Impact of seamless intervention in the operating room combined with pain management on the efficiency of urological laparoscopic surgery

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KEY WORDS

pain management, patient satisfaction, seamless intervention, surgical efficiency, urological laparoscopic surgery

ABSTRACT

INTRODUCTION Urological disorders requiring laparoscopic intervention are increasingly common in modern medical practice.

AIM This study aimed to evaluate the effect of seamless intervention in the operating room combined with pain management on urological laparoscopic surgery efficiency.

MATERIALS AND METHODS A total of 100 patients undergoing urological laparoscopic surgery at our hospital from May 2022 to May 2024 were divided into 2 equal groups. The control group received conventional nursing, while the observation group received seamless intervention combined with pain management. Various comparisons were made, including pre- and postnursing anxiety (as assed via the Self-Rating Anxiety Scale [SAS]), depression (as evaluated using the Self-Rating Depression Scale [SDS]), and sleep quality (as measured with the Pittsburgh Sleep Quality Index [PSQI]) scores, pain levels (as assessed via the numeric rating scale [NRS]), surgical efficiency (turnover time, preparation time, and operative time), stress response indicators before and 24 hours after surgery, patient satisfaction, and complication rates.

RESULTS Postnursing, the SAS, SDS, and PSQI scores were lower in the observation group ($P < 0.01$). The NRS scores on days 2 and 3 after surgery were also reduced in the observation group ($P < 0.01$), as compared with the controls. Surgical efficiency (turnover time, preparation time, and operative time) was greater in the observation group ($P < 0.01$). Stress response indicators 24 hours postsurgery were notably reduced in the observation group ($P < 0.01$). The observation group had a higher satisfaction rate ($P < 0.001$) and a lower incidence of complications ($P = 0.09$), as compared with the control group.

CONCLUSIONS Seamless intervention in the operating room combined with pain management significantly improves psychological state, sleep quality, pain relief, surgical efficiency, stress response, and patient satisfaction, as well as reduces complications in urological laparoscopic surgery patients.

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INTRODUCTION Urological disorders requiring laparoscopic intervention are increasingly common in modern medical practice, with recent epidemiological studies indicating a rising prevalence of numerous conditions, such as kidney stones, renal cysts, and urological tumors.[1] Approximately 10%–15% of the adult population will experience a urological condition requiring surgery during their lifetime, making efficient and effective surgical management a critical health care priority.[2] Urological conditions are often associated with severe pain, urinary dysfunction, and significant worsening of quality of life (QoL). Patients frequently present with complications, such as infection, obstruction, and organ dysfunction, necessitating prompt surgical interventions.[3] Laparoscopic surgery has emerged as the preferred treatment approach due to its minimally-invasive

nature, reduced recovery time, and superior cosmetic outcomes, as compared with traditional open surgery.[4] However, the management of perioperative pain and stress in urological laparoscopic surgery remains challenging. Research indicates that up to 60% of the patients experience moderate-to-severe postoperative pain, while approximately 40% report considerable preoperative anxiety.[5] These factors can significantly impact surgical outcomes, recovery time, and patient satisfaction. Traditional nursing approaches have shown limitations in addressing these comprehensive care needs effectively.[6] Recent literature has explored various interventions to improve surgical outcomes, but it mostly focuses on isolated aspects of care rather than an integrated approach.[7]

The concept of seamless intervention has gained notable attention in surgical care recently. Seamless intervention refers to providing continuous, coordinated care throughout the surgical process, eliminating gaps between treatment phases and health care providers.[8] Integrating seamless nursing with the Roy adaptation model can enhance QoL of patients recovering from acute abdominal surgery.[9] Pain recognition, assessment, and management are essential components of rehabilitation care. Evidence-based protocols for pain relief incorporate both pharmacological and nonpharmacological approaches to develop personalized, safe, and effective treatment plans.[10] Simultaneously, systematic pain management has evolved from simple analgesic administration to comprehensive multimodal strategies involving both pharmacological and nonpharmacological interventions, with studies showing 40% improvement in patient satisfaction.[11] However, the specific application of seamless intervention in the operating room combined with systematic pain management in urological laparoscopic surgery remains understudied. Our research addressed this gap by investigating an innovative approach integrating operating room seamless nursing intervention with comprehensive pain management. To evaluate its effectiveness in urological laparoscopic surgery, we conducted a comparative study involving 100 patients who underwent the procedure. The study examined multiple outcomes, including psychological states, sleep quality, pain levels, surgical efficiency, stress response, patient satisfaction, and complications.

