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Application effect of standardized nursing process of abdominal drainage tube in cholelithiasis: a single-center retrospective cohort study

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Abstract

Background and aims: Although abdominal drainage tubes have been widely used to treat cholelithiasis, complications still affect patients' prognoses. There is no Standardized Nursing Process (SNP) for abdominal drainage tubes after Laparoscopic cholecystectomy (LC). This study aims to observe the clinical efficacy and explore the feasibility of SNP intervention for abdominal drainage tubes in cholelithiasis patients after LC.

Methods This retrospective study included the patients with cholelithiasis admitted to Xishan People's Hospital of Wuxi City between Jan 2023 and Aug 2024. Patients were separated into Standardized Nursing Process (SNP) group and non-Standardized Nursing Process (non-SNP) group. The outcomes were compared between the two groups, and Univariate and multivariate analyses were performed to analyze the factors associated with SNP. P values less than 0.05 were considered statistically significant.

Results Among a total of 264 patients with cholelithiasis who were included in the study, 147 patients were treated with SNP, and the other 117 patients were treated without SNP. Compared with non-SNP, multivariate analysis suggested that SNP was an independent factor linked to alleviation of postoperative pain (OR = 0.22, 95%CI: 0.13–0.36) ($P < 0.001$), strongly associated with the activity rate of getting out of bed within 24 h (OR = 2.28, 95%CI:1.33–3.91), effectively associated with a lower incidence of drainage tube outlet leakage and post-extubation leakage. Importantly, SNP management correlated with higher patient satisfaction ($p < 0.001$).

Conclusions SNP implementation correlated with improved activity rate of getting out of bed within 24 h after LC, fewer occurrence of post-extubation leakage, reduced postoperative pain and higher satisfaction rates.

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Introduction

Abdominal drainage tube is an important means of treating diseases and maintaining the life safety of patients, and widely used in the field of surgery [1, 2]. Abdominal drainage is mainly divided into therapeutic and preventive, used to drain blood and purulent secretions out of the body. In contrast, abdominal drainage after surgery for hepatobiliary diseases is mainly preventive drainage [3]. Placement of a preventive abdominal drain after hepatobiliary and pancreatic surgery is the most common strategy to monitor postoperative complications directly [1, 4, 5]. If unplanned detachment, blockage, breakage or damage occurs, it may lead to complications, prolonged hospitalization, increased medical costs, medical disputes, and even increased mortality rate [2].

Laparoscopic cholecystectomy (LC) is the gold standard for symptomatic gallstones [4, 6]. However, even though LC is a minimally invasive surgery, there are still related complications, including biliary injury, bleeding, acid-base imbalance, abnormalities of the cardiopulmonary vascular system, and even liver damage [6, 7]. Previous studies have reported that primary suture after common bile duct exploration is less invasive than T-tube drainage in the surgical strategy for treating cholelithiasis and choledocholithiasis [4, 8]. Additionally, some studies indicated that abdominal drainage did not seem to prevent postoperative complications. On the contrary, drainage-related complications, such as fever, wound infection, wound hernia, or bleeding, may cause unnecessary clinical symptoms to patients [9, 10]. However, these studies focused on observing the relevant conditions of biliary surgery and did not pay more attention to the effectiveness and rationality of abdominal drainage tubes during nursing process management. Moreover, improper placement of the drainage tube may also lead to secondary infection, which may cause increased fluid accumulation in the abdominal cavity and aggravate the foreign body reaction of the drainage tube [11]. While, the research focuses on whether it is necessary to place an abdominal drainage tube after biliary surgery routinely, and there has been ongoing controversy [5, 12–14]. In fact, abdominal drainage tubes are considered to be a strategy that should be taken for granted, but little attention was paid to the strategy of abdominal drainage tubes during nursing process management [15, 16].

Therefore, standardized management of abdominal drainage tubes has important clinical significance for the rapid recovery of patients after LC surgery. Herein, we observed and evaluated the efficacy of standardized nursing process management of drainage tubes in patients undergoing LC in a single center, which may provide clinical feedback and a theoretical basis for improving nursing strategies in the later stage.

Methods

Study design and patients

Patients with cholelithiasis admitted at the Xishan People's Hospital of Wuxi City between Jan 2023 and Aug 2024 were included in this retrospective cohort study. Our team initiated the Standardized Nursing Process in November 2023. Consequently, patients admitted between January 2023 and October 2023 were categorized into the non-SNP group, while those admitted from November 2023 to August 2024 were classified into the SNP group.

Inclusion criteria (1) Patients with cholelithiasis. (2) Aged from 18 to 80. (3) Patients underwent abdominal drainage tube placement (both SNP group and non-SNP group) after LC surgery. (4) Preoperative ultrasonography or magnetic resonance cholangiopancreatography (MRCP) showed no significant bile duct stenosis, bile duct variation, or intrahepatic bile duct stones; (5) No liver or biliary tract tumors were found in previous examinations; (6) No signs of cholangitis such as thickening or edema of the bile duct wall.

Exclusion criteria (1) Patients undergoing surgery were converted from LC to open surgery. (2) Patients who underwent LC without drainage tube placement. (3) Patients who underwent residual cholecystectomy. (4) Uncorrectable coagulation disorders. (5) Anesthesia intolerance. (6) Pregnant and breastfeeding women. (7) Lost to follow-up. The study complied with the Declaration of Helsinki and was approved by the Ethics Committee of the Xishan People's Hospital of Wuxi City (No. xs2024ky074). The requirement for informed consent was waived.

