Improving pain management through addition of the functional activity score

AUTHORS

Ying Ge Tong
Dip Nurs (Hons), Pain Liaison Nurse, Associate Professor, Hangzhou Normal University,
16# Xue Ling Road, Xia Sha, Hangzhou, Zhejiang, PRChina 310016
1352597965@qq.com

Alex H Konstantatos
MB Bs (Hons), FANZCA, Visiting Professor, Sir Run Run Shaw Hospital, Zhejiang University School of Medicine
3 Qingchun East Rd, Jianggan, Hangzhou, Zhejiang PR China 310016

Senior Lecturer
Department of Anaesthesia and Perioperative Medicine, Alfred Hospital, Monash University,
Commercial Rd, Melbourne, Victoria, Australia
A.Konstantatos@alfred.org.au

Yan Cheng
Dip Nurs(Hons), Pain Liaison Nurse
Zhejiang Provincial People's Hospital
158# Shang Tang Road , Xiacheng District,
Hangzhou, Zhejiang, PRChina 310014
5254113942@qq.com

Ling Chai
Dip Nurs, Hangzhou Normal University
16# Xue Ling Road , Xia Sha, Hangzhou, Zhejiang, PRChina 310016,
847903517@qq.com

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KEY WORDS

pain measurement; nursing assessment; pain management; pain, postoperative, Mainland China

ABSTRACT

Objective

This study investigated the benefits of adding a new measurement tool, the Functional Activity Score to a validated measurement tool, the Numeric Rating Scale.

Design

Prospective cohort comparing cases (with intervention) to controls (usual care).

Setting

Inpatients from a Chinese Mainland teaching hospital.

Subjects

Eighty three postoperative patients of mixed gender and Chinese ethnicity.

Interventions

Adding Functional Activity score, a subjective observer assessed pain measurement tool, to usual postoperative pain intensity assessment.

Main outcome measures

Median 24 hour dynamic pain rating intensity. Episodes of moderate to severe pain.

Results

Median 24 hour dynamic numeric rating pain postoperative pain intensity rating with cough 3 [2.25, 3.75] versus 6 [5, 7] ($p< 0.001$), and at rest 0 [0,0] versus 2 [0,3] ($p < 0.001$) were both significantly lower in the intervention group versus the control group. The intervention group also experienced significantly less episodes of moderate to severe pain ($p=0.02$) and reported significantly less cough related interference with pain ($p=0.003$).

Conclusion

Functional activity score is easy to teach and apply, complements existing objective pain assessment after surgery and is beneficial for patient care.

INTRODUCTION

Early postoperative mobilisation is associated with a decrease in pulmonary and thrombotic complications and reduced length of stay after pulmonary surgery (Epstein 2014). Conversely, immobility resulting from postoperative pain is linked to increased risk of pulmonary complications after open heart and knee surgery (Korean Knee Society 2012; Milgrom et al 2004).

Dynamic pain combines nociceptive and non-nociceptive signaling, for example deep breathing and coughing involving a thoracic or upper abdominal wound. Uncontrolled dynamic pain may promote hyperalgesia and allodynia (Gilron et al 2002).

Despite improvements in analgesic techniques, postoperative pain is still inadequately treated as a result of inadequate assessment (Joshi and Ogunnaike 2005). Recent patient estimates of moderate or severe postoperative pain were as high as 75% in a United States of America survey conducted in 2003 (Apfelbaum et al 2003), while a Swiss survey reported inadequate assessment of pain and provision of postoperative analgesia by nurses and physicians (Klopfenstein et al 2000).

Insufficient postoperative pain poses significant problems in Mainland China, as evidenced by high rankings of functional restriction reported by patients after thoracotomy (Ying Ge et al 2013). Inadequate pain assessment is thought to be a common accompaniment to inadequate pain management (Srikandarajah and Gilron 2011), a conclusion supported by authors of this study who estimate that 71% of nurses in Mainland China have never assessed the effect of pain on function among patients with pain (Ying Ge et al 2013).

Assessment and analgesia directed at dynamic pain has the potential to facilitate mobilisation, and improve outcomes after surgery (Breivik et al 2008). At present there is heavy reliance on patient rated static and dynamic pain assessment, which is subjective in nature and does not offer benefits arising from combination with objective assessment by health professionals (D'Arcy 2011; Wood et al 2010).

