USE OF IONTOPHORETIC ANAESTHESIA IN UROLOGIC SURGERY: A PRELIMINARY EXPERIENCE

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ABSTRACT

Iontophoretic anaesthesia involves the active transport of lignocaine into underlying tissues, by means of an electric field, for anaesthesia. Its use in urology in transurethral operations on the bladder and prostate have been well documented. We present a preliminary experience of its use in the following cases: a transurethral resection of a bladder tumour, a transurethral resection of bladder cysts and incision of the bladder neck and a transurethral resection of the prostate.

In the few cases that we did, we found that patient selection and patient preparation is of utmost importance as unlike a complete anaesthesia, the patients can feel deep pressure and heat if diathermy is prolonged. It is also important not to oversedate the patients with midazolam as an uncooperative patient may render any procedure impossible. The greatest drawback of this procedure is that the degree of anaesthesia tends to vary from person to person. As such, it is difficult to predict who would or would not respond to this form of anaesthesia.

However, with improvements in protocols, current delivery systems and different anaesthetic agents used, one may see a proliferation of this form of anaesthesia in urology in the not too distant future.

Keywords: iontophoresis, anaesthesia, transurethral

SINGAPORE MED J 1996; Vol 37: 636-638

INTRODUCTION

Iontophoresis is the active transport of drug ions into underlying tissues by means of an electric field. It was first described by Veratti in as early as 1747[1] and has had a long and sporadic history since then. The first documented use of iontophoretic transport of lignocaine for local anaesthesia was on the eardrums in 1973 by Comeau et al[2]. This was followed by a number of articles of its anaesthetic applications in dermatology[3-7].

Iontophoretic anaesthesia in urology was first described by Fontanella et al in 1992 for hydrodilatation of the bladder in interstitial cystitis[8]. Since then, there has been a generous amount of interest in this form of anaesthesia which in obviating the need for regional or general anaesthesia, may provide an alternative form of anaesthesia which can be used for patients who are unfit for anaesthesia or in day surgery procedures of many urological conditions.

We present three cases done under iontophoretic local anaesthesia using lignocaine which include a transurethral resection of multiple tumours of the bladder, a transurethral resection of the prostate gland for benign prostatic hypertrophy and a transurethral resection of cystitis cystica of the bladder neck.

All three cases were done as inpatients and were admitted one day before the procedure for pre-operative preparations.

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METHODS

The patients were all prepared using a fixed protocol as follows:

1. Pre-operative Patient Preparation

1. Salt-free diet commencing 36 hours prior to procedure
2. Nil by mouth 12 hours prior to procedure
3. Nasal insufflation of vasopressin 2 hours before procedure
4. Psychological preparation to obtain relaxed and cooperative patient and midazolam for mild sedation

2. Technique for Iontophoretic Local Anaesthesia

1. Patient is sedated 5 minutes before procedure with small dose of midazolam.

2. Prepare 2 sterile bowls containing 2 drug solutions which include:
   85 mL of salt-free 4% lignocaine
   1.5 mg of adrenaline
   20 mg of buscopan
   65 mL of bi-distilled water

3. Catheterize patient with CE-DAS UROGENIC/Ag 9304 bladder/prostate catheter electrode using lignocaine gel.

4. Rinse bladder twice to remove residual urine.

5. Infuse first drug solution into bladder and set Physionizer (Battery-powered DC source) to positive polarity; pulsed current at 18 mA with a rise rate of 40 μA/s.

6. Wet the two white dispersive electrodes with 0.9% saline and cover abdomen, after having cleaned it with ether or alcohol, with 1-2 mm thick conductive gel. Ensure complete adhesion to skin without air bubbles by pressing and sliding side to side the two dispersive electrodes.

7. Connect wires from the bladder/prostate catheter electrode to the Physionizer 30 and start treatment.

8. Open the catheter at the 11th minute and allow to free drain till empty at about 15 minutes. A beep will sound at the end.

9. Repeat whole procedure with second drug solution for another 15 minutes in males. The anaesthesia will last about 50 to 60 minutes and will allow superficial resections of bladder walls and small prostate glands.

CASE PRESENTATIONS

Case 1

The first patient was a 61-year-old lady who presented with gross haematuria associated with clots. An intravenous urogram showed multiple filling defects over the bladder walls and floor and a 1.5 cm defect over the right pelvicalyceal system.

Cystoscopy and a transurethral resection of multiple bladder tumours after iontophoretic local anaesthesia using lignocaine was done. She was given 2 mg of midazolam just before the procedure and was fully conscious throughout the procedure. She tolerated the procedure very well and was able to feel distension of the bladder which was easily corrected by adjusting the inflow rate. She could feel the diathermy during coagulation of the bleeding vessels describing it as a hot but bearable sensation and did not feel any pain when cutting diathermy was used except when a deep muscle cut was made. Operating time was 15 minutes.

Intraoperative monitoring showed a slight rise in pulse rate from 80 to 90 beats a minute, a slight rise in blood pressure from 140/90 to 150/90 with no drop in oxygen saturation. No ECG changes occurred throughout the whole procedure.

She recovered well post-operatively with catheter removed on the second post-operative day. Histology showed a TIG2 transitional cell carcinoma. She is currently being worked up for the lesion in her right renal pelvis and will require intravesical chemotherapy.

