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Original Article

Effect of FTS-based perioperative nursing on postoperative rehabilitation of tibia-fibula fracture

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Abstract: Objective: This study aimed to analyze the effects of fast track surgery (FTS)-based perioperative nursing in patients with tibia-fibula fracture. Methods: 79 patients with tibia-fibula fracture in our hospital from June 2018 to May 2019 were divided into the Group 1 (G1, n=40, FTS-based perioperative nursing) and the Group 2 (G2, n=39, routine perioperative nursing) according to their time of admission. Postoperative recovery, swelling of the affected limb, pain intensity, incidence of complications, ankle range of motion (ROM), and functions of lower extremities were compared between the two groups. Results: Compared with the G2, the G1 consumed less time to first exsufflation, stay in the hospital, and fracture healing (P<0.05), and obtained lower swelling scores of the affected limb from 1 week to 4 weeks and VAS scores at the end, 6 h, 24 h, 48 h and 72 h after the surgery (P<0.05), higher scores of ankle function and knee joint function at 3 and 6 months, and larger extension, bending, pronation, supination, loaded eversion and inversion angles of the ankle at 6 months (P<0.05). Furthermore, the incidence of complications was 12.50% in the G1 and 30.77% in the G2 (P<0.05). Conclusion: While improving ankle ROM and functions of lower extremities, FTS-based perioperative nursing can reduce swelling, postoperative deep vein thrombosis of lower extremities and other complications in patients with tibia-fibula fracture.

Keywords: FTS, perioperative nursing, tibia-fibula fracture, deep vein thrombosis of lower extremities, prevention

Introduction

Along with the development of construction and communication industries, people travel more and also face a rising incidence of fractures, including tibia-fibula fracture [1]. Surgery is an important tool for patients diagnosed with fractures, but affects their prognosis significantly as a consequence of obvious surgical trauma and many complications [2].

Tibia-fibula fracture accounted for over 6% of the fractures which may happen, and tibia and fibula, as one of the important weight bearing backbones, are at higher risk of violent injury in life and work due to their relatively shallow position [3]. Patients with tibia-fibula fracture have to stay in bed for a long time even after a successful surgery with the affected limb immobilized, which affects venous blood flow, and results in a high risk of thrombosis [4]. Moreover, continuous limb immobilization is also associated with many other complications such as myophagism of lower extremity and joint movement disorder, which prolong the length of stay, increase the medical burden and affect the speed and quality of recovery [5].

For patients with fracture, routine nursing mainly focuses on the observation of conditions and basic recovery guidance that individualized needs are rarely satisfied. Fast track surgery (FTS) proposes to accelerate the postoperative recovery rate, minimize physiological and psychological stress [6] and help patients leave the hospital as soon as possible [7] via multiple optimized perioperative nursing measures, including minimal invasive operations. The concept therefore has been applied in the nursing of many kinds of fractures, but less in tibia-fibula fracture, in which, its specific role and related mechanisms have not been fully elucidated [8]. In this study, 79 patients with tibia-fibula fracture surgery were selected to explore the application value of FTS-based perioperative nursing.

Materials and methods

Materials

79 patients with tibia-fibula fracture were selected from our hospital from June 2018 to May 2019 and divided into two groups, 39 in G2 and 40 in G1 based on their time of admission. All patients were clear in consciousness, informed of the study content, and provided their consent to participate in the study approved by the ethics committee. (1) Inclusion criteria: Diagnosed with tibia-fibula fracture by CT [9]; a selective operation expected; age ≥18; no visual or hearing abnormalities affecting the study; and normal communication and comprehension. (2) Exclusion criteria: Open or old fractures; fractures in other sites; mental disorders; severe dysfunctions of the heart, liver, kidneys and lungs; active infection or neurovascular injury.

Methods

Patients in the G2 were routinely nursed in the perioperative period, including basic education before hospitalization, prohibition of water and food before the surgery, closely monitoring of vital signs after the surgery, and administration of analgesics if necessary. They were allowed to take in water and food only after the gas passed by anus, to remove the catheter after voluntary micturition was recovered, and to take recovery exercises as they wished.

