

Percutaneous Cavernous Nerve Electro-Stimulation for Treatment of Erectile Dysfunction

Qing Hu¹, Wen-Zhi Wang², Bo-Dong Lv³, Guo-Guang Lou⁴

ABSTRACT

Pelvic fracture urethral injury (PFUI) is the major etiological factor of neurological erectile dysfunction (NED). We reported a patient whose Index of Erectile Function-5 (IIEF-5) score was 7 (severe ED) and experienced a failed treatment of Tadalafil. NED was the final diagnosis made by examinations such as nocturnal penile tumescence (NPT), penile cavernous contrast and three-dimensional reconstruction and the penial dorsal nerve somatosensory evoked potential. Percutaneous cavernous nerve electro-stimulation was used as treatment for NED. After three courses of treatment, the IIEF-5 score was up to 18 points and the level of erection hardness was between grade III and IV. We concluded that percutaneous cavernous nerve electro-stimulation will be a new strategy to treat patients with NED with PFUI history.

KEYWORDS: Erectile dysfunction, Pelvic fracture urethral injury, Percutaneous nerve electro-stimulation.

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1. Qing Hu
 2. Wen-Zhi Wang
 3. Bo-Dong Lv
 4. Guo-Guang Lou
- 1-3 Department of Urology, The Second Affiliated Hospital, University of Zhejiang Traditional Chinese Medicine, Hangzhou, 310005, China.
- 4 Department of Urology, The First Affiliated Hospital, Zhejiang University, School of Medicine, Hangzhou 310003, China.

Corresponding Author:

Guo-Guang Lou: Department of Urology, The First Affiliated Hospital, Zhejiang University, School of Medicine, 79#Qingchun Road, Hangzhou, China.
E-mail: gg_l19@outlook.com

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INTRODUCTION

Erectile dysfunction (ED), a common arousal disorder in men, is defined as the persistent inability to attain and maintain an erection sufficient to permit satisfactory sexual performance.^{1,2} Pelvic fracture urethral injury (PFUI) and urethral structural damage are the major etiological factors of ED. The incidence of ED in PFUI patients ranges from 27.5% to 72%

secondary to pelvic fracture or perineal trauma based on diagnostic abnormalities.³

PFUI can lead to ED by damaging cavernous nerve that originates from pelvic plexus (also called inferior hypogastric plexus), walking along posterior lateral of prostate, distributing eventually into cavernous corpus of penis to control penile erection adjacent to prostatic which interrupt the erectile nervous pathways.⁴

Percutaneous nerve electro-stimulation is a simple but effective neurorehabilitation therapy. Electric field formed by continuous exogenous electrical stimulation can move nerve growth factors (NGF) that induce the growth of nerve axons toward the cathode of nerves.⁵ It can also increase the expressions of insulin-like growth factors in the area of injured nervous tissues and make the improvement of survival neurons as well as the regeneration and restoration of nerve fibers.⁶ We can assume that the percutaneous nerve electro-stimulation will be a potential therapy strategy for the treatment of ED caused by PFUI.

Here the authors report a case of erectile dysfunction due to PFUI. Patient did not respond to conventional treatments effectively. To determine

the pathology, multiple investigations were conducted followed by percutaneous nerve electro-stimulation as a therapeutic strategy.

CASE PRESENTATION

A 45 years old male patient presented to the Department of Urology, the Second Affiliated Hospital, University of Zhejiang Traditional Chinese Medicine, Hangzhou, China for the evaluation of ED. He had no hypertension, diabetes mellitus, and hepatonephric diseases history. He had undergone PFUI six months ago and was recovered when reported to hospital. The patient had a satisfactory sex life before PFUI and the erectile hardness grade was IV with erectile angle more than 90° during the sexual intercourse. However, after PFUI, the erectile hardness grade was II with an erectile angle 60-70° approximately during the patient's sexual activities. The sexual desire of the patient was normal, and the erectile hardness in the morning was grade III. The effect of oral administration with 5 mg Tadalafil queues nocte was unsatisfactory for the treatment of ED. Therefore, a series of detailed assessments and examinations were performed for the patient to ascertain the cause of ED. The report is published after taking approval from the Institutional Ethics Committee (Project No: ZJ1101WK023).

