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Original Article

Effectiveness of Electroacupuncture for Managing Urinary Retention Post Lumbar Spine Surgery: a retrospective single-cohort study

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Objectives: Post-operative urinary retention (POUR) is a frequent complication following surgical procedures, characterized by an acute inability to void, leading to additional complications and extended hospitalization. Acupuncture has been shown to be effective in facilitating spontaneous urination and alleviating anxiety in patients experiencing poor urination. The present study aims to evaluate the effectiveness of electroacupuncture in the management of POUR in patients who have undergone lumbar spine surgery.

Methods: This retrospective study conducted at the National Hospital of Acupuncture in Vietnam and reviewed the medical records of patients over 18 years old who underwent lumbar spine surgery and were diagnosed with POUR between January to December 2019. Electroacupuncture was administered at five specific acupuncture points: Qugu (CV2), Zhongji (CV3), Zhibian (BL54), Pangguanshu (BL28), and Kunlun (BL60). This study monitored key parameters related to the effectiveness of the acupuncture treatment, including the number of acupuncture treatment sessions required until a patient was successfully treated was recorded, with a maximum of three acupuncture treatment sessions per patient, the time elapsed until urination following the treatment (minutes), and urinary bladder volume before and after treatment (mL).

Results: The study demonstrated a 93.3% success rate in treating POUR with electroacupuncture. A significant reduction in post-void residual volume was noted, and patients could void within 30 minutes post-treatment. No significant differences in treatment effectiveness were observed across difference genders and age groups.

Conclusion: Electroacupuncture proved to be a highly effective treatment for POUR in patients post-lumbar spine surgery, with a rapid response time and substantial reduction in PVR. However, the retrospective nature of the study and single-center focus limit its generalizability. Future research incorporating randomized controlled trials or multi-center observational studies are recommended to validate these findings and explore the potential of acupuncture in POUR management on a broader scale.

Keywords: post-operative urinary retention, electroacupuncture, post-lumbar spine surgery, retrospective research, traditional Chinese medicine

INTRODUCTION

Post-operative urinary retention (POUR) is a common complication of surgical procedures characterized by an acute and painful inability to urinate, which can potentially lead to further complications and prolonged hospitalization [1]. The incidence rate of urinary retention post-anesthesia and surgery has been reported to be between 5-70% [2]. The clinical diagnosis is confirmed when the post-void residual (PVR) volume exceeds 400 mL [3]. The risk of POUR following posterior lumbar spine

surgery is estimated to be around 5% [4]. Notably, factors such as male gender, benign prostatic hyperplasia, advanced age, diabetes, and depression have been identified as significant contributors to POUR according to a retrospective review by Gandhi et al. [4].

Untreated POUR may result in bladder overdistension, leading to acute kidney injury and damage to the detrusor muscle [2]. These complications further extend the duration of hospitalization and necessitate additional post-discharge care [1]. Treatment strategies for POUR are typically based on pharmacological interventions (i.e., cholinergic agents and alpha-adrenergic blockers), massage, and indwelling catheterization [1]. Additionally, acupuncture has emerged as a viable method for both the prevention and treatment of POUR [1, 5, 6].

Previous studies have demonstrated the efficacy of acupuncture in facilitating spontaneous urination and alleviating anxiety in patients experiencing poor urination [5-7]. Furthermore, it has been shown that acupuncture can effectively reduce the incidences of POUR and urinary tract infections, thereby shortening the duration of hospitalization [6, 8]. This study aims to evaluate the efficacy of electroacupuncture in managing POUR in patients who have undergone lumbar spine surgery.

MATERIALS AND METHODS

1. Study design

This study is a retrospective analysis based on pre-existing patient records of lumbar spine surgery at the National Hospital of Acupuncture, Vietnam. The records used for the analysis were obtained between January and December 2019. The study was approved by the Institutional Ethical Review Board of Vietnam National Hospital of Acupuncture (IRB-VN01/026 – No. 17/BB-HDDD). The study was carried out in accordance with the Declaration of Helsinki and Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) guidelines [9]. Additionally, the Standard Recommendation in Clinical Trial of Acupuncture (STRICTA) guidelines were employed for the formulation of the acupuncture treatment protocol [10].