Surgical technique

All surgeries were completed by the same surgical team. Surgical procedures of LC were performed as previously published [17–19]. All LC operations were performed as an American Society of Anesthesiologists (ASA) grade [20].

Standardized nursing process

In this study, all patients included in the SNP group were cared for and given feedback by a unified nursing team according to the SNP management. The focus of SNP includes Position, Properties of drainage fluid, Peritubular skin condition, and General observation. The SNP nursing team analyzes and gives feedback every 8 h, making corresponding adjustments and/or treatments. The Position of the drainage tube is an important factor in maintaining the patency of peritoneal drainage. If it is not patency (NO), it needs to be adjusted in time according to the specific situation, such as whether it is Blocking, Twist/Fold/Pressure, Dislodged, or Broken/damaged. Based on this, timely feedback and medical adjustments are required, and the attending physician is reported to take timely measures when necessary. Properties of drainage fluid are divided into Clear and Turbid. According to the properties of the drainage fluid, culture and dosage are taken when necessary to facilitate timely feedback to the attending physician. Peritubular skin condition mainly includes observations of Redness, Heat, Swelling, and Pain, subsequent information is recorded and given timely feedback. The general observation is divided into Vital signs and Feeling of the drainage tube. Through the observation and SNP care of this part, the patient's pain, and discomfort combined with clinical satisfaction information will be fed back. Through this time loop, procedural feedback, and analysis of the information, medical staff take measures to make reasonable adjustments, which may promote patient comfort and satisfaction (Fig. 1).

Data collection

Baseline information

The baseline information of the patients included Gender (Female/Male), Age(year), BMI (Body mass index), Hypertension (No/Yes), Diabetes (No/Yes), Surgeon(A/B), Operating time(min).

Hematological indicators

The hematological indicators were collected prior to the operation and on the third postoperative day, including Leukocyte(10^9/L), C-reactive protein (CRP), Heparin Binding Protein (HBP), Direct bilirubin (DB), Total bilirubin (TB), Alanine transaminase (ALT), Aspartate transaminase (AST).

Postoperative information

Postoperative information included Activity rate of getting out of bed within postoperative-24-hour (No/Yes), Drainage tube outlet Leakage (No/Yes), Drainage tube Dislodged (No/Yes), Postextubation leakage (No/Yes), Postextubation infection (No/Yes), Days (Drainage tube), Total inflow.

Process of collecting VAS pain pcores: (postoperative 24 h)

Preparation: Provide a 10 cm horizontal line labeled "No Pain (0)" to "Worst Pain (10)"; Patient Education: Explain that 0 = no pain, 10 = unbearable pain. Use visual aids; Assessment: Ask the patient to mark their pain level on the line independently; Recording: Measure the distance from "0" to the mark (0–10 scale) and document the score, pain location, characteristics, and functional impact.

Nursing satisfaction

The nursing satisfaction questionnaire was used for evaluation, covering aspects such as nursing skills, nursing attitude, psychological needs, and physiological needs. The scale adopted a 100-point scoring system: scores > 90 indicated "Very satisfied" 76–90 denoted "Good" 61–75 represented "Common" 46–60 signified "Dissatisfied," and scores ≤ 45 were categorized as "Very dissatisfied.

Statistical analysis

SPSS 22.0 (IBM, Armonk, NY, USA) was used for data analysis. The Shapiro normality test was used to determine the normality of the sample data for continuous (quantitative) data. If the data conformed to the normal distribution, the mean ± standard deviation was used for expression. The independent sample t-test was used for comparison between the two groups. If the data did not conform to normal distribution, the median (25% quantile, 75% quantile) was used, and the comparison between the two groups was conducted using the Wilcox test. Categorical (qualitative) data were described statistically using frequency (percentage), and comparisons between groups were performed by using the $\chi 2$ test or Fisher's exact test. Univariate and multivariate binary logistic regression analyses were performed by the application of the GLM function. Ordered categorical variables (VAS score and degree of satisfaction) were analyzed using ordered multinomial logistic regression models. In univariate logistic regression analysis, variables with p-values less than 0.05 are initially identified. If more than two such variables exist, they will be included in the multivariate regression analysis. However, if only one variable has a p-value less than 0.05, additional variables with p-values less than 0.2 will be screened and included in the multivariate regression analysis. Based on the median value of VAS score, patients were categorized into mild group and moderate group. According to the median value of degree of satisfaction, patients were divided into very satisfied group and not very satisfied group in logistic regression analyze. P-value less than 0.05 was considered statistically significant.

Results

Characteristics of the patients

A total of 728 patients diagnosed as cholelithiasis at Xishan People's Hospital of Wuxi City were initially identified between Jan 2023 and Aug 2024.