Erectile function was assessed by completing the International Index of Erectile Function-5 (IIEF-5) which consisted of 5 items of the full-scale IIEF-15. A score of 21 or less indicated the presence of ED: mild ED (score 21-17), mild to moderate ED (score 16-12), moderate ED (score 11-8) and severe ED (score 7-1).⁷ After evaluation by IIEF-5, the score was 7 which confirmed severe ED in patient. Moreover, nocturnal penile tumescence (NPT), a useful method for detection of erectile function was used.⁸ Three times of continuous NPT measurement showed dissatisfactory results for the patient (Table-1).

Table-1: Erectile function detected by NPT.

Date	Number of Erection	Duration of Erection (min)	Average Erectile Blood Volume (ml)
Day 1	1	38	192
	2	28	150
	3	30	171
Day 2	1	14	176
	2	12	146

Day 3	1	80	134
	2	37	136

The diagnosis of organic ED with the history of pelvic fracture, was made.

Hormonal profile including luteinizing hormone, prolactin, estrogen 2, testosterone and progesterone of the patient was performed which showed higher levels of prolactin in patient serum was 561.7 mIU/L than normal level (86.0-324.0 mIU/L) (Table-2).

Table-2: Hormonal profile of the patient.

Hormonal Profile	Value		Normal Range
	Pre-treatment	Post-treatment	
Follicle-stimulating hormone (IU/L)	8.0	6.7	1.5-12.4
Luteinizing hormone (IU/L)	4.99	3.77	1.7-8.6
Prolactin (mIU/L)	561.70	197.20	86.0-324.0
Estrogen 2 (pmol/L)	48.0	90.8	28.0-156.0
Testosterone (nmol/L)	12.77	14.34	8.64-29.0
Progesterone (nmol/L)	1.45	1.11	0.70-4.30

A dose of 2.5 mg bromocriptine (Novartis, Switzerland, H20030658) once a day was applied to down regulate the expression level of prolactin which reduced to 197.20 mIU/L at day 10 after treatment.

Though the hyperprolactinemia was controlled by bromocriptine but the IIEF-5 score (9) and erectile hardness (grade III) of the patient were still on a lower level. This result indicated that serological pathogenesis was not the reason of ED. Then, the image production of penile nerve was made by penile cavernous contrast with three-dimensional reconstruction (Fig.1) and the penial dorsal nerve somatosensory evoked potential (SSEP).

After injected 10 ug alprostadil (Beijing ted pharmaceutical, H10980024) in the penis sponge body, the penile erectile duration was for nearly 2 hours, the erectile hardness grade was IV, erection angle was greater than 90° and extracavernous injection (ICI) activity test of corpus cavernosum was positive.

During the sustained erection, 60 ml of 30% of the ventromediamine was injected into the sponge at the rate of 80 ml/min, and computed tomography (CT) examination was done to monitor. The results showed no obvious abnormality in the penile vascular system. Mean

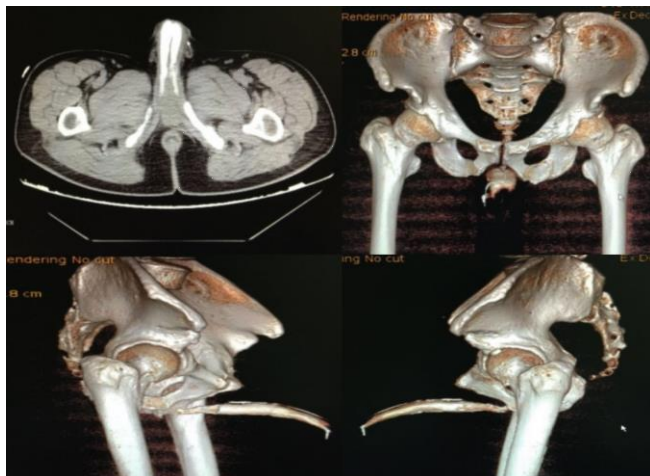


Fig.1: The images of penile cavernous contrast and three-dimensional reconstruction.

