The Impact of A Procedural Nursing Intervention to Prevent Deep Vein Thrombosis in Patients after Laparoscopic Distal Pancreatectomy and Splenectomy: A Retrospective Cohort Study

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Research Article

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Abstract

Purpose The purpose of this study was to investigate the effect of procedural nursing intervention to prevent deep vein thrombosis (DVT) in patients after laparoscopic distal pancreatectomy and splenectomy (LDPS).

Methods We conducted a retrospective analysis of data from 80 patients with tumours of the pancreatic corpus or tail who underwent surgery at a high volume single centre. T-test and c^2 test were performed for data analysis. Study variables included incidence of DVT after LDPS, coagulation function indexes, and patient satisfaction.

Results For patients after LDPS, individuals receiving the procedural nursing intervention had a lower incidence of DVT compared to individuals receiving routine nursing care. There was no significant difference in Fibrinogen (FBI), D-Dimer(D-D), Activated Partial Thromboplastin Time (APTT), Prothrombin Time (PT), Thrombin Time (TT) between the two groups (P>0.05). Platelet Count (PLT) among individuals receiving the procedural nursing intervention were significantly lower than those receiving routine nursing care. The procedural nursing interventions were associated with higher patient satisfaction compared to routine care.

Conclusions A procedural nursing intervention contributes to a lower incidence of DVT, lower PLT, higher satisfaction.

Introduction

Global Cancer Statistics 2018 summarized that in in 2018 the estimated number of new cases of pancreatic cancer was 458,918, and the number of deaths was 432,242 globally [3]. L. Rahib et al. [22] projected pancreatic cancer to surpass breast, prostate, and colorectal cancers to become the second leading cause of cancer-related death by 2030 in the United States. Surgical resection is the only treatment that offers a potential cure for pancreatic cancer [17].

In the past decades, with the rapid development of laparoscopic surgical techniques, laparoscopic distal pancreatectomy (LDP) has become a widespread operation performed in the abdominal surgery [18, 19]. LDP is recommended as the standard procedure for resecting benign, borderline, and malignant tumors of the pancreatic corpus or tail [5, 20]. Because of the special anatomic relationship between the spleen and pancreas, LDP is usually performed with splenectomy, known as laparoscopic distal pancreatectomy splenectomy (LDPS) [28]. However, there are certain complications which may occur after LDPS, including pancreatic fistula, infection, post-surgical hemorrhage, overwhelming post-splenectomy infection (OPSI), thromboembolic event, etc.

Venous thromboembolism (VTE), manifests mainly as deep vein thrombosis (DVT) of the lower extremities and pulmonary embolism. The most substantial risk factors for the formation of VTE are certain types of surgery and malignancies [23]. Patients undergoing surgery are at an increased risk of

VTE, which often results in poor postoperative recovery and endangerment of the patient's life [6, 10]. European and American data showed that the incidence of DVT in patients after general surgery was 10–40% when there was no preventive measures against DVT [7]. Studies have revealed that the risk of DVT increased after splenectomy, liver surgery and pancreatic surgery [8, 24]. As a potentially life-threatening complication, DVT after LDPS continues to challenge nurses daily. Therefore, shifting the assessment and interventions to prevention is one key point of clinical nursing work. In our study, 80 patients who underwent LDPS from January 2016 to December 2019 were selected to investigate the impact of procedural nursing intervention on the incidence of DVT after LDPS.

Methodology

The purpose of this study was to investigate the effect of procedural nursing intervention to prevent deep vein thrombosis (DVT) in patients after laparoscopic distal pancreatectomy and splenectomy (LDPS).

A retrospective cohort study design was used. The Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) EQUATOR checklist was used for this study (see Supplementary Table 1). This retrospective study was conducted in the department of biliary and pancreatic surgery, totaling 200 beds at our hospital. After receiving institutional review board approval for a retrospective cohort study, a review of the medical records of patients after LDPS from January 1, 2016 to December 31, 2019 was undertaken. All patients were identified by being assigned a code.