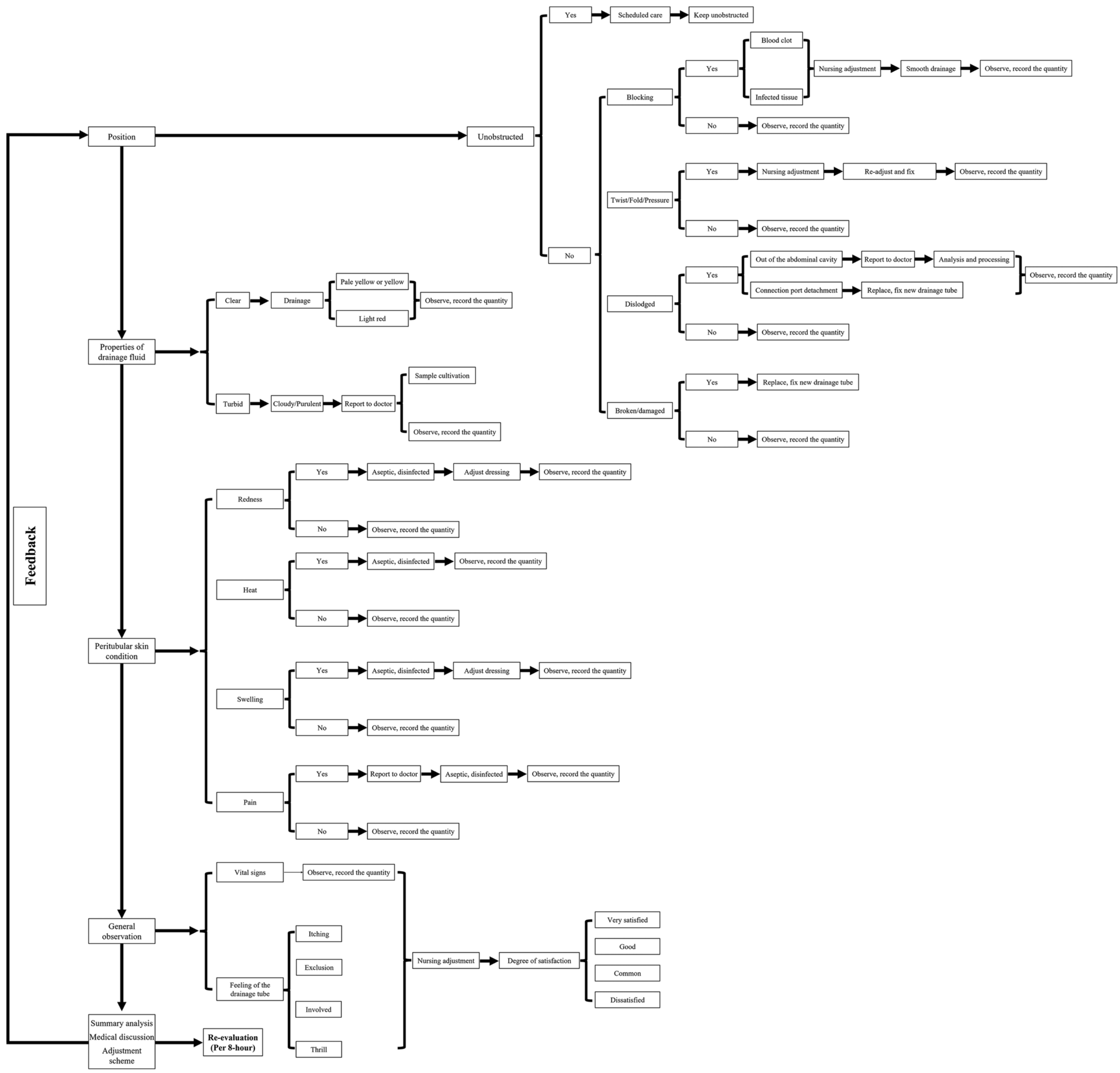

Fig. 1 Flow-chart of SNP. A representative process is promoted by loop feedback management combined with the treatment of adjusting abdominal drainage by nursing care

Among these patients, 38 patients were excluded because no surgery was performed. Three patients were excluded due to transferred to open surgery, 3 patients were excluded due to residual cholecystectomy, 16 patients were excluded because recurrent hemorrhoids, 337 patients were excluded because there is no abdominal drainage tube after surgery, 27 patients were excluded because lost to follow-up, and 56 elderly patients over 80 years old were also excluded. Finally, a total of 264 patients were included in this study. Of them, 147 patients were treated with SNP, while 117 patients were treated with non-SNP (Fig. 2). Compared non-SNP group to SNP group, there were no significant differences in terms of Gender, Age, BMI, Hypertension, Diabetes, Surgeon, Operating time, Leukocyte, CRP, HBP, Neutrophil, DB, TB, ALT, and AST ($P > 0.05$, Table 1).

SNP had no association with postoperative inflammatory markers and liver function

In order to investigate the association of SNP with postoperative inflammatory markers and liver function, we used the preoperative value divided by the value on the third day after surgery to express it as a "△". Comparing the ratio of preoperative and postoperative hematological

