia, pelvic thrombophlebitis, retroperitoneal haemorrhage, and obstruction of venous outflow by tumours. Other causes can be the use of drugs or chemicals like heparin, testosterone, hydralazine, phenothiazines, carbon monoxide, and neurological diseases such as spinal cord injury, tuberculosis, as well as penile trauma and pelvic regional surgery.[9-12] However, causes of intraoperative erection during general anaesthesia are not very clear, but appear to be reflexogenic and psychogenic.[3]

The mechanism of penile erection involves arterioles, venules, and arteriovenous anastomotic channels of the corpora cavernosa.[1] in the flaccid state, the arterioles are partially closed while the venules and arteriovenous channels remain open leading to an unimpeded drainage of the arterial inflow. Psychic or local sensory stimulation leads to sacral (S2-S4) parasympathetic outflow resulting in relaxation of corporal arterioles and partial closure of the venules and arteriovenous shunts. This results in subsequent engorgement of corpora cavernosa. Normal process of detumescence occurs because of sympathetic mediated arteriolar constriction, which results in the reduction of inflow and enhanced venous drainage. Bosch et al have shown that detumescence is mediated by adrenergic stimulation causing a constriction of penile venous sinusoids opening emissary veins and hence increasing blood drainage.[13]

During spinal anaesthesia, the sympathetic and parasympathetic innervation of the penis is interrupted, but erection may still occur.[3] Psychogenic and reflex erection may occur during the early stages of spinal anaesthesia when the pathways involved in erection are still incompletely blocked.

The ability of patients with incomplete spinal cord injuries to have erection supports this mechanism.[14] another mechanism can be incomplete blockade of sacral segments of the spinal cord during spinal anaesthesia. Since local anaesthetic is diluted by cerebrospinal fluid, its concentration is minimal in areas, which are more distal to the site of injection.[15]The same mechanism can be applied for the erection during epidural anaesthesia.

The mechanism of erection during general anaesthesia maybe psychogenic. It may involve the depression of cortical centres in the brain that inhibit penile erection in conscious patients. Thus, it may result in enhanced response to tactile stimulation.[3] Santha et al[16] reported that increased auditory sensation during second stage of anaesthesia may result in erection. Earlier methods of relieving penile erection by increasing the depth of anaesthesia might be based on this.[17] However, this is a complex phenomenon and its mechanism is still not clear. Vesta et al reported an association between propofol and priapism. They suggested a dose dependant vasodilation as the possible mechanism.[18]

In the treatment of this condition, cessation of all stimuli may help to achieve detumescence. In one of our patients, detumescence occurred within 15 minutes with masterly inactivity only. It shows that cessation of tactile stimuli can also help in detumescence.

Miller et al have reported the use of topical ethyl chloride sprayed liberally along the shaft of the penis in 10 cases. Its favourable effects may be due to obliteration of the local reflex, but it also has cooling properties that result in vasoconstriction[19]. This was not available at our centre.

Ketamine has been widely used in treatment of anaesthetic erection. It has dissociative effect on the limbic system and its penile relaxing property is probably due to this.[20] Ravindram et al reported 2 cases of priapism.[21] They used 0.5 mg per kg body weight of ketamine and 1.5 mg of physostigmine intravenously and detumescence was achieved. But, complete flaccidity occurred in 90-110 min. Gale et al treated intraoperative penile erection during

general anaesthesia with 1 mg per kg body weight of ketamine intravenously, the complete flaccidity occurred in 25 minutes after ketamine.[22] However, two cases of Benzon et al, who had spinal anaesthesia for transurethral resection of prostate did not respond satisfactorily to ketamine.[20] They reported the increase in blood pressure as well as the prolonged onset of action with the use of ketamine. Because of its delayed onset of effect, limited success and production of hallucinations in awake patients makes ketamine less attractive in the treatment of intraoperative erections, although it is easily available.

Detumescence following intracavernosal injection of sympathomimetics like adrenalin (1-100 µg).[5,23,24] noradrenalin.[25] phenylephrine (10 mg).[4] metaraminol (10 µg-3 mg).[26] has also been described with equal efficacy. These sympathomimetics because of their additional β-1 activity carry a risk of cardiovascular instability, so cardiovascular monitoring is mandatory.[27] In contrast, phenylephrine, which is a pure α-1 adrenergic agonist in a dose of 100-500 µg lacks such cardiac effects and is preferred.[27] Baltogiannis et al used 250 µg phenylephrine intracorporeally in patients with erection and in all patients detumescence occurred rapidly with single injection.[3]

In the event of non-availability of phenylephrine at our centre, adrenalin was used intracorporeally after waiting for 15 minutes in a dose of 5 µg in two of the patients and achieved prompt and persistent detumescence with single injection and we could proceed with the procedure without any hindrance. As the dose used was only 5 µg, no tachycardia or rise in blood pressure was noticed.