The Functional Activity Score (FAS), recommended by the Australian and New Zealand College of Anaesthetists (ANZCA) and Faculty of Pain Medicine of Australia and New Zealand has been recommended as an adjunctive measurement tool adopted for postoperative analgesia care in Australia (Victorian Quality Council 2008). One of the defining properties of the FAS is that it is undertaken by persons caring for and managing patients, making it objective. Statistical validation and reliability of Chinese version-FAS has been confirmed in a recent study involving Chinese patients (Cheng et al 2015). Moreover, this same study confirmed that Mainland Chinese Hospitals are ideally suited for evaluation of the effectiveness of educational intervention as nursing knowledge of dynamic pain management is currently at low levels.

Pain management programs conducted by nursing educators are essential in developing knowledge, improving attitudes and assessment skills in the context of managing patients experiencing pain (Tse and Ho 2014; Zhang et al 2008). Such programs offer an ideal environment to assess the usefulness of FAS to evaluate analgesia therapies directed at dynamic pain.

We propose a study which aims to confirm that FAS can be easily incorporated into nursing practice alongside standard more traditional observations such as patient rated pain intensity. A further aim is for nurses to be able to interpret and use information from FAS and pain intensity in a way that can lead to improved analgesia management.

This links in with our hypothesis that FAS guided escalation in analgesia management can be effectively implemented after intensive education of nursing and medical professionals in Mainland China, allowing for more effective postoperative analgesia rehabilitation through better timing of analgesia delivery. We hope

to prove this hypothesis by showing improved patient rated dynamic pain intensity ratings in an intervention group where nurses and doctors use FAS and pain intensity information to guide analgesia management compared with a control group where FAS and pain intensity were measured but not used to guide analgesia management.

METHOD

Quasi-experimental research was used for this controlled study.

Design

We received approval from the Institutional Review Committee of the participating hospital on 28 October 2014 for our prospective cohort. This study was conducted at a teaching hospital from March to June 2015. This teaching hospital was chosen because its nursing and medical staff had not received previous education as to the concept of using the FAS to guide escalation of analgesia care.

FAS is an objective observer rated measurement that assesses restriction of functional activities related to an anatomical area where a patient experiences pain following surgery. FAS has not been tested in research settings in Australia, but a Chinese version has undergone psychometric validation, reliability and clinical utility testing (Cheng et al 2015). Internal consistency reliability, Interclass Correlation Coefficient (ICC) and Content Validation Index (CVI) were 0.93, 0.93 and 0.97 respectively. Criterion validity was r=0.48; ($p<0.001$) between the FAS and the NRS for pain intensity. Clinical application of FAS was first explored in this same observational study involving 107 patients after major surgery (Cheng et al 2015).

FAS involves an observer requesting a patient is to complete a physiological task relevant to the site of their pain. An example relevant to this study might be to deep breathe and cough after thoracic or upper abdominal surgery. The observer then uses a simple ordinal scale to objectively rate how the pain affects their ability to perform this task. Scoring the patient at “A” indicates the patient is unrestricted by pain when performing the chosen activity. Scoring the patient at “B” indicates the patient’s activity is only partly limited by pain and the activity can be largely undertaken. Scoring the patient at “C” indicates the patient’s activity is severely limited by pain (Victorian Quality Council 2008).

Sample size

Primary Hypothesis: Group 1(experimental group, N1) =Group 2 (control group, N2).

According to the $N_1=N_2=2 \times \left[\frac{\left(u^{\alpha}+u^{\beta}\right)}{\delta/\sigma}\right]^2$ "δ" is mean difference (MD) of two groups, “σ” is combined standard deviation of two groups, $\alpha=0.05, u^{a}=1.96$, $\beta=0.01$, $u^{\beta}=1.282$. According to the results of a preliminary experiment whose evaluation index is pain interference with coughing (0-10), the MD of experimental group (3.87) and control group (5.03) is 1.16, and the combined standard deviation of two groups is 1.59. These calculations suggest that each group needs 39 cases in this study. We have added 15% to the sample size to account for loss of subjects, resulting in a sample size of 45 for each of the control and intervention groups.

Participants

To be included in this study, patients had to provide informed consent, be aged 18-80 years, be capable of understanding questions provided in the survey, be able to accurately rate their pain, and present for elective open thoracic or upper abdominal surgery. Patients with allergy or contraindication to opioid or nonsteroidal anti-inflammatories, or who had a diagnosis of severe renal or hepatic impairment were not eligible for inclusion. Nurses who were employed by the participating hospital were eligible for educational intervention. All nurses included in the educational intervention had to provide informed consent.

During the research, five patients of the Intervention Group quit the study because of personal reasons. In the Control Group, two patients refused to answer the whole questionnaire. As a result, eighty three patients were included in the study. There were forty patients in the Intervention Group and forty three patients in the Control Group.

Procedures

Prior to recruitment of the patients, two education programs were developed by the research team, comprising a pain specialist nurse and senior nursing staff from the participating hospital. The same team validated the content of the educational programs.