2. Participants

The study focused on patients who were 18 years or older and had been diagnosed with POUR following various types of lumbar spine surgery: traumatic lumbar spine surgery, discectomy/disc replacement, lumbar tumor resection, and vertebroplasty. The diagnosis of POUR was confirmed when the patient was incapable of urinating or when the volume exceeded 400 mL. Patients with significant comorbidities that could have potentially affected urinary retention were excluded from the study. Specifically, individuals with the following conditions were excluded: prostate cancer, benign prostatic hypertrophy, bladder outlet obstruction, pelvic organ prolapse, pelvis masses, and renal calculi. Additionally, individuals with a history of trauma to the pelvis, urethra, or penis were excluded. Neurological conditions such as spinal cord injury, traumatic brain injury, stroke, Alzheimer's disease, Parkinson's disease, and multiple sclerosis were also excluded, due to their potential impact on the urinary functions.

3. Study treatment

The acupuncture treatment and consultations were provided by a skilled acupuncturist with over a decade of experience. The selection of acupuncture points was guided by the traditional Chinese medicine (TCM) meridian theory and was approved by the Ministry of Health of Vietnam.

The acupuncture points used for the treatment were Qugu (CV2), Zhongji (CV3), Zhibian (BL54), Pangguanshu (BL28), and Kunlun (BL60). Initially, the patient was positioned supine and acupuncture needles were inserted into the Qugu (CV2) and Zhongji (CV3) points. Subsequently, the patient was shifted to a lateral position for the bilateral insertion of acupuncture needles to the Pangguanshu (BL28), Zhibian (BL54), and Kunlun (BL60) points. The needles were inserted perpendicularly to the Kunlun (BL60), Zhibian (BL54), Pangguanshu (BL28), and Qugu (CV2) points. In contrast, to the Zhongji (CV3) point, the needle was inserted obliquely at a 45-degree angle, pointing towards the urinary bladder. Prior to needle insertion, the acupuncture points were disinfected. Disposable sterile acupuncture needles with a dimension of 0.25 × 40 mm (Wujiang Yunlong Medical Device Co., Ltd., Jiangsu, China) were used for all procedures. The insertion depth ranged between 10 to 30 mm depending on the acupuncture point. Once the sensation of De-qi was achieved, the needles were connected to an electroacupuncture stimulator M8 (National Hospital of Acupuncture, Vietnam) using cables from the same stimulator. At the end of each cable, there were two electrode clips. These clips were then attached to the handle of each acupuncture needle. Each acupuncture session lasted 25 to 30 minutes, followed by

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a monitoring period of 30 minutes. The electroacupuncture parameters were as follows: the frequency was set between 5 to 10 Hz and the amplitude was increased from 0 to 150 μA. All patients were monitored for 30 minutes post-treatment.

The treatment was considered successful when the patient was able to urinate spontaneously with a PVR volume of less than 100 mL [11]. If these criteria were not met, additional acupuncture sessions were provided. The maximum number of sessions possible was three per patient. The treatment was considered unsuccessful when the patient failed to urinate and/or the PVR volume exceeded 100 mL.

4. Outcome measures

This study analyzed several key parameters related to the efficacy of acupuncture in improving POUR. The number of acupuncture sessions required for a successful outcome was recorded for every patient. In addition, the time elapsed until urination post-treatment (minutes) and the urinary bladder volume before and after the treatment (mL) were recorded for every case. The PeakSonic M2 bladder scan ultrasound device (Suzhou PeakSonic Medical Technology Co., Ltd., Jiangsu, China) was employed to measure urinary bladder volume. The patients were positioned supine during the measurement. We applied a liberal quantity of ultrasound gel to the scanning probe. The scanning probe was positioned directly above the pubic symphysis along the midline of the lower abdomen. Next, the probe was angled caudally towards the coccyx to ensure proper alignment with the bladder. Clear images of the urinary bladder were acquired, and the device automatically calculated the bladder volume. The measured volume was then recorded by the operator.

5. Statistical analysis

All collected data were recorded in Microsoft Excel and statistically analyzed using SPSS version 26.0 (SPSS Inc. Chicago, IL, USA). Descriptive analysis was performed, in which categorical variables were presented as numbers and percentages, and continuous variables as mean ± standard deviation (SD). The Chi-squared test was used to assess the differences between categorical variables. For comparison of PVR volumes before and after the treatment, paired sample t-tests were employed. P-value < 0.05 was considered statistically significant.

