Postoperative Pain Management and the Risk Factors in Major Operation: A Baseline Study of Acute Pain Service, Siriraj Hospital

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Background: *Acute pain service (APS) has been set up at Siriraj Hospital with the aim of providing postoperative pain management for patients receiving anesthetic pain control and other complicated cases undergoing major operations.*
Objective: *To identify the incidence of moderate to severe postoperative pain and its risk factors. To describe the techniques used and adverse effects in patients under APS care.*
Material and Method: *A prospective study in 340 surgical patients under APS care from January to September 2008 was performed. Data were obtained from medical records and patients' answers during 48 hours postoperatively.*
Results: *The incidences of postoperative pain scores 4-10 at 24 and 48 hours were 28.8% and 7.4%, with median pain intensity (0-10, [interquartile range]) of 2.5 [1.0-4.0] and 1.0 [0.0-2.0], respectively. The risk factors related to pain score 4-10 included analgesic intake for >2 consecutive weeks prior to operation, type of surgery with severe degree of pain and age ≤65 years (odds ratios [95% CI] of 7.12 [1.92, 26.44], 6.17 [1.37, 27.77], and 1.87 [1.07, 3.29], respectively). Of the patients, 67.9% received epidural block for postoperative analgesia. The incidences of nausea/vomiting and itching that needed treatment were 12.4% and 9.4%, respectively.*
Conclusion: *Risk factors that should be concerned were age ≤65 years, pre-operative prolonged analgesic use and surgeries with expected severe degree of pain.*

Keywords: *Postoperative pain, Risk factors, Acute pain service*

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Before acute pain service (APS) was established in Siriraj Hospital, the incidence of severe postoperative pain in surgical patients, which was surveyed in 1996, was as high as 85%[1]. The situation was not much different from what was happened in the UK in 1990 when APS had not been set up widely[2].

Adequate postoperative analgesia without complications is a part of quality improvement for patient care. Siriraj Hospital, which is one of the largest tertiary medical centers in Thailand, has high volume of surgeries performed, approximately 2,000 to 3,000 cases per month. APS has been set up at Siriraj Hospital since September 2006 with the aim towards excellent postoperative pain management and reduced postoperative complications and had cost effectiveness[3,4]. After establishing the Service for a while, the authors planned to audit the service for quality control and to keep it as a baseline for a future study. The authors also planned to investigate the factors related to pain level that need to be concerned preoperatively so that physicians should form the effective postoperative pain management plans in such patients.

Many risk factors for moderate to severe postoperative pain were reported and found to be varied, including sex[5-7], age[5,7-12], ASA physical status[7,10], level of education[12], preoperative pain[8,10], chronic pain[10,11], pre-emptive analgesia[13], operative time[7], type of operation[8,11], and anesthetic technique[14].

The purposes of this study were to examine the incidence of postoperative pain score 4-10 within 48 hours after operation in patients under APS care during the initial phase of service and to identify the risk factors associated with moderate to severe postoperative pain (pain scores 4-10) and the incidence of adverse effects related to pain management including nausea, vomiting, and respiratory depression.

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Material and Method

After approval by Institution Review Board and patient written informed consent was obtained, the study was conducted in patients under APS care from January to September 2008. The study design was prospective observational study. Patients with communication problem or with history of illicit drug used were excluded.

Data including sex, age, body weight, height, American Society of Anesthesiologists (ASA) physical status, diagnosis, operation, operative time, premedication, preemptive analgesia, anesthetic technique, and postoperative analgesia technique were obtained from anesthetic record and operative note. Level of education, presence of chronic pain, analgesic intake for >2 consecutive weeks prior to surgery, history of previous surgery, the global pain scores on the day before surgery, 24 and 48 hours after surgery were obtained from patient interview. Pain scores in each hour, depend on nursing care, were obtained from nurse records on the ward. Anticipated pain level according to type of operation, and details of postoperative analgesia technique including medications and its adverse effects with any treatment were obtained from APS records.

