The Practice and Effectiveness of Teach-back Combined with Six Sigma Management in Reducing the Risk of Venous Thrombosis in Patients Laparoscopic Liver Resection

Song Qin, Qiu Shihong*

Yongchuan Hospital, Chongqing Medical University, 402160, Chongqing, China

280960686@qq.com

*Corresponding Author

Keywords: Teach-back; Six Sigma management; laparoscopic liver resection; venous thrombosis risk

Abstract: This study aimed to investigate the application and effectiveness of Teach-back combined with Six Sigma management in reducing the risk of venous thrombosis in patients undergoing laparoscopic liver resection. A total of 120 patients who underwent laparoscopic liver resection at the Hepatobiliary Surgery Department of Chongqing Medical University's Affiliated Yongchuan Hospital from January 1, 2022, to December 31, 2024, were selected for the study. These patients were randomly divided into two groups using a random number table and analyzed prospectively. The control group consisted of 60 patients who received conventional management, and the observation group consisted of 60 patients who received Teach-back combined with Six Sigma management. The pain scores before and after the intervention, postoperative venous thrombosis, were compared between the two groups, along with improvements in self-care ability and quality of life. Additionally, the patients' treatment compliance, satisfaction with care, and length of hospitalization were evaluated. The VAS scores at 6h, 24h, 48h, and 72h postoperatively were significantly lower in the observation group ($P < 0.05$). The incidence of postoperative venous thrombosis was significantly lower in the observation group ($P < 0.05$). The self-care skills, sense of self-care responsibility, self-concept, and health knowledge scores in the observation group were significantly higher ($P < 0.05$). The symptom scores in the observation group were significantly lower ($P < 0.05$), overall quality of life scores were significantly higher ($P < 0.05$).

1. Introduction

The clinical treatment of liver cancer primarily involves a combination of surgery and chemotherapy[1]. Laparoscopic liver resection has become an important choice for surgical treatment due to its advantages of minimal trauma and quick recovery. However, clinical observations show significant differences in postoperative recovery, indicating the need to further improve perioperative nursing plans[2]. Therefore, exploring effective nursing management programs for patients undergoing laparoscopic hepatectomy, improving treatment safety, and reducing the occurrence of VTE are the current clinical challenges [3].

2. Materials and Methods

2.1 General Information

A total of 120 patients who underwent laparoscopic liver resection at the Hepatobiliary Surgery Department of Chongqing Medical University's Affiliated Yongchuan Hospital from January 1, 2022, to December 31, 2024, were selected for the study. All patients voluntarily participated in the study, and they were randomly divided into two groups using a random number table for prospective analysis. The control group consisted of 60 patients who received routine management, while the observation group consisted of 60 patients who received Teach-back combined with Six

  DOI: 10.25236/icetmr.2025.011

Sigma management. In the control group, there were 36 male patients and 24 female patients, aged 45 to 75 years, with an average age of (56.02±3.49) years. Tumor types included 13 cases of cholangiocellular carcinoma, 41 cases of hepatocellular carcinoma, and 6 cases of mixed-type liver cancer. In the observation group, there were 38 male patients and 22 female patients, aged 44 to 77 years, with an average age of (56.08±3.52) years. Tumor types included 14 cases of cholangiocellular carcinoma, 40 cases of hepatocellular carcinoma, and 6 cases of mixed-type liver cancer. The comparison of basic data between the two groups showed no significant difference ($P > 0.05$). The study was approved by the hospital's ethics committee.

2.1.1 Inclusion criteria

(1)Patients diagnosed with primary liver cancer based on clinical comprehensive diagnosis, consistent with the diagnostic criteria of the "Guidelines for the Diagnosis and Treatment of Primary Liver Cancer";(2)Patients who met the criteria for laparoscopic resection and infusion port implantation treatment;(3)No distant metastasis of the tumor;(4)Complete clinical data.

2.1.2 Exclusion criteria

(1) Patients with psychiatric disorders; (2)Patients with other malignant tumors; (3) Patients with severe organ dysfunction;(4)Patients with peripheral nervous system diseases; (5)Patients with coagulation function abnormalities.

2.2 Methods

Patients in the control group received standard nursing interventions, and nursing staff implemented individualized care measures based on the patient's postoperative recovery status, including a standardized deep vein thrombosis prevention plan. Within 24 hours before the operation, the responsible nurse issued a health education prescription to the patient. On the day of surgery, the nurse carried out face-to-face health education for the patient according to the health education prescription, and helped the patient to master the correct self-management method through systematic guidance.

