Original Article
Efficacy and safety of tracking extended nursing on patients with urinary tract stones after holmium laser lithotripsy: a prospective study

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Abstract: Objective: This study aimed to assess the efficacy and safety of tracking extended nursing (TEN) on patients with urinary tract stones after holmium laser lithotripsy (HLL). Patients and Methods: A total of 232 patients with urinary tract stones after HLL were prospectively randomized into 2 groups. One hundred and sixteen patients in the study group accepted TEN mode and 116 patients serving as control accepted only traditional nursing mode. The Hamilton Depression Scale (HAMD) and Hamilton Anxiety Scale (HAMA) scores, measured at different time points, were considered the primary outcomes for evaluating patients' psychological state. The secondary end points were Quality of life (QOL) scores and complications between the two groups. Results: After the TEN mode was applied to the study group, the HAMD and HAMA scores were significantly lower than those in the control group at the second and fourth week (P<0.05). With regard to the secondary variables, the QOL scores in the study group was significantly higher than that in the control group at the second and fourth week (P<0.05). In addition, the overall incidence of complications was significantly lower in the study group than in the control group (P<0.05). No serious complications were reported in either group. Conclusions: The TEN mode improves psychological well-being and Qol in urinary tract stone patients undergoing HLL, accelerates recovery, reduces complications, and enhances self-care.

Keywords: Tracking extended nursing, hamilton depression scale, hamilton anxiety scale, quality of life, complications

Introduction

Urolithiasis is a prevalent urinary system disease that significantly affects the physical health and quality of life of patients [1]. Various treatment methods have been adopted in clinical practice, including the widely used holmium laser lithotripsy (HLL) [2]. However, patients with urinary tract stones often experience unstable psychological states and a reduced quality of life postoperatively [3]. Post-surgical discomfort, recovery concerns, and postoperative complications can negatively affect their psychological health [4]. Thus, effective nursing models must be investigated to improve the psychological state and quality of life of patients with urinary tract stones.

Tracking Extended Nursing (TEN), an emerging nursing model, emphasizes close interaction and continuous monitoring to provide comprehensive personalized care and support [5, 6]. A TEN team conducts regular patient follow-ups to promptly identify their rehabilitation progress and problems, providing targeted nursing interventions and educational guidance [7]. Through continuous health education, the nursing team explains the surgical process, rehabilitation goals, precautions, and other relevant information. This approach allows patients to better understand and to actively participate in the rehabilitation process. Concurrently, the nursing team assesses the emotional state and psychological pressure of patients during on-

line follow-up, providing psychological counseling to alleviate their psychological burden [8].

The TEN mode reduces postoperative psychological pressure, boosts enthusiasm for rehabilitation, and enhances willingness to cooperate through personalized care, professional support, and continuous communication. Consequently, rehabilitation outcomes improve, together with the psychological state and quality of life of the patients. However, relevant research remains limited. Thus, we conducted this prospective, randomized trial to assess the effectiveness and safety of TEN on patients with urinary tract stones after HLL.

Methods

Patients

From August 2022 to July 2024, eligible patients undergoing upper urinary tract lithotripsy were selected. Inclusion criteria were applied, and patients were randomly assigned using the envelope technique. The inclusion criteria included: 1) The patient's age was between 18 to 70 years old; 2) Diagnosed as upper urinary tract stones received holmium laser lithotripsy; 3) No contraindications for surgery; 4) Ability to provide written informed consent and comply with the trial requirements. The exclusive criteria included: 1) Uncontrollable UTI and requires drainage; 2) Severe cardiovascular and cerebrovascular diseases; 3) Bilateral upper tract stones; 4) Pregnant and lactating wowen; 5) Unable to understand or comply with trial records. This process resulted in 232 patients: 116 patients in the study group and 116 patients in the control group (**Figure 1**). No statistically significant difference between the two groups was found regarding demographics and clinical characteristics, including mean age at diagnosis, body mass index, gender, history of hypertension and diabetes, and stone location (all $P>0.05$). The study was approved by the ethics committee of the Affiliated Jiangning Hospital with Nanjing Medical University (ethics approval number: 202210611). Written informed consent was obtained from all participants.