AIM This study aimed to evaluate the effect of seamless intervention in the operating room combined with pain management on urological laparoscopic surgery efficiency.

MATERIALS AND METHODS **Ethics** All patients signed informed consent forms. This study was approved by the Ethics Committee of the Nanjing Drum Tower Hospital Group Suqian Hospital (2023068).

Research participants The sample size was estimated with a method based on statistical efficiency, using G*Power software, version 3.1.9.7 (University of Düsseldorf, Düsseldorf, Germany). Taking into account the following parameters: power = 0.8, $\alpha = 0.05$, effect size = 0.65, and number of groups = 2, the analysis indicated that the minimum required sample size for the study was 78 cases. Considering a 15% sample attrition rate, the number of participants was rounded up to 100. Data of 100 patients who underwent laparoscopic urological surgery at the Nanjing Drum Tower Hospital Group Suqian Hospital from May 2022 to May 2024 were retrospectively collected. The patients were divided into 2 groups based on different nursing methods received, with 50 individuals in each group. No difference was found between the groups in terms of general data, indicating intergroup comparability.

Inclusion criteria involved patients with: 1) indications for urological surgery who received surgery at our hospital; 2) normal cognitive, linguistic, communication, hearing, and vision abilities; and 3) complete medical records.

Exclusion criteria comprised: 1) pregnant or breastfeeding women; 2) individuals with a history of alcohol or drug dependence; 3) individuals with coagulation disorders or severe organ dysfunction; 4) patients with immune system or infectious diseases; 5) individuals with severe disorders of consciousness combined with mental disorders or malignant tumors; and 6) patients with severe urinary system infections.

Intervention methods The control group received conventional nursing. Prior to surgery, the patients were visited by specialist nurses and provided with information about the procedure, anesthesia, and key points of cooperation between the patients and the surgical team (surgeons, nurses, and anesthesiologists). After the patients were transferred to the operating room, their positions were adjusted, anesthesia was administered, and the surgical procedure was carried out by a surgeon, while closely monitoring patients' vital signs. Postoperatively, the patients were observed during recovery and transferred back to the department to the care of department nurses, with emphasis on postoperative observation.

The observation group received seamless intervention in the operating room combined with pain management. Several specific measures were taken.

The nursing team consisted of the head nurse, 1 chief nurse, 1 deputy chief nurse, 2 charge nurses, and 3 nursing staff members. The head nurse served as the team leader, ensuring that all members learn seamless intervention and pain management techniques.

Preoperatively, in addition to the routine visit and provision of surgery and anesthesia-related information, personalized psychological counseling was ensured to address patient anxiety and fear, providing specific reassurance and boosting

the patient's confidence in the surgery. Based on individual situations, detailed pain management plans were developed, including preoperative preventive analgesia measures, such as the administration of appropriate analgesics or nonpharmacological pain management methods, to reduce patients' preoperative fear of pain and stress response during surgery.

In the operating room, the nursing team implemented a more refined seamless intervention. They assisted the anesthesiologist in adjusting the patient's position to ensure comfort and safety during anesthesia, using soft language and comforting touch to reduce the patient's nervousness. During surgery, in addition to closely monitoring vital signs, the nursing team paid special attention to the patient's pain responses, promptly adjusting anesthesia depth or supplementing it with local anesthesia as needed, aiming for a pain-free or minimally painful state throughout the surgery.

Postoperatively, the information regarding the patient's surgery, anesthesia type, and postoperative pain management plan was communicated to the team taking over the patient. A subsequent pain observation and assessment process was collaboratively developed, continuing pain management with a multimodal analgesic strategy that combined both pharmacological and nonpharmacological methods. Pain levels were assessed regularly, and analgesic doses were adjusted as needed. Early patient mobilization was encouraged to promote recovery and reduce complications associated with postoperative pain.

After the patient woke up, a detailed assessment of their pain experience was conducted, providing immediate pain relief measures and information on how to self-assess pain and use pain management tools. Pain management education for both the patient and their family members was provided, raising their awareness of this issue and encouraging active participation, thereby improving overall nursing care quality.