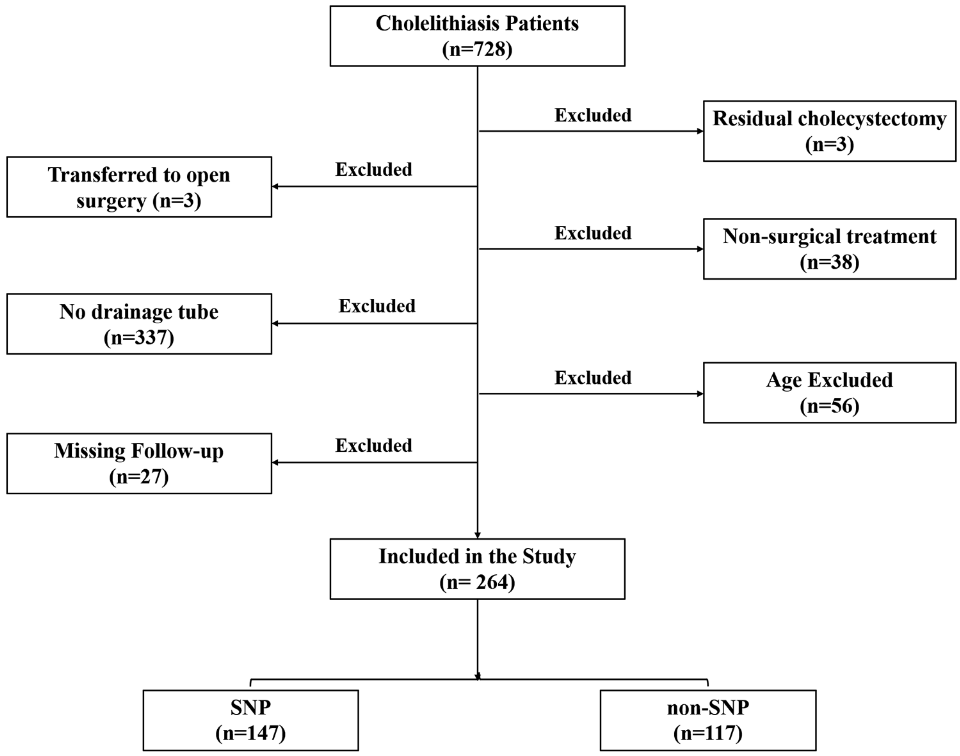

Fig. 2 Detailed Surgery Flow Diagram

Table 1 Characteristic and clinical features of patients

Items	non-SNP (*n* = 117)	SNP (*n* = 147)	*P* Value
Gender			0.644
Female	67 (57.26%)	80 (54.42%)	
Male	50 (42.74%)	67 (45.58%)	
Age(year)	61 (46,70)	56 (45,68.50)	0.216
BMI	24.34 (22.49,26.83)	24.97 (22.58,27.34)	0.613
Hypertension			0.419
No	96 (82.05%)	126 (85.71%)	
Yes	21 (17.95%)	21 (14.29%)	
Diabetes			0.606
No	101 (86.32%)	130 (88.44%)	
Yes	16 (13.68%)	17 (11.56%)	
Surgeon			0.056
A	62 (52.99%)	95 (64.63%)	
B	55 (47.01%)	52 (35.37%)	
Operating time	70 (55,90)	70 (55,90)	0.699
CRP	12.7 (5.50,24.10)	11.3 (4.60,32.80)	0.860
HBP	12.7 (9.32,23.50)	16.4 (6.70,33.95)	0.671
Neutrophil (%)	57.7 (50.40,65.30)	59.7 (53.30,68.05)	0.184
DB	4 (2.60,6.20)	4.1 (2.80,5.70)	0.682
TB	12.8 (9.20,16.90)	12.8 (10,20.85)	0.171
ALT	20 (14,32)	23 (13,47.50)	0.140
AST	19 (16,26)	19 (15,32)	0.727

BMI, Body mass index, CRP, C-reactive protein; HBP, Heparin Binding Protein; DB, Direct bilirubin; TB, Total bilirubin; ALT, alanine transaminase; AST, Aspartate transaminase

parameters between these two groups, there were no statistically significant differences in the items of Leukocyte, CRP, HBP, Neutrophil, DB, TB, ALT, and AST ($P > 0.05$, Table S1). These results indicated that SNP management is not associated with postoperative inflammatory markers and liver function.

Comparison of clinical characteristics related to drainage tubes

However, we further found that the SNP group had a higher activity rate of getting out of bed within the 24-hour postoperative period (%) and degree of satisfaction, a lower VAS score (postoperative 24 h), and a lower incidence of drainage tube outlet Leakage and post-extubation leakage ($P < 0.05$, Table 2).

SNP was significantly correlated with an increased activity rate of getting out of bed within postoperative-24-hour

Subsequently, we applied the GLM function for univariate and multivariate binary logistic regression analysis. Univariate regression analysis showed that SNP was closely related to the activity rate of getting out of bed within the 24-hour postoperative period (OR = 2.19, 95%CI:1.28–3.75). After adjusting for CRP in multivariate regression analysis, the results indicated that SNP was still strongly associated with the rate of getting out of bed within 24 h (OR = 2.28, 95%CI:1.33–3.91) ($P < 0.01$, Table 3). Therefore, SNP is an independent influencing

Table 2 Analysis of drainage tube related parameters after surgery

Items	non-SNP (*n* = 117)	SNP (*n* = 147)	*P* Value
Activity rate of getting out of bed within postoperative-24-hour (%)			0.004
No	89 (76.07%)	87 (59.18%)	
Yes	28 (23.93%)	60 (40.82%)	
VAS score (postoperative 24 h)			***< 0.001***
1	14 (11.97%)	49 (33.33%)	
2	62 (52.99%)	85 (57.82%)	
3	37 (31.62%)	13 (8.84%)	
4	4 (3.42%)	0 (0%)	
Drainage tube outlet Leakage			***0.013***
No	89 (76.07%)	129 (87.76%)	
Yes	28 (23.93%)	18 (12.24%)	
Drainage tube Dislodged			0.281
No	112 (95.73%)	145 (98.64%)	
Yes	5 (4.27%)	2 (1.36%)	
Post-extubation leakage			***< 0.001***
No	99 (84.62%)	144 (97.96%)	
Yes	18 (15.38%)	3 (2.04%)	
Post-extubation infection			1.000
No	117(100%)	147(100%)	
Yes	0(0%)	0(0%)	
Days (Drainage tube)	2 (1,2)	2 (1,3)	0.715
Total inflow	52 (25,95)	50 (25,85)	0.587
Degree of satisfaction			***< 0.001***
Dissatisfied	5 (4.27%)	3 (2.04%)	
Common	5 (4.27%)	2 (1.36%)	
Good	71 (60.68%)	18 (12.24%)	
Very satisfied	36 (30.77%)	124 (84.35%)	

VAS, Visual analogue scale

factor associatied with a higher activity rate of getting out of bed within the 24-hour postoperative period.