Pain scores were assessed using Numeric Rating Scale (NRS), 0 to 10 (0 = no pain, 10 = the worst pain imaginable, reported to one decimal place). In children, postoperative pain was assessed using Children Hospital of Eastern Ontario Pain Scale (CHEOPS), 4 to 13 (no pain to the worst pain) with interpretation of scale 4-13 to scale 1-10 in NRS. In Siriraj Hospital, ward nurses recorded pain scores together with vital signs. If the patients were not asleep, nurses would ask their pain scores, together with observing their sedation scores, every hour for 4 times, every two hours for 4 times, and every 4 hours for 3 times during the first 24 hours, and then every 4 hours continuously until 72 hours. The numbers of all pain scores recorded by ward nurses and the pain score >3 were counted. Any patients who had pain scores of $\geq$7 that occurred successively on the record were recorded.

Most of the patients under APS care had undergone operations that were extensive, that could disturb patient's physiology, such as interfering respiratory effort, shifting of intravascular fluid, or nothing by mouth for more than one day; and/or surgeries that could cause severe pain, otherwise surgeons would manage postoperative pain by themselves. We considered these operations as major ones in this study. Those patients who had undergone spinal block, with local anesthetic and opioid, with no anticipated postoperative problems did not receive routine care from the APS team.

Anticipated pain level according to the type of operation was divided into 2 groups: moderate and severe pain groups (Box 1). The division was done according to the notice of postoperative pain level in patients under APS care before this study. Surgeries with non- extensive lower abdominal surgeries, laparoscopic major surgeries, spine surgery of 1-2 levels without instrumentation, etc. were categorized as moderate pain type. For those with extensive surgeries, upper abdominal surgeries, thoracotomy, total knee arthroplasty, spine surgery with instrumentation, etc. were formed into a severe pain group. Techniques of anesthesia were divided into two groups, i.e., general anesthesia only, and the others, including epidural/ spinal anesthesia or peripheral nerve blockade, with or without general anesthesia.

Statistical analysis

Data from medical records of 50 patients revealed the incidence of moderate to severe pain within 48 hours after operation of 30%. Based on 95% CI of moderate to severe pain of 30$\pm$5%, a sample size of 323 was required. A drop-out rate of 5% was expected, so n = 340 were planned. This number could serve the other aim of the study which was to determine the risk factors for moderate to severe pain, with the incidence of 30%. To determine factors associated with moderate to severe pain, Chi-square tests and multiple logistic regression were used. Independent variables were sex, age, ASA classification, level of education, preoperative chronic pain, analgesic intake for >2 weeks preoperatively, previous surgery, pre-medication, pre-emptive analgesia, operative time, anticipated pain level, and anesthetic techniques. All statistical analyses were performed using PASW 18.0. A *p*-value of <0.05 was considered statistically significant.

Results

Three hundred and forty patients were studied, 168 males (49.4%) and 172 females (50.6%). Patient data (mean $\pm$ SD [min-max]) regarding age, weight, and height were 54.8$\pm$17.8 [1-87] years old, 57.8$\pm$13.4 [10-100] kg, and 159.3$\pm$9.5 [101-183] cm, respectively.

The expected pain level after surgery was categorized to moderate and severe pain according to types of surgery (Box 1). The numbers of patients with moderate and severe pain (global PS 4-6 and 7-10) in

each period are shown in Table 1. The incidence of global pain scores 4-6 and 7-10 in the first 24 hours postoperatively were 23.8% and 5%, respectively. In the second 24 hours postoperatively, the pain scores were much lower than that of the first day. Median pain intensity (0-10, [interquartile range]) at 24 and 48 hours were 2.5 [1.0-4.0] and 1.0 [0.0-2.0], respectively, and the numbers of pain score >3 counted from all pain scores recorded were 15.5% and 3.9%, respectively. The pain score ≥7 that occurred successively in the 24-h postoperative records were noted in 14.4%. All the pain scores were recorded (data not shown) and found that there were significant difference between the moderate pain and the severe pain types of operation at postoperative hours 9th ($p = 0.032$), 10th ($p = 0.031$), and 12th ($p = 0.028$).

