Original Article

The Effect of Magnetic Therapy on Postoperative Urinary Retention in Patients Undergoing Surgery: A Randomized Clinical Trial

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Abstract

Background: Urinary retention is a postoperative problem that causes pain and discomfort for patients, even when catheters are used. The potential role of magnetic therapy in treating postoperative urinary retention through acupuncture points remains uncertain. This research aims to assess the impact of magnetic therapy on urinary retention in patients undergoing surgery. **Materials and Methods:** This single-blind clinical trial study was conducted in a recovery department within an operating room and subsequently in the Surgery Department of Amin Hospital. The study took place in Isfahan in 2022, with a sample of 64 patients selected using a simple random sampling method and divided equally into two groups. In the intervention group, magnet plates were applied, while the control group received iron plates at seven specific points for duration of 35 ± 5 minutes. Demographic information, the type of urinary excretion, the duration of urinary retention, and the volume of excreted urine were recorded using a researcher-made checklist for both intervention and control groups. These data were compared and subjected to descriptive and analytical statistical analysis. **Results:** Among the participants (N = 64), the majority were male (N = 37, 57.80%), and the mean age was 40.17 years. The Chi-square analysis revealed no significant difference between the intervention and control groups in terms of the type of urinary excretion ($p = 0.106$). However, the Mann–Whitney U-test demonstrated significant difference between the two groups regarding the duration required to eliminate urinary retention and the volume of excreted urine ($F_{2,41} = 62$ and $F_{1,76} = 62$; $p < 0.001$). **Conclusions:** The use of a novel approach involving magnetic therapy applied to acupuncture and reflexology points has been shown to reduce the time required for the first urination and increase the volume of urine in post-surgery patients.

Keywords: *Acupuncture points, complementary therapies, magnets, nurses, urinary retention*

Introduction

Urinary retention is a frequent postoperative complication that can lead to pain and discomfort for patients during the postoperative period. The reported incidence of postoperative urinary retention varies depending on the type of anesthesia used. For surgeries performed under spinal anesthesia, the incidence ranges from 5% to 70%, whereas for procedures conducted under general anesthesia, it typically falls within the range of 10% to 15%.[1] Nurses in the department often encounter postoperative urinary retention as a common complication. This can hinder the care of other patients and lead to delays in hospital discharge. Notable factors contributing to postoperative urinary retention include the use of spinal and epidural anesthesia, patient age, gender, surgical procedure duration, and the administration of narcotic drugs or anesthesia.[1,2] Postoperative urinary retention is marked by the incapacity to void the bladder despite feeling the urge to do so. This condition typically manifests within 4–8 hours following surgery, particularly when the bladder's volume exceeds 200 ml.[1] This condition can give rise to various complications, including urinary tract infections, overdistension of the bladder, damage to the detrusor muscle, and in some cases, long-term bladder dysfunction.[3] The management of this complication typically involves the use of intraluminal catheterization. It is essential to recognize that hospitalized patients who develop nosocomial urinary tract infections, especially following, have been observed to experience a higher mortality rate.[4] The prevalence of bacteremia after a single catheterization has been reported to be 8%.[5] Furthermore, painful stimulation

How to cite this article: Zarei G, Mosleh S, Zare S, Abotalebi MS. The effect of magnetic therapy on postoperative urinary retention in patients undergoing surgery: A randomized clinical trial. Iran J Nurs Midwifery Res 2024;29:417-23.

Submitted: 18-Apr-2023. **Revised:** 04-Oct-2023. **Accepted:** 08-Oct-2023. **Published:** 24-Jul-2024.

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Access this article online

Website: https://journals.lww.com/jnmr

DOI: 10.4103/ijnmr.ijnmr_106_23

Quick Response Code:

arising from bladder overdistension and catheter insertion can give rise to various symptoms, including nausea and vomiting, bradycardia, hypotension, hypertension, or cardiac dysrhythmias.[1]

Non-pharmacological methods, such as acupuncture, acupressure, and reflexology, offer alternative approaches with considerably fewer side effects when compared to pharmaceutical drugs.[6] Studies have demonstrated that magnetite therapy can be effective in treating conditions such as constipation, pain, and depression, employing various methods, including the direct application of magnets to the affected area.[7-9] These methods have been recognized and approved by the World Health Organization for their effectiveness and minimal adverse effects.[10] Moreover, magnetic therapy applied to acupuncture points is recognized as a safe complementary method with minimal side effects.[11] According to studies, the application of magnets to acupuncture and reflexology points has been shown to reduce the side effects of parasympathetic overpowering, particularly in post-surgery conditions, and can generate therapeutic effects in addressing urinary retention.[7,12,13] As the healthcare field evolves, it is imperative for nurses to remain updated on emerging techniques and therapies to offer the highest level of care to their patients. Complementary medicine, such as the use of magnets on acupuncture and reflexology points, can be integrated by nurses as a means to assist in managing these medical conditions.[11,14]

Magnetic therapy, using natural magnets or lodestones, is believed to have been used around 2000 BCE by civilizations such as the Aztec Indians, Greeks, Egyptians, and Chinese. It falls within the category of complementary therapies related to medical energy.[15] Over time, magnetic therapy has been employed in various ways to ameliorate symptoms and treat a range of diseases. For instance, it was found effective in addressing conditions such as chronic urinary retention by placing the magnet directly on the bladder.[16] Stress and anxiety in patients can adversely affect digestion, bladder sphincter function, and kidney function. Stimulating specific acupressure and acupuncture points can significantly improve these conditions by reducing pain and promoting relaxation. Notably, acupressure and acupuncture are well-documented for their ability to induce sedation and relaxation.[17,18] The use of magnets on acupuncture points holds promise for potentially alleviating the side effects of parasympathetic dominance, especially in post-surgical scenarios. Additionally, it may have therapeutic benefits for addressing urinary retention.[19] Previous studies on the effect of reflexology and acupressure on urinary retention have provided positive results, but the time-consuming nature of these methods may not be ideal for nurses, especially in busy healthcare settings.[20-26]

In this study, the method of placing magnets was used. This method represents the simplest form of magnetic therapy, known as magnetic static therapy, where magnets are applied to specific points as needed.[18] This study aimed to explore the novel approach of magnetic therapy on acupuncture points and reflexology points related to the bladder to address post-surgical urinary retention. Consequently, the research sought to assess the impact of magnetic therapy on the occurrence of postoperative urinary retention in surgical patients.

Materials and Methods

This single-blind clinical trial (IRCT20210415050985N1) study was conducted in a recovery department of an operating room and subsequently in the Surgery Department of Amin Educational Hospital in Isfahan during the months of June and July 2022. The research population consisted of all patients requiring surgery with anesthesia. The inclusion criteria encompassed patient consent before surgery, patients aged at least 18 years, absence of urinary catheter, classification as American Anesthesiology Association (ASA) class I or II, no history of drug addiction, selective and non-urological surgery, no prior history of urinary retention, absence of cardiovascular issues and pacemaker usage, no prior interventions for urinary retention or catheterization (patients without catheter), absence of the urge to urinate upon entering the recovery room, and availability of suitable locations for magnet placement on the patient's body. The exclusion criteria encompassed patient withdrawal from the study, urine voided volume less than 200 ml, regardless of whether with or without a catheter (urine collection container), and patients unable to tolerate urinary retention for any reason, requiring immediate assistance for urination, and being managed according to the department's standard protocol without regard to the study process. In cases where urinary catheter insertion was necessary, it was deemed a study failure. Information regarding these criteria was obtained through patient observation, questioning, and examination of their medical records. A simple sampling method was used according to the entry criteria. Allocation of samples into the control and intervention groups was performed using minimization software, which automatically randomized participants without researcher intervention, ensuring minimal bias. Data on age, sex, duration of surgery, type of surgery, and anesthesia method were provided to the software to control these potential confounders. It is noteworthy that, in accordance with the exclusion criteria, for each sample removed due to these criteria, another sample was substituted. The sample size for this study was determined to be a minimum of 32 participants in each group, accounting for potential dropouts. The calculation of the sample size was conducted using a specific formula that $Z1 = 1.96$, $Z2 = 0.84$, S = It is an estimate of the standard deviation of the measured variables between the two groups and d = The minimum difference in the average of the measured variables between the two groups,

which shows a significant difference, was considered 0.7S which resulting in a total of 64 participants for the study. A total of 181 patients who met the inclusion criteria were initially recruited, with 99 assigned randomly to the intervention group and 82 to the control group. However, 67 patients from the intervention group and 50 patients from the control group were excluded from the study due to voided urine volumes of less than 200 ml. None of the patients withdrew from the study during the course of the study. Consequently, the statistical analysis phase involved 32 patients in each group [Figure 1].

Before surgery, the study objectives were for all patients and written consent was obtained from each patient. In the intervention group, magnet plates were attached to points P6, H7 on both the right and left hands, as well as SP6, and ST36 on the left foot, in addition to one point on the sole of the left foot associated with the bladder/digestion. These plates were attached with adhesive in both the morning and the evening. Each magnet possessed a diameter of 10 mm and a thickness of 5 mm, was nickel chrome-plated, had a magnetic strength of 3500G, and belonged to the neodymium type. In contrast, the control group received iron plates without magnetic properties which were of the same size as those used in the intervention group. These iron plates were placed on the exact same points at the outset of the patient's admission to the recovery department. The SP6 point is located on the inner side of the leg, approximately the width of four closed fingers above the inner part of the inner ankle, along the posterior line, and adjacent to the tibia bone (about five centimeters above the inner angle of the tibia). The ST36 point is located four fingers below the patella bone of the knee and approximately 2.5 cm from the edge of the tibia. The P6 point is located between the inner forearm of the arm and in the cavity between the bones of the forearm, three finger widths above the crease of the wrist crease. The H7 point is located on the side of the ulnar and pisiform bone, in the transverse line of the wrist crease. These points are inspired by acupressure points. The last point is exclusive to the sole of the left foot, corresponding to the bladder point in reflexology. This point is located within the central hollow of the sole of the foot, facing inside and toward the back of the foot.

A total of seven magnets were used to stimulate the seven points. These magnets were placed on the points once for approximately 35 ± 5 minutes each time. The entire intervention process was conducted by a nurse who had received training in acupuncture, acupressure, reflexology, and magnetic therapy. The nurse's activities were supervised and coordinated by the attending physician. Data, including age, sex, duration of surgery, type of surgery and anesthesia, the duration of time until the patient could pass urine following the placement of magnets or iron plates, and the volume of excreted urine, were documented in both the intervention and control groups. This information was recorded using a researcher-designed checklist, which included these seven previously mentioned items. It is important to note that these seven items were not scored or graded. In cases where patients in both the intervention and control groups experienced intolerance or exhibited symptoms of urinary retention, catheterization or other necessary medical actions were performed as

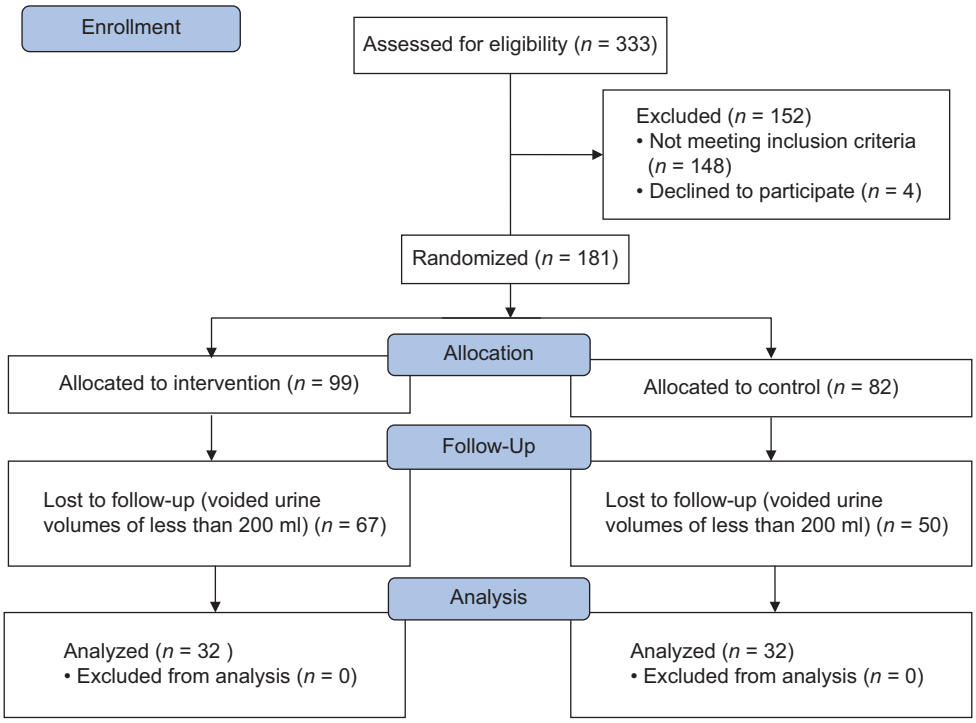

Figure 1: Flowchart of sample allocation according to the CONSORT 2010 flow diagram

directed by the attending physician. If urinary retention persisted and was not relieved, its time and the volume of urine were recorded. Then, patients were excluded from the study if the volume of urine discharged, whether with or without catheterization, was less than 200 ml in both the intervention and control groups.

As a standard checklist was unavailable, the researcher created one and submitted it to 10 faculty members of the Isfahan University of Medical Sciences for evaluation. Their feedback was incorporated, and after necessary adjustments and obtaining approval, the final version was formulated following the resolution of any discrepancies. To ensure reliability, the checklist was concurrently completed by two nurses for 10 patients, and the interobserver reliability was calculated to be 0.8. The data were analyzed using IBM Corporation's SPSS version 16 software and were summarized in terms of frequencies, means, and standard deviations. The normality of the data was evaluated using the Kolmogorov–Smirnov test. The data recorded in both the intervention and control groups were compared using descriptive and analytical statistical methods including the Friedman, Mann–Whitney, and Chi-square tests, as well as analysis of covariance (ANCOVA). The significance level for all tests was set at 0.05.

Ethical considerations

The study involving human subjects adhered to all applicable national regulations and institutional policies, as well as the principles outlined in the Declaration of Helsinki. It received approval from the Research Ethical Committee of the University of Medical Sciences (IR.MUI.NUREMA.REC.1400.04759142 at ethics.research.ac.ir). Written informed consent was obtained from all patients, who were also informed of their right to withdraw from the study at any time during the research. Furthermore, the patients were assured that their personal information would be kept strictly confidential.

Results

A total of 64 patients participated in the experiment, of which the majority [N = 37 (57.80%)] were male, and the mean age was 40.17 years. The Mann–Whitney test revealed no significant differences in age ($p = 0.532$) and duration of surgery ($p = 0.092$) between the intervention and control groups [Table 1]. Table 1 also presents the distribution of patient sex, surgery type, and anesthesia method. The Chi-square test indicated no significant differences in terms of sex ($p = 0.206$), surgery type ($p = 0.751$), and anesthesia method ($p = 0.197$) between the intervention and control groups.

Table 2 shows that the Chi-square test revealed no significant difference in terms of the type of urinary excretion between the intervention and control groups ($p = 0.106$). However, the Mann–Whitney test indicated a significant difference in terms of the duration required to eliminate urinary retention ($F_{2,41} = 62$; $p < 0.001$) and the volume of excreted urine ($F_{1,76} = 62$; $p < 0.001$) between the two groups. Urinary retention in the intervention group was resolved faster, and the volume of excreted urine in this group was also lower [Table 3].

Discussion

This study found no significant difference between the intervention and control groups in terms of postoperative urinary retention. Nonetheless, notable differences were observed between the two groups in terms of the duration of the eliminated retention period and the volume of excreted urine. These results are consistent with those of Gao *et al*.,[27] who investigated the efficacy of electroacupuncture in restoring post-anesthetic bladder function. Their study found that electroacupuncture reduced the proportion of bladder over-distension and shortened the time to spontaneous micturition in patients undergoing spinal anesthesia. However, similar to our study, no significant difference was observed in the incidence of postoperative urinary retention between the two groups. However, He *et al*.[24] investigated this problem with acupuncture after spinal anesthesia and found different results. Their study indicated a lower incidence of urinary retention in the observation group compared to the control group. In the observation group, the first spontaneous urination occurred earlier, typically within 30 minutes after spinal anesthesia, in contrast to the control group. The comfortable urination rate was also higher in the observation group than in the control group. Of course, it should be noted that this study differed from these previous studies in terms of the methods and nature of the work.

A review conducted by Zheng *et al*. showed that acupuncture can effectively promote spontaneous urination and reduce anxiety in patients with poor urination. Their study found significant differences in residual urine volume between the acupuncture group and the control group; indeed, it is crucial to recognize that variations in research outcomes can be attributed to differences in acupuncture techniques, including the selection of acupuncture points and the utilization of electrostimulation.[30] Therefore, there are many studies in this field that have investigated different methods.[2,28-30] Variations in results across different studies may stem from differences in study methodology, varying definitions of urinary retention, the selection of acupuncture points, and disparities in surgical and anesthesia procedures. It is worth mentioning that no similar study utilizing magnets and this specific methodology has been identified in Iran.

In addition, there have been studies on the relief of urinary retention after radical hysterectomy and postpartum using acupressure in the form of auricular therapy[24] and studies have shown that the use of acupuncture points with and without preventive nursing care can be effective in relieving urinary retention.[22,31] Similar to this study, research on

Table 1: Characteristics of participants (*n*=64)

Variables	Mean (SD)	Minimum	Maximum	Intervention Mean(SD)	Control Mean(SD)	*p**
Age	40.17 (11.34) (years)	20	63	41.31 (12.25) (years)	39.03 (10.41) (years)	0.532
Duration of surgery	2.02 (0.64) (h)	0.50	4	2.10 (0.70) (h)	1.93 (0.57) (h)	0.092
Variables	**Subgroup**	**Total *n* (%)**		**Intervention *n* (%)**	**Control *n* (%)**	***p****
Gender	Male	37 (57.80)		16 (50)	21 (65.62)	0.206
	Female	27 (42.20)		16 (50)	11 (34.37)	
Type of surgery	Neurology	5 (7.81)		2 (6.25)	3 (9.37)	0.751
	Orthopedics	23 (35.93)		10 (31.25)	13 (40.62)	
	General surgery	11 (17.18)		6 (18.75)	5 (15.62)	
	Feminine	14 (21.87)		9 (28.12)	5 (15.62)	
	Ear, neck, and nose (ENT)	11 (17.18)		5 (15.62)	6 (18.75)	
Anesthesia method	General	52 (81.25)		28 (87.50)	24 (75)	0.197
	Local	12 (18.75)		4 (12.50)	8 (25)	

*Mann–Whitney test. **Chi-square test

Table 2: Comparison of type of urinary excretion between the intervention and control groups after the initiation of magnetic therapy

Variable	Subgroup	Total *n* (%)	Intervention *n* (%)	Control *n* (%)	*p**
Urinary excretion type	Normal (spontaneous micturition)	41 (64.06)	25 (78.12)	19 (59.37)	0.106
	Abnormal (with catheter)	23 (35.94)	7 (21.87)	13 (40.62)	

*Chi-square test

Table 3: Comparison of the duration of urinary retention and the volume of urine excreted between the intervention and control groups after the initiation of magnetic therapy

Variables	Mean (SD)	Minimum	Maximum	Intervention Mean(SD)	Control Mean(SD)	*p**
Eliminated retention period	80.94 (45.53) (min)	10	180	47.81 (26.21) (min)	114.06 (35.52) (min)	$p<0.001$
The volume of urine excreted	1360.94 (315.53) (ml)	800	2500	1178.13 (201.18) (ml)	1543.75 (304.73) (ml)	$p<0.001$

*Mann–Whitney test

acupressure has indicated a shorter time to initial urination in intervention groups, along with a reduced incidence of urinary retention. Additionally, a significantly smaller residual urine volume was observed in the intervention group compared to the control group at both 4 and 12 hours after delivery.[22,24] In this study, the volume of urine excreted was lower in the intervention group. However, it is essential to clarify that this does not necessarily imply a lower actual urine production. The average time spent waiting for urination in the intervention group was approximately 47 minutes, compared to approximately 114 minutes in the control group. Assuming an average urine output of 1.5 cc/kg, the one-hour difference in waiting time between the two groups would result in a difference of approximately 100 cc (in a 70 kg individual). Therefore, the intervention group's reduced waiting time for urination may contribute to a lower incidence of urinary retention.

Khosravan *et al*.[32] evaluated the effect of foot reflexology massage on postoperative urinary retention. Their study found a significant difference between the intervention and control groups in terms of urinary retention after surgery and the time taken for urination. However, no significant difference was observed between the two groups in terms of the volume of excreted urine, which is in line with this study in terms of urination time. However, this study diverges from the research by Khosravan *et al*. in terms of methodology, as magnets were employed instead of massage, and stimulation was focused solely on the left leg rather than both legs.[32] It is important to emphasize that there is limited evidence to support any specific effect of reflexology in most conditions, except for urinary symptoms associated with multiple sclerosis.[26,31]

This study introduced a novel and combined approach utilizing magnets, warranting further investigation. Previous studies have suggested that extracorporeal magnetic stimulation may be effective in treating urinary incontinence and improving quality of life, with no major safety issues reported.[9,13] However, there is a lack of studies that have specifically investigated the effect of magnetic therapy on postoperative urinary retention, particularly employing the same methodology as this study.

A limitation of this study is the absence of urodynamic evaluation of bladder function and the use of ultrasound or bladder scan methods for precise diagnosis of urinary retention. However, these methods may cause discomfort for patients and can be a burden for both patients and healthcare providers. Moreover, the relatively small sample size in this study could have tempered the strength of our results, emphasizing the need for larger-scale studies to bolster our findings. Also the long-term process of intervention and the emergency of the patient's condition, which can affect the results. Because the researcher cannot have much control over these two items. Given the existing discrepancies in the literature and the novelty of the combined method, further investigations are necessary. Specifically, it may be beneficial to examine acupuncture and reflexology points separately.

Conclusion

The findings of this study suggest that utilizing a novel combined method of magnetic therapy on acupuncture and reflexology points can reduce the time to first urination and the volume of urine in post-surgery patients. Nurses can consider integrating this noninvasive intervention as part of their holistic patient care approach for individuals experiencing urinary retention after surgery, thereby enhancing patient care without significant adverse effects. However, it is essential to acknowledge that further research is required to validate the study's findings and ascertain the applicability of this method across different patient populations. While the method shows promise, its universal application should be approached with caution until additional evidence is gathered. The integration of new and evidence-based methods into nursing practice is a dynamic process that requires continuous education and adaptability.

Acknowledgements

This article is taken from the research project code 199683 approved by the Isfahan University of Medical Sciences.

Financial support and sponsorship

Isfahan University of Medical Sciences

Conflicts of interest

Nothing to declare.

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