SNP was associated with lower postoperative 24-hour pain scores

Then, univariate regression analysis showed that SNP was negatively correlated with the VAS score (postoperative 24 h) (OR = 0.22, 95%CI: 0.13–0.37). After adjusting for the influencing factor of neutrophil percentage, the multivariate analysis suggested that SNP was an independent factor for reducing postoperative pain (OR = 0.22, 95%CI: 0.13–0.36) ($P < 0.001$, Table 4). This result suggests that the SNP pattern helps alleviate postoperative pain in patients with cholelithiasis after LC.

SNP was significantly correlated with reduced incidence of drainage tube outlet leakage and post-extubation leakage

Meanwhile, we also analyzed the relationship between SNP and drainage tube outlet leakage and post-extubation leakage. Univariate regression analysis showed that SNP could reduce the occurrence of drainage tube outlet leakage (OR = 0.44, 95%CI:0.23–0.85) ($P < 0.05$, Table S2), and negatively correlated with post-extubation leakage (OR = 0.11, 95%CI:0.03–0.4) ($P < 0.01$, Table S3). After excluding the confounding factors of DB and TB, multivariate analysis proved that SNP was an independent influencing factor associated with reduced incidence of postoperative drainage tube outlet leakage (OR = 0.48,

Table 3 Univariable and multivariable analysis for activity rate of getting out of bed within postoperative-24-hour

Items	Univariable		Multivariable	
	OR [95%CI]	*P* Value	OR [95%CI]	*P* Value
SNP	2.19[1.28,3.75]	***0.004***	2.28[1.33,3.91]	***0.003***
Gender	0.81[0.49,1.36]	0.431		
Age	1.00[0.98,1.02]	0.988		
BMI	1.02[0.98,1.07]	0.330		
Hypertension	0.67[0.32,1.40]	0.286		
Diabetes	0.60[0.26,1.40]	0.240		
Surgeon	1.36[0.81,2.28]	0.250		
Operating time	1.00[0.99,1.01]	0.851		
Leukocyte(10^9/L)	0.99[0.95,1.03]	0.632		
CRP	1.00[0.99,1.00]	0.172	0.99[0.99,1.00]	0.115
HBP	1.00[0.99,1.00]	0.308		
Neutrophil (%)	1.00[0.98,1.01]	0.510		
DB	1.01[0.99,1.03]	0.500		
TB	1.01[0.99,1.02]	0.268		
ALT	1.00[1.00,1.00]	0.263		
AST	1.00[1.00,1.00]	0.867		

BMI, Body mass index, CRP, C-reactive protein; HBP, Heparin Binding Protein; DB, Direct bilirubin; TB, Total bilirubin; ALT, alanine transaminase; AST, Aspartate transaminase

Table 4 Univariable and multivariable analysis for postoperative-24-hour VAS score

Items	Univariable		Multivariable	
	OR [95%CI]	*P* Value	OR [95%CI]	*P* Value
SNP	0.22[0.13,0.37]	***< 0.001***	0.22[0.13,0.36]	***< 0.001***
Gender	1.05[0.66,1.68]	0.826		
Age	1.00[0.98,1.01]	0.818		
BMI	0.98[0.95,1.01]	0.250		
Hypertension	0.80[0.42,1.51]	0.484		
Diabetes	0.53[0.26,1.11]	0.091	0.49[0.23,1.03]	0.060
Surgeon	1.31[0.81,2.11]	0.271		
Operating time	1.00[0.99,1.01]	0.347		
Leukocyte(10^9/L)	1.00[1.00,1.01]	0.873		
CRP	1.00[1.00,1.01]	0.710		
HBP	1.00[1.00,1.01]	0.697		
Neutrophil (%)	1.01[1.00,1.02]	0.052	1.01[1.00,1.02]	0.119
DB	1.00[0.98,1.02]	0.904		
TB	1.00[0.99,1.01]	0.617		
ALT	1.00[1.00,1.00]	0.711		
AST	1.00[1.00,1.00]	0.887		

BMI, Body mass index, CRP, C-reactive protein; HBP, Heparin Binding Protein; DB, Direct bilirubin; TB, Total bilirubin; ALT, alanine transaminase; AST, Aspartate transaminase

Table 5 Univariable and multivariable analysis for degree of satisfaction

Items	Univariable		Multivariable	
	OR [95%CI]	*P* Value	OR [95%CI]	*P* Value
SNP	10.78[6.12,19.64]	***<0.001***	7.81[4.08,15.46]	***<0.001***
Gender	0.89[0.55,1.45]	0.646		
Age	0.98[0.96,1.00]	***0.016***	0.98[0.96,1.00]	0.064
BMI	0.99[0.97,1.01]	0.337		
Hypertension	1.04[0.54,2.06]	0.920		
Diabetes	0.67[0.33,1.39]	0.276		
Surgeon	0.92[0.56,1.51]	0.734		
Operating time	1.00[0.99,1.01]	0.875		
Leukocyte(10^9/L)	1.00[0.99,1.01]	0.412		
CRP	1.00[1.00,1.01]	0.191		
HBP	1.01[1.00,1.01]	0.148		
Neutrophil (%)	1.00[0.99,1.01]	0.314		
DB	1.04[1.01,1.08]	***0.039***	1.00[0.90,1.09]	0.986
TB	1.03[1.01,1.06]	***0.012***	1.03[0.98,1.10]	0.368
ALT	1.00[1.00,1.00]	0.987		
AST	1.00[1.00,1.00]	0.442		
Activity rate of getting out of bed within postoperative-24-hour (%)	1.74[1.03,3.01]	***0.042***	1.08[0.57,2.06]	0.813
VAS score (24 h)	0.47[0.32,0.67]	***<0.001***	0.71[0.47,1.08]	0.113
Drainage tube outlet Leakage	0.23[0.12,0.43]	***<0.001***	0.28[0.14,0.57]	***0.001***
Postextubation leakage	0.15[0.06,0.34]	***<0.001***	0.49[0.19,1.28]	0.147
Drainage tube Dislodged	4.09[0.69,77.59]	0.195		