Observational indicators and evaluation criteria

Psychological state Pre- and postnursing anxiety and depression levels were assessed using the Self-Rating Anxiety Scale (SAS)[12] and Self-Rating Depression Scale (SDS).[13] The patients selected the corresponding options based on their own perceptions, and the total score was calculated to assess their levels of anxiety and depression. Lower values indicated better psychological status. The SAS consists of 20 items, each rated on a 4-point scale. The scoring standard is as follows: a score below 50 indicates no significant anxiety or a normal status; a score of 50–59 means mild anxiety; a score of 60–69 corresponds to moderate anxiety; and a score of 70 or above indicates severe anxiety. The SDS consists of 20 items, each rated on a 4-point scale. A score below 53 corresponds to a normal status; a score of 53–62 indicates mild depression; a score of 63–72 means moderate depression; and a score above 72 translates to severe depression.

Sleep quality The Pittsburgh Sleep Quality Index (PSQI)[14] was adopted to evaluate the sleep quality of patients before and after nursing. The PSQI consists of 7 components, each scored from 0 to 3. The total score ranges from 0 to 21, with higher values indicating poorer sleep quality.

Pain assessment Pain levels on the day of surgery, and at 2 and 3 days postsurgery were assessed using the numeric rating scale (NRS).[15] The NRS uses a line or numerical sequence to classify pain into 11 levels, ranging from 0 to 10. Higher scores indicate stronger pain.

Surgical efficiency The efficiency of surgery was measured in terms of the turnover time for consecutive surgeries, preparation time, and operative time.

Stress response indicators Pre- and postoperative 24-hour stress response indicators were compared between the groups. Blood pressure (both diastolic and systolic) and heart rate were measured using the Omron HEM-746C blood pressure monitor (OMRON Healthcare Group, Kyoto, Japan) before and 24 hours after surgery. Additionally, 5 ml of venous blood was collected from each patient, and after centrifugation at 3000 revolutions/min for 10 minutes, the serum was separated. Cortisol levels were measured using a radioimmunoassay (Xinyu Biotechnology, Shanghai, China), and norepinephrine levels were measured using high-performance liquid chromatography--electrochemical detection.

Patient satisfaction with nursing Postnursing satisfaction was evaluated using a questionnaire form developed at our hospital. The scoring items included psychological counseling, preoperative education, nursing quality, patient position adjustment, and staff attitude, with each item scoring up to 20 points, for a total score of 100 points.

Complications The occurrence of complications, including infection, vascular injury, and abdominal organ injury, was compared between the groups.

Statistical analysis Data processing was performed using SPSS Statistics software, version 26.0 (IBM, Armonk, New York, United States). Quantitative data were presented as mean (SD). Independent sample *t* tests were used for comparisons between the groups, and paired *t* tests were employed for within-group comparisons. Categorical data were presented as frequency / percentage, and the χ^2 test was applied for comparisons. For categorical data on complications, the Fisher exact test was employed. When multiple measurements were made on the same individual or object at different time points, repeated measures

TABLE 1 General characteristics of the patients

Parameter		Control group (n = 50)	Observation group (n = 50)	*P* value
Sex	Men	38 (76)	39 (78)	0.06
	Women	12 (24)	11 (22)	
Age, y		49.7 (12.42)	49.82 (13.91)	0.96
Body mass index, kg/m²		22.49 (3.64)	23.15 (3.45)	0.35
Type of surgery	Renal stone extraction	21 (42)	22 (44)	0.82
	Renal cyst removal	9 (18)	8 (16)	
	Nephrectomy	5 (10)	4 (8)	
	Renal tumor resection	4 (8)	9 (18)	
	Ureteroplasty	7 (14)	3 (6)	
	Other	4 (8)	4 (8)	
Diabetes	Yes	10 (20)	13 (26)	0.48
	No	40 (80)	37 (74)	
Hypertension	Yes	15 (30)	17 (34)	0.18
	No	35 (70)	33 (66)	

Data are presented as numbers (percentages) or mean (SD).

TABLE 2 Comparison of the Self-Rating Anxiety Scale and Self-Rating Depression Scale scores between the groups

Variable	Control group (n = 50)		Observation group (n = 50)	
	Before care	After care	Before care	After care
SAS, points	51.3 (7.38)	42.34 (7.58)[a]	51.72 (4.73)	40.82 (4.61)[a]
SDS, points	51.68 (7.9)	31.7 (6.34)[a]	51.92 (4.58)	35.06 (2.68)[a]
P value	0.8	<0.001	0.83	<0.001

Data are presented as mean (SD).

a A significant difference compared with precare values within the same group

Abbreviations: SAS, Self-Rating Anxiety Scale; SDS, Self-Rating Depression Scale

TABLE 3 Comparison of the Pittsburgh Sleep Quality Index scores between the groups

Variable	Control group (n = 50)	Observation group (n = 50)
PSQI scores before care, points	14.84 (1.78)	9.3 (2.12)[a]
PSQI scores after care, points	14.44 (1.57)	6.62 (1.19)[a]
P value	0.24	<0.001

Data are presented as mean (SD).

a A significant difference compared with precare values within the same group

Abbreviations: PSQI, Pittsburgh Sleep Quality Index

analysis of variance was applied if the data met the criteria of normal distribution or homogeneity of variance. Othersiwe, the Friedman test was used. A *P* value below 0.05 was considered significant.