The inclusion criteria were (1) patients were aged from 18 to 70 years old; (2) patients received LDPS. Patients were excluded if they (1) had a previous history of lower limb DVT or had other vascular diseases in lower limbs; (2) had severe heart disease or myocardial infarction; (3) had a cerebrovascular disease or hemorrhagic tendency; (4) had obvious abnormal coagulation indicators before surgery; (5) taken anticoagulants or antiplatelet medications one month before surgery.

A total of 80 patients presenting after LDPS, were chart audited. Considering that procedural nursing interventions against perioperative thrombosis were carried out since January 1, 2018 in our hospital, 40 patients who underwent LDPS and received routine care from January 1, 2016 to December 31, 2017 were selected as the control group, and another 40 patients who underwent LDPS and received a procedural nursing intervention from January 1, 2018 to December 31, 2019 were selected as the observation group.

The Caprini scale was built into the electronic medical record in January 2018. In the electronic medical record, a DVT risk assessment was completed the by the clinical nurses after the patient underwent the operation. Depending on the total scale score, patients were categorized as at low, medium or high risk for DVT consequence. The clinical nurses were then alerted of different risk level for each patient. Within each of these categories, targeted interventions were defined (Table 1).

If the score was a high risk, it was required that the patients signed a notification form for preventing DVT; red warning signs that read " Deep Vein Thrombosis Prevention " were hung on the patient's bedside.

Appropriate DVT prevention measures needed for each patient were included in the priority nursing handover. Detailed intervention measures undertaken are as follows.

Health education:

Multi-channel health education was provided throughout the hospital stay. Patient education pamphlets and DVT precautionary lists were developed and were placed at the patient's bedside. Videos of postoperative lower extremity functional exercises were created and played every morning. Activity maps were created to engage patients in effective prevention methods. Some practical and acceptable advice was posted regularly via the public WeChat account. For example, some of the advice posted were “to avoid smoking and alcohol consumption, ensure that you get enough sleep, limit sugar and salt intake” among many others.

Basic prevention:

When the patients were in bed, soft pillows or trapezoidal pillows (about 25°) were placed under their extremities. Their upper body was raised to a 15° angle, knee joints were flexed at a 15°angle and lower limbs raised to 15–30° to fully relax the muscles. Patients were encouraged to perform functional exercises early, to turn over, take deep breaths, to cough, increase diaphragm movement and promote blood flow. Furthermore, postsurgical patients were instructed to perform lower extremity exercises to include plantar flexion, dorsal extension, rotation of the ankle; isometric contraction of the quadricep and non-weight-bearing straight leg lifting of the quadriceps. They were instructed to perform these exercises in groups of 20 to 30 patients for 3 to 4 times a day. Exercise time and frequency were adjusted according to the patient's activity tolerance.

Physical prevention:

Intermittent pneumatic compression devices (IPC) were applied during the periods of inactivity for 30 minutes each time, once in the morning and afternoon. IPC inflates and deflates multi-chamber balloons in an orderly manner to squeeze the limbs from the distal end to the proximal end in an orderly manner to form circulatory pressure, promoting blood flow, slowing venous stasis, and reducing the occurrence of DVT [21].

Drug prevention:

High-risk patients used low-molecular-weight heparin sodium following the doctor’s order. Both the US ACCP [8] guidelines and the UK NICE [4] guidelines to prevent DVT mentioned that under the conditions where anticoagulants could be used, they recommended it to be combined with some physical activity/ambulation to reduce the incidence of DVT.

The data was extracted retrospectively from the medical records of the patients. Data was collected from January 1, 2016 to December 31, 2019 (a total of 48 months). We completed the following data collection on the participants (1) baseline sample characteristics (age, gender, comorbidities), (2) the incidence of DVT, (3) the coagulation function indexes (FIB, DD, PLT, APTT, PT, TT), (4) nursing

satisfaction. All statistical analyses were performed using SPSS 23.0. The measurement data was expressed as mean ± standard deviation and analyzed by t-test; the count data was expressed as frequency or percentage, and the χ^2test was used. Differences were considered statistically significant when $P < 0.05$.