Randomization and masking

Stratified parallel randomization was conducted. A total of 232 participants were enrolled and randomly assigned in a 1:1 ratio to either the study or control group. The randomization sequence was electronically generated before patient inclusion. Sequentially numbered sealed envelopes were used to ensure random sequence allocation and concealment. Upon patient consent and admission, a designated nurse opened the sealed envelope to reveal the nursing mode. The nurse then recorded post-intervention clinical data.

Study procedure

The Control group: This group adopted traditional nursing mode. Patients received postoperative routine health education and health education manuals. They were instructed to follow a healthy diet, consume at least 1 liter of water daily, and drink moderate amounts of water after exercise or before sleep. Strenuous exercise was to be avoided prior to double-J tube removal. Following tube removal, a gradual increase in exercise, as tolerated, was recommended to promote functional recovery.

The Study group: The TEN mode was applied to the study group on the basis of routine care. (1) Formation of the TEN mode team: The TEN mode was formed, consisting of the head nurse as team leader, 4 responsible nurses as team members, and 1 attending physician. The head nurse provided training to team members, ensuring they understood the principles and implementation methods of the TEN mode. A workflow and task allocation for the TEN mode were formulated to clarify the responsibilities and work scope of team members, as well as to establish effective communication channels. Concurrently, a tracking and recording system was developed to monitor patient care and rehabilitation progress, recording important information for team members to share and review. (2) Confirmation of a tracking mechanism: Regular follow-up plans were developed, including telephone follow-up, face-to-face follow-up, and online platform communication. Follow-up frequency was adjusted based on the health condition of the patient to ensure timely monitoring of rehabilitation progress and concerns. During follow-up, water intake, dietary regulation, and management of catheterization-related complications were evaluated. Through regular assessments, the nursing team promptly identified and resolved any issues or
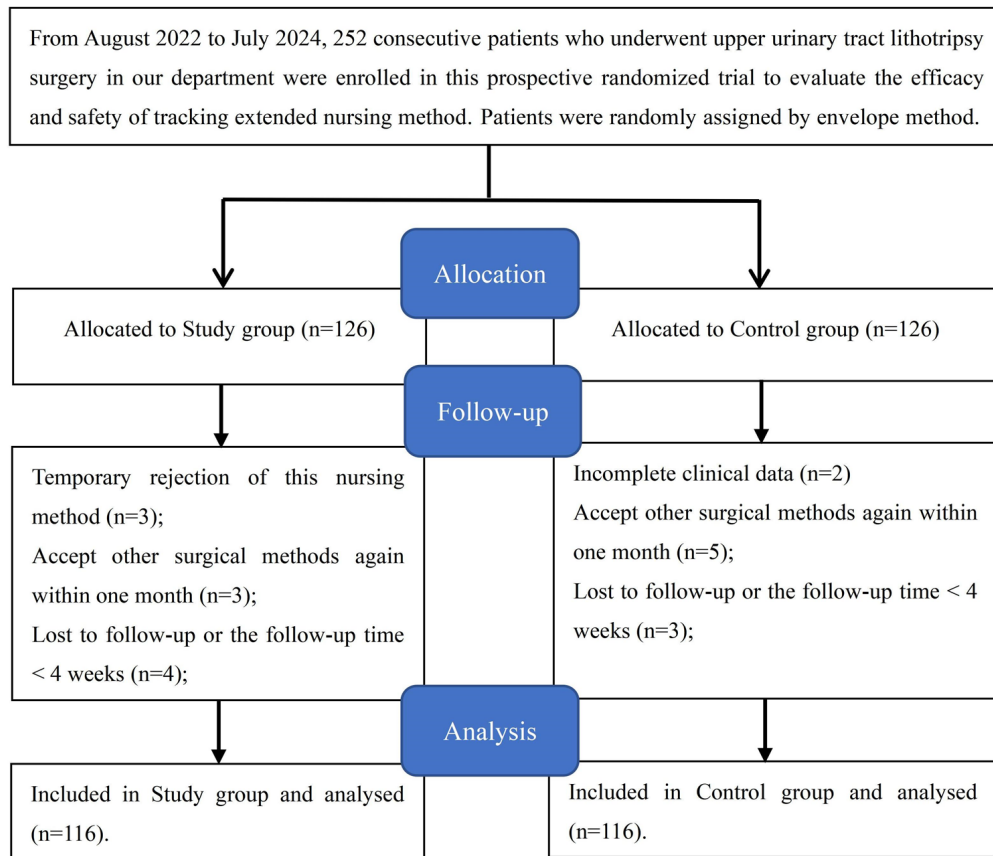
Figure 1. Flowchart for cases selection of the trial outlining enrollment, randomisation, allocation, follow-up, and analysis according to intention-to-treat standards.