RESULTS

1. Characteristics of patients

A total of 45 patients participated in this study. The average age of the participants was 55.8 ± 12.4 years, ranging between 24 to 79 years (Table 1). This broad age range indicated the inclusivity of our study population: 3 participants (6.7%) were between 18 to 30 years, 2 participants (4.4%) between 31 to 40 years, 6 participants (13.3%) between 41 to 50 years, 14 participants (31.1%) between 51 to 60 years, and 20 participants (44.5%) were 61 years or older.

The gender distribution of the participants was relatively balanced, with 21 males (46.7%) and 24 females (53.3%). In terms of occupation, 14 participants (31.2%) were associated with manual labor, 20 participants (44.4%) with office jobs, and 11 participants (24.4%) with other occupational categories.

The clinical characteristics of the cohort were diverse. The types of surgery the participants underwent included traumatic lumbar spine surgery (55.6%), discectomy or disc replacement (28.9%), lumbar tumor resection (11.1%), and vertebroplasty (4.4%) (Table 1). The majority of the participants (36; 80.0%) did not report any history of urinary retention, with only 9 participants (20.0%) reporting it. The mean duration of urinary retention until acupuncture treatment was 7.3 ± 1.1 hours, ranging between 5 to 10 hours. Here, 29 participants (64.4%) reported experiencing urinary retention for less than 8 hours of urinary retention, while 16 (35.6%) reported experiencing urinary retention for more than 8 hours.

Furthermore, the symptoms associated with the participants' conditions were evaluated. The intensity of suprapubic tenderness varied, with 8 participants (17.8%) reporting mild symptoms and 37 participants (82.2%) reporting moderate symptoms; no participant reported severe symptoms. In terms of urinary urgency, 4 participants (8.9%) experienced mild urgency, 21 participants (46.7%) experienced moderate urgency, and 20 participants (44.4%) experienced severe urgency. Lastly, the distance from the bladder dome to the superior border of the pubic symphysis was measured: 22 participants (48.9%) had a distance between 6 and 10 cm, while 23 participants (51.1%) had a distance of more than 10 cm.

2. Acupuncture treatment

The acupuncture treatments showed notable efficacy in

Table 1. Patients' characteristics

Patients' characteristics	Summary statistics
Demographics	
Age (years), mean ± SD	55.8 ± 12.4 (24 to 79)
Age group, n (%)	
18-30 years	3 (6.7%)
31-40 years	2 (4.4%)
41-50 years	6 (13.3%)
51-60 years	14 (31.1%)
≥ 61 years	20 (44.5%)
Sex, n (%)	
Male	21 (46.7%)
Female	24 (53.3%)
Occupation, n (%)	
Manual labour	14 (31.2%)
Office work	20 (44.4%)
Others	11 (24.4%)
Types of surgery, n (%)	
Traumatic lumbar spine surgery	25 (55.6%)
Discectomy/Disc replacement	13 (28.9%)
Lumbar tumour resection	5 (11.1%)
Vertebroplasty	2 (4.4%)
Past history of urinary retention, n (%)	
Yes	9 (20.0%)
No	36 (80.0%)
Mean duration of urinary retention till acupuncture treatment (hours), mean ± SD	7.3 ± 1.1 (5 to 10)
Less than 8 hours, n (%)	29 (64.4%)
More than 8 hours, n (%)	16 (35.6%)
Symptoms	
Suprapubic tenderness, n (%)	
Mild	8 (17.8%)
Moderate	37 (82.2%)
Severe	0 (0.0%)
Urinary urgency, n (%)	
Mild	4 (8.9%)
Moderate	21 (46.7%)
Severe	20 (44.4%)
Distance from bladder dome to superior border of the pubic symphysis, n (%)	
From 1 to 5 cm	0 (0.0 %)
From 6 to 10 cm	22 (48.9%)
More than 10 cm	23 (51.1%)

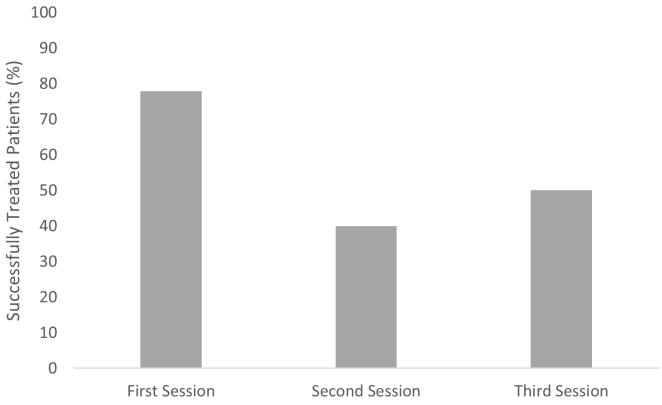

Figure 1. Percentage of successfully treated patients after each acupuncture treatment session.

treating urinary retention, with 35 participants (77.8%) showing successful outcomes after their initial acupuncture sessions (Fig. 1). This success rate indicated the utility of acupuncture as a primary intervention for treating urinary retention. However, not all participants showed successful outcomes after their initial sessions. After the second session, only 4 out of 10 remaining participants showed successful outcomes, demonstrating a progressive yet diminished efficacy (Fig. 1). After the third session, half of the remaining participants (3 out of 6) showed successful outcomes (Fig. 1). Collectively, the treatment success rate was 93.3%, with only three participants failing to show positive outcomes to acupuncture. For these unsuccessful cases, indwelling catheters were inserted as an alternative intervention.

There was no significant difference in treatment efficacy between the male and female participants. The odds ratio (OR) was 0.41 with a 95% confidence interval (CI) ranging between 0.04 to 4.91. Additionally, the age of the participants did not appear to impact the efficacy of acupuncture. When comparing the participants aged less than 60 years with those aged 60 years or older, the odds ratio was 0.61 (95% CI: 0.05 to 7.20). Furthermore, the duration of urinary retention prior to treatment did not significantly affect the treatment outcome (OR 1.23; 95% CI: 0.97 to 1.56).

The time elapsed until urination post-treatment was considered a crucial aspect in this study. In the initial acupuncture session, the participants typically began urinating 15.3 ± 4.0 minutes post-treatment on average (Fig. 2). This duration increased in subsequent sessions, averaging 22.3 ± 2.1 minutes post-treatment in the second session and 28.7 ± 1.5 minutes post-treatment in the third session (Fig. 2). Significantly, the

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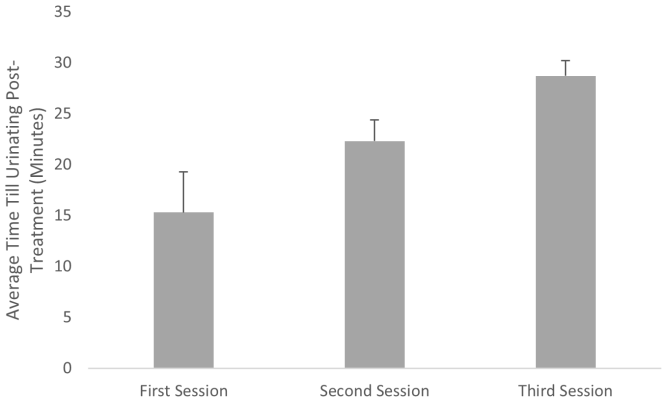

Figure 2. Average time till urinating post-treatment after each acupuncture treatment session.

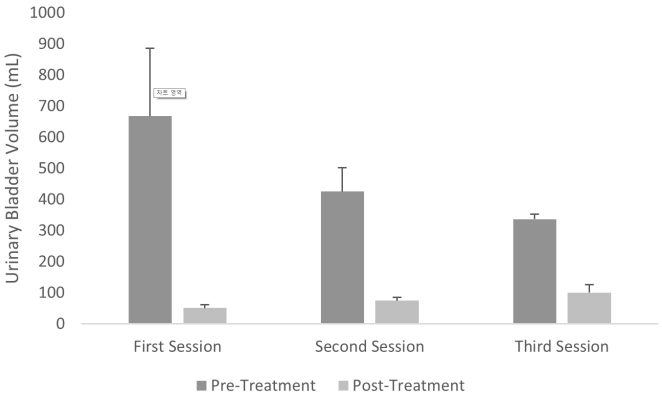

Figure 3. Urinary bladder volume before and after each acupuncture treatment session.

urinary bladder volume markedly decreased after acupuncture treatment across all sessions (Fig. 2). After the first treatment session, the average bladder volume significantly decreased from 667.7 ± 218.9 mL to 50.9 ± 11.0 mL ($P < 0.001$) (Fig. 3). After the second session the average bladder volume decreased from 452.5 ± 76.3 mL to 74.6 ± 10.8 mL ($P < 0.001$) (Fig. 3). After the third session, the average urinary bladder volume decreased from 336.7 ± 15.3 mL to 100.9 ± 24.7 mL ($P < 0.001$) (Fig. 3). Notably, no side effects or secondary urinary tract infections were reported throughout the treatment.

DISCUSSION

Urinary retention frequently occurs after giving birth, myelopathy, and lumbar spine surgery. Several underlying causes can lead to urinary retention. Nerve damage that impairs communication between the bladder and brain may result in the loss of bladder control. In addition, dysfunctions in the muscles or nerves governing urination can disrupt the bladder and ureter functions or hinder pelvic floor relaxation [7]. Previous studies have suggested that the direct nerve signal initiating the bladder contraction might emerge from the Barrington nucleus, a key part of the urinary circuit [12]. This nucleus aids in urination by activating the spinal excitatory pathway or inhibiting the spinal inhibitory mechanism [13]. Animal studies have shown that acupuncture can modify the discharge patterns of neurons linked to bladder activity around the Barrington nucleus, thereby regulating urination [14].

TCM theory categorizes urinary retention as "LongBi" [15-17]. This condition is characterized by excessive blood loss or kidney Qi injury during childbirth or surgery, Qi depletion, kidney Qi deficiency, urinary adjustment failure, and post-operation liver Qi stagnation, which all contribute to urinary retention [7, 17]. The mechanism of acupuncture is based on the meridians, in which stimulating specific points can strengthen the kidney Qi and encourage urination [7].

Various acupuncture points have been recommended for treating urinary retention. Previously, Chen has suggested the importance of Zhongji (CV3), Guanyuan (CV4), Sanyijiao (SP6), Yinlingquan (SP9), Pangguanshu (BL28), and Ciliao (BL32) [17]. Furthermore, Tran has recommended the uses of Sanjiaoshu (BL22), Zhongji (CV3), Guanyuan (CV4), Qihai (CV6), Shenshu (BL23), Sanyijiao (SP6), and Xuehai (SP10) [15]. Also, Nguyen has suggested utilizing Zhongji (CV3), Sanyijiao (SP6), Ciliao (BL32), Zigong (Extra point), and Lanmen (Extra point) [16]. Importantly, a meta-analysis by Zheng et al. suggested the utility of common points like Ciliao (BL32), Sanyinjiao (SP6), Zhongji (CV3), and Guanyuan (CV4) [5].

In our evaluation of acupuncture points for treating urinary retention post-lumbar surgery, we included Qugu (CV2), Zhongji (CV3), Zhibian (BL54), Pangguanshu (BL28), and Kunlun (BL60). Qugu (CV2) is located on the midline of the lower abdomen, above the pubic symphysis, and is part of the Conception Vessel meridian [18]. It is known to regulate the urinary bladder by harmonizing the lower "Jiao" [15, 19]. Zhongji (CV3), positioned 4 cun below the umbilicus on the midline of the lower abdomen, is a significant point in the Conception Vessel meridian that influences Qi and blood flow, thereby positively impacting the urinary bladder [18, 19]. Zhibian (BL54) in the Bladder meridian, which runs along the back, is also known to support the treatment of urinary disorders [17, 19]. Pangguanshu (BL28), also in the Bladder meridian,

has been suggested to regulate urination by balancing Qi in the bladder [17, 20]. Kunlun (BL60), which is also located in the Bladder meridian, indirectly regulates the urinary system and is particularly effective in pain treatment; this point impacts urinary health through its position in the meridian [20]. Stimulation at these points relaxes tendons, promotes circulation, relaxes tendons, promotes circulation, activates blood flow, alleviates stagnation, and increases endorphin levels, thereby reducing contractions in the bladder neck muscles [5, 15]. The stimulation can also enhance bladder muscle contractility, increase bladder pressure, and reduce urinary tract resistance, thus facilitating urine expulsion [15]. Periodic electroacupuncture stimulation assists bladder muscle contractions in response to nerve stimulation by activating the central nervous system and the urinary system center, thereby restoring the urinary reflex [15].

Numerous studies have highlighted the efficacy of acupuncture in managing various types of urinary retention, including chronic, neurogenic, and post-partum [21-24]. A meta-analysis encompassing 12 randomized controlled trials underscored the safety and efficacy of acupuncture in treating urinary retention [5]. Particularly in the context of POUR, a retrospective cohort study by Chen et al. revealed a significant treatment success rate, with 87.6% of the 113 participants cured and 7.1% showing improvement [7]. This study also noted a substantial reduction in the average PVR volume by 477.7 mL after the treatment [7]. Among the 113 participants, 4 participants had undergone lumbar surgery; only 50% of these participants showed successful outcomes. The acupuncture points used in the respective study were Baihui (GV20), Zhongji (CV3), Guanyuan (CV4), Qihai (CV6), Shuidao (ST28), Sanyinjiao (SP6), and Yinlingquan (SP9) [7]. An observational cohort study by Yi et al. reported successful acupuncture treatment in 90% of the participants with urinary retention following radical hysterectomy [25]. The acupuncture points employed in the respective study were Zusanli (ST36), Sanyijiao (SP6), Shuidao (ST28), and Shenque (CV8) [25]. Their treatment success rate was slightly lower compared to our study. Another randomized controlled trial involving 50 participants demonstrated that a combination of acupuncture and cupping effectively managed urinary retention post-cervical cancer surgery, showing a 92.0% success rate [26]. The acupuncture points used in the respective study were Shuidao (ST28), Zusanli (ST36), Sanyijiao (SP6), Yinlingquan (SP9), Zhongji (CV3), Guanyuan (CV4), Qihai (CV6), Pangguanshu (BL28), and Zhibian (BL54) [26].

In Western medicine, aside from bladder decompression techniques such as indwelling catheterization or intermittent catheterization, selective alpha blockade (e.g., tamsulosin) is commonly used to treat POUR. However, due to its delayed maximal therapeutic effect, tamsulosin is typically recommended for preventing POUR rather than immediate treatment [27, 28]. In this regard, acupuncture can actively and immediately cure urinary retention, including POUR. This study demonstrated that acupuncture can result in spontaneous urination within 30 minutes after a successful session.

This study also demonstrated that the efficacy of acupuncture is not significantly influenced by gender (OR 0.41; 95% CI: 0.04 to 4.91) or age (OR 1.23; 95% CI: 0.97 to 1.56). It has been reported that urinary retention is more common in males than females, possibly due to the anatomical and physiological differences between the sexes [29, 30]. This study demonstrated that acupuncture was effective for both genders. Analogously, it has been reported that the elderly population generally faces a higher risk of urinary retention due to weakened bladder and pelvic floor muscles, polypharmacy, and comorbidities. This study showed that acupuncture is effective for all age groups [31]. There was no significant difference in treatment efficacy between the participants under 60 years of age and those aged 60 years or older.

This retrospective analysis-based study was conducted without a control group and was limited to a single center. One notable limitation of this approach is the small sample size, which increases the risk of Type I error, particularly when conducting subgroup analyses based on gender and age. This error can lead to the incorrect rejection of a true null hypothesis, thereby overestimating the efficacy or impact of the observed outcomes. Furthermore, the study population was exclusively composed of patients who underwent lumbar spine surgery. This specificity in the sample selection limits the results from being generalized to other cases. Specifically, the findings may not apply to a bigger population with different characteristics or medical backgrounds.

We propose the following suggestions to enhance the robustness and applicability of future research in this field. Firstly, implementing randomized controlled trials will provide more reliable evidence by reducing bias and allowing a clear interpretation of causal relationships. Secondly, adopting a multi-center design will increase the sample size and enhance the diversity of the study population, thereby improving the generalizability of the results. Thirdly, conducting an observational study involv-

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ing multiple hospitals and departments of acupuncture on a national scale will provide a comprehensive overview of different practices and corresponding outcomes across various settings and populations. These approaches will collectively contribute to an in-depth and reliable understanding of this subject.

CONCLUSION

In summary, this retrospective study assessed the efficacy of electroacupuncture in treating POUR. For the treatment, five specific acupuncture points were used: Qugu (CV2), Zhongji (CV3), Zhibian (BL54), Pangguanshu (BL28), and Kunlun (BL60). After three acupuncture sessions, a high treatment success rate of 93.3% was achieved. Notably, no significant differences in efficacy were observed across different genders and age groups. Remarkably, the participants were able to urinate within 30 minutes post-treatment, leading to a substantial reduction in the PVR volume. Despite such positive outcomes, this study is limited by its retrospective nature, single-center focus, and small sample size. These limitations prevent the generalization of the results. Future studies based on randomized controlled trials and/or large-scale observations involving multiple centers are warranted to more reliably demonstrate the efficacy of acupuncture in managing POUR.

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CONFLICT OF INTEREST

The authors declare no conflicts of interest in this work.

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