Results

Baseline sample characteristics

Table 2 details the baseline sample characteristics. For the entire group, the mean age of the participants were 48.53±16.30 years. Mean age of the control group and observation group were 44.88±15.97 years and 51.03±16.26 years, respectively. Differences in age between the two groups were insignificant (p=0.14). Of the 80 participants, 38 were male, and 42 were female, with little difference between groups (p=0.654). Comorbidities were also considered in our study with 13 participants having hypertension, and 6 having diabetes, but no significant difference was found between groups (p=0.363 for hypertension, p=0.692 for diabetes). Patients with malignant tumors may have had changes in their hemodynamics, which urged us to take pathology into account. 17 of the 80 patients have a malignant tumor, with 7 from control group and 10 from the observation group. No significant difference was found between groups (p=0.412). Basic clinical data of patients in the two groups were balanced and comparable (P>0.05) (Table 2).

Incidence of DVT

The diagnosis of DVT was determined by the symptoms and signs of DVT, D-D and color Doppler ultrasound (Figure 1). The diagnostic criteria were in accordance with the standards set by the Peripheral Vascular Disease Committee of the Chinese Society of Integrative Medicine [12]. The incidence of DVT seven days after the operation in the observation group was lower than that in the control group (2.5% (1/40) *vs* 20% (8/40), P<0.05) (Table 3).

Coagulation function indexes

There was no significant difference in FBI, D-D, APTT, PT, TT between the two groups (P>0.05). The PLT level of the patients in the observation group (356.6±191.34) was significantly lower than that of the control group (450.7±165.10, P<0.05) (Table 3).

Nursing satisfaction

In light of our hospital's self-made nursing satisfaction rating scale, patients were characterized as dissatisfied, satisfied or very satisfied. Overall satisfaction rate = (very satisfied + satisfied) / total number of cases × 100%. As is shown in Table 4, the nursing satisfaction score of the patients in the observation group was significantly higher than that of the control group (P<0.05) (Table 4).

Discussion

The aims of this study were to investigate the effects of procedural nursing intervention on patient outcome and to identify the preliminary results of evidence-based clinical practice. The results demonstrate that appropriate assessment and effective intervention based on risk level can help to decrease the prevalence of DVT after LDPS. In addition, nurses are in a critical position to implement procedural care and help improve patient care related to the prevention of DVT.

There are three factors that contribute to DVT: venous stasis, vessel wall injury and hypercoagulability, which is known as the Virchow's triad [2, 16]. Also, C. N. Gutt et al. [9]supported the notion that surgical patient accumulated more risks than non-surgical patients from every side of the Virchow triad. The Society of American Gastrointestinal and Endoscopic Surgeons (SAG-ES) laparoscopic surgery DVT prevention guidelines believed that all laparoscopic surgery could cause blood hypercoagulability in varying degrees [26]. Additionally, studies have reported that about 75% of patients after splenic resection developed thrombocytosis, and about 1.6–55% of patients due to their inability or unwillingness to ambulate participate in lower extremity exercise among many other negative practices caused thrombosis [27]. The above literature show that patients after LDPS present a high incidence of DVT. Similar to previous studies, we observed an increased incidence of postoperative DVT in the control group when patients were not under monitoring and management. Many Euro-American guidelines recommended that verified best approaches should be given to patients with different DVT risk stratification [4, 8]. Furthermore, Chinese General Surgery Perioperative Thrombosis Prevention and Management Guidelines identified that preventive measures for DVT in general surgery patients [14]. The American Society of Clinical Oncology VTE Guideline Pane demonstrated that patients undergoing major surgery for malignant disease should be considered for pharmacologic thromboprophylaxis [15]. Due to the understanding of the guidelines and the integration of evidence into clinical practice, a systematic and thoughtful protocol for DVT prevention was developed, which could account for the lower incidence of DVT in the observation group.

It is well known that DVT is closely related to coagulation. Participants' coagulation parameters (including FBI, DD, PLT, APTT, PT, TT) were also observed and recorded in the study. Our results suggested that FBI, D-D, APTT, PT and TT in two groups were different, but there was no significant difference ($P > 0.05$); the PLT count of the patients in the observation group was smaller than that in the control group. Several studies provide the evidence that high PLT is associated with the occurrence of VTE [13, 25, 29]. From the perspective of PLT level, the procedural nursing intervention was beneficial to those who underwent LDPS.