complications arising during rehabilitation. (3) Delivery of continuous health education: Education plans were developed based on individual patient needs, including patient basic data assessment, learning ability, and comprehension level, to adopt the most effective information delivery method. The nursing team provided detailed preoperative health education to ensure patients understood the surgical process, risks, and expected outcomes. Rehabilitation education was provided to patients during the postoperative and rehabilitation stages, including an explanation of rehabilitation goals, timetable, and expected progress, teaching patients correct rehabilitation exercise methods, self-care skills, and precautions during the rehabilitation period. The nursing team provided advice on water intake, dietary control, moderate exercise, and lifestyle

modifications. If medication was required, the nursing team offered guidance, including information on effectiveness, dosage, side effects, and precautions. (4) Online follow-up: To maintain long-term contact with patients, the nursing team used WeChat, fostering comfortable and reassuring relationships through friendly interaction, trust, and respect for patient privacy. The nursing team understood patient emotions and psychological pressure through telephone calls and other forms of communication, encouraging patients to express their feelings and concerns, and providing emotional support.

Follow-up

All patients received follow-up care within four weeks post-discharge. Nursing outcomes and

Table 1. Comparisons of patients' demographics and clinical characteristics between two groups

Variables, mean ± SD or n (%)	Study Group (n=116)	Control Group (n=116)	χ^2/t-value	P-value
Age, year	47.3 ± 5.4	46.1 ± 5.7	1.646	0.101
BMI, kg/m^2	22.7 ± 3.3	23.2 ± 2.9	-1.226	0.221
Gender				
Male	61 (52.6)	57 (49.1)	-	-
Female	55 (47.4)	59 (50.9)	0.276	0.599
Hypertension history				
No	82 (70.7)	79 (68.1)	-	-
Yes	34 (29.3)	37 (31.9)	0.183	0.669
Diabetes history				
No	93 (80.2)	87 (75.0)	-	-
Yes	23 (19.8)	29 (25.0)	0.892	0.345
Stone location				
Ureter	56 (48.3)	49 (42.2)	0.852	0.356
Renal pelvis	31 (26.7)	30 (25.9)	0.022	0.881
Renal calyx	29 (25.0)	37 (31.9)	1.355	0.244

BMI = body mass index; SD = standard deviation.

incidence of complications were compared between the two groups. No statistically significant difference was found between the groups at the time of diagnosis or treatment. Patients reported any nursing-related adverse weekly.