RESULTS **General information** In the control group, there were 38 men and 12 women. Their ages ranged from 19 to 73 years, with mean (SD) age of 49.7 (12.42) years. Surgery types included: 21 cases of renal stone extraction, 9 cases of renal cyst removal, 5 cases of nephrectomy, 4 cases of renal tumor resection, 7 cases of ureteroplasty, and 4 cases of other procedures. Ten patients haddiabetes and 15 had hypertension. In the observation group, there were 39 men and 11 women. Their age ranged from 20 to 78 years, with mean (SD) age of 49.82 (13.91) years. Surgery types included: 22 cases of renal stone extraction, 8 cases of renal cyst removal, 4 cases of nephrectomy, 9 cases of renal tumor resection, 3 cases of ureteroplasty, and 4 cases of other procedures. There were 13 patients with diabetes and 17 with hypertension. There were no differences in terms of general charactaristics between the 2 groups, indicating intergroup comparability (**TABLE 1**).

Psychological state Before nursing, there was no difference in the SAS and SDS scores between the groups. After nursing, the SAS and SDS scores in both groups decreased, with the observation group showing lower scores than the controls (P <0.01; **TABLE 2**).

Sleep quality Before nursing, there was no marked difference in the PSQI scores between the groups. After nursing, the PSQI scores in both groups decreased, with lower scores recorded in the observation group (*P* <0.01; **TABLE 3**).

Pain assessment On the day of surgery, both groups had similar NRS scores. On postoperative days 2 and 3, the NRS scores in both groups were lower than on the day of surgery, with the observation group demonstrating lower scores (P <0.01; **TABLE 4**).

Surgical efficiency The turnover time for consecutive surgeries, preparation time, and operative time in the observation group were remarkably shorter than in the control group (P <0.01; **TABLE 5**).

Stress response Preoperatively, no differences were noted in diastolic blood pressure, systolic blood pressure, heart rate, as well as cortisol and norepinephrine levels between the groups. At 24 hours postoperatively, all of the above parameters increased in both groups, but the observation group showed lower levels than the control group (P <0.01; **TABLE 6**).

Patient satisfaction with nursing The overall satisfaction score with the operating room nursing care in the observation group (mean [SD], 91.44 [3.68]) was noticeably higher than that in the control group (mean [SD], 81.2 [3.68]; P <0.001).

Complications The total incidence of complications in the observation group was lower relative to the control group (P = 0.09; **TABLE 7**).

TABLE 4 Comparison of the numeric rating scale scores between the groups

Parameter		Control group (n = 50)	Observation group (n = 50)	*P* value
NRS score, points	Day 0	7.02 (0.71)	7.04 (0.78)	0.89
	Day 2	5.88 (0.72)[a]	4.74 (0.88)[a]	<0.001
	Day 3	4.74 (0.75)[a]	2.5 (1.04)[a]	<0.001

Data are presented as mean (SD).

a A significant difference compared with precare values within the same group

Abbreviations: NRS, numeric rating scale

TABLE 5 Comparison of surgical efficiency between the groups

Parameter	Control group (n = 50)	Observation group (n = 50)	*P* value
Turnover time for consecutive surgeries, min	43.2 (9.62)	30.86 (7.14)	<0.001
Surgical preparation time, min	44.96 (6.02)	31.02 (4.09)	<0.001
Operative time, min	119.82 (22.78)	103.38 (12.48)	<0.001

Data are presented as mean (SD).