For patients in the G1, FTS-based perioperative nursing was provided. The FTS team consisted of senior nurses of bone surgery who were professionally trained in advance and in terms of preoperative bowel preparation, insulation, pains, and nutrition management, functional exercise guidance, and health education contents and methods. The specific nursing is implemented as follows:

Admission education: Intensive education was performed in the ward twice a week by means of oral explanation, pictures, videos, and words, and also involved family members. The contents included notes in the hospital, knowledge related to FTS concept, pain, fracture and recovery, which were introduced in great details for understanding and cooperation from patients and family members. Preoperative guidance required patients to quit alcohol and tobacco, practice coughing and blowing air balloon actively according to the contents and methods specified.

Nutrition guidance: Preoperative time of food and water prohibition was shortened to 6 h and 2 h respectively. As the patients regained consciousness from anesthesia, vital signs were monitored, sensory motions of the extremities were evaluated, and any nausea and vomiting were observed. Patients without adverse reactions were provided with food, before which, the lips were swabbed with warm water and observed for 30 min, and then 100 ml of water was provided. Liquid food was acceptable 6 h later, and changed to semi-liquid or normal diets based on patients' tolerance. At a gradually rising amount, the diets were rich in energy, vitamins and quality proteins.

Pain intervention: Before the surgery, knowledge of pains was passed onto patients, including analgetics types and effects. Pain intensity was evaluated by the VAS, and measures were adopted correspondingly, including oral administration of analgetics in case of moderate and severe pains, or distraction in case of mild pains before and after the surgery.

Functional exercise guidance: Passive exercises were taken from 1 d to 3 d after the surgery, supplemented with active exercises. From 4 d to 7 d after the surgery, active exercises dominated from a small to a large amount. Nurses patiently communicated with patients who were unwilling to be involved in recovery exercise due to intensive pains after the surgery by explaining the importance of early participation in functional exercise. Appropriate methods were adopted to mitigate the pains, and then patients were guided for functional exercise. As the effects of anesthesia disappeared, the affected limb was elevated 15° for regular massage of toes and pulps. Under the guidance from nurses, patients bent and extended the toes for 10 s and then had a break of 5 min. Exercises after the surgery included ankle pump exercise and quadriceps femoris relaxation and contraction at the 1 d, gluteus maximus contraction at the 2 d, calf muscle contraction and exercise of

back muscles at the 3 d, straight leg raising at the 4 d, knee joint bending and extending at the 5 d, and hip joint movements at the 6 d.

Observation indexes

Postoperative recovery: The two groups were compared for the postoperative time to first exsufflation, length of stay and fracture healing time (blurred fracture line continuously passed by poroma according to the X-ray machine).

Swelling of the affected limb: Swelling of the affected limb before, at 1 week, 2 weeks, 3 weeks and 4 weeks after the surgery [10] were classified at 3 levels: level I: minor swelling, 1 point; level II: obvious swelling with rising skin temperature, 2 points; level III: bright swelling with tension blisters, 3 points.

Pain intensity: VAS was used to evaluate pain intensity before, at the end of surgery, 6 h, 24 h, 48 h and 72 h after the surgery. Patients selected a number on the scale from 0 to 10 to represent the pain they were suffering from. A larger number indicates more serious pains.

Complications: All patients were followed up for 6 months to compare the incidence of constipation, urinary tract infection (UTI), pulmonary infection and deep vein thrombosis of lower extremities. Deep vein thrombosis of lower extremities was diagnosed with color Doppler ultrasound by pressurizing the longitudinal and cross sections, which shall not press the vessels, during which, blood flow and sound disappeared.

Ankle range of motion (ROM): The extension, bending, pronation, supination, loaded eversion and inversion angles of the ankle before and at 6 months after the surgery were recorded for both groups.