BMI, Body mass index, CRP, C-reactive protein; HBP, Heparin Binding Protein; DB, Direct bilirubin; TB, Total bilirubin; ALT, alanine transaminase; AST, Aspartate transaminase

95% CI: 0.25–0.93) ($P<0.05$, Table S2). At the same time, by excluding the influence of age and gender, SNP was found to be an independent factor associated with reduced incidence of post-extubation leakage (OR = 0.12, 95% CI: 0.03–0.41) due to multivariate analysis ($P<0.01$, Table S3).

SNP correlated with higher patient satisfaction

Finally, we analyzed the relationship between SNP and satisfaction. Univariate analysis showed that SNP was positively correlated with patient satisfaction (OR = 10.78, 95%CI:6.12–19.64) ($P<0.001$, Table 5). By adjusting for interference factors (including age, CRP, HBP, DB, TB, Activity rate of getting out of bed within postoperative-24-hour, VAS score, Drainage tube outlet Leakage, and post-extubation leakage), multivariate regression analysis showed that SNP was an independent influencing factor correlated with increased patient satisfaction score (OR = 7.81, 95% CI: 4.08–15.46) ($P<0.001$, Table 5).

Discussion

Cholelithiasis is a common gastrointestinal disease, the incidence of cholelithiasis has always been at a high level [21, 22]. The latest research reported that the incidence of gallstones in Europe and Asia is 0.273/1000 and 0.48/1000 people per year, respectively [23]. LC is the gold standard for treating cholelithiasis [24].

In this study, we retrospectively analyzed the clinical parameters of drainage tubes after LC in patients with cholelithiasis managed by SNP, and the differences were clinically significant as demonstrated by the data analysis results. The standard management mode for patients receiving drainage tubes after LC, using the feedback nursing process developed by our team, could help alleviate discomfort symptoms caused by abdominal drainage tubes and benefit more patients.

For a long time, postoperative drainage has become an important component of LC. Normally, abdominal drainage tubes were often selectively placed after laparoscopic biliary surgery to prevent intra-abdominal fluid accumulation and early detection of complications (including postoperative bleeding and bile leakage). Excessive carbon dioxide can also be discharged through the drainage tubes to alleviate shoulder pain [25, 26]. However, there were reports indicating that routine placement of an abdominal drain after elective laparoscopic cholecystectomy may result in more postoperative complications, such as pain and prolonged hospital stay [10, 27]. In fact, prophylactic indwelling drainage tubes also have the risk of complications, such as drainage tube displacement, bleeding, drainage tube rupture, drainage tube-related fever or secondary abdominal infection, and intestinal perforation [28, 29],Furthermore, the drainage tubes themselves may also slip into the abdominal cavity and cause foreign body reactions [30]. Although the use of prophylactic abdominal drainage is controversial [31], it is still widely used in biliary surgery.

More importantly, effective abdominal drainage is the key to preventing and treating bile leakage and abdominal infection. Clinically, although many factors cause complications of postoperative abdominal infection, improper management of drainage tubes can lead to poor drainage and abdominal infection, forcing abdominal re-puncture catheter drainage or even secondary surgery [12]. While, computed tomography (CT) imaging can quickly detect the location and patency of the abdominal drainage tube, which is conducive to taking timely measures to adjust the drainage tube strategy. More attention was focused on whether to place an abdominal drainage tube after LC surgery [29, 32, 33]. However, there have been no research reports on the SNP for abdominal drainage tubes.

As known, China has entered an aging society [34], and the number of elderly patients with clinical cholelithiasis has gradually increased [35]. Therefore, the care of drainage tubes after biliary surgery is particularly important. SNP may provide appropriate guidance for the activities of elderly patients after operation. When caring for patients (such as changing beds and sheets, etc.), the drainage tubes should be properly protected to avoid dislocation, twisting, or even accidental removal. Guo et al. [12] described the importance of abdominal drainage tubes after major abdominal surgery. Dislocation and poor drainage could lead to postoperative abdominal complications. Postoperative complications could be reduced by improving the fixation method and maintaining the correct position of the abdominal drainage tube. Moreover, the unified management model for abdominal drainage tubes has not yet been established, especially due to the nursing team's lack of assistance. Combined with the results of this study, standardized management of abdominal drainage tubes after surgery helps improve clinical diagnosis and treatment outcomes, highlighting the importance of postoperative nursing management. The SNP for abdominal drainage may better help alleviate patients' discomfort, may benefit more patients. Collectively, our results obtained in this study through retrospective analysis have certain clinical guiding significance and may provide a better theoretical basis for future clinical care.