Eighty three patients who underwent open thoracic and open upper abdominal surgery were included in this study. Consent discussions with patients did not include explanations of the use of the FAS to guide pain management; rather patients were informed that usual medications for pain management would still be employed and the study would evaluate how the patient controlled analgesia (PCA) was used to treat postoperative pain. The consent described NRS pain assessment where patients were shown the NRS and educated to describe their pain intensity in relation to the numeric scale where zero indicated no pain and 10 the worst pain imaginable. Patients had to demonstrate appropriate understanding of the NRS and ordinal rating scales used for collection of additional data before they were recruited to the study. NRS was the favored measure of patient rated pain intensity in this study owing to its reliable and valid qualities as a measurement tool (Wood et al 2010). All patients in the study were instructed both in the consent and by nurses to use their PCA to reduce their pain levels at rest and when undertaking painful activities, as is usual practice at this hospital.

All patients had demographic variables of age, gender, educational attainment, and surgical operation recorded.

Forty three subjects were initially enrolled to the control group. The control group received usual analgesia care for the participating hospital. This involved PCA boluses of 0.5 ml of a solution of Flurbiprofen (2 mg/ml) and Sufentanyl (1ug/ml) with a 15 minute lockout together with a background infusion of 1.5 ug Sufentanyl per hour.

Prior to recruitment of controls, nursing staff from surgical wards in the participating hospital attended the first education program and received education in measurement of the FAS, so they were able to record FAS scores for the purpose of comparison with controls. The pain specialist nurse and one of the research team members delivered lectures to the nurses.

After surgery, control patients provided static and dynamic NRS ratings at 4 hourly intervals, and staff also recorded FAS of controls at 4 hourly intervals for the first 24 postoperative hours.

Following recruitment of controls, a second intensive educational program was provided to the same nurses from surgical wards and also to medical staff. This program comprised a series of lectures and printed material describing the FAS and how to use the FAS to improve analgesia care. The lectures were given by the same pain specialist nurse and researcher as the first program, and followed by case scenarios encouraging interactive discussion about analgesia care based on FAS assessment. Nurses and medical staff were required to pass a test based on educational content before they were allowed to further participate in the study.

Recruitment of forty subjects to the intervention group followed the intensive education of medical and nursing staff. Patients in the intervention group received FAS guided analgesia intervention.

FAS was assessed by nurses in the intervention group at four hourly intervals in the first twenty four postoperative hours. An FAS of B or C accompanied by a dynamic NRS patient rated pain intensity of greater than 4 activated

an intervention whereby the patient was instructed to deliver a bolus injection from their PCA. Two consecutive FAS of C in combination with an NRS pain intensity of greater than 4 elicited an intervention from a doctor who provided appropriate escalation of analgesia care irrespective of patient rated dynamic pain intensity. The intervention consisted of additional doses of opioid or non opioid analgesic other than NSAID. Patients who had FAS of A alone, or B in combination with dynamic pain intensity reports of less than or equal to 4 did not require an intervention.

Data Collection

Twenty four hours after completion of surgery, patients in both control and intervention groups were asked a series of questions in relation to their pattern of PCA use and experience of pain. The survey questions were mostly derived from "Quality indicators and suggested measures for pain management" adapted from a survey recommended by American Pain Society Quality of Care Task Force (Gordon et al 2005). Six quality indicators were analysed from 20 studies performed at eight large hospitals in the United States of America from 1992 to 2001. The study suggested that although there were no perfect measures of quality, longitudinal data support the validity of a core set of indicators that could be used to obtain benchmark data for quality improvement in pain management in the hospital setting (Gordon et al 2002). In 2013, six quality indicators and a set of standardised measures were translated to Mandarin Chinese, and used to evaluate quality of post-surgery management at five hospitals in China (Ying Ge et al 2013.). Content Validation Index (CVI) was 0.97. A similar survey was used in a pilot for this current study (Cheng et al 2015). The questionnaire used in our study has been specifically adapted for our aims, replacing one question from the survey by Gordon (Gordon et al 2005), "how does pain interfere with your activity, mood and sleep" with more specific questions about pain interference with coughing and mood.

Five survey questions covered patterns of PCA use prior to undertaking painful activities (Yes/No response), worst and least pain intensity, pain interference with coughing, pain interference with mood, with the last three questions involving use of a numeric rating scale.

The final two questions utilised ordinal assessment scales and enquired about the amount of time where moderate to severe pain was experienced; and adequacy of preoperative explanation of analgesia technique. The survey questionnaire is included in figure 1.