Main analgesic techniques used during the study were continuous epidural analgesia, and

Box. 1 Types of surgery, categorized according to the anticipated level of postoperative pain, during the study period

Moderate pain level (n = 122)	Severe pain level (n = 218)
Colorectal, hepatobiliary, vascular, head-neck-breast, plastic surgeries: Colectomy/Sigmoidectomy (34), Low anterior resection (17), Colostomy (1), Diagnostic laparoscopy (1), Abdominoplasty (1), Modified radical mastectomy with transverse rectus abdominal muscle (TRAM) flap (1) Urology: Nephrectomy (8), Radical retropubic prostatectomy (5), Laparoscopic radical prostatectomy with/without robot assisted (4), Nephro-ureterectomy (3), Reimplantation (1), Sling procedure for urinary incontinence (1)	Colorectal, hepatobiliary, vascular, head-neck-breast, plastic surgeries: Hepatectomy (38), Abdominoperineal resection (17), Explor-lap with different procedures (16), Whipple's operation (16), Cholecystectomy (15), Gastrectomy (7), Splenectomy (7), Esophagectomy (4), Pancreatectomy (3), AK/BK amputation (3), Rectoplexy and sigmoidectomy (2), Choledochoduodenostomy (2), Gastrojejunostomy (2), Surgical revision of hepaticojejunostomy strictures (1), Double bypass for CA pancreas (1), Closure colostomy (1), Wide excision of CA tongue (1), Mandibulectomy (1) Urology: Cystectomywith or without conduit (4), Explore kidney (4) CVT: Thoracotomy (22), Aneurysmorrhaphy (1)
Gynecology: Transabdominal hysterectomy with/without other procedures (22), Anterior and posterior (A-P) repair (1), Vaginal hysterectomy with A-P repair (1)	Gynecology: Radical hysterectomy with node dissection ± other procedures (8), Vulvectomy (1)
Orthopedics: Total hip arthroplasty (6), ORIF with different kinds of instrument (4), Anterior cervical discectomy and fusion (2), Discectomy (2), Tendon transfer (2), Laminectomy of 2 levels without instrumentation (1), Dynamic hip screw (1), Resection of neurofibroma (1), Debridement with plate removal (1), Hemiarthroplasty (1)	Orthopedics: Laminectomy with instrumentation (19), Total knee arthroplasty (14), Wide excision with allograft (5), Revision of loosening prosthesis (2), Hemipelvectomy (1)

Numbers of patients are shown in parentheses

Table 1. Number of patients with each level of pain in 24-h preoperative, 24-h, and 24-48-h postoperative periods, number of patients with pain score ≥7 in a row in 24-h postoperative period, and ratios of pain score 4-10 of total pain scores recorded at 24-h, and 24-48-h postoperative periods

	24-h preoperative	24-h postoperative	24-48-h postoperative
Global pain scores 0-3	300 (88.2)	242 (71.2)	315 (92.6)
Global pain scores 4-6	20 (5.9)	81 (23.8)	23 (6.8)
Global pain scores 7-10	20 (5.9)	17 (5.0)	2 (0.6)
Pain score ≥7 in a row	-	49 (14.4)	-
Pain scores 4-10	-	755/4,885 (15.5)	97/2,453 (3.9)

Values are number (%)

continuous intravenous (IV) infusion which accounted for 67.9% and 20.6% of the cases, respectively (Table 2). During the study period, there were a few PCA pumps and peripheral nerve blocks under ultrasound guided technique were not available in our hospital.

After univariate analysis, the factors related to moderate and severe pain in 24-h postoperative period were age ≤65 years old, analgesic intake >2 consecutive weeks preoperatively, operative time >4 hours, type of operation with anticipated level of severe pain, and anesthetic technique of GA only, whereas in 48-h postoperative period, the factors were the presence of chronic pain, analgesic intake >2 consecutive weeks preoperatively, and type of operation with anticipated level of severe pain. The authors selected the factors in both periods that had *p*-values of less than 0.2, including sex and previous surgery besides the factors mentioned above, to be analyzed in multiple logistic regression. The risk factors, after multiple logistic regression, included age ≤65 years old (odds ratio [95% CI] of 1.87 [1.07, 3.29] on day 1), taking analgesics >2 consecutive weeks preoperatively (OR 7.12 [1.92, 26.44] on day 2), and type of surgery which would cause severe degree of postoperative pain (OR 6.17 [1.37, 27.77] on day 2) (Table 3 and 4).