Patient satisfaction is a sensitive measure of a well-functioning health service system in modern healthcare [11]. As a critical outcome quality indicator, satisfaction was also taken into account in the current study. The overall satisfaction of the observation group (97.5%) within this study was significantly higher than that of the control group (80.0%), demonstrating that patients thought procedural care was positive and effective at preventing DVT after LDPS. In the implementation of

procedural care, clear, high-quality information and education were provided to the patients. Consequently, they had an in-depth understanding of DVT and recognized that they were susceptible to potentially life-threatening complications. Furthermore, procedural nursing interventions have proven to be an acceptable way to allow patients to engage in their rehabilitation after major surgery; which may be the mechanism behind improved satisfaction. Our findings are synonymous with those of J. Andrawis et al. [1] who confirmed after his study that satisfaction scores were higher when patients were involved in their health promotion.

Limitations

The findings of the present study should be interpreted considering certain limitations. First, a small sample was used to conduct the study, which reduced the statistical strength of some important findings. Second, as a chart review study, the quality of the information is dependent on coherent and accurate medical charting. A third limitation of our study was that several unobserved confounders (e.g., postoperative bedtime) were not adequately documented in the charts. The lack of these additional data may or may not have an impact on the accuracy of clinical outcomes. To counter these limitations, a prospective study design with robustly calculated sample size would add further valuable insights on the topic.

Conclusions

Although the prevention of DVT after LDPS remains a challenge for healthcare providers, we have strived to integrate evidence from research and guidelines into nursing practice to create procedural care. It is evident that procedural care provides significant benefits to the patient. Procedural nursing measures include health education, primary prevention, physical prevention and drug prevention. Obviously, with the implementation of the comprehensive and targeted DVT prevention interventions, DVT risks could be assessed and managed promptly, resulting in lower incidences of DVT, normal PLT levels and higher patient satisfaction. Overall, our study upholds the reliability of procedural nursing interventions.

Declarations

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Ethics approval: This study was approved by institutional review board of Affiliated Tongji Hospital, Tongji Medical College, Huazhong University of Science and Technology.

Consent to participate: N/A

Consent for publication: N/A

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Tables

Table 1

DVT Risk Level and Prevention Program

Score	Risk level	Prevention program
1-2 points	Low risk	Health education + basic prevention
3-4 points	Medium risk	Health education + basic prevention +physical prevention
≥5 points	High risk	Health education + basic prevention +physical prevention + drug prevention

Table 2

Baseline Sample Characteristics

	Total	Control	Observation	
	(N=80)	(n=40)	(n=40)	
Characteristics	n	n	n	p
Age	48.5±16.30	44.88±15.97	51.03±16.26	0.140
Gender				0.654
Male	38	18	20	
Female	42	22	20	
Comorbidities				
Hypertension	13	8	5	0.363
Diabetes	6	3	3	1.000
Tumor				0.412
Benign	63	33	30	
Malignant	17	7	10	

Table 3

Comparison of Coagulation Function Between Two Groups of Patients (N=40)

	Normal range	Control	Observation	P-value
FBI（g/L）	2.00-4.00	4.52±1.41	4.68±1.66	0.687
D-D(ug/mL)	<0.5	3.71±2.81	3.48±2.29	0.722
PLT ($\times 10^9$)	125.0-350.0	450.7±165.10	356.6±191.34	0.046
APTT(s)	29.0-42.0	40.1±5.37	38.1±5.05	0.130
PT(s)	11.5-14.5	14.8±1.54	14.6±1.30	0.608
TT(s)	14.0-19.0	15.4±1.09	15.8±1.48	0.357
Incidence of DVT		8	1	0.034

Table 4

Comparison of Nursing Satisfaction Between the Two Groups

	Control (n=40)	Observation (n=40)	
Variable	n(n/40×100)	n(n/40×100)	P
Very satisfied	16（40.00）	25（62.50）	0.116
Satisfied	16（40.00）	14（35.00）	0.644
Dissatisfied	8（20.00）	1（2.50）	0.034
Overall satisfaction	32（80.00）	39（97.50）	0.034