Figure 1: Patient survey questions at 24 hours after surgery

Survey Question	Measurement
During the first postoperative 24 hours did you push the PCA button before undertaking painful activities?	Yes/No
On this scale please circle the number that indicates the worst pain intensity that you experienced in the first 24 hours after surgery (0 means no pain, 10 means worst imaginable pain)	Rating placed on 100mm numeric rating scale
On this scale please circle the number that indicates the least pain intensity you experienced in the first 24 hours after surgery (0 means no pain, 10 means worst imaginable pain)	Rating placed on 100mm numeric rating scale
Please circle the number that best describes how much pain interfered with your coughing during the first 24 hours after surgery (0 means does not interfere at all, 10 means interferes completely)	Rating placed on 100mm numeric rating scale
Please circle the number that best describes how much pain interfered with your mood during the first 24 hours after surgery (0 means does not interfere at all, 10 means interferes completely)	Rating placed on 100mm numeric rating scale
How often did you experience moderate to severe intensity pain in the first 24 hours after surgery?	Never, almost never, often, almost always, always.
Describe the adequacy of information that you received about the best way to control your pain	Poor, fair, good, very good, excellent.

Data Analysis

SPSS version 17.0 for windows (Chicago, IL, USA) was used for data analysis. Descriptive statistics were used for sample characteristics of demographic data including age, gender, education and types of surgery. Chi squared testing compared categorical variables such as use of PCA prior to functional activity, frequency of moderate to severe pain and adequacy of information about pain during hospitalization. Mann–Whitney U test was used for evaluation of the questionnaire such as current pain (at rest and during cough), worst and least pain in the past 24 hours, pain interference with coughing and with mood. A p value of less than 0.05 was considered significant.

FINDINGS

Demographic data are included in table 1. Mean age of subjects was 60-63 years, approximately two thirds male, with educational attainment mostly at or below primary school level, with both control and intervention groups undergoing similar surgeries.

Table 1: Demographic characteristics of study participants. Data are presented as number (%), mean (SD), and median [interquartile range] as appropriate.

Variable	Intervention Group (n=40)	Control Group (n=43)	P Value
Age (years)	60.4 (11.5)	62.9 (10.5)	0.50
Gender			
Male	25 (62.5)	27(62.8)	0.96
Female	15(37.5)	16(37.2)	
Educational attainment			
College	2(5)	1(2.3)	0.32
High School and Middle School	18(45)	16(37.2)	
Primary School and Below	20(50)	26(60.5)	
Type of surgery			
open pneumonectomy	11(27.5)	21(48.8)	0.71
open partial gastrectomy	11(27.5)	8(18.6)	
open proctectomy	10(25)	6(14)	
Open colectomy	8(20)	8(18.6)	

Static and dynamic patient rated and observer rated FAS are included in table 2. Subjects in the intervention group reported significantly lower static ($p< 0.001$) and dynamic pain ($p< 0.001$), while observer rated FAS was higher in the intervention group ($p=0.02$)

Table 2: Static and *Dynamic pain intensity measurement over 0-24 hours following surgery and observer rated FAS. Data presented as median [interquartile range] and number (percentage) as appropriate. P< 0.05 is considered significant.

Variable	Intervention Group (n=40)	Control Group (n=43)	P Value
Static pain intensity	0[0-0]	2[0-3]	< 0.001
Dynamic pain intensity	3[2.25-3.75]	6[5-7]	<0.001
Observer rated FAS			
A	4(10)	3(7)	
B	33(82.5)	27(62.8)	0.02
C	3(7.5)	13(30.2)	

* Denotes primary end point

Survey of pattern of use of PCA before undertaking painful activities are included in table 3. The intervention group also reported more preemptive PCA use (p=0.02).

Table 3: Pain measurements and responses to survey questions taken from patients 24 hours following surgery. Data presented as median [interquartile range] or number (percentage) as appropriate. P< 0.05 is considered significant.

Variable	Intervention Group (n=40)	Control Group (n=43)	P Value
Worst pain intensity	6[5-6.75]	7[5-8]	0.029
Least pain intensity	2[0-2.75]	2[2-3]	0.150
Frequency of moderate to severe pain			
Always	3(7.5)	4(9.3)	
Almost always	3(7.5)	11(25.6)	0.020
Often	5(12.5)	12(27.9)	
Almost never	21(52.5)	13(30.2)	
Never	8(20)	3(7)	
Pain interference with mood	4[3-5]	5[3-6]	0.284
Pain interference with cough	5[3-5]	5[5-6]	0.003
Adequacy of information			
Poor	3(7.5)	3(7)	0.076
Fair	2(5)	5(11.6)	
Good	12(30)	23(53.5)	
Very good	17(42.5)	8(18.6)	
Excellent	6(15)	4(9.3)	
Using PCA before painful activity			
Yes	14(35)	5(11.6)	0.01
No	26(65)	38(88.4)	