However, this study has several limitations that warrant consideration. First, the retrospective design inherently introduces potential selection bias or unmeasured confounders. As patients were categorized into SNP and non-SNP groups based on admission dates (pre- and post-November 2023), unmeasured confounders such as temporal changes in surgical techniques, perioperative protocols, or patient characteristics may have influenced outcomes. Future prospective and multicenter studies should prioritize randomized controlled trials (RCTs) with standardized protocols to validate our findings. Second, the non-SNP group lacked standardized nursing practices, as care was delivered by different nurses with varying experience levels and institutional guidelines during the pre-intervention period. This heterogeneity in non-SNP care could have introduced variability in outcomes such as pain management or drainage tube handling, potentially obscuring the true effect of SNP. Third, the single-center nature of this study may limit generalizability. Our findings may not fully apply to hospitals with differing patient demographics, nursing training systems, or surgical workflows. Future prospective studies should adopt standardized protocols for both intervention and control groups, incorporate multicenter collaborations, and rigorously control for temporal and institutional confounders to strengthen validity. Fourth, the absence of a concurrent control group may introduce certain limitations in analyzing causal relationships.

Additionally, future research should explore the long-term impacts of SNP, such as 30-day readmission rates, quality of life metrics, and cost-effectiveness analyses, to assess both clinical and economic benefits. Subgroup analyses based on age, gender, and baseline inflammation severity could identify populations that benefit most from SNP. Furthermore, integrating digital health technologies (e.g., real-time drainage monitoring systems or mobile apps for nursing feedback) may optimize SNP implementation and adherence.

Finally, while this study focused on cholelithiasis, extending SNP validation to other abdominal surgeries (e.g., hepatic or pancreatic procedures) is critical. A phased approach—beginning with pilot feasibility studies followed by large-scale RCTs—would provide robust evidence for standardizing postoperative drainage care across specialties.

Conclusions

Although there is controversy about whether to place drainage tubes after cholelithiasis surgery, abdominal drainage tubes are still an important measure for effective observation and prevention of complications in clinical practice. This study reports the effect of standardized nursing application of abdominal drainage tubes. Based on the common disease cholelithiasis, the SNP feedback nursing process, may help to improve patients' early bed activities, reduce postoperative pain, alleviate the symptoms caused by drainage tubes, and enhance patient satisfaction. Therefore, the formulation of disease-related postoperative drainage tube SNP may better improve patients' symptoms and benefit patients, which is worth promoting.

Supplementary Information

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Supplementary Material 1

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Author contributions
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Data availability
The datasets used and/or analyzed during the current study are available from the corresponding author (Chaobo Chen) on reasonable request. For any queries, kindly contact bobo19820106@gmail.com.

Declarations

Ethics approval and consent to participate
The need for written informed consent was waived by the Xishan People's Hospital of Wuxi City Ethics Committee due to the retrospective nature of the study (No. xs2024ky074). The study complied with the Declaration of Helsinki.

Consent for publication
Not applicable.

Competing interests
The authors declare no competing interests.