Adrenalin is a strong sympathomimetic and it has been used for anaphylaxis and resuscitation from decades, it acts on both alpha and beta receptors[6]. Safety of using adrenalin in end arterial structures has been questioned and many text books and references note that digital ischaemia can be a problem after use of epinephrine especially in concentrated form. But, a retrospective cohort study by Muck et al on cases reported to six poison centres during six years using a search of Texas Poisoning Centre Network Database concluded that the ischaemia after digital epinephrine autoinjection is rare. Hence, there is a growing body of evidence that suggests that the use of adrenalin in the fingers in low concentration (1:100000 to 1:200000) typically found in local anaesthetic mixtures for the purpose of digital nerve block is safe and without adverse effects[28]. There have been no reports of digital gangrene after the use of epinephrine for digital block since the introduction of commercially prepared mixture of lidocaine and epinephrine. An extensive review of literature was done from 1880 to 2005 and identified 48 cases of digital gangrene after local anaesthesia of the finger. Of those, only 21 cases involved epinephrine that was injected in combination with procaine, not lidocaine. Subsequent analysis demonstrated that at that time enforcement of medication expiration dates was poor and over the time procaine degraded into para-amino benzoic acid contributing to highly acidic environment that was responsible for tissue loss both in fingers and elsewhere in the body.[29] Collen reviewed and reported 59 cases of finger injection with high-dose epinephrine of which 32 cases were untreated. There were no instances of skin loss or necrosis, but neurapraxia lasting as long as 10 weeks and reperfusion pain were documented.[30]

As in hand surgery, use of adrenalin is considered safe in penile surgery depending on the concentration of adrenalin used.[31] Theddeus et al used adrenalin in concentration of 1 in 10,00,000 in tumescent solution for hypospadias surgery and did not find any penile ischaemia or flap necrosis.[31] These studies break the paradigm of the danger of adrenalin injection into the penis.

Adrenalin has also been used earlier by Zappala et al for intraoperative erections in different doses (1-100 µg) with good results, but inherent cardiovascular risk was reported.[24] Keskin et al studied the effect of adrenalin in nineteen patients of priapism.[32] He injected 2 mL of lignocaine with adrenalin (1:1,00,000 i.e. 10 microgram/mL) into each cavernous body. In 50% of patient, he achieved detumescence with single injection and in rest of the cases repeated injections of adrenalin were used up to five time, which resulted in detumescence. The number of injections used were related with the duration of erection; the more the duration more was the number of injections used. These repeated intracavernosal adrenalin injections in doses of 20µg each were without any cardiovascular side effects. There was no ischaemic injury to the penis nor any erectile dysfunction were noticed later. Brierly et al, also used lidocaine 2% with adrenalin 1 in 80,000(12.5µg) to induce detumescence in cases of intraoperative penile erection and found this technique simple and easily available without any side effects.[5]

Santha et al[16] and Miyabe et al[33] reported the successful systemic use of the sympathomimetics, terbutaline (5 mg orally or 0.25-0.5 mg subcutaneously), and ephedrine, respectively[16,33] Rao et al also found use of subcutaneous terbutaline (0.5 mg) effective for detumescence following cold saline application to the shaft of penis[10] Terbutaline, a beta-2-adrenergic agonist (5 mg orally or 0.25-0.5 mg subcutaneously or intravenously) has been found to be effective for the treatment of intraoperative penile erection in patients undergoing surgery. Terbutaline acts by relaxing the smooth muscle of the cavernous tissue, arteries, veins in these blood vessels, and tunica albuginea and its trabeculae in the pelvis. As a result, blood from arteries, cavernous sinusoids, and capillaries flows easily through the veins and out of the penis resulting in detumescence.[16]

Valley et al, reported the successful use of intravenous glycopyrrolate an anticholinergic in one high risk patient.[34] They administered glycopyrrolate incrementally to a total dose of 0.4 mg. They proposed glycopyrrolate as an alternative to intracavernosal sympathomimetic treatment in cardiovascularly high-risk patients. In another report by Natrajan P et al found glycopyrrolate effective for detumescence, but it took long time of four hours and surgery had to be abandoned.[35]

Dorsal nerve of penis has both somatic and autonomic components that enable it to regulate erectile and ejaculatory functions. Local anaesthetic block of this nerve interrupts the locally elicited parasympathetic reflex and causes detumescence.[36] It is free of cardiovascular side effects and provides additional postoperative analgesia. But, it was found difficult to administer at the time of erection.

Amyl nitrate is a potent smooth muscle relaxant and has been used successfully in penile erection.[37] Robert et al used amyl nitrate to overcome this problem. They recommended to inhale the amyl nitrite (0.3 mL) through the breathing

system. Complete flaccidity occurred within 4 minutes after inhalation. But, it is not possible to find the effect of amyl nitrite on detumescence during spinal anaesthesia as with any potent vasodilator, chances of fall in blood pressure are there. Availability is another question to be answered. Smita et al have reported the use of salbutamol aerosol in one patient under general anaesthesia when deepening of anaesthesia did not resolve tumescence.

They had to use eight actuations of metered-dose inhaler via tracheal tube for detumescence to achieve.[38]

Other alternative treatments include topical nitroglycerin.[39] intracorporeal prostaglandins (PGE1).[40] with variable results.

CONCLUSION

The incidence of intraoperative penile erection in our study was 0.57%. Although, the pathophysiology and management of penile erection is not very clear, but recent understanding has shown that relationship of treatment to the duration of erection is the critical factor in the successful management of erection. So, anaesthetist must start the treatment as early as possible. Intracavernosal use of adrenalin gives the anaesthetist this advantage as adrenalin is readily available in the operation theatre and it is easy to administer also. The aim of achieving detumescence is rapidly reached in all the patients reported. So, we recommend that in case of erection during anaesthesia, cessation of tactile stimuli should be tried first, which may induce detumescence; failing which, we should use adrenalin in doses of 5µg, which is quite safe and effective in achieving detumescence without any haemodynamic effects.

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