Worst pain intensity, episodes of moderate to severe pain, together with pain interference with coughing were all statistically significantly lower in the intervention group compared with the control group (refer table 3). Lowest pain intensity, impact of pain on mood, and adequacy of information about pain at 24 hours following surgery were not statistically different (refer table 3)

DISCUSSION

Our prospective cohort has confirmed that intensive education of Mainland Chinese nurses and medical staff in the role of FAS combined with dynamic NRS pain intensity can successfully influence delivery of analgesia after major surgery. This is highlighted by improved patient rated dynamic pain intensity in the 24 hours following chest and upper abdominal surgery.

The current study involved a hospital setting where staff were introduced to FAS for the first time. This contrasts with our pilot study involving a different hospital, where nursing staff were familiar with the FAS (Cheng et al 2015). This meant that control subjects were able to receive usual analgesia care free from nursing bias and that the intervention (addition of FAS to help guide escalation of usual analgesia care) was assessed as accurately as possible. This contrasts with the previous study whose aim was to confirm the validity, reliability and utility of the FAS as a clinical measurement tool in a Mainland Chinese population.

Our experience in Mainland China is that nursing staff do not yet appreciate the significance of measuring dynamic pain, and will usually only record pain at rest (Ying Ge et al 2013). It is also likely that doctors and

nursing staff in Mainland China as well as other countries can not differentiate between subjective and objective measures of pain intensity as the FAS is not in common use throughout the world. Pain intensity is currently evaluated subjectively by adult patients in normal practice, and objectively using behavioral, subjectively by visual cues in pediatric (Voepel-Lewis et al 1997; Wong and Baker 1988) and objectively by carers in critical care settings (Payen et al 2001). It is our belief that objective pain assessment should extend to all clinical settings and be combined with subjective patient assessment where possible, to direct analgesic intervention.

Our intervention group was more likely to preemptively use their PCA to facilitate painful activities compared to controls. This is despite both groups receiving the same advice about reducing pain at rest and with painful activities prior to surgery, as is part of usual care in this Mainland Chinese hospital. It is possible that the intervention group recognized the pattern of PCA use in the setting of low FAS and began to use the PCA autonomously in the setting of potentially painful situations. This represents a situation where a concept that is discussed and demonstrated through nurse led intervention is more effectively understood by the patient.

Patients of Chinese ethnicity are more likely preoperatively to expect severe pain and prefer to exercise less autonomy in the control of their own pain management (Konstantatos et al 2012). This is combined with the wrongful perception that rest is more beneficial than early rehabilitation after surgery (Liu et al 2013). It appears that patients in this study were able to overcome these preconceived beliefs and favorably change their behaviours through adoption of patterns of PCA use initiated by nurses to facilitate postoperative rehabilitation.

We were unable to show a difference in pain intensity effect on mood. Age and educational attainment, both similar among intervention and control groups, are correlated with anxiety levels among Mainland Chinese (Xie et al 2010). Age and educational attainment may have stronger influence on mood than pain intensity in people of Mainland Chinese ethnicity.

A limitation of our study was that we did not evaluate patient satisfaction with pain management in our cohort. We evaluated satisfaction in our pilot study that preceded this cohort (Cheng et al 2015) and found that satisfaction did not vary between the control and intervention groups. We felt that Chinese patients may have had trouble conceptualising the benefits brought about by active rehabilitation, given their low educational attainment and contrasting belief that rest is beneficial after surgery (Liu et al 2013). Another potential limitation is the ethnic context of our study. People of Chinese ethnicity are known to exhibit less autonomy in the management of their pain in the postoperative setting compared with Caucasian Australians (Konstantatos et al 2012), making them less likely to self- deliver bolus doses of PCA without prompting from nurses. A Caucasian population experiencing conditions similar to the controls in our study may have initiated more PCA analgesia without prompting from nurses, and may have experienced less increase in dynamic pain intensity compared to an intervention group.

CONCLUSION

This study's findings have highlighted the importance of nursing assessment for improving patient analgesia following painful surgery. Evaluation combining FAS with dynamic NRS allows nurses to guide and educate patients to better use PCA dosing to facilitate functional recovery. Skillful patient management, in turn, requires that nurses be educated competently to record and accurately interpret FAS to improve analgesia care. These findings may be of universal benefit, especially where nurses require more experience in the use of multiple pain management tools to deliver effective postoperative analgesia.

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