The Hamilton Depression Scale (HAMD) and Hamilton Anxiety Scale (HAMA) scores, measured at different time points, were considered the primary outcomes for evaluating patients' psychological state. The HAMD comprised 17 items, including common symptoms of depression such as low mood, decreased interest, sleep disorders, weight changes, and self-blame. Each item was rated from 0 to 3 points, with higher scores indicating more severe depressive symptoms. HAMA included 14 items, covering common anxiety symptoms such as anxiety, tension, fear, sleep disorders, muscle tension, and others. Each item was rated from 0 to 5 points, with higher scores indicating more severe anxiety symptoms. The secondary end points were Quality of life (QOL) scores and complications between the two groups. QOL assessment after HLL was crucial to evaluate recovery, treatment success, and patient satisfaction. Several validated scoring systems were used, each focusing on different aspects of QOL, including urinary symptoms, pain, physical/emotional well-being, and stone-specific impacts. Complications included lower back pain, bladder irritative symptom, hematuria, urinary tract infection, and double-J stents displacement or detachment. The incidence of complications was a key metric used to evaluate the safety and effectiveness of tracking extended nursing on patients with urinary tract stones after HLL. It referred to the number of new cases of a complication occurring in a population during a follow-up period. This was typically calculated as: Incidence (%)=(Number of patients with the complication/Total number of patients studied)×100.

Statistical analysis

Statistical analysis was conducted using SPSS v.32.0 for Windows (IBM Corp., Armonk, NY, USA). Continuous variables were presented as mean ± standard deviation. Patient demographics, follow-up time, and nursing outcomes were compared between the two groups by using independent samples t tests. Chi-squared tests were used to compare other clinical characteristics between the groups. P<0.05 was considered statistically significant.

Results

This study enrolled 232 patients, who were randomly assigned to two groups: 116 patients to the study group and 116 patients to the control group. Patient' demographics and clinical characteristics are listed in **Table 1**. The mean age was 47.3 years in the study group and 46.1 years in the control group. No significant differences in body mass index, gender, history of hypertension or diabetes, or stone locations were found between the groups (all P>0.05).

Nursing outcomes showed no statistically significant difference between the two groups before intervention (P>0.05). After the TEN mode was applied to the study group, the HAMD and HAMA scores were significantly lower than those in the control group at the second and fourth week (P<0.05). The difference between the two groups gradually increased

Table 2. Comparisons of HAMD and HAMA score between two groups

Variables, mean ± SD	Study Group (n=116)	Control Group (n=116)	t-value	P-value
HAMD Score				
Baseline	25.4 ± 3.5	26.1 ± 3.8	-1.459	0.146
1st week	17.7 ± 2.4	18.3 ± 2.7	-1.789	0.075
2nd week	9.6 ± 1.6	10.2 ± 1.1	<0.001**	<0.001**
4th week	6.7 ± 1.3	7.6 ± 1.2	-5.479	<0.001**
HAMA Score				
Baseline	30.3 ± 3.1	29.9 ± 3.3	0.951	0.342
1st week	23.7 ± 2.4	24.2 ± 2.7	-1.491	0.137
2nd week	14.8 ± 1.2	15.1 ± 1.0	-2.068	0.040*
4th week	6.2 ± 1.5	6.8 ± 1.3	-3.255	0.001**
Qol Score				
Baseline	59.7 ± 4.3	59.1 ± 3.5	1.165	0.245
1st week	65.6 ± 4.1	64.7 ± 4.4	1.612	0.108
2nd week	78.7 ± 4.6	77.3 ± 4.8	2.268	0.024*
4th week	90.5 ± 4.9	88.2 ± 5.2	3.467	0.001**

SD = standard deviation; HAMD = Hamilton Depression Scale; HAMA = Hamilton Anxiety Scale; QoL = Quality of life; *$P<0.05$, **$P<0.01$.

(**Table 2**). With regard to the secondary variables, the QOL scores in the study group was significantly higher than that in the control group at the second and fourth week ($P<0.05$) (**Figure 2**). In addition, the overall incidence of complications was significantly lower in the study group than in the control group (3.4% vs. 10.2%, $P=0.038$). No serious complications were reported in either group (**Table 3**).

Discussion

HLL is a commonly used technique for treating urinary tract stones, providing precise treatment tailored to stone size and location. It is widely recognized as one of the preferred treatment methods [9, 10]. HLL is a minimally invasive procedure that avoids the trauma of open surgery and has a low risk of surgical complications. Therefore, its postoperative effects on patients can be achieved better therapeutic benefits, lower potential complications, and rapider postoperative recovery. However, for patients post-lithotripsy, standardized procedures were often used for routine nursing, which had limitations and shortcomings [11]. First, differences in the physical conditions and postoperative reactions of the patients prevent standardized nursing from addressing individual needs, failing to meet patient requirements.