Case 2

The second case was a 75-year-old gentleman who presented with symptoms of bladder outlet obstruction for a year and acute retention of urine. Flexible cystoscopy showed moderately obstructing lateral lobes of the prostate and a transurethral resection of the prostate and incision of the bladder neck at 3 o'clock was carried out after iontophoretic local anaesthesia. 5g of prostate was resected and the operation took 20 minutes.

Because of some technical problems, he was given only one exchange of lignocaine instead of the usual two for males but tolerated the whole procedure very well.

Two milligrams of midazolam was given and he was fully alert and conscious throughout the procedure. He complained of occasional burning sensation during the deeper resections but was able to tolerate it comfortably well.

Intra-operative monitoring showed only a slight rise in pulse rate with no rise in blood pressure. No changes in oxygen saturation nor ECG changes were noted.

He developed post-operative fever after the procedure which resolved with intravenous antibiotics after two days. He was continent on the second post-operative day and was discharged a day later. He was also satisfied with the anaesthesia and surgery.

Case 3

The third case was a 35-year-old Indian male with a history of straining at micturition and dysuria over a year. A previous cystoscopy done in India showed mild bladder neck obstruction. Uroflow showed poor flow and a flexible cystoscopy showed cystitis cystica causing a ball-valve effect at the bladder neck. A transurethral resection of the cysts and a bladder neck incision were carried out after iontophoretic local anaesthesia using lignocaine.

This patient was given a total of 5 mg of midazolam and was drowsy and restless even before the resection. He started moving his lower limbs when the sheath of the resectoscope was introduced and was unable to obey commands well. The resection was completed but the patient continued to be restless even after the procedure. We suspected that his restlessness was contributed by inadequate anaesthesia and he tried to pull his catheter out. Intravenous propofol and fentanyl were given then. Operative time was 5 minutes.

Intra-operative monitoring showed a rise in pulse rate from 80 to 90 beats per minute and a rise in blood pressure from 120/80 to 140/90. No drop in oxygen saturation or ECG changes were noted.

Although he was restless intra-operatively, his post-operative recovery was unremarkable once the midazolam wore off. He was discharged on the second post-operative day, continent with a good flow. He was unable to recall the procedure at all, unlike the other two patients, but was satisfied with the outcome.

DISCUSSION

Since the first case of hydrodilatation of the bladder using iontophoretic local anaesthesia was described in 1992, there has been an increase in interest in this method of local anaesthesia in the field of urology.

The principle of iontophoretic local anaesthesia involves the use of an electric field to accelerate the movement of ionised molecules, in this case lignocaine, through a membrane (bladder wall). This allows better penetration of the anaesthetic agent into the bladder compared with normal passive diffusion and this has been well demonstrated with dye studies[9]. A pulsed current has also been shown to increase the amount of drug transported compared to a constant direct current and hence its use in the cases described.

As demonstrated in this report, iontophoretic local anaesthesia is a viable option for use in urology. Its indications in urology include cold biopies, resection of bladder tumours up to T1 lesions, transurethral incisions of bladder neck, urethrotomies, transurethral resection of small prostates (up to 30g), laser ablation of the prostate and transurethral needle ablation of the prostate.

In addition to its use in anaesthesia, iontophoresis is also being investigated in urology for use in delivery of chemotherapeutic agents, hydrodilation, andrology, spastic bladders, recalcitrant cystitis, pharmacotherapy in prostatic hyperplasia and prostatitis. Complications that have been documented in humans include erythema and blisters at the abdominal electrode when it was not applied properly. Proper degreasing of the area and liberal use of conductive gel are essential[9]. Animal studies have also shown it to be otherwise safe and blood levels of lignocaine are well below that used in anti-arrhythmic treatment[10].

Pre-operative preparation is essential as sodium ions present in the urine will compete with the lignocaine molecules for transport. As such, all patients require a 36-hour salt-free diet before the procedure. Nasal insufflation of vasopressin also reduces/inhibits urine flow and salt excretion which together with a washout of the bladder ensures an almost salt-free environment in the bladder.

In the few cases that we did, we found that patient selection and patient preparation are of utmost importance as unlike a complete anaesthesia, the patients can feel deep pressure on overdistension of the bladder, heat on diathermy and sensation at the bladder neck on manipulation of the rigid cystoscopes and resectoscopes. It is important to warn the patient before undertaking any manoeuvres and also avoid overdistension of the bladder. It is also important not to oversedate the patients with midazolam as an uncooperative patient even if he is pain-free, may render any procedure impossible. We also learnt that

the anaesthesia of the bladder wall by iontophoresis is superior to that around the bladder neck. This could probably be the smaller contact area of the prostatic urethra with the lignocaine solution than the bladder wall. The anaesthesia also does not seem to penetrate the deep detrusor muscle well and if the resection is too deep, the patient might feel some pain. However, this is not consistently so. The degree of anaesthesia also varies from person to person and we felt that in the third case, there was inadequate anaesthesia. There must therefore be a mechanism to assess the level of anaesthesia in the patient before any other procedures are carried out. This is due to both varying levels of anaesthesia delivered and different thresholds and responses to pain in each patient, hence the importance of pre-operative psychological preparation remains unresolved.

In short, iontophoretic delivery of local anaesthesia in urology seems very promising. With the improvements in protocols, current delivery systems and different anaesthetic agents used, one may see a proliferation of this form of anaesthesia in urology in the near future.

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