Fast-track rehabilitation and nursing care in post-anesthesia care unit on orthopedic patients

AUTHORS

Xiulan Zou,
NR
Central Hospital of Weihai,
3 Mishandong Road West
Weihai, Shandong, China
scisci163@163.com

Zhiping Yu,
MD
Central Hospital of Weihai,
3 Mishandong Road West
Weihai, Shandong, China
yu458774122@163.com

Ling Cong,
NR
Central Hospital of Weihai,
3 Mishandong Road West
Weihai, Shandong, China
wjrwhw@sohu.com

Junru Wang,
NR
Central Hospital of Weihai,
3 Mishandong Road West
Weihai, Shandong, China
Junruwang33@126.com

KEY WORDS

orthopedic surgery, general anesthesia; fast-track rehabilitation; nursing

ABSTRACT

Objective
To assess the efficacy and outcome of fast-track rehabilitation (FTR) for orthopedic surgery patients.

Design
Randomised trial.

Setting
primary care.

Subjects and Methods
Two hundred and twenty patients undergoing orthopedic surgery under general anesthesia between November 2015 to March 2017 were randomly divided into traditional care (control, n=110) and fast-track rehabilitation (FTR, n=110) groups. Patients in the control group were given regular and routine care, while those in FTR group were cared for with multimodal rehabilitation. Demographic and data, postoperative hospital stays, surgical and general complications were assessed.

Results
One hour postoperative body temperature was higher in FTR group than in the control, and the incidence of restlessness, pain and 24 hour postoperative nausea and vomiting were significantly lower ($P < 0.05$, $P < 0.01$). The hospital stays were shorter following the FTR, but the difference was not statistically significant as compared with the control.

Conclusion
FTR can effectively reduce the complications and promote the recovery of the orthopedic patient.

INTRODUCTION

Fast-track surgery (FTS) initiated in the early 1990s aiming to reduce the length of hospital stays has been adapted in many hospitals (Esakov et al 2018; Kastelik et al 2018; Rao et al 2017). The main goal of this concept is to reduce the postoperative length of hospital stay (LOS) and accelerate the recovery of patients. To achieve this, a multidisciplinary team approach is implemented to maintain cardiovascular, pulmonary, gastrointestinal, neurological and humoral functions (Kehlet 2005) under the Consensus Guidelines for ERAS (Lassen et al 2009). This approach combines new technologies and methods with traditional care to reduce the postoperative stress response, complication rate and mortality, and hospitalisation costs (Na et al 2014; Anderson et al 2003). Based on syndrome medicine, a series of interventions can be implemented on preoperative, intraoperative and postoperative patients to minimize intraoperative stress and accelerate postoperative rehabilitation (Offodile et al 2018; Sizonenko et al 2018; Fierens et al 2012). Patients undergoing orthopedic surgery often have severe trauma and are slow to recovery (LeBlanc et al 2014). It is therefore important to develop pathways that reduce surgical stress and enhance rehabilitation for them. Post-Anesthesia Care Unit (PACU) care has been proposed to provide continuous monitoring of patients following anesthesia and surgery to reduce postoperative complications (Varadhan et al 2010; Jakobsen et al 2006). Several studies have shown that FTS rehabilitation improves patient's recovery. For example, it was found that adding a 15-minute-walk on the day of surgery did not increase pain in patients after total knee arthroplasty with enhanced recovery (Zietek et al 2015). Reduced length of stay, increased patient satisfaction and low revision rates together with improved health-related quality of life and functionality have been reported when FTS is implemented (Winther et al 2015). However, it is unclear if and how FTR in PACU would enhance the recovery of orthopedic patients. We investigated the recovery of orthopedic patients with FTR interventions in PACU, and report the role of nursing in the FTR.

PATIENTS AND METHODS

Two hundred and twenty patients undergoing orthopedic surgery under general anesthesia and moved to PACU with tracheal tubes between November 2015 and March 2017 at our hospital were selected for the study. All patients had limb fractures. Patients with pathological fractures and serious cardiovascular or other organ dysfunction were excluded. The patients were randomly divided into 110 cases in the control and the FTR groups using a random number table. The control group consisted of 46 male and 64 female, aged from 29 to 91 (57.76 ± 13.76) years with 24 cases of upper limb fracture and 86 cases of lower limb fracture. The operation time ranged from 55 to 220 (128.04 ± 69.29) minutes. There were 54 males and 56 females in the FTR group, aged from 25 to 88 (59.22 ± 15.74) years. 28 and 82 patients in the group had upper limb lower extremity fracture, respectively, and the operation time was 65 to 210 (120.26 ± 55.16) minutes. There was no significant difference in gender, age and operation time between the two groups ($P > 0.05$).

THE FAST–TRACK PROCEDURE

The fast–track procedure is based on principles previously described (Husted 2012; Kehlet and Wilmore 2008) and was implemented by the nursing team. For patients in the control group, the traditional anaesthesia and PACU resuscitation cares were used. After surgery, the patients with tracheal tubes were sent to the PACU at 22 to 24 degrees celsius with a humidity of 50% to 60%, where they were connected to a connecting ventilator with a tidal volume of 8 to 10mL/kg, respiratory frequency of 12 times/ min at an oxygen flow rate of 1 to 2L/min. The patients were monitored for heart rate, respiration, arterial blood pressure and blood oxygen saturation using a multifunction monitor (MP30, Philipps, USA). Postoperative infusion liquid was heated to 37 degrees celsius and infused at a speed of 40 of 60gtt/min. Patients were prescribed analgesic agents

if the pain was unbearable. Once breathing spontaneously, the patients were intravenously injected with 0.02mg/kg of neostigmine (0.02 mg/kg) and atropine (0.01 mg/kg). After extubation oxygen (2-3 L/min) was supplied using nasal cannula till the Steward score was equal to or more than four, and the patient was sent back to the ward. For patients in the FTR group, the nursing team performed the following additional cares:

Body temperature Control

Once sent to the PACU, patient's axillary temperature was measured. If the temperature was < 36 degrees celcius, heating was given at 38 degrees celcius till the temperature reached 37 degrees celcius.

Infusion control

Infusion volume and rate were carefully controlled according to the change of vital signs of patients after operation to meet minimum effective perfusion. In general, the infusion rate was between 20 to 40gtt/ min to avoid excessive heart and lung burden.

Reducing extubation stimulation

Patients continued to use propofol after entering PACU till spontaneous breathing occurred, tidal volume and ventilation volume had restored to the normal range. The patients ceased to use the ventilator. If SpO_2 was > 0.95 and swallowing was observed, the tube was removed and propofol was then discontinued.

Pain care

Thirty minutes before extubation or operation, patients were given analgesics. After operation, analgesics were applied with enhanced and foreseeable pain care. The pain was evaluated as soon as the patients become conscious. If the pain score was two to three, the nurses would take measures to transfer patient's attention, such as playing light music or conducting psychological counseling. If the score was > four, appropriate analgesics were given. If necessary, the analgesic pump might be used for individualised analgesia.

Nausea and vomiting prevention

For patients undergoing lower extremity surgery, nerve block analgesia was applied to reduce opioid drugs that may cause nausea and vomiting. When necessary, antemetics such as droperidol were used.

Psychological intervention

Once conscious, the nurses were introduced to the patients, who would explain the details of surgery, location and time where he/she stayed, as well as the function of PACU to the patients. The purpose was to let patient to have a full understanding of surgery and postoperative care processes for better compliance and cooperation.

Evaluation method

Temperature at the completion of the operation and one hour after were compared. Riker sedation-agitation scale (SAS) and pain numeric rating (PNR) scale were used to assess the sedation-agitation and pain after extubation. The incidence of nausea and vomiting within 24 hours after operation was recorded.

ETHICS

The Declaration of Helsinki (World Medical Association 2008) ethical principles for research involving human subjects were applied. The study was approved by the ethics committee of the hospital. All patients were informed about the study's purpose, the voluntary nature of their participation, and the right to withdraw at any time. Oral informed or written consent was obtained from every participant.

STATISTICAL ANALYSIS

Data were analyzed using SPSS21.0 software. Measurement data were compared using the t test and rank sum test. χ^2 test was used to compare enumeration data. The significant level was set at 0.05.

FINDINGS

Temperatures in the two groups are presented in table 1. As shown, the average one hour post-operative temperature in the FTR group was significantly higher as compared to those in the control, while the temperatures immediately after operation were similar.

Table 1: Body temperatures of orthopedic patients immediately and one hour after surgery

Group	No. patients	Immediately after surgery	1 hour after surgery
Control	110	34.84±0.27	36.00±0.20
Fast-track rehabilitation	110	34.90±0.23	37.12±0.25
t		1.196	22.627
P		>0.05	<0.01

The scores of sedation-agitation and pain and the incidence of nausea and vomiting after extubation and hospital stay days are shown in table 2. These figures were significantly less in the FTR group than in the control group.

Table 2: Scores of sedation-agitation and pain, the incidence of nausea and vomiting after extubation and hospital stay days

Group	No. patients	Sedation-agitation	Pain	Nausea	Vomiting	Hospital stays (day)
Control	110	4.06±0.82	4.02±1.31	18 (16.4)	16 (14.5)	34.4±6.55
Fast-track rehabilitation	110	3.78±0.42	1.90±0.88	4 (3.6)	2 (1.8)	30.6±4.55
X^2/t		2.10	7.06	5.01	4.39	12.22
P		<0.05	<0.05	<0.05	<0.05	<0.05

DISCUSSION

Perioperative stress results from many aspects, including tension, anxiety, hunger, hypothermia, pain, anesthesia and infusion and each of them has an impact on the whole treatment and recovery effect. Applying the concept of FTR would optimize the efforts of medical treatments and nursing measures, reduce the stress and accelerate recovery (Fierens et al 2012; Basse et al 2002) . Several nursing care measures were implemented in our study as part of FTR care to accelerate patient's recovery. Psychological nursing is an important part of FTS. Since the operation causes injury of the body, the patient has the psychology of fear, tension, anxiety and depression. The study shows that 38.46% and 23.08% of fracture patients feel anxious and depressed, respectively (Tang et al 2008). Anxiety and depression often make patients less cooperative in the surgery and increase the risk of operation and postoperative complication rate (Brooke et al 2014). Appropriate psychological care helps relieve patients from the fear, anxiety and physiological stress, resulting in better recovery with less complications (Na et al 2014). In addition, psychological nursing helps develop a good nurse - patient relationship and reduce the emotional fluctuation, psychological and physiological stress of patients. In this hospital, much of psychological nursing is offered by senior nurses, who have been specifically trained or acquired relevant know-how during their career.

Preventing hypothermia after an operation is another important aspect of postoperative care. Perioperative hypothermia is a common complication of surgery, leading to 1.0 to 15 degrees celcius reduction of body temperature in 50% to 70% patients after surgery (Giuliano and Hendricks 2017). Hypothermia may cause a number of adverse reactions, such as incision infection, myocardial ischemia, adverse cardiac events, chills,

and coagulation dysfunction, and prolong and affect the effect of drugs, delay the awakening of anaesthesia and increase mortality. Maintenance of normothermia can reduce the influence of body temperature on coagulation mechanism, drug metabolism and oxygen consumption, and reduce low temperature-associated complications (Prunet et al 2012; Khan et al 2011). As part of FTR, controlled infusion on operation day and after operation is closely monitored by the nursing team in the hospital. It was noted that in the traditional surgical operation and post operation, large infusion is used to maintain desirable blood pressure. However, the postoperative stress would lead to increased secretion of antidiuretic hormones, resulting in water and sodium retention. Therefore, large infusion would aggravate cardiovascular burden. There is evidence that reduced liquid infusion is beneficial for reducing postoperative complications and shortening the postoperative hospital stay (Brandstrup 2006). Therefore, as long as the patient's vital signs are normal, the amount of fluid infusion should be restricted. Reducing pain-induced irritation is an important step in FTR care. Although preventive analgesia effectively reduces the stress response of patients (Buvanendran and Kroin 2009), this study found that nursing care also assists calm the patient's emotion and irritation and should be enhanced. Prevention of postoperative nausea and vomiting, which are common complications after surgery, is another part of nursing intervention to alleviate the negative emotions of patients. This can be achieved by providing a comfortable, clean environment, and if necessary, the use of prescribed antiemetics.

This study shows that by practicing the above-mentioned FTR care through the nursing team, the one hour post-operative temperature, scores of sedation-agitation and pain, the incidence of nausea and vomiting and hospital days were significantly reduced compared to traditional care, demonstrating these nursing measures are effective in accelerating the recovery of the orthopedic patient. The study shows that for orthopedic patient care in the PACU following general anesthesia, it is possible to shorten the hospitalisation time, improve patient satisfaction, minimise surgical stress, prevent and reduce the complications and promote postoperative rehabilitation through combined use of several care measures.

CONCLUSION

A FTR care helps improve the treatment outcomes of patients undergoing orthopedic surgery and the nursing team plays a pivotal role in implementing the program.

REFERENCES

Anderson, A.D., McNaught, C. E., MacFie, J., Tring, I., Barker, P. and Mitchell, C.J. 2003. Randomized clinical trial of multimodal optimization and standard perioperative surgical care. *British Journal of Surgery,* 90(12):1497-1504.

Basse, L., Jacobsen, D.H., Billesbolle, P. and Kehletn, H. 2002. Colostomy closure after Hartmann's procedure with fast-track rehabilitation. *Diseases of the Colon & Rectum*, 45(12):1661-1664.

Brandstrup, B. 2006. Fluid therapy for the surgical patient. *Best Practice & Research Clinical Anaesthesiology*, 20(2):265-283.

Brooke, K.J., Faux, S.G., Wilson, S.F., Liauw, W., Bowman, M. and Klein, L. 2014. Outcomes of motor vehicle crashes with fracture: a pilot study of early rehabilitation interventions. *Journal of Rehabilitation Medicine*, 46(4):335-340.

Buvanendran, A. and Kroin, J.S. 2009. Multimodal analgesia for controlling acute postoperative pain. *Current Opinion in Anesthesiology,* 22(5):588-593.

Esakov, Y.S., Pechetov, A.A., Raevskaya, M.B., Khlan, T.N., Sizov, V.A. and Makov, M.A. 2018. Fast-track rehabilitation after anatomical lung resection: prospective single-center non-randomized trial. *Khirurgiia (Mosk)*, (11):5-10.

Fierens, J., Wolthuis, A.M., Penninckx, F. and D'Hoore, A. 2012. Enhanced recovery after surgery (ERAS) protocol: prospective study of outcome in colorectal surgery. *Acta chirurgica Belgica,* 112(5):355-358.

Giuliano, K.K. and Hendricks, J. 2017. Inadvertent Perioperative Hypothermia: Current Nursing Knowledge. *AORN Journal*, 105(5):453-463.

Husted, H. 2012. Fast-track hip and knee arthroplasty: clinical and organizational aspects. *Acta Orthop Suppl,* 83(346):1-39.

Jakobsen, D.H., Sonne, E., Andreasen, J. and Kehlet, H. 2006. Convalescence after colonic surgery with fast-track vs conventional care. *Colorectal Disease*, 8(8):683-687.

Kastelik, J., Fuchs, M., Kramer, M., Trauzeddel, R.F., Ertmer, M., von Roth, P., Perka, C., Kirschbaum, S.M, Tafelski, S.and Treskatsch, S. 2018. Local infiltration anaesthesia versus sciatic nerve and adductor canal block for fast-track knee arthroplasty: A randomised controlled clinical trial. *European Journal of Anaesthesiology*, 36(4):255-263.

Kehlet, H. 2005. Fast-track colonic surgery: status and perspectives. Recent Results in Cancer Research, 165:8-13.