Supplementary File

Supplementary Table 1 is not available with this version

Figures

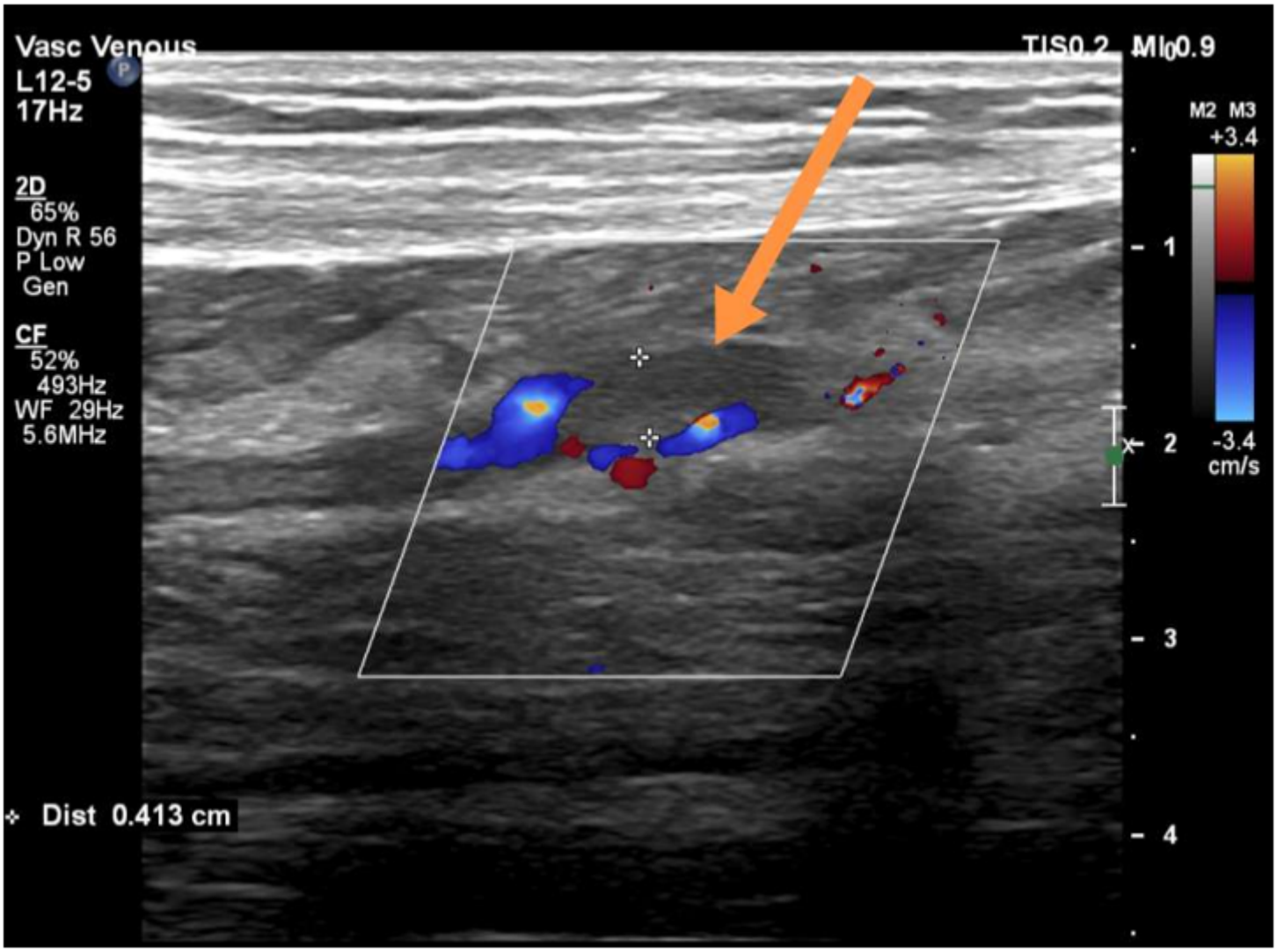

Figure 1

The result of color Doppler ultrasound (CDU) in patient with DVT in control group. The arrow indicates blood flow filling defect in intermuscular vein.