Second, the nursing staff lacks corresponding professional knowledge and training, which hinders the delivery of comprehensive and professional care, resulting in compromised nursing quality. In addition, neglecting communication and explanation with patients and their families may lead to a deficient understanding of the surgical process, postoperative care, and rehabilitation plan. This lack of comprehension can negatively affect the emotional well-being and willingness to cooperate, impairing the rehabilitation process. Therefore, improving patient prognosis and implementing more effective nursing modes have gained significant clinical attention in recent years.

The TEN mode ensures continued professional care post-discharge and is gradually being promoted in clinical practice. Proactive nursing, combined with catheter-tracking nursing, reduces postoperative urinary system infections and pain in elderly patients [12]. By implementing catheter tracking nursing, the nursing team can promptly monitor and manage catheter drainage, ensuring its patency, preventing blockage or slippage, and minimizing infection risk [13]. Tracking nursing management is a nursing method based on monitoring and guidance. By combining technology and medical resources, it can improve the effectiveness of treatment, reduce adverse reactions, and provide patients with the support and guidance they need [14]. Research has shown that tracking nursing care through QQ, home visits, and other methods significantly promote postoperative recovery in patients with urinary tract stones, markedly enhancing both psychological and physiological aspects [15, 16]. The current study demonstrated that HAMD and HAMA scores in the study group were lower than those in the control group after nursing intervention ($P<0.05$) (**Figure 2**), indicating that the TEN mode could improve the psychological well-being of patients with urinary tract stones undergoing HLL. The TEN mode emphasized individualized care and paid attention to the psychological needs of patients. By establishing strong patient rela-
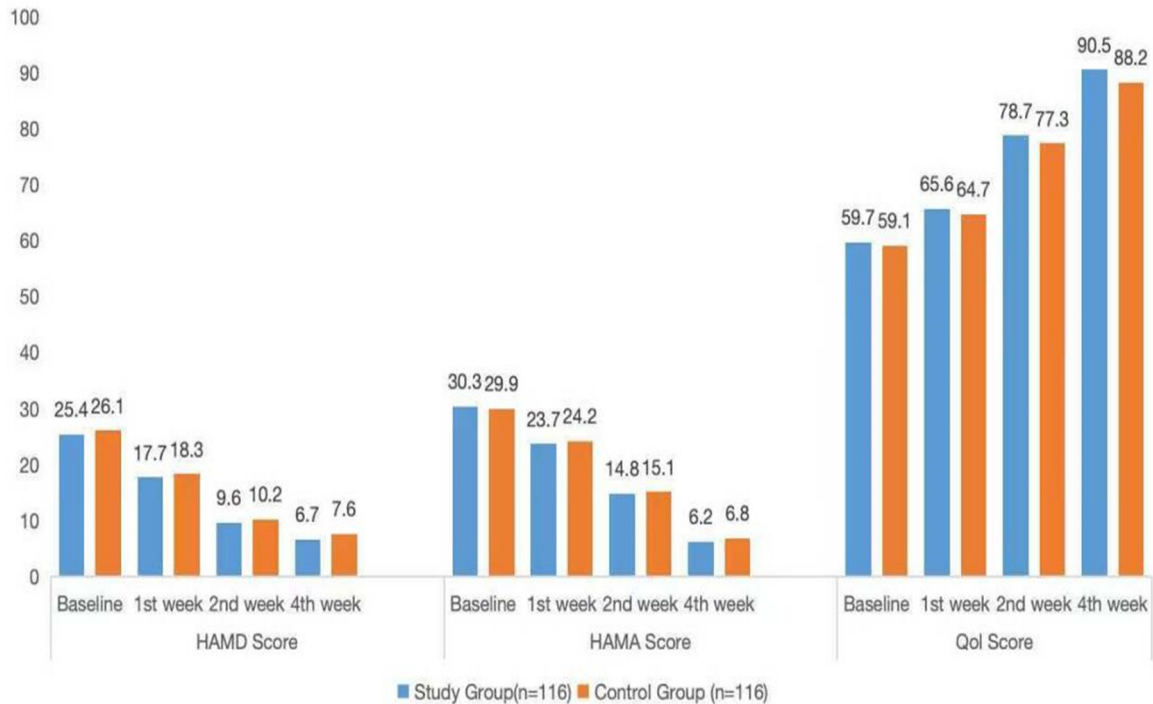
Figure 2. Bar Chart Diagram for HAMD, HAMA, and Qol Score.