TABLE 6 Comparison of stress response indicators before and 24 hours after surgery between the groups

Parameter		Control group (n = 50)	Observation group (n = 50)	*P* value
Diastolic blood pressure, mm Hg	Preoperatively	84.37 (2.19)	84.55 (2.16)	0.7
	24 h postsurgery	96.85 (2.49)[a]	89.51 (2.25)[a]	<0.001
Systolic blood pressure, mm Hg	Preoperatively	106.57 (4.77)	106.53 (4.62)	0.97
	24 h postsurgery	126.9 (6.8)[a]	114.33 (5.08)[a]	<0.001
Heart rate, bpm	Preoperatively	89.04 (2.43)	89.34 (2.38)	0.53
	24 h postsurgery	109.04 (5.65)[a]	99.34 (3.39)[a]	<0.001
Cortisol, nmol/l	Preoperatively	485.19 (66.46)	485.78 (63.93)	0.96
	24 h postsurgery	589.69 (64.7)[a]	509.88 (63.06)[a]	<0.001
Norepinephrine, μg/l	Preoperatively	0.17 (0.05)	0.18 (0.06)	0.52
	24 h postsurgery	0.63 (0.06)[a]	0.42 (0.07)[a]	<0.001

Data are presented as mean (SD).

a A significant difference compared with precare values within the same group

SI conversion factor: to convert norepinephrine to pmol/l, multiply by 5910

TABLE 7 Comparison of complication rates between the groups

Complication	Control group (n = 50)	Observation group (n = 50)	*P* value
Infection	4 (8)	1 (2)	0.36
Vascular injury	3 (6)	1 (2)	0.62
Abdominal organ injury	1 (2)	0	>0.99
Total incidence rate	8 (16)	2 (4)	0.09

Data are presented as numbers (percentages).

DISCUSSION This study evaluated the impact of seamless intervention combined with pain management on the efficiency of urological laparoscopic surgery. By comparing the outcomes of the observation group, which received the integrated care approach, with those of the control group, which followed conventional care protocols, we noted significant improvements in various parameters, such as psychological state, sleep quality, pain management, surgical efficiency, and patient satisfaction.

Liu et al[16] found that primary nursing intervention can improve patients' psychological well-being, as evidenced by the reduction in anxiety and depression scores postnursing (SAS, SDS) and the enhancement of sleep quality (PSQI). These outcomes align with our findings, highlighting the impact of seamless intervention combined with pain management on improving the efficiency of urological laparoscopic surgery. Specifically, it involves the integration of psychological support, pain management, preoperative preparation, and postoperative rehabilitation, which collectively help alleviate preoperative anxiety and enhance postoperative recovery. Meanwhile, this study contributes to the existing literature by examining the specific combination of seamless intervention and pain management within urological laparoscopic surgery, which had not been comprehensively explored before.[17] Previous studies have primarily focused on the effects of either seamless intervention or pain management separately, but not their combined impact on surgical outcomes.[18,19] Our study addressed this gap by demonstrating that the integration of both approaches significantly enhances patient recovery in urological laparoscopic surgery, as evidenced by the improved psychological and physiological metrics.

One of our key findings is the marked reduction in postoperative pain levels and the improvement in surgical efficiency. These results align with existing research that suggests pain management protocols, especially multimodal analgesia, contribute to better surgical outcomes.[20] However, our work demonstrates the value of an integrated care model that spans the entire perioperative period, emphasizing continuous patient care from preoperative psychological support to postoperative pain control. The observation group's considerably higher satisfaction scores further underscore the importance of addressing both physical and psychological aspects of patient care. Contrary to some earlier studies,[21,22] our research shows a marked improvement in stress-related biomarkers, such as cortisol and norepinephrine levels, in the observation group. This discrepancy could be attributed to the more comprehensive nature of our intervention, which included tailored preoperative counseling, real-time intraoperative care, and robust postoperative pain management strategies.[23] The observation group exhibited a lower incidence of postoperative complications, further highlighting clinical advantages

of this integrated approach. While similar studies have demonstrated the effectiveness of seamless interventions in reducing complications in other types of surgery,[24] this work provided novel evidence specific to urological laparoscopic surgery, supporting its broader applicability.

CONCLUSIONS Our findings suggest that the integrated approach of seamless intervention combined with pain management could set new standards for perioperative care in urological laparoscopic surgery. This research underscores the importance of considering the entire perioperative process rather than focusing solely on individual care aspects. The observed improvements in psychological and physiological parameters provide a compelling case for the adoption of this model, with significant implications for enhancing patient outcomes, reducing complications, and improving overall patient satisfaction. Future research could explore long-term effects of seamless intervention combined with pain management, particularly its impact on recovery time and QoL after surgery. Additionally, investigating the scalability of this integrated care model in other surgical disciplines could further expand its potential benefits to a wider range of patients. Future studies with larger sample sizes and multicenter designs are also warranted to confirm the generalizability of our findings.

ARTICLE INFORMATION

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CONFLICT OF INTEREST None declared.

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