Functions of lower extremities: The two groups were evaluated for recovery of ankle function by the AOFAS Ankle Hindfoot Scale [11] and knee joint function by the Lysholm criteria [12] before, at 3 months and 6 months after the surgery. The AOFAS Ankle Hindfoot Scale consisted of 9 items valuing 100 points, including pains, function and autonomous movements, limited daily activities, ground walking, abnormal gait, forefoot activities, backfoot activities, ankle-heel stability, and foot alignment. A point at or below 50 indicates poor performance, a point between 50 and 74 indicates acceptable performance while good performance is defined as a point between 75 and 89, and excellent performance with a point from 90 to 100. The Lysholm criteria contained 8 items of climbing stairs, pains, swelling, crouching, supporting, unstability, limping, interlocking, and adopted the centesimal system. Patients were normal with a point over 84, acceptable with a point between 66 and 84, and poor with a point below 65.

Statistical analysis

Statistical analysis was performed with SPSS22.0. In case of numerical data expressed as mean ± standard deviation, comparison studies were carried out through independent-samples T test; in case of nominal data expressed as [n (%)], comparison studies were carried out through X^2 test. For intragroup comparison at multiple points, ANVOA and F test were adopted. For all statistical comparisons, significance was defined as $P<0.05$.

Results

General materials

No statistical differences were found between the two groups in terms of proportions of male and female, educational background, history of alcohol and smoking, average age and BMI ($P>0.05$) (**Table 1**).

Postoperative recovery

Postoperative recovery comparison revealed shorter time to first exsufflation, length of stay and fracture healing in the G1 as compared with the G2 ($P<0.05$) (**Table 2**).

Swelling of the affected limb

The two groups were compared for improvement of swelling of the affected limb, and there was no statistical difference in the swelling scores before the surgery ($P>0.05$). At 1 week, 2 weeks, 3 weeks and 4 weeks after the surgery, G1 yielded lower swelling scores ($P<0.05$) (**Figure 1**).

Pain intensity

The two groups were not significantly different in VAS scores before the surgery ($P>0.05$). But

Table 1. Intergroup comparison of general materials ($\bar{x}$ ± sd)/[n (%)]

Materials		G1 (n=40)	G2 (n=39)	t/X^2	*P*
Gender	Male	23 (57.50)	21 (53.85)	0.107	0.744
	Female	17 (42.50)	18 (46.15)		
Age (y)		43.25±21.69	45.19±23.31	0.383	0.703
BMI (kg/m^2)		23.13±1.82	23.61±1.91	1.144	0.256
Educational background	Elementary school	13 (32.50)	11 (28.21)	0.623	0.281
	Junior or senior high school	21 (52.50)	21 (53.85)		
	College or undergraduate	6 (15.00)	7 (17.95)		
History of alcohol	Y	18 (45.00)	16 (41.03)	0.127	0.721
	N	22 (55.00)	23 (58.97)		
History of smoking	Y	25 (62.50)	27 (39.23)	0.398	0.528
	N	15 (37.50)	12 (30.77)		

Table 2. Intergroup comparison of postoperative recovery ($\bar{x}$ ± sd)

Group	n	Time to First Exsufflation (h)	Length of Stage (d)	Fracture Healing Time (m)
G1	40	16.25±3.29	20.13±11.45	3.12±1.08
G2	39	20.31±4.18	28.75±13.61	3.86±1.25
t		4.804	3.049	2.818
P		0.000	0.003	0.006