Table 3. Comparison of complications between two groups

Variables, n (%)	Study Group (n=116)	Control Group (n=116)	χ^2-value	*P*-value
Low back pain	2 (1.7)	2 (1.7)	-	-
Bladder irritative symptom	1 (0.9)	3 (2.6)	-	-
Hematuria	1 (0.9)	3 (2.6)	-	-
Urinary tract infection	0 (0.0)	2 (1.7)	-	-
Double-J stent displacement or detachment	0 (0.0)	2 (1.7)	-	-
Total incidence of complications	4 (3.4)	12 (10.2)	4.296	0.038*

*P<0.05.

tionships and effective communication, the nursing team gained a deeper understanding of their negative emotions and concerns, allowing the implementation of appropriate nursing interventions to improve patient satisfaction and sense of security, and alleviate anxiety and depression. The TEN mode included a fixed on-site follow-up system, with the nursing team conducting regular follow-up visits to monitor postoperative recovery and quality of life. By regularly evaluating indicators such as psychological status, pain level, and life function, the nursing team can promptly identify problems and intervene. Continuous support and care helped patients develop a positive psychological attitude, enhance their ability to cope with

difficulties and stress, and alleviate anxiety and depression.

The recovery of postoperative physical condition was closely related to the nursing mode [17]. The current study showed that the Qol score in the study group was significantly higher than that in the control group at Weeks 2 and 4 (*P*<0.05) (**Figure 2**). This finding also indicated that the TEN mode could significantly improve the rehabilitation outcomes and Qol of patients with urinary tract stones, providing them with higher quality care and support, thus demonstrating the importance and effectiveness of this mode. The TEN mode emphasized continuous patient education, providing com-

prehensive education throughout the perioperative period and rehabilitation. By guiding patients on appropriate dietary adjustments, rehabilitation exercise techniques, and self-care skills, it promoted recovery. Regular follow-up with the extended care team monitors patient recovery and outcomes. Regular assessments promptly identify and resolve potential problems or complications that may arise during rehabilitation. Early intervention accelerates patient recovery and shortens hospitalization time [18, 19].

Meanwhile, the overall incidence of complications in the study group was significantly lower than that in the control group (3.4% vs. 10.2%, P=0.038). Patients in the control group received routine care and undifferentiated interventions but not effective psychological intervention. During discharge and rehabilitation, patients lacked self-management and follow-up care. Meanwhile, the TEN mode used online chat platforms and on-site follow-up to deliver health education and psychological counseling, thus alleviating negative emotions. In addition, tracking nursing care by the nursing team improved patient self-management, cultivated good habits such as lifestyle and diet, promoted disease recovery, and improved Qol [20, 21].

Limitations to the study included the short follow-up period, which might have affected outcomes. The study relied on patient complaints for symptom evaluation, which may have introduced subjective deviation. Its single-center design and small sample size may have introduced sampling error. Therefore, large-scale, multicenter, prospective studies are required to validate the findings. Ideal procedures are likely to be formulated through long-term clinical application and observation.

Conclusions

The TEN mode improves psychological well-being and Qol in urinary tract stone patients undergoing HLL, accelerates recovery, reduces complications, and enhances self-care. This method is safe and reproducible in clinical practice; however, large-scale, multicenter, prospective studies are required to prove these conclusions.

Disclosure of conflict of interest

None.

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