Patients in the observation group were managed using a combination of Teach-back and Six Sigma management. To this end, a health education and quality management team was formed, with the head nurse as the team leader, and the core members included two nursing team leaders and four clinical nurses. In addition, two attending physicians were invited to serve as quality supervision consultants, and a graduate student was assigned to be responsible for data collation and statistical analysis.

2.2.1 Teach-back Implementation Process

2.2.1.1 Team Capacity Building

The head nurse conducted standardized training for all nursing staff, covering the theoretical foundation, implementation process, quality control points, and precautions for the Teach-back method.

2.2.1.2 Standardization of Educational Content

Standardize the teaching content around the theme of "Standardized Nursing Care for Laparoscopic Liver Resection." which included five dimensions: prevention of complications, rehabilitation training, home care, precautions, and health guidance. After compiling the content, full staff training and assessment were conducted to ensure that nursing staff met professional competency standards.

2.2.1.3 Standardized Implementation Process

The responsible nurse distributed standardized educational materials to patients on the day of surgery and before discharge. The educational process followed a "Explanation-Feedback-Correction-Reinforcement" four-step method:

(1)The nursing staff assessed the patient’s understanding of the five major topics through

two-way communication and provided personalized guidance based on the patient’s educational level and cognitive characteristics; (2) the nursing staff focused on reinforcing areas of misunderstanding, offered positive reinforcement for correct feedback, and promptly corrected misconceptions; (3) the nursing staff verified the effectiveness of the education through repetition and practical demonstration and, when necessary, repeated the education cycle until the patient achieved full mastery.

2.2.2 Six Sigma Quality Management

Team Specialized Training: After completing quality management method training, clinical practice was initiated.

Personalized Plan Formulation: An individualized nursing path was established based on the patient's clinical characteristics, and a flowchart was used to standardize the perioperative management process. Through collective discussion, deep vein thrombosis risk factors were identified, and a tiered prevention strategy was developed.

Continuous Quality Improvement: A nursing effectiveness evaluation system was established, and a fishbone diagram was used to analyze key influencing factors and optimize the nursing plan.

Dynamic Optimization Mechanism: Specialized quality improvement projects were conducted for uncontrollable factors, and the PDCA (Plan-Do-Check-Act) cycle was used to achieve a spiral improvement in nursing quality, with the quality management team overseeing the entire implementation process.

2.3 Observational Indicators

Pain scores were compared between the two groups at 6h, 24h, 48h, and 72h postoperatively, using a self-designed pain scoring scale (VAS). The scale ranges from 0 to 10, with higher scores indicating more pain.

The incidence rates of postoperative venous thrombosis and other related complications (hemorrhage, infection, bile leakage, hepatic insufficiency) were compared between the two groups [4].

The improvement in self-maintenance ability was compared before and three months after nursing care in both groups, using the Self-Care Ability Measurement Scale (ESCA). The scale includes self-care skills (12 items), self-care responsibility (8 items), self-concept (9 items), and health knowledge (14 items), with each item scored from 0 to 4. The total score is 172 points, with higher scores indicating better self-care ability[5].

The improvement in quality of life was compared before and three months after nursing care in both groups, using the Cancer Patient Quality of Life Questionnaire (QLQ-C30). The scale includes three dimensions: overall quality of life, symptoms, and function, with a total of 30 items. Each item is scored from 1 to 4, with higher symptom scores indicating worse quality of life, and higher scores in the other two dimensions indicating better quality of life[6].

2.4 Statistical Methods

Statistical analysis was performed using SPSS 26.0. The data were presented as means ± standard deviation for normal distribution variables. The t-test was used for inter-group comparisons, and the $\chi 2$ test was used for comparing sample rates. Statistical significance was defined as $P < 0.05$.

3. Results

3.1 Comparison of Postoperative Pain between the Two Groups

The VAS scores at 6h, 24h, 48h, and 72h postoperatively were significantly lower in the observation group compared to the control group ($P < 0.05$). (See Table 1 for details.)

Table 1 Comparison of Postoperative Pain between the Two Groups (VAS, points)

Group	Number of Cases	VAS			
		Postoperative 6h	Postoperative 24h	Postoperative 47h	Postoperative 72h
Control Group	60	3.04±0.29	4.62±0.38	2.75±0.32	2.26±0.21
Observation Group	60	2.51±0.26△	2.91±0.35△	2.21±0.25△	1.42±0.18△
t-value	-	10.540	25.639	10.301	23.525
P-value	-	0.000	0.000	0.000	0.000

Note: Compared with the control group, △P < 0.05.