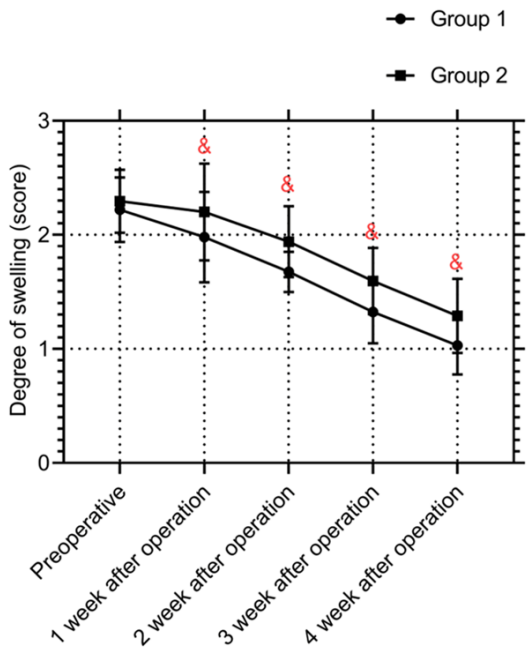

Figure 1. Intergroup comparison of swelling of the affected limb. Before the surgery, no significant difference was found between the two groups (P>0.05); At 1 week, 2 weeks, 3 weeks and 4 weeks after the surgery, the swelling scores were lower in the G1 (P<0.05). &P<0.05 vs the G2.

the VAS scores of the G1 at the end of surgery, 6 h, 24 h, 48 h and 72 h after the surgery were obviously lower (P<0.05) (**Figure 2**).

Incidence of complications

During the 6-month follow up, patients with constipation, UTI, pulmonary infection, deep vein thrombosis of lower extremities were 2, 1, 1, leading to an incidence of 12.50%, and 1 in the G1, but they were 4, 2, 2, and 4 in the G2 with an incidence of 30.77% (P<0.05) (**Table 3**).

Ankle ROM

Ankle ROM before the surgery showed no significant difference between the two groups in extension, bending, pronation, supination, loaded eversion and inversion angles of the ankle (P>0.05). At 6 months after the surgery, those indexes were significantly larger in the G1 (P<0.05) (**Table 4**).

Ankle function

According to changes of ankle function, no statistical difference was reported before the surgery for ankle function score (P>0.05). At 3 months and 6 months after the surgery, the ankle function score was markedly higher in the G1 (P<0.05) (**Figure 3**).

Knee joint function

For changes in knee joint function, the difference of knee joint function score was not

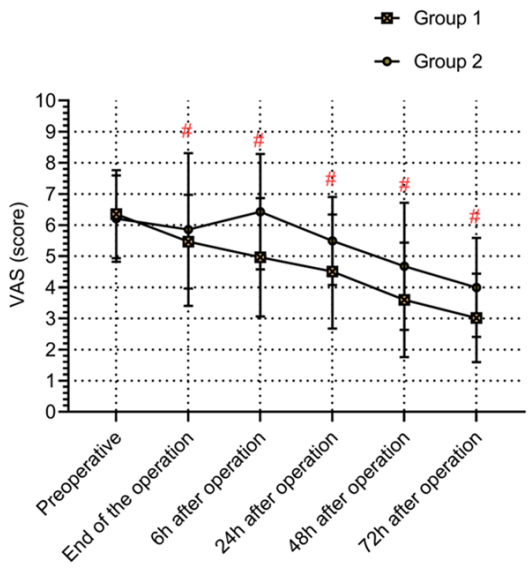

Figure 2. Intergroup comparison of pain intensity. The VAS scores were not statistically different between the two groups before the surgery (P>0.05). At the end, 6 h, 24 h, 48 h and 72 h after the surgery, the VAS scores were far lower in the G1 (P<0.05). #P<0.05 vs the G2.

statistically significant before the surgery (P>0.05). At 3 months and 6 months after the surgery, the G1 demonstrated significantly higher scores (P<0.05) (**Figure 4**).

Discussion

The specific requirements of FTS-based nursing include optimizing perioperative medical measures, preoperative education, pain management, thromboembolism prevention, standard anesthesia program, intraoperative fluid management, gastrointestinal function recovery, early guidance of recovery exercise, etc. [13]. Its purposes are mainly to stabilize the internal environment, control decomposition and metabolism, reduce muscle strength and protein content to avoid cell dysfunction, and ultimately minimize the body response to surgical stress [8].

