Singapore Med J 1997; Vol 38(5):209-213

A Two-Year Experience Of An Acute Pain Service In Singapore

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ABSTRACT

The first anaesthesia-based acute pain service in Singapore is described. The benefits, risks and resource implications of such a service during its first two years are reviewed. One thousand two hundred and sixty-eight (1,268) post-operative patients were treated with either patient-controlled analgesia (310 patients) or epidural opioid analgesia (958 patients). Retrospective analysis of the data revealed good patient satisfaction with a low incidence of potentially life threatening side-effects: more than 79% of patients reported satisfaction with pain control while only 0.2% of patients receiving epidural opioid analgesia experienced clinically significant respiratory depression. There were no reports of respiratory depression in the patient-controlled analgesia group.

The authors conclude that the provision of an acute pain service in the local context was safe and resulted in excellent post-operative patient satisfaction.

Keywords: pain, post-operative analgesia, acute pain service

INTRODUCTION

The provision of post-operative pain relief has been consistently shown to be unsatisfactory despite improvements in analgesic techniques[1-3]; in fact studies suggest that 30% - 60% of all post-operative patients experience moderate to severe pain[4]. This is distressing in the face of mounting evidence that better perioperative analgesia can potentially influence incidence of post-operative pulmonary dysfunction[5,6], reduce stress response[7] and facilitate early post-operative ambulation[6]. While the common practice of on-demand intramuscular opioid injections has been shown to result in marked undertreatment[8], the recent use of epidural opioids and patient-controlled analgesia has been a major advancement in improving the efficacy and safety of post-operative pain management[9-12]. The subsequent introduction of the Acute Pain Service (APS) by Ready and colleagues as well as many other similar services in hospitals worldwide[13-16] has demonstrated that these advanced techniques can be used safely and have resulted in improved post-operative pain control and patient satisfaction.

With the aim of achieving better post-operative pain management, the Anaesthesia Department of Singapore General Hospital undertook to set up an Acute Pain Service in 1993. This paper is a description of the experience of such a service in our hospital.

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METHODS

Organisation of the APS

The APS started as a one-year pilot project in 1992 which provided supervised pain management services for patients in the Department of Colorectal Surgery. After its official launch in 1993, it has since extended to involve all the major surgical disciplines, including General Surgery, Orthopaedic Surgery, Obstetrics & Gynaecology, Paediatric Surgery, Cardiothoracic Surgery, Plastic Surgery, Hand Surgery and Burns Centre.

The APS manpower staffing was met by 3 specialist anaesthetists and a clinical pain nurse specialist while 24-hour on-call services were provided by anaesthetists from the Department of Anaesthesia. The APS team was responsible for treatment protocols, equipment procurement, staff education, troubleshooting and audit of the service.

Techniques of pain management

The APS provided for the safe administration of advanced pain management techniques, particularly epidural opioid analgesia (EOA) and patient-controlled analgesia (PCA).

Epidural opioid analgesia

The predominant technique in EOA was the use of preservative-free morphine boluses on a twice-daily basis given via an indwelling lumbar or thoracic epidural catheter (Braun(R) Perfix Lorsoft 520 model, Germany). Other less common options included continuous epidural bupivacaine-morphine infusion, bupivacaine-fentanyl infusion and single-administration of caudal morphine. Intrathecal opioid administration was not utilised by the service.

Patient-controlled analgesia

Morphine PCA was the mainstay of this modality. The common settings in morphine PCA included bolus doses of 1 to 2 mg and lockout times of 5 to 8 mins. The routine use of a basal infusion was discouraged. The other opioid used occasionally was fentanyl, mainly in brittle asthmatics or morphine-intolerant patients. Pethidine PCA was not utilised in

Table I - Patient data for 1993-1994 [mean (SD or Range)]

	PCA	EOA
No. of Patients	310	958
Male: Female (%)	59.3 : 40.7	58.1: 41.9
Age (year)	45.2 (12-73)	60.1 (14-91)
Weight (kg)	55 (12)	53.5 (12)
Dose of morphine (mg/24H)	33.0 (21)	4.00 (1.83)
Duration of treatment (days)	4.2 (1-8)	3.1 (1-6)

PCA patient-controlled analgesia
EOA epidural opioid analgesia

Table II - Referral pattern (%)

	1993	1994
Colorectal Surgery	64.0	36.1
General Surgery	25.1	34.3
Urology	1.3	5.0
Orthopaedic Surgery	3.6	9.2
Paediatric Surgery	4.5	5.1
Cardiothoracic Surgery	0.6	3.1
Obstetrics & Gynaecology	0.9	3.2
Others	0	4.0
Total	100	100

view of possible normeperidine toxicity[17]. The APS had fourteen Graseby(R) 3300 PCA pumps (USA) in its inventory.

Accreditation of wards

The APS introduced the concept of ward accreditation to facilitate safe use of PCA and EOA. The criteria for accreditation included mandatory APS-organised training programmes, nursing proficiency tests as well as minimum monitoring standards in these wards. These facilities allowed for basic cardio-respiratory monitoring of blood pressure, heart rate and respiratory rate, somnolence level and pulse oximetry in selected cases. With this accreditation process, the use of EOA was restricted to the High Dependency Units (HDU) and Surgical Intensive Care Unit (SICU) while the use of PCA was extended to encompass the general surgical wards as well.

Procedure for admission and discharge from the APS

The selection of a suitable patient for PCA or EOA was made by the attending anaesthetist who was also responsible for the necessary pre-operative patient education and proper conduct of the chosen technique intra-operatively. The prescription for subsequent post-operative analgesia was entered in a standard APS form which also contained information on monitoring requirements, treatment strategies for side-effects and relevant precautionary information. Satisfactory pain relief was always ensured in the immediate post-operative period by the recovery room anaesthetic staff before further care was continued by the APS in the wards. Documentation on an acute pain management form served as the means for the APS to track the patient's progress.

The patients continued to be monitored by the APS until they were comfortable on alternative analgesic techniques. Assessment of overall satisfaction, removal of epidural catheters and recommendations for follow-up analgesia were made by the APS upon discharge from the service.

Ward rounds

The APS conducted twice daily ward rounds on all referred patients. During these rounds, the patients were assessed for their pain scores (at rest and movement) using a four-point verbal rating scale, the presence of side effects (pruritis, nausea and vomiting, sedation, urinary retention and respiratory depression) and their management. Special attention was paid to the epidural or intravenous sites to detect early inflammatory changes. In addition, adjustments to treatment protocols, administration of epidural morphine boluses, proper documentation and patient-oriented discussions with nursing staff were integral to the ward rounds.

Education

Great emphasis was placed on education of all caregivers involved in the APS. In particular, formal training and assessment packages for nurses were conducted before implementation of EOA or PCA in the particular ward. These two-day instructional courses included lectures on concepts of pain, monitoring requirements, pharmacology of analgesics, treatment for side effects, documentation as well as practical experience on PCA equipment. Regular six-monthly in-house refresher courses were also conducted for anaesthetic and surgical housestaff to help them keep abreast with departmental protocols and new developments.

The APS also prepared information brochures on post-operative pain management (available in the four main languages) for patient education. These were distributed to the patients on admission to the hospital.

RESULTS

Patient data (Table I)

The APS managed 310 patients on PCA and 958 on EOA in the review period of 1993-1994. The weight and gender ratio were similar between the two groups. The average daily dose of morphine used was 33 mg and 4 mg and the average duration of treatment was 4 and 3 days for PCA and EOA groups respectively.

Referral pattern (Table II)

In the first year of the APS, referrals were predominantly from the Colorectal Surgery Unit. The distribution in 1994 reflected the gradual incorporation of the other surgical disciplines into the service. The small percentage (4%) listed under the "others" category represented the occasional involvement of the APS in non-surgical referrals.

Table III - Pain assessment and patient satisfaction (%)

Pain Assessment	PCA	EOA
None to mild	78.0	75.0
Moderate	13.5	15.0
Severe	8.5	10.0
Patient satisfaction	81.5	79.5

PCA patient-controlled analgesia
EOA epidural opioid analgesia

Table IV - Incidence of complications (%)

	PCA	EOA
Nausea & vomiting		
incidence	28.7	27.4
% requiring treatment	9.8	8.6
Pruritis		
incidence	21.3	22.7
% requiring treatment	5.3	4.6
Respiratory depression		
incidence	0.0	0.2
% requiring treatment	0.0	0.2

PCA patient-controlled analgesia
EOA epidural opioid analgesia

Pain assessment and patient satisfaction (Table III)
Data on patients' pain assessment and overall satisfaction indicated that less than 10% of patients on the APS experienced severe pain with either treatment modality, while more than 75% reported none to mild pain. In response to direct questioning, 81.5% and 79.5% of patients expressed overall satisfaction with PCA and EOA respectively.

Complications (Table IV)
Nausea and Vomiting
The incidence of nausea and vomiting in patients on PCA and EOA was relatively high, 28.7 % and 27.4% respectively. However the proportion requiring treatment was low.

Pruritis
Mild pruritis not requiring medical intervention was again common in patients on PCA and EOA (21.3 % and 22.7 % respectively). Titrated intravenous doses of naloxone was the drug of choice in the treatment of problematic pruritis and in most cases, satisfactory relief was obtained without compromising analgesia.

Respiratory depression
There were 2 cases of respiratory depression in patients on EOA, constituting 0.2 % of patients on EOA in the review period. Both cases responded satisfactorily to naloxone reversal without any long-term sequelae. There was no respiratory depression detected in patients on PCA in the same period.

Others (data not shown)
In the EOA group, the rate of inadvertent catheter dislodgement was 5.5%, and 1.5% of patients reported backache attributable to the epidural puncture site. There was superficial skin inflammation as evidenced by skin redness (but no pus formation) in 3.4 % of patients on EOA but no epidural space infection was detected during the review period. There was however one report of accidental epidural catheter breakage during removal. In the PCA group, there were no problems with machine malfunction or programming errors encountered.

DISCUSSION

The main concerns in the provision of an APS revolved around the issues of efficacy and safety. The experience with the APS in the Singapore General Hospital has highlighted several other issues pertinent to local practice. These included local socio-cultural bias, limited resources in equipment, manpower and monitoring facilities and the role of nurses in the APS.

Efficacy

The APS assisted in the pain management of 1,268 patients in the two-year review period during which more than 75% reported no pain to mild post-operative pain. In addition, overall patient satisfaction was extremely high, averaging 80% for both groups. While this has not been compared in a prospective randomised fashion to conventional intramuscular opioid therapy, it is noteworthy that 2 recent studies examining the latter modality have demonstrated dismal results[18,19]. Kuhn and colleagues in a study of patients undergoing abdominal surgery, found that only 26% of their patients scored their pain as mild or absent[19].

A further measure of the efficacy of the APS was indirectly reflected by the patients' response to the question of whether they would request for a similar analgesic technique if they had a second operation (data not shown); 79% of the respondents reported in the affirmative, suggesting satisfaction with the service.

Safety

It was very heartening for the APS to be able to provide PCA services without any major complications. While this is compatible with other reports[20,21], it is believed that the safety was enhanced by adopting strict protocols which limit concomitant administration of other analgesics or sedatives, discourage routine use of basal opioid infusions[22] and a very rigorous quality control programme conducted by the APS.

The two cases of epidural opioid-related respiratory depression warrant further discussion. The first patient was a middle-aged male who received a single bolus of 3 mg epidural morphine via an indwelling lumbar epidural catheter after hemicolectomy. He was found to be barely arousable

and bradypnoeic (4-6 breaths/min) 7 hours after the epidural opioid administration. No other opioids or sedatives had been served. His respiratory rate improved with naloxone boluses and he was subsequently managed with a continuous naloxone infusion for the next 24 hours after which his post-operative course was uneventful. Satisfactory analgesia was provided with epidural morphine boluses of 1 mg every 12 hours.

The second patient was an elderly male who received 3 mg epidural morphine for an anterior resection of rectal carcinoma. He was inadvertently transferred to a general ward and was only discovered on routine ward round by the APS doctor who noted a respiratory rate of 6 breaths/min. Naloxone reversal was instituted and his subsequent stay in the HDU was uneventful. These seemingly straightforward and uncomplicated cases reflect the importance of continued surveillance and it remains the APS's policy to restrict patients with EOA to the ICU and HDUs despite studies which suggest safety of EOA in general wards[12]. These two cases represented an incidence of 0.2% which compared favourably with results of similar APS worldwide[12,16,21] and it is also pertinent to contrast this incidence of respiratory depression to the reported 0.9% incidence of "life threatening respiratory depression" in 860 hospitalised patients receiving morphine either orally or parenterally[23].

The incidence of the minor complications (pruritis, nausea and vomiting) were also comparable to experience elsewhere[12,15,24,25]. Rapp and colleagues found that in patients undergoing major gynaecological procedures, nausea and vomiting occurred in 21% and 28% of those receiving PCA and EOA respectively[25]. This is similar to our incidence of 28.7% and 27.4% for patients on the respective treatment modalities. The proportion of our patients who required treatment for the minor side effects however was very low.

Local socio-cultural bias

Some of the initial problems encountered by the APS included resistance and anxiety among caregivers of perceived risks of opioid abuse or side effects and certain patients' reluctance to assume control of their own pain relief. These required patience and endless explanations to win over the doubtful and the unwilling.

It is also interesting to note the apparent difference in the average age of patients on PCA and EOA (Table I). This perhaps reflected the anaesthetists' bias in selecting younger patients for PCA in the belief that they may better comprehend the use of these complicated pumps. Indeed, the multitude of races and languages posed great difficulty in communication, especially with the use of PCA in the elderly.

Resource implications

Staffing

One of the outstanding problems faced by the APS was the provision of 24-hour coverage for problems encountered in the service. It had relied on duty anaesthetists who were also rostered to provide coverage for the SICU labour ward and emergency anaesthetic services. This system had resulted in inadvertent delays in response and had also given rise to the current practice of twice-daily administration of epidural opioids (rather than in response to patients requests).

It is also necessary to emphasise the importance of a dedicated clinical pain nurse specialist in any APS. She has the important task of being a resource person to the nurses to ensure daily quality control of the service.

Equipment

The PCA pumps have proven to be robust, user-friendly and reliable. The only complaint regarding the pumps was their inadequate numbers. The initial cost of each pump was high (approximately S$4,500) and the daily running cost significantly higher than conventional analgesia therapy[26]. However this expenditure may possibly be defrayed by savings in nursing time which could eventually lead to improved nursing care quality in the ward[27]. The APS had elected to use the microprocessor-based PCA pumps as opposed to the disposable variety to ensure high standards of performance and reliability.

Monitoring facilities

The cornerstone of monitoring requirements in the APS was regular nursing observations of pain scores, respiratory rates and sedation scores. These simple clinical observations have been shown in established pain services to be an excellent monitoring strategy and they do not require extra nursing time[12].

The use of more advanced monitoring equipment such as pulse oximetry was not routine but restricted to selected patients who might be at increased risk of respiratory depression. These included the elderly, the morbidly obese ASA III to IV patients and those with pre-existing respiratory disease.

Role of nursing

The administration of all epidural opioids and reprogramming of PCA pumps were performed by the APS team. While this was arguably the safest approach, it was limiting in terms of response time. The local situation unfortunately did not permit a practice similar to the University of Washington experience in which nurses administered epidural opioids and programmed PCA pumps under strict

protocols[12,13]. Nevertheless, it would be impossible to provide an APS without the co-operation of adequately trained nurses in the daily monitoring of the patients. The challenge remains with the service to expand the role of nurses in the future.

CONCLUSION

The experience of the APS has demonstrated that the provision of an integrated pain service can lead to excellent post-operative pain relief with good patient acceptance and satisfaction. It is the authors' hope that such services will proliferate in Singapