JBUON 2018; 23(5): 1426-1431
ISSN: 1107-0625, online ISSN: 2241-6293 • www.jbuon.com
E-mail: editorial_office@jbuon.com

ORIGINAL ARTICLE

Application and efficacy evaluation of an NBASS-APS pain management model in postoperative analgesia for gastric cancer patients

Miao Zhang, Rui Li, Hong Chen, Juan Zhou, Ye Zhang

Anesthesia Department, the Second Hospital of Anhui Medical University, Hefei, China

Summary

Purpose: *Postoperative pain is a complex physiological and psychological response caused by noxious stimulation and almost occurs in every patient. The purpose of this study was to investigate the outcome of an NBASS-APS pain management model, which refers to nurse-based, anaesthesiologist and specialist-supervised (NBASS) acute pain services (APS), in postoperative analgesia for gastric cancer patients.*

Methods: *228 patients were included and were randomly divided into an observation group of 113 individuals and a control group of 115 individuals. The observation group subjects were provided with an NBASS-APS pain management model; the control group subjects were provided with customary APS (C-APS), which included postoperative analgesia services managed by pain care nurses and physicians. In addition, a comparative study was performed to examine the postoperative analgesic outcome, postoperative recovery of physiological function, and the patient satisfaction levels of the two groups.*

Results: *The observation group had significantly lower values for the postoperative visual analogue score (VAS) after return to the ward compared with those in the control group ($p<0.05$), the postoperative VAS mean, duration of the maximal VAS value, and duration of the VAS value >3 than those in the control group ($p<0.05$), and the patients in the observation group exhibited the same effect in the first ambulation time and postoperative hospital stay ($p<0.05$). The observation group had a significantly greater sleep duration within the first postoperative 48 hrs ($p<0.05$), and also showed a significantly greater score in the satisfaction level for the postoperative analgesic effect ($p<0.05$).*

Conclusion: *These findings suggest that the NBASS-APS pain management model effectively reduced the postoperative pain of gastric cancer patients, benefited their recovery of physiological functions, and improved their satisfaction with the postoperative analgesic effect.*

Key words: *gastric cancer, model of acute pain services, pain*

Introduction

Postoperative pain is the most common acute pain that occurs immediately after surgery and requires the highest level of emergency treatment. It has been reported that 91.4% of surgical patients experienced some medium to several levels of postoperative pain [1, 2]. With the rapid development of medicine, the mechanisms of postoperative pain have been thoroughly investigated and many analgesic drugs and technologies are being clinically applied [3]. However, the postoperative pain of 50-70% surgical patients cannot be effectively alleviated [4]. Such inadequate quality of postoperative pain care lies mainly in the improper use and management of analgesic drugs and treatments

Correspondence to: Ye Zhang, MD. Anesthesia Department, the Second Hospital of Anhui Medical University, 678 Furong Road, Hefei Economic and Technological Development Zone, Hefei 230601, Anhui, China.
Tel and fax: +86 0551 63869485, E-mail: zhangy_sina@163.com
Received: 27/02/2018; Accepted: 14/03/2018

[5]. Although the nurse-based, anaesthesiologist-supervised acute pain service (NBAS-APS) allows nurses to fully play their roles and is regarded as a good postoperative pain management model [6], there still exist some problems, evidenced by the insufficient number of anaesthesiologists employing it and the poor coordination between ward nurses and anaesthesiologists [7-9], and no acute pain management model has been reportedly used in postoperative analgesic management for gastric cancer patients so far. Hence, we modified the NBAS-APS to establish nurse-based, anaesthesiologist- and specialist-supervised APS (NBASS-APS) and applied it in the postoperative analgesic treatment for gastric cancer patients who underwent radical gastrectomy to investigate the influence of this new model on the postoperative pain care of such patients.

Methods

Ethics

All this study's protocols were approved by the Second Hospital of Anhui Medical University and in accordance with the guidelines provided by the CPCSEA and World Medical Association Declaration of Helsinki on Ethical Principles for Medical Research. Written informed contents and permissions were obtained from all participants.

Study subjects

Recruited patients had undergone radical gastrectomy in the Second Hospital of Anhui Medical University between July 2015 and June 2016. The inclusion criteria were as follows: i) patients with American Society of Anesthesiologists (ASA) physical status classification of I-III(10); ii) patients diagnosed with gastric cancer based on clinicopathological examination; iii) patients scheduled for radical gastrectomy; iv) patients receiving intravenous general anaesthesia; v) patients 18 years of age or older; vi) patients with education levels of elementary school or above; vii) patients receiving 2 days of intravenous analgesic administration of Sufentanil (1.5 μg/kg/d) + Granisetron hydrochloride (2 mg) after their operation; viii) patients being monitored in an anaesthesia recovery room after the operation; and ix) patients who signed informed consent. The exclusion criteria included the following: i) patients with a history of chronic pain and a long history of taking analgesics; ii) patients with a history of drug addiction; iii) patients with history of concurrent diabetes, hypertension, and cardiovascular diseases; iv) patients with history of concurrent liver diseases, kidney diseases, and bleeding/coagulation dysfunction; and v) patients with cognitive impairment and mental illness.

A total of 228 patients who met the inclusion criteria were randomly divided into a control group (113 subjects) and an observation group (115 subjects). The control group was cared with customary acute pain services (C-APS), whereas the observation group with NBASS-APS. Patients in both groups were subjected to intravenous general anaesthesia. Subjects of the observation group, consisting of 32 females and 81 males, had an age range of 35-75 years and an average age of 64.84±6.17 years. Among them, there were 35 individuals with ASA I, 57 with ASA II, and 23 with ASA III scores. The mean duration of surgery was 258.76±13.51 min. Subjects of the control group, consisting of 31 females and 84 males, had an age range of 35-80 years and an average age of 64.94±5.94 years. Among them, there were 27 individuals with ASA I, 60 with ASA II, and 26 with ASA III scores. The mean duration of surgery was 240.50±13.35 min. The two groups showed no significant differences in age, gender, disease diagnosis, anaesthesia means, ASA classification, or duration of surgery ($p>0.05$), thus, they were comparable.

Research methods

Control group (C-APS group)

The control group was provided with C-APS, a postoperative analgesic management model managed by ward pain care nurses and physicians. When a patient felt apparent pain and reported to a surgeon via a ward nurse, the surgeon provided the patient with analgesic medication according his/her conditions.

Observation group (NBASS-APS group)

Establishment of a postoperative analgesic management panel

A postoperative analgesic management panel was established in the Department of Anaesthesia, which included anaesthesiologists, ward physicians, and ward pain care nurses. Among them, there were four pain care nurses who were trained with pain management knowledge, including pain identification, assessment, non-drug analgesic methods, drug-based analgesic methods, and surveillance and treatment for side effects of common analgesic medications. The pain care nurses were trained to use VAS to assess the postoperative pain intensity of the patients such that minor pain corresponded to VAS scores of 1-3, intermediate pain corresponded to VAS scores of 4-6, and severe pain corresponded to VAS scores of 7-10.

Implementation of postoperative analgesic management

A 24-h pain hot-line was established in the Department of Anesthesia. When a patient returned to the ward, the patient and his/her family members were trained by pain care nurses on pain cognition, pain assessment, and non-drug analgesic methods. Subsequently, postoperative analgesic assessment was performed by a panel composed of pain care nurses and surgeons for the patient using the VAS, with 10 as the maximum score. If a VAS score was below 3, a surgeon would advise a nurse to perform non-drug analgesic care and psychological care based on patient conditions. If a VAS score was above 3, a surgeon would consult an APS anaesthesiologist and use appropriate analgesic drugs under

the guidance of the anaesthesiologist. In addition, APS anaesthesiologists were responsible for directing the ward surgeons to treat intermediate and severe pain, to perform one ward round daily for the postoperative analgesic patients, to determine the efficacy and safety of analgesic treatment, and to modify a patient's analgesic plan if necessary.

Observation indices

We designed a questionnaire of analgesic effects for the patients, which included the following contents: i) general information, such as age, gender, disease diagnosis, anaesthesia means, surgical duration, and ASA classification; ii) VAS score (within the first 72 hrs after a patient returned to the ward, he/she was documented every 4 hrs; the score was simplified into four indices based on the method reported by Brooks [11], namely, maximal postoperative VAS, postoperative VAS mean, duration of maximal VAS, and duration of VAS>3); iii) recovery of physiological function, including first ambulation time, sleep duration in the first postoperative 48 hrs, and postoperative hospital stay; and iv) satisfaction with postoperative analgesic outcome evaluated on a scale of 4 (very unsatisfactory, unsatisfactory, satisfactory, very satisfactory).

Data collection

The questionnaire of analgesic effects was used to evaluate the observation indices. Before implementation, pain care nurses were all trained by the postoperative analgesic management panel; the questionnaire of analgesic effects was surveyed by pain care nurses. Within the first 72 hrs after a patient returned to the ward, his/her VAS score was recorded every 4 hrs. Recovery of physiological function was also documented, including first ambulation time, sleep duration in the first postoperative 48 hrs, and postoperative hospital stay. After the first 72 hrs of returning to the ward, the patient's satisfaction with their analgesic efficacy was evaluated. Lastly, the postoperative analgesic management panel inspected the analgesic outcome questionnaires filled out by the pain care nurses every day to avoid missing any items. The questionnaires were collected every week. A total of 228 valid questionnaires were collected in this study.

Statistics

Microsoft Excel was used to establish a database. Data input was performed by two researchers. SPSS 20.0 statistical software (IBM, Armonk, NY, USA) was used for statistical analyses. Measurement data with normal distribution were all expressed as means±standard deviations (x±s); those data that did not match a normal distribution were expressed as medians and interquartile ranges. Comparisons of measurement data between the two groups were accomplished with the two-sample t-test if the data matched normal distribution or with the rank-sum test if the data was not normally distributed. Comparison of count data between the two groups was accomplished with the x^2 test. $p<0.05$ indicated statistical significance.

Results

General characteristics of the study subjects

As shown in Table 1, there were no significant differences in age, gender, operation time and ASA classification ($p>0.05$).

Comparison of the two groups in VAS scores after return to the ward

As shown in Table 2, the VAS scores of the observation group after return to the ward were significantly lower from 4 hrs to 32 hrs than those in the control group ($p<0.05$).

Comparison of the two groups in postoperative analgesic VAS scores and pain duration

As shown in Table 3, the maximal postoperative VAS, the mean postoperative VAS, duration of maximal VAS and duration of VAS >3 of the observation group were all significantly lower than those of the control group ($p<0.05$).

Comparison of the two groups in postoperative recovery of physiological functions

As shown in Table 4, the comparisons of postoperative recovery of physiological functions revealed that the first ambulation time and the postoperative hospital stay of the observation group were both significantly lower than those of the control group ($p<0.05$). In addition, the sleep duration in the first postoperative 48 hrs of the observation group was significantly longer than that of the control group ($p<0.05$).

Comparison of the two groups in terms of patient satisfaction over their postoperative analgesic outcomes

As shown in Table 5, the observation group showed a significantly superior satisfaction over postoperative analgesic outcome compared with that of the control group ($p<0.05$).

Discussion

Postoperative pain is a common condition after surgery that not only agonizes patients mentally but may also affect disease progression and compromise treatment outcome [12]. The NBAS-APS postoperative pain management model is currently regarded as a relatively good choice. However, in practice, the model still has some limitations. First, this model of postoperative analgesia was based on the duty of ward nurses and was supervised by anaesthesiologists. China is in great short supply of anaesthesiologists, which is common even in

the top tier (Tertiary Class A) hospitals [13]. The insufficient number of anaesthesiologists can result in tremendous difficulties in fully performing postoperative analgesia for surgical patients. In addition, it is not always easy to coordinate the duty of ward nurses and anaesthesiologists. Furthermore, although pain care nurses receive training from anaesthesiologists in pain management knowledge, they still need guidance from specialist clinicians in executing the advised medication and handling the side effects of certain drugs [14].

On the basis of the NBAS-APS, this study introduces specialist surgeons into the panel of postoperative analgesic management, fully integrating human resources in anaesthesia, surgery and nursing to provide comprehensive and reliable postoperative analgesia for the patients. This NBASS-APS model overcomes the current situation of inadequate human resources of anaesthesiologists and improves the coordination between specialist clinicians and pain care nurses. As a consequence, the enthusiasm of specialist clinicians in postoperative analgesic management is encouraged, which makes this model superior to C-APS and NBAS-APS. Postoperative pain is a nociceptive stimulation that may cause gastrointestinal

Table 1. Demographic and clinical characteristics of all participants (observation group and control group)

Characteristics	*Observation group (n=113) n (%)*	*Control group (n=115) n (%)*	*p value*
Age,years (mean±SD)	64.84±6.17	64.94±5.94	0.694
Sex			0.455
Female	32 (28.3)	31 (27.0)	
Male	81 (71.7)	84 (73.0)	
Operation time, min (mean±SD)	258.76±13.51	240.50±13.35	0.219
ASA grading			0.187
I	23 (20.3)	21 (18.3)	
II	73 (64.6)	82 (71.3)	
III	17 (15.1)	12 (10.4)	

Table 2. Comparison of the two groups in VAS scores after return to the ward

Characteristics	*Observation group (n=113)*	*Control group (n=115)*	*p value*
VAS scores after return to the ward (time/h), mean±SD			
0	3.74±0.74	3.81±0.71	0.995
4	3.51±1.10	5.32±0.79	<0.001
8	3.31±0.67	3.70±0.69	0.007
12	3.19±0.68	3.70±0.50	0.008
16	3.11±0.57	3.49±0.52	0.025
20	3.04±0.56	3.48±0.74	0.037
24	2.95±0.32	3.05±0.26	0.044
28	2.09±0.29	2.90±0.32	0.009
32	2.07±0.26	2.30±0.48	0.017
36	2.00±0.00	2.02±0.16	0.077
40	2.00±0.00	2.00±0.00	0.477
44	2.00±0.00	2.00±0.00	0.478
48	2.00±0.13	1.99±0.16	0.359
52	1.91±0.29	1.93±0.26	0.081
56	1.51±0.50	1.69±0.47	0.059
60	1.16±0.37	1.37±0.50	0.041
64	0.92±0.50	1.16±0.59	0.037
68	0.68±0.62	0.91±0.67	0.020
72	0.09±0.40	0.42±0.61	0.009

Table 3. Comparison of the two groups in postoperative analgesic VAS scores and pain duration

Characteristics	*Observation group (n=113) Mean±SD*	*Control group (n=115) Mean±SD*	*p value*
Maximal VAS score	4.49±0.50	5.55±0.60	0.003
Mean of postoperative VAS	1.70±0.33	2.67±0.35	0.003
Duration of maximal VAS (h)	2.51±0.25	4.20±0.23	0.007
Duration of maximal VAS>3 (h)	3.58±0.61	5.47±0.65	0.003

Table 4. Comparison of the two groups in postoperative recovery of physiological functions

Characteristics	*Group A (%) (n=113) mean ± SD*	*Group B (%) (n=115) mean ± SD*	*p value*
First ambulation time (h)	50.70±13.27	75.67±10.56	0.004
Postoperative 48-h sleep duration (h)	15.23±2.41	10.56±2.15	0.007
Postoperative hospital stay (d)	10.52±1.25	14.27±1.27	0.004

Table 5. Comparison of the two groups in terms of patient satisfaction over their postoperative analgesic outcomes

Characteristics	*Observation group (n=113) n*	*Control group (n=115) n*	*p value*
			<0.001
Satisfactory	32	32	
Unsatisfactory	3	29	
Very unsatisfactory	0	14	

dysfunction, weakened urethral and bladder movement and complications such as sleep disorders in the affected patient [15]. As a consequence, if postoperative pain is not properly managed, patients may experience prolonged hospital stays and larger medical bills. It has been reported that the popularization of analgesic knowledge could markedly improve patients' awareness of pain control, ameliorate their postoperative analgesic demand, improve their acceptance of postoperative analgesia, and effectively control postoperative pain [16]. In this study, the pain care nurses were first trained with pain management knowledge, which helped them to better educate patients on postoperative pain. Correspondingly, patients exhibited increased acceptance of postoperative analgesia and willingness to cooperate with medical staff, which ultimately translated into a variety of benefits, including early ambulation time, improved sleep, faster recovery of physiological functions, and shortened postoperative hospital stay.

Patient satisfaction is a crucial index to evaluate nursing performance. It has been previously reported that utilizing satisfaction surveys with hospitalized patients can boost continuous improvements in nursing quality [17]. In traditional acute pain services, patients have to endure postoperative pain until it becomes unbearable, when they inform physicians to receive medical advice that is executed by nurses. In comparison, the NBASS-APS enlists multidisciplinary human resources of anaesthesiologists, specialists and nurses to proactively prevent patients' pain and provide them with postoperative analgesic pain management. This strategy decreased patients' postoperative pain and improved their satisfaction. As such, the NBASS-APS offered great safety and comfort to postoperative patients, improved the safety of perioperative patients, and augmented the quality of anaesthesia nursing. This approach fully embodies the concept of humanized holistic nursing.

Conclusions

In conclusion, application of the NBASS-APS in surgical patients with gastric cancer greatly decreased their postoperative pain, benefited their recovery of physiological functions and improved their satisfaction over postoperative analgesic out-

come. Hence, this approach is suitable for clinical application. Nevertheless, this study has several limitations. Specifically, the model was only applied in surgical patients with gastric cancer; in addition, this was not a multicentric study with a large sample size. In the future, a multicentric study with a large sample size will be conducted to further examine the performance of NBASS-APS and to apply it in other diseases, thereby formulating a sound protocol of postoperative analgesic management.

Acknowledgement

We acknowledge the financial support of this study by the Natural Science Foundation in the Education Department of Anhui province, China (Grant No. KJ2016A327).

Conflict of interests

The authors declare no conflict of interests.

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