The concept of FTS was put forward in the 1990s by scholars who believed that patients receiving surgical treatment had changes in organ functions, namely, stress reactions manifested as postoperative pains, discomfort and complications [14, 15]. Since its establishment, the FTS concept has been applied in multiple surgical nursing fields with good effects [16, 17], including gynecology, orthopedics, urinary surgery, cardiothoracic surgery, department of hepatobiliary surgery, and gastrointestinal surgery. It was introduced into the surgical nursing of China in 2007. Afterward, the accumulation of clinical experience, convention of China FTS conference and consensus on application of FTS in colorectal surgery laid a foundation for its further application in Chinese surgical nursing [18, 19].

The study of Wanden-Berghe et al. [20] showed that compared with the routine nursing, the integration of FTS in nursing could effectively shorten the post-executive length of stay, and the medical burden on patients. In this study, a FTS group was set up for the perioperative nursing of G1. The results indicated that the postoperative time to first exsufflation, length of stay and fracture healing was shorter, while the swelling scores of the affected limb from 1 week to 4 weeks after the surgery, the VAS scores at the end of surgery and from 6 h to 72 h after the surgery were lower in the G1 (P<0.05). It is suggested that FTS can accelerate the recovery of patients after fracture surgery, and mitigate swelling and pain quickly. Menger et al. [21] found that because of the shortened and early lifting of prohibition on food and water in the FTS nursing, less time was taken till the first postoperative exsufflation, and higher recovery exercise quality was achieved as compared with patients receiving routine perioperative nursing. Reasons are suggested to be the shortened prohibition on food and water in the FTS-based perioperative nursing that patients could face out and tolerate the surgery at better physiological status, which ensure their rapid recovery after the surgery. Besides, the FTS nursing emphasizes early food provision to patients without abnormality for a body strong enough through timely and sufficient nutrition supply to involve in postoperative recovery exercise and for better fracture healing effects. The obvious mitigation of swelling and pain intensity shall be explained by the FTS nursing which pays more attention to pain management through regular pain intensity evaluation, timely adjustment of individual and multimodal intervention means, such as distraction in case of mild pains, or analgesic and analgesia pump to stop moderate and severe pains. Such an intervention

Table 3. Intergroup comparison of postoperative incidence of complications [n (%)]

Group	Constipation	UTI	Pulmonary infection	Deep vein thrombosis of lower extremities	Total incidence
G1 (n=40)	2 (5.00)	1 (2.50)	1 (2.50)	1 (2.50)	5 (12.50)
G2 (n=39)	4 (10.26)	2 (5.13)	2 (5.13)	4 (10.26)	12 (30.77)
X^2					3.903
P					0.048

UTI: urinary tract infection.

Table 4. Intergroup comparison of ankle ROM improvement ($\bar{x}$ ± sd, °)

Group	Time	Extension	Bending	Pronation	Supination	Loaded eversion	Loaded inversion
G1 (n=40)	Before the surgery	5.46±1.03	15.27±1.32	12.85±1.33	16.85±1.28	11.25±1.56	5.37±1.62
	6 months after the surgery	11.53±2.06	30.88±2.24	20.16±1.96	30.23±1.88	4.85±0.58	2.62±0.89
G2 (n=39)	Before the surgery	5.61±1.09	15.31±1.39	13.02±1.37	17.12±1.33	11.50±1.63	5.41±1.69
	6 months after the surgery	7.49±1.37	18.41±1.92	15.24±1.43	20.34±1.55	9.46±1.31	4.31±1.52
t		10.237	26.536	12.719	25.477	20.311	6.049
P		0.003	0.000	0.002	0.000	0.001	0.008

Note: *t* and *p* as the comparative statistical values of both groups at 6 months after the surgery.

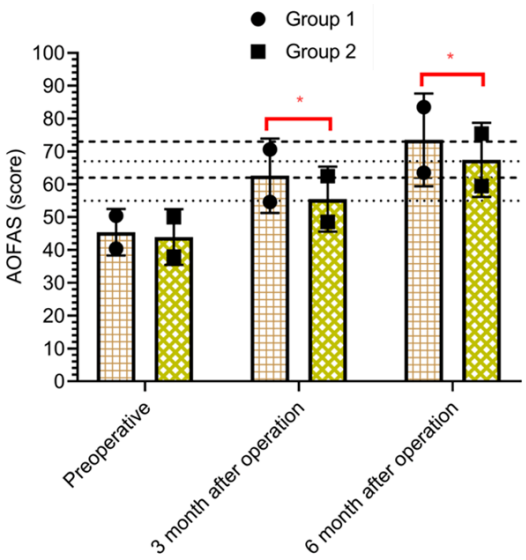

Figure 3. Intergroup comparison of ankle function. The two groups demonstrated no significant difference in ankle function score before the surgery (P>0.05). At 3 months and 6 months after the surgery, the ankle function score was higher in the G1 (P<0.05). *P<0.05 vs the G2.

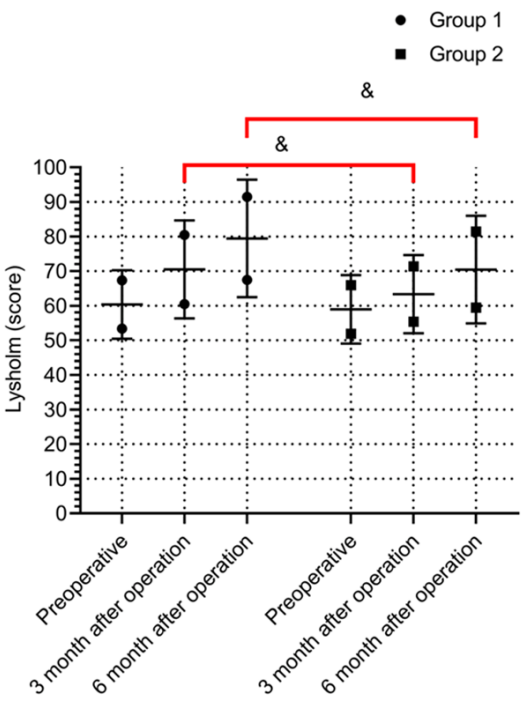

Figure 4. Intergroup comparison of knee joint function. The difference was not significant between the two groups for knee joint function scores before the surgery (P>0.05). At 3 months and 6 months after the surgery, the knee joint function score was markedly higher in the G1 (P<0.05). &P<0.05 vs the G2.

model managed to avoid misuse of analgesics and ensure the efficiency and quality of pain management.

Chen et al. [22] found in their study that the FTS-based nursing has played an active role in reducing various complications related to fracture surgery. In the present study, the incidence of complications in the 6 months af-

ter the surgery was lower, and the extension, bending, pronation, supination, loaded eversion and inversion angles of the ankle at 6 months after the surgery as well as the scores of ankle and knee joint functions at 3 months and 6 months after the surgery were higher in the G1 ($P<0.05$). Those data proved that the FTS-based perioperative nursing could improve surgical safety, accelerate postoperative recovery of knee and ankle joints, and play a significant role in guaranteeing the postoperative overall recovery quality. In addition, Schultz et al. [23] observed a sharp reduction in the incidence of deep vein thrombosis of lower extremities after FTS nursing, as the FTS stressed educating and equipping patients and their family members with health knowledge and practical understanding on the importance of their active cooperation in the surgery and nursing, which ensures high compliance during and after the surgery, surgery success rate and postoperative recovery quality. In this study, the G1 was associated with a lower incidence of deep vein thrombosis of lower extremities as compared with the G2. It is because that during the FTS nursing, nurses paid more attention to preventative education, guidance on early involvement in recovery exercise, correct dieting, minimization of repeated vessel puncturing in nursing to reduce the impact on and improve the status of blood flow in the lower extremities.

In conclusion, the FTS-based perioperative nursing, when applied on patients with tibia-fibula fracture, could mitigate swelling, postoperative deep vein thrombosis of lower extremities and other complications, and improve ankle ROM and knee-ankle functions. However, the limited number of patients and short follow-up duration led to results not representative enough and comprehensively analyzed. Further studies shall be based on a larger sample size and a longer follow-up duration, in order to obtain more scientific and representative conclusions for references during the nursing of patients with tibia-fibula fracture.

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Disclosure of conflict of interest

None.

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