The incidence of nausea and vomiting was 31.5%, but needed treatment in 12.4% of all patients. Itching occurred in 47.1%, but needed medications only in 9.4% of all patients. No respiratory depression was found. All patients were satisfied with the APS care.

Discussion

In this study, the incidences of pain scores 4-10 on postoperative day 1 and 2 in patients under APS care at Siriraj Hospital were 28.8% and 7.4%, respectively, with the median postoperative pain intensities of 2.5 and 1.0, respectively. Nearly the same time with this study, there was a report from APS in Israel that a VAS for pain >30 was noted in 15.3% of all pain scores recorded[15], which was similar to ours

Table 2. Main analgesic technique used by anesthesiologists on discretion and the available facilities for analgesia, during the study period

Main analgesic technique	Moderate pain level (n = 122)	Severe pain level (n = 218)	*p*-value
Continuous epidural analgesia (CEA)	67 (54.9)	145 (66.5)	0.105
Continuous intravenous infusion	26 (21.3)	44 (20.2)	
Basic pain treatment	11 (9.0)	11 (5.0)	
Epidural (single injection)	9 (7.4)	10 (4.6)	
Intravenous patient-controlled analgesia (IV-PCA)	6 (4.9)	3 (1.4)	
Continuous peripheral nerve block (CPNB)	3 (2.5)	4 (1.8)	
Peripheral nerve block (PNB) (single injection)	0	1 (0.5)	

Values are number (%)

Table 3. Factors related to moderate to severe postoperative pain (global pain score ≥4) during the first 24 hours after multiple logistic regression

Risk factors	Odds ratio	95% CI	*p*-value
Sex (male)	1.37	0.83, 2.26	0.216
Age (≤65 years)	1.87	1.07, 3.29	0.029
Presence of chronic pain (yes)	0.81	0.27, 2.46	0.710
Analgesic intake >2 consecutive weeks preoperatively (yes)	2.51	0.92, 6.83	0.071
Previous surgery (yes)	0.70	0.42, 1.15	0.157
Operative time (>4 hours)	1.61	0.91, 2.83	0.099
Anticipated pain level, according to type of operation (severe)	1.64	0.95, 2.84	0.076
Anesthetic technique (GA only)	1.69	0.97, 2.93	0.063

GA = general anesthesia

Table 4. Factors related to moderate to severe postoperative pain (global pain score ≥4) during 24-48 hours after multiple logistic regression

Risk factors	Odds ratio	95% CI	*p*-value
Sex (male)	0.96	0.40, 2.33	0.936
Age (≤65 years)	3.09	0.98, 9.81	0.055
Presence of chronic pain (yes)	0.64	0.15, 2.69	0.540
Analgesic intake >2 consecutive weeks preoperatively (yes)	7.12	1.92, 26.44	0.003
Previous surgery (yes)	1.20	0.50, 2.92	0.684
Operative time (>4 hours)	1.61	0.63, 4.11	0.318
Anticipated pain level, according to type of operation (severe)	6.17	1.37, 27.77	0.018
Anesthetic technique (GA only)	1.01	0.37, 2.73	0.986

GA = general anesthesia

(15.5%). Another key performance index for the quality control in Siriraj Hospital was the number of patients who had pain score ≥7 in a row, as it could reflect the inadequacy of severe pain treatment at the moment.

Yimyaem et al reported that patients under APS care had pain scores 2.7±2.5 at rest and 5.2±2.9 on movement[16]. Wongswadiwat et al reported that the incidence of moderate to severe postoperative pain at Khon Kaen University and Chiang Mai University hospitals were 48.9% and 26.1%, respectively[17]. Both had APS team. These suggested the improvement in the quality of postoperative pain care under APS.

The authors found that some factors were related to moderate to severe postoperative pain. These included analgesic intake >2 consecutive week preoperatively, and anticipated postoperative pain on univariate analysis, whereas sex, ASA physical status, level of education, previous surgery, premedication, and preemptive analgesia did not show any relations. Other results, including age, presence of chronic pain, operative time, and the anesthetic technique used were conflicting between the first and the second days. These might be from the pain level in each patient which was changed from the first day. After multiple logistic regression, sex, presence of chronic pain, previous surgery, operative time >4 hours, and technique of general anesthesia only had no statistical significance. Some of these factors were either the same or different from previous studies. Female was found in some studies to have more severe pain and needed more morphine for postoperative pain management than male[5-7], whereas there was a study reported that sex was not a consistent predictor as traditionally believed[8]. Elderly patients reported less postoperative pain intensity than that of younger patients[7,9,10]. Majority of the patients under Siriraj Hospital APS care received epidural analgesia, whereas effectiveness of epidural analgesia also had a role in degree of postoperative pain[14]. Our institute is a teaching hospital so some procedures consumed much time for other reasons than for the degree of tissue injury, so operative time did not always reflect the degree of tissue injury. Other risk factors that were reported, including ASA 1-2[7] or 3[10], and the most important predictors seemed to be preoperative moderate to intense pain, chronic pain, high trait-anxiety, pain catastrophizing, and moderate to intense depressive mood[8,10,11,18]. Besides these clinical factors, quantitative sensory tests (defined as quantifiable mechanical, thermal, or electrical stimuli) have been investigated and found to demonstrate that the preoperative testing can have high predictive strength for postoperative pain experience[19].

In this study, anesthetic techniques were planned by anesthesiologists on discretion, so APS needed to provide analgesia in accordance with the techniques that patients had received. Most of patients in the anticipated severe degree of surgical pain group had appropriate pain management such as epidural analgesia, nerve blockade, and multimodal analgesia. In those who received basic pain treatment as a main analgesia technique, they received non-opioid or weak opioid IV intermittent around the clock, as appropriate, ± strong opioid IV prn algorithm, with per oral medication around the clock ± prn if they were not NPO. The basic pain treatment technique used here was different from many other hospitals at the same time of the study in that the non-opioids were usually administered in regular basis together with a strong opioid IV prn in algorithm manner instead of prn with one fixed dose. For IV prn algorithm, patients were assessed according to the hospital standard practice and got opioid

according to their pain scores, if the first dose could not relieve pain adequately, it could be repeated for maximum of two more doses after assessment of sedation score and respiratory rate. If the patient was still in pain after the third dose, the nurse would report the physician. In this study there were no one needed to be reported. For oral technique, patients received medication around the clock. On the other hand, the analgesic techniques for patients in the anticipated moderate pain group were more than adequate in some cases. This may explain why the risk factors could not be clearly distinguished.

There are some limitations in this study. First, the authors did not study the psychological factors which could play an important role in some patients. Second, during the study period the anesthesiologists had no standardized protocol for selection of proper techniques for postoperative analgesia for some types of operation. Some patients might receive continuous regional analgesia for the operations that yielded just moderate pain. Third, the authors categorized the type of surgery according to the expected level of pain using the previous experience from working in the APS unit.

Moreover the facilities of analgesia have increased a lot after the study was finished, in both the number of PCA machine and the variety of techniques. More personnel for APS team were provided to cover the increasing number of patients under APS care. The clinical guideline for postoperative pain was set up and revision was planned whenever the situations had been changed. Nevertheless, the data from this study could provide baseline for future improvement and for benchmarking with other institutes.

Conclusion

During the study period, 28.8% of surgical patients under APS care experienced moderate to severe postoperative pain on the first day and reduced to 7.4% of the patients on the second day. Some risk factors that should be identified preoperatively and the effective postoperative pain management should be planned beforehand, included patients age ≤65 years old, receiving analgesic drugs >2 consecutive weeks before operation, and surgeries with expected severe degree of pain. Continuous epidural analgesia was the major analgesia technique used. No serious complication was found in this study.

What is already known on this topic?

Besides psychological traits that play some roles, other risk factors were female, younger age, ASA 1-2 or 3, level of education, preoperative moderate to intense pain, presence of chronic pain, preemptive analgesia, operative time >4 hours, type and extent of surgery, and technique of general anesthesia only.

What this study adds?

The risk factors included age ≤65 years old (odds ratio [95% CI] of 1.87 [1.07, 3.29] on day 1), taking analgesics >2 consecutive weeks preoperatively (OR 7.12 [1.92, 26.44] on day 2), and type of surgery which would cause severe degrees of postoperative pain (OR 6.17 [1.37, 27.77] on day 2).

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Potential conflicts of interest

None.

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การระงับปวดหลังการผ่าตัดใหญ่และปัจจัยเสี่ยง, การศึกษาพื้นฐานของหน่วยระงับปวดเฉียบพลันโรงพยาบาลศิริราช

วิมลลักษณ์ สนั่นศิลป์, สุกัญญา เดชอาคม, สิทธิพร ดีทายาท

ภูมิหลัง: *หน่วยระงับปวดเฉียบพลัน (acute pain service, APS) ก่อตั้งขึ้นในโรงพยาบาลศิริราชโดยมีเป้าหมายเพื่อให้การระงับปวดในรายผ่าตัดใหญ่ที่ได้รับการระงับปวดด้วยหัตถการทางวิสัญญีหรือรายที่มีภาวะซับซ้อน*

วัตถุประสงค์: *เพื่อหาอุบัติการณ์และปัจจัยเสี่ยงของความปวดในระดับปานกลางจนถึงรุนแรงหลังการผ่าตัดใหญ่และแสดงจำนวนเทคนิคระงับปวดที่ใช้กับผู้ป่วยในความดูแลรวมถึงผลข้างเคียง*

วัสดุและวิธีการ: *เป็นแบบศึกษาไปข้างหน้าในผู้ป่วย 340 รายภายใต้การดูแลของหน่วย APS ตั้งแต่เดือนมกราคมถึงกันยายน พ.ศ. 2551 ข้อมูลภายใน 48 ชั่วโมงหลังการผ่าตัดได้จากบันทึกทางการแพทย์และจากการถามผู้ป่วย*

ผลการศึกษา: *อุบัติการณ์ของคะแนนปวด 4-10 ที่ 24 และ 48 ชั่วโมงคือร้อยละ 28.8 และ 7.4 ตามลำดับ โดยค่ามัธยฐานของคะแนนปวด (0-10 [interquartile range]) คือ 2.5 [1.0-4.0] และ 1.0 [0.0-2.0] ตามลำดับ ปัจจัยเสี่ยงของคะแนนปวด 4-10 ได้แก่ การได้รับยาแก้ปวดติดต่อกันมากกว่า 2 สัปดาห์ก่อนการผ่าตัด, ชนิดของการผ่าตัดที่คาดว่าจะมีความปวดรุนแรงหลังการผ่าตัด และอายุ 65 ปีลงมา (อัตราส่วน odds [95%CI] เป็น 7.12 [1.92, 26.44], 6.17 [1.37, 27.77], และ 1.87 [1.07, 3.29] ตามลำดับ) เทคนิคที่ใช้ระงับปวดหลังผ่าตัด ได้แก่ การบริหารยาทางช่องเหนือเยื่อบุ dura ร้อยละ 67.9 อุบัติการณ์ของอาการคลื่นไส้อาเจียนและคันที่ต้องการยารักษาคือร้อยละ 12.4 และ 9.4 ตามลำดับ*

สรุป: *ควรวางแผนการระงับปวดให้เหมาะสมสำหรับผู้ป่วยที่มีปัจจัยเสี่ยงได้แก่ รายที่มีอายุ 65 ปีลงมา ได้รับยาแก้ปวดก่อนการผ่าตัดติดต่อกันนานกว่า 2 สัปดาห์ และมารับการผ่าตัดที่คาดว่าจะมีความปวดรุนแรงหลังการผ่าตัด*