while, the results of SSEP showed that the average of P41 wave incubation period was 50.60 ms, which was significantly higher than the normal average digital data (40.1+/-2.2ms). It suggested that the nerve conduction function of the penile dorsum was seriously damaged. Based on the above theoretical findings and the anatomical structure of CN, percutaneous cavernous nerve electro-stimulation method was applied on this patient. We used 0.40 mm × 100 mm needles to contact with the patient's CN as therapeutic tools. Two puncture points were located on two centimeters above the midpoint of the symphysis pubis (the angle of acupuncture direction maintained as 45° to the skin at the point of penetration); another two puncture points were set on four centimeters above the midpoint of the symphysis pubis (the angle of acupuncture direction maintained as 15-30° to the skin at the point of penetration). When the needles acupunctured on CN, electric shock feeling with erection occurred and the angle of puncture was adjusted needles repeatedly until the above reactions were disappeared. These needles were connected with G6805-2 electric acupuncture apparatus and the condensation-rarefaction wave was used to stimulate the CN in an appropriate intensity. The stimulation maintained 40 min and every single treatment was carried twice a day. Every course of treatment consisted of 10 single treatments and the patient received three courses of treatment. Any oral medicine was prohibited during percutaneous cavernous nerve

electro-stimulation treatment. After three courses of treatment, the patients' IIEF - 5 score was 18 points and the level of erection hardness was between III-IV grade and the erection angle was about 90°. In addition, the satisfaction of sexual activity was increased significantly.

DISCUSSION

In the above-mentioned case report, erectile dysfunction due to pelvic fracture with posterior urethral injury was treated by percutaneous cavernous nerve electro-stimulation. While considering the history of pelvic fracture, the diagnosis of organic ED was reasonably established. Organic ED can be divided into secretory, vascular, neural and mixed ED based on pathogenesis and more studies are aimed to reveal the cellular and molecular basis of erectile physiology as treatment strategies are determined by pathogenesis.^{9,10}

Hyperprolactinemia detected in patient often lead to loss of libido, erectile dysfunction, abnormal ejaculation, and spermatogenic disorders in male patients thereby downregulation of serum prolactin should be carry out considering any other treatment.¹¹ According to the existing examination results by penile cavernous contrast, three-dimensional reconstruction, SSEP and the patient's previous history of trauma, diagnosis of neurological erectile dysfunction (NED) was established. Currently, drug treatment, vacuum constriction device (VCD) and prosthesis implantation are the main strategies to treat NED. The drug treatment consists of oral medications injected (intra cavernous injection, ICI) into sponge body and transurethral drugs (medicated urethral system for erection, MUSE).¹² In the present case, patient was not satisfied with pre-trial oral treatment of Tadalafil. In addition, cost of long-term treatment of Tadalafil was high with unmanageable side effects. Also, the other strategies like VCD lacks the natural sexual intercourse and the implant can destroy the natural structure of the corpus cavernosum, which may lead to infection and mechanical failure.¹³

So considering the above mentioned side effects percutaneous nerve electro-stimulation is considered as simple and effective neurorehabilitation therapy that can induce the

Nerve growth factors (NGF), by continuous exogenous electrical signals which can stimulate the growth of nerve axons toward the cathode of nerves.⁵ It has been found that high frequency electrical field stimulation can mediate nerve sprouting by increasing the expression of NGF in a canine model of atrial fibrillation.¹⁴ Immediate or late transcutaneous high-frequency electrical stimulation exhibit the potential to stimulate the motor nerve regeneration in animals.¹⁵ In addition, percutaneous nerve electro-stimulation can also upregulate the expressions of insulin-like growth factors which regenerate the nerve fibers.⁶ NED improved the patient's ED conditions effectively so it can be considered as a suitable strategy to treat ED by nerve regeneration.

CONCLUSION

Percutaneous nerve electro-stimulation has a potential ability to stimulate the nerve regeneration in ED caused by pelvic fracture posterior urethral injury.

LIMITATIONS OF THE STUDY

We need more clinical cases to formulate a more comprehensive treatment strategy to deal with patients with NED.

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CONFLICT OF INTEREST

None to declare.

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Author's Contribution

QH, WZW, BDL, GGL: Conception and design of study, acquisition of data, drafting of manuscript, revising it critically for important intellectual content.

ALL AUTHORS: Approval of the final version of the manuscript to be published.