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References

1. Baron TH, DiMaio CJ, Wang AY, Morgan KA. American gastroenterological association clinical practice update: management of pancreatic necrosis. Gastroenterology. 2020;158(1):67–75. e61.
2. Leppaniemi A, Tolonen M, Mentula P. Complex duodenal fistulae: a surgical nightmare. World J Emerg Surg. 2023;18(1):35.
3. Shirai D, Shinkawa H, Kabata D, Takemura S, Tanaka S, Amano R, et al. Laparoscopic liver resection reduces postoperative infection in patients with hepatocellular carcinoma: a propensity score-based analysis. Surg Endosc. 2022;36(12):9194–203.
4. Zhao C, Xu Z, Hu W, Ge C, Zhang Z, Dai Z, et al. A retrospective study on the Three-Port technique of laparoscopic common bile duct exploration for the management of cholelithiasis and choledocholithiasis. Int J Gen Med. 2023;16:3435–45.
5. He S, Xia J, Zhang W, Lai M, Cheng N, Liu Z, et al. Prophylactic abdominal drainage for pancreatic surgery. Cochrane Database Syst Rev. 2021;12(12):CD010583.
6. Wu S, Tang M, Liu J, Qin D, Wang Y, Zhai S et al. Impact of an AI-Based laparoscopic cholecystectomy coaching program on the surgical performance: a randomized controlled trial. Int J Surg 2024.
7. Ahmed I, Hudson J, Innes K, Hernandez R, Gillies K, Bruce R, et al. Effectiveness of Conservative management versus laparoscopic cholecystectomy in the prevention of recurrent symptoms and complications in adults with uncomplicated symptomatic gallstone disease (C-GALL trial): pragmatic, multicentre randomised controlled trial. BMJ. 2023;383:e075383.
8. Bosley ME, Zamora IJ, Neff LP. Choledocholithiasis-a new clinical pathway. Transl Gastroenterol Hepatol. 2021;6:35.
9. Pai D, Sharma A, Kanungo R, Jagdish S, Gupta A. Role of abdominal drains in perforated duodenal ulcer patients: a prospective controlled study. Aust N Z J Surg. 1999;69(3):210–3.
10. Cirocchi R, Amato L, Ungania S, Buononato M, Tebala GD, Cirillo B et al. Management of acute cholecystitis in High-Risk patients: percutaneous gallbladder drainage as a definitive treatment vs. Emergency Cholecystectomy-Systematic review and Meta-Analysis. J Clin Med 2023; 12(15).
11. Yamamoto M, Kobayashi T, Oshita A, Abe T, Kohashi T, Onoe T, et al. Laparoscopic versus open limited liver resection for hepatocellular carcinoma with liver cirrhosis: a propensity score matching study with the Hiroshima surgical study group of clinical oncology (HiSCO). Surg Endosc. 2020;34(11):5055–61.
12. Guo Y, Guo X, Wang J, Li K, Xu G, Yan W, et al. Abdominal infectious complications associated with the dislocation of intraperitoneal part of drainage tube and poor drainage after major surgeries. Int Wound J. 2020;17(5):1331–6.
13. Sun Y, Li Y, Zong K, Jiang N, Zhou B. Prophylactic abdominal drainage after distal pancreatectomy: really unnecessary? Lancet Gastroenterol Hepatol. 2024;9(10):906.
14. Zheng M, Niu T, Peng J, Shi L, Shao C. Active Intra-Abdominal drainage following abdominal digestive system surgery: A Meta-Analysis and systematic review. J Invest Surg. 2023;36(1):2180115.
15. Clark K, Hoffman A. Educating healthcare students: strategies to teach systems thinking to prepare new healthcare graduates. J Prof Nurs. 2019;35(3):195–200.
16. Orth K. Preventing surgical site infections related to abdominal drains in the intensive care unit. Crit Care Nurse. 2018;38(4):20–6.
17. Kim SS, Donahue TR, Laparoscopic Cholecystectomy. JAMA. 2018;319(17):1834.
18. Romucho Aguilar FB, Zapata Ormeno GC, Alzamora de Los Godos Urcia LA, Calderon Saldana JP, Ausejo Galarza JR. Efficacy of mini-laparoscopic cholecystectomy and laparoscopic cholecystectomy in acute cholecystitis. Rev Esp Enferm Dig. 2023;115(9):521.
19. Coccolini F, Catena F, Pisano M, Gheza F, Fagiuoli S, Di Saverio S, et al. Open versus laparoscopic cholecystectomy in acute cholecystitis. Systematic review and meta-analysis. Int J Surg. 2015;18:196–204.
20. Daabiss M. American society of anaesthesiologists physical status classification. Indian J Anaesth. 2011;55(2):111–5.
21. Dan WY, Yang YS, Peng LH, Sun G, Wang ZK. Gastrointestinal Microbiome and cholelithiasis: current status and perspectives. World J Gastroenterol. 2023;29(10):1589–601.
22. Adou C, Magne J, Gazere N, Aouida M, Chastaingt L, Aboyans V. Global epidemiology of lower extremity artery disease in the 21st century (2000-21): a systematic review and meta-analysis. Eur J Prev Cardiol. 2024;31(7):803–11.
23. Wang X, Yu W, Jiang G, Li H, Li S, Xie L, et al. Global epidemiology of gallstones in the 21st century: A systematic review and Meta-Analysis. Clin Gastroenterol Hepatol. 2024;22(8):1586–95.
24. Sauerland S, Langenbach MR. Managing symptomatic gallstone disease. BMJ. 2023;383:2624.
25. Picchio M, De Angelis F, Zazza S, Di Filippo A, Mancini R, Pattaro G, et al. Drain after elective laparoscopic cholecystectomy. A randomized multicentre controlled trial. Surg Endosc. 2012;26(10):2817–22.
26. Jorgensen JO, Gillies RB, Hunt DR, Caplehorn JR, Lumley T. A simple and effective way to reduce postoperative pain after laparoscopic cholecystectomy. Aust N Z J Surg. 1995;65(7):466–9.
27. Tzovaras G, Liakou P, Fafoulakis F, Baloyiannis I, Zacharoulis D, Hatzitheofilou C. Is there a role for drain use in elective laparoscopic cholecystectomy? A controlled randomized trial. Am J Surg. 2009;197(6):759–63.
28. Edlich RF, Haines PC, Pearce RS, Thacker JG, Rodeheaver GT. Evaluation of a new, improved surgical drainage system. Am J Surg. 1985;149(2):295–8.
29. Yang J, Liu Y, Yan P, Tian H, Jing W, Si M, et al. Comparison of laparoscopic cholecystectomy with and without abdominal drainage in patients with non-complicated benign gallbladder disease: A protocol for systematic review and meta analysis. Med (Baltim). 2020;99(20):e20070.

30. Elmunzer JB, Feussner DJ, Payne MK, Nadig SN, Yamada R. Combined Endoscopic-Percutaneous biliary restoration following severe bile duct injury during cholecystectomy. Am J Gastroenterol. 2018;113(3):328.
31. Liang L, Liu X, Liu F, Su Q. The effect of placing prophylactic abdominal drainage tube after hepatobiliary surgery on postoperative infection: A systematic review and meta-analysis. Int Wound J. 2024;21(2):e14579.
32. Loozen CS, van Santvoort HC, van Duijvendijk P, Besselink MG, Gouma DJ, Nieuwenhuijzen GA, et al. Laparoscopic cholecystectomy versus percutaneous catheter drainage for acute cholecystitis in high risk patients (CHOCOLATE): multicentre randomised clinical trial. BMJ. 2018;363:k3965.
33. Yong L, Guang B. Abdominal drainage versus no abdominal drainage for laparoscopic cholecystectomy: A systematic review with meta-analysis and trial sequential analysis. Int J Surg. 2016;36(Pt A):358–68.
34. Chen X, Giles J, Yao Y, Yip W, Meng Q, Berkman L, et al. The path to healthy ageing in China: a Peking University-Lancet commission. Lancet. 2022;400(10367):1967–2006.
35. He L, Wang J, Ping F, Yang N, Huang J, Li Y, et al. Association of Glucagon-Like Peptide-1 receptor agonist use with risk of gallbladder and biliary diseases: A systematic review and Meta-analysis of randomized clinical trials. JAMA Intern Med. 2022;182(5):513–9.

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