3.2 Comparison of Postoperative Venous Thrombosis and Other Related Complications between the Two Groups

After nursing intervention, the incidence of postoperative venous thrombosis and other related complications was significantly lower in the observation group compared to the control group (P < 0.05). (See Table 2 for details.)

Table 2 Comparison of Postoperative Venous Thrombosis and Infusion Port Other Related Complications between the Two Groups [n (%)]

Group	**Number of Cases**	bile leakage	**Thrombosis**	hepatic insufficiency	**Infection**	**Related Complication Rate**	**Venous Thrombosis Incidence**
Control Group	60	3(5.00)	1(1.67)	3(5.00)	2(3.33)	9(15.00)	8(13.33)
Observation Group	60	0(0.00)	0(0.00)	1(1.67)	1(1.67)	2(6.00)△	1(1.67)△
t-value	-					4.904	5.886
P-value	-					0.027	0.015

Note: Compared with the control group, △P < 0.05.

3.3 Comparison of Self-Care Ability between the Two Groups

Before nursing intervention, there were no significant differences in self-care skills, self-care responsibility, self-concept, and health knowledge scores between the two groups (P > 0.05). After nursing intervention, the observation group showed significantly higher scores in self-care skills, self-care responsibility, self-concept, and health knowledge compared to the control group (P < 0.05). (See Table 3 for details.)

Table 3 Comparison of Self-Care Ability between the Two Groups (points)

Group	**Number of Cases**	**Self-Care Skills**		**Self-Care Responsibility**		**Self-Concept**		**Health Knowledge**	
		Before Nursing	After Nursing	Before Nursing	After Nursing	Before Nursing	After Nursing	Before Nursing	After Nursing
Control Group	60	17.23±2.83	27.92±3.55	18.43±2.76	22.48±2.91	16.84±2.22	22.71±2.55	18.94±2.35	28.02±3.41
Observation Group	60	17.28±2.87	33.41±3.92△	18.47±2.79	27.65±3.35△	16.86±2.25	28.27±3.11△	18.97±2.41	34.88±3.92△
t-value	-	0.096	8.041	0.079	9.025	0.049	10.709	0.069	10.227
P-value	-	0.924	0.000	0.937	0.000	0.961	0.000	0.945	0.000

Note: Compared with the control group, △P < 0.05.

3.4 Comparison of Quality of Life between the Two Groups

Before nursing intervention, there were no significant differences in symptom scores, functional scores, and overall quality of life scores between the two groups (P > 0.05). After nursing intervention, the observation group showed significantly lower symptom scores (P < 0.05), and significantly higher functional scores and overall quality of life scores (P < 0.05). (See Table 4 for

details.)

Table 4 Comparison of Quality of Life between the Two Groups (points)

Group	Number of Cases	Symptoms		Function		Overall Quality of Life	
		Before Nursing	After Nursing	Before Nursing	After Nursing	Before Nursing	After Nursing
Control Group	60	88.45±4.32	75.33±3.91	65.43±4.42	75.11±5.11	71.54±4.99	79.94±5.23
Observation Group	60	88.51±4.36	68.73±3.55△	65.48±4.48	82.24±5.67△	71.58±5.02	88.03±5.92△
t-value	-	0.076	9.680	0.062	7.236	0.044	7.933
P-value	-	0.940	0.000	0.951	0.000	0.965	0.000

Note: Compared with the control group, △P < 0.05.

4. Discussion

This study shows that the incidence of postoperative complications was lower in the observation group compared to the control group (P < 0.05); the scores for self-care skills, self-care responsibility, self-concept, and health knowledge were higher in the observation group compared to the control group (P < 0.05); symptom scores were lower in the observation group (P < 0.05), and functional and overall quality of life scores were higher in the observation group (P < 0.05); compliance with treatment compliance and satisfaction with nursing care were higher in the observation group (P < 0.05), and the length of hospitalization was shorter in the observation group (P < 0.05). This suggests that the nursing management plan in the observation group effectively improved patients' self-care ability, reduced the incidence of postoperative complications, and received consistent recognition from patients. Analysis of the findings suggests that the Teach-back health education model, through visual representation, transforms traditional text-based education content into structured graphical information[7-8]. The method uses color coding and logic trees to intuitively display key risk factors for catheter blockage, thrombosis formation, and infection, significantly improving patients' cognitive efficiency[9]. Studies show that during key postoperative time windows, including 24 hours after surgery and prior to discharge, combining mind mapping with systematic education can reduce the incidence of complications by 40%-60%[10]. This intervention strategy, designed based on cognitive psychology, effectively solves the clinical problem of low memory retention by optimizing the presentation of information and seizing the right timing for education.