Kehlet, H. and Wilmore, D.W. 2008. Evidence-based surgical care and the evolution of fast-track surgery. *Annals of Surgery*, 248(2):189-198.

Khan, Z.H., Arab, S. and Emami, B. 2011. Comparison of the effects of anesthesia with isoflurane and total intravenous anesthesia on the intensity of body temperature reduction during anesthesia and incidence of postoperative chills. *Acta Medica Iranica*, 49(7):425-432.

Lassen, K., Soop, M., Nygren, J., Cox, P.B., Hendry, P.O, Spies, C., von Meyenfeldt, M.F., Fearon, K.C., Revhaug, A., Norderval, S., Ljungqvist, O., Lobo, D.N., Dejong, C.H. and Enhanced Recovery After Surgery Group. 2009. Consensus review of optimal perioperative care in colorectal surgery: Enhanced Recovery After Surgery (ERAS) Group recommendations. *Archives of Surgery*, 144(10):961-969.

LeBlanc, J., Donnon, T., Hutchison, C. and Duffy, P. 2014. Development of an orthopedic surgery trauma patient handover checklist. *Canadian Journal of Surgery,* 57(1):8-14.

Na, J., Wang, R., Wang, G., Bao, H., Tao, H., Bai, Z. and He, S. 2014. Application of perioperative nursing care based on fast-track surgery for patients with hepatocellular carcinoma. *Journal of Nursing Science,* 29(16):32-35.

Offodile, A.C., 2nd, Gu C., Boukovalas, S., Coroneos, C.J, Chatterjee, A., Largo, R.D. and Butler, C. 2019. Enhanced recovery after surgery (ERAS) pathways in breast reconstruction: systematic review and meta-analysis of the literature. *Breast Cancer Research and Treatment,* 173(1):65-77.

Prunet, B., Asencio, Y., Lacroix, G., Bordes, J., Montcriol, A., D'Aranda, E., Pradier, J.P., Dantzer, E., Meaudre, E., Goutorbe, P. and Kaiser, E. 2012. Maintenance of normothermia during burn surgery with an intravascular temperature control system: a non-randomised controlled trial. *Injury*, 43(5):648-652.

Rao, J.H., Zhang, F., Lu, H., Dai, X.Z., Zhang, C.Y., Qian, X.F., Wang, X.H. and Lu, L. 2017. Effects of multimodal fast-track surgery on liver transplantation outcomes. *Hepatobiliary & Pancreatic Diseases International,* 16(4):364-369.

Sizonenko, N.A., Surov, D.A., Solov'ev, I.A., Demko, A.E., Osipov, A.V., Gabrielyan, M.A. and Pavlovsky, A.L. 2018. Evolution of enhanced recovery after surgery: from the beginning of the study of stress to the introduction in emergency surgery. *Khirurgiia (Mosk),* (11):71-79.

Tang, H., Yang, M. and Zhang, L. 2008. The relationship between anxiety, depression and heart of fracture patients with psychological control source and coping style. *Chinese Journal of Nursing*, 14(27):2841-2844.

Varadhan, K.K., Neal, K.R., Dejong, C.H., Fearon, K.C., Ljungqvist, O. and Lobo, D.N. 2010. The enhanced recovery after surgery (ERAS) pathway for patients undergoing major elective open colorectal surgery: a meta-analysis of randomized controlled trials. *Clinical Nutrition,* 29(4):434-440.

Winther, S.B., Foss, O.A., Wik, T.S., Davis, S.P., Engdal, M., Jessen, V. and Husby, O.S. 2015. 1-year follow-up of 920 hip and knee arthroplasty patients after implementing fast-track. *Acta Orthopaedica,* 86(1):78-85.

Zietek, P., Zietek, J., Szczypior, K. and Safranow, K. 2015. Effect of adding one 15-minute-walk on the day of surgery to fast-track rehabilitation after total knee arthroplasty: a randomized, single-blind study. *European Journal of Physical and Rehabilitation Medicine*,51(3):245-252.