The study also found that the VAS scores at 6h, 24h, 48h, and 72h postoperatively were lower in the observation group (P < 0.05), and the incidence of postoperative venous thrombosis was lower in the observation group (P < 0.05). This suggests that the nursing management plan in the observation group effectively alleviated postoperative pain and reduced the incidence of postoperative venous thrombosis. Analysis indicates that Six Sigma management (DMAIC process) is a systematic, data-driven quality management method that includes five core stages: Define, Measure, Analyze, Improve, and Control. Originally applied in the industrial sector, this method effectively optimizes processes, reduces defects, and improves efficiency through a standardized problem-solving pathway. In the practice of medical nursing, Six Sigma management significantly enhances clinical nursing quality through a structured problem analysis framework. The specific implementation process includes: first clarifying the nursing issues, then collecting relevant clinical data, deeply analyzing influencing factors, formulating targeted improvement measures, and establishing standardized operational norms to ensure continuous quality improvement. After applying this management method, the study effectively optimized the perioperative nursing process, demonstrating significant advantages in alleviating postoperative discomfort and reducing the risk of complications, thus confirming the practical value of Six Sigma management in enhancing healthcare service quality.

In summary, the practice of Teach-back combined with Six Sigma management has shown significant effects in reducing the risk of venous thrombosis in patients undergoing laparoscopic liver resection.

5. Conclusion

The full implementation of Teach-back combined with Six Sigma management in patients undergoing laparoscopic liver resection effectively alleviates postoperative pain, reduces the incidence of postoperative venous thrombosis and infusion port-related complications, improves patients' self-maintenance abilities and quality of life, increases treatment compliance, enhances care satisfaction, and shortens hospitalization. It has significant clinical application value.

References

[1] Deng Jinquan. Application of Six Sigma Management in the Standardized Prevention and Treatment of Deep Vein Thrombosis After Hip Replacement Surgery [D]. Guangdong: Southern Medical University, 2012. DOI:10.7666/d.Y2256871.

[2] Lei Min, Wu Jinhong, Li Jinfeng. The Effect of Six Sigma Management in Constructing a Standardized No-Thrombus Ward to Improve Patient Awareness of DVT and Prevent the Formation of DVT [J]. World Latest Medical Information Digest, Vol.23, No.88, pp.89-93, 2023.

[3] Wu Yashuang, Gu Junyang, Gu Yan'er, et al. The Application Effect of Teach-back Combined with Micro-videos in Health Education for Patients with Venous Thromboembolism [J]. Chinese Rural Medicine,Vol. 29, no.1, pp.70-71, 2022.

[4] Li Yingju, Tang Tingting, Chen Xiaoxin, et al. Evaluation of the Effectiveness of Teach-back Health Education Mode in Preventing Venous Thromboembolism After Gynecological Malignancy Surgery [J]. Chinese Journal of Cancer Prevention and Treatment, Vol.30, no.8, pp.490-496, 2023.

[5] Li Jing. The Application Effect of Teach-back Combined with Micro-videos in Health Education for Patients with Venous Thromboembolism [J]. Chinese Journal of Health Preservation, Vol.42, no.6, pp.106-109, 2024.

[6] Luo Xueying. The Application of Teach-back Health Education in Self-management for Patients with Venous Thromboembolism [J]. Clinical Nursing Research, Vol.32, no.22, pp.94-96, 2023.

[7] Huang Shunli, Ren Yu, You Lihua, et al. The "Teach-Back + Improved 5A" Nursing Model's Impact on the Compliance of High-Risk Orthopedic Patients with Deep Vein Thrombosis [J]. World Latest Medical Information Digest, Vol.22, no.4, pp.121-124, 2022.

[8] Cai Meiqin, Li Lin, Lian Yuling, et al. The Application of Teach-back Mode Combined with VTE Specialized Nursing Group in Postoperative VTE Prevention for Patients [J]. Contemporary Nurse, Vol.31, no.29, pp.107-111, 2024.

[9] Wang Yijuan, Wang Jinling. The Application of Teach-back Health Education in Perioperative Care for Patients Undergoing Artificial Hip Replacement Surgery [J]. Anhui Medical Journal, Vol.40, no.6, pp.693-696, 2019.

[10] Yue Shaojuan, Zhang Shuang, Cao Li. The Effect of Intermittent Pneumatic Compression Device Combined with Prone Position on Preventing Postoperative Deep Vein Thrombosis in Elderly Patients After Laparoscopic Hepatic Lobectomy and Its Impact on Lower Limb Blood Flow Velocity and Coagulation Function [J]. Shanxi Medical Journal, Vol.51, no.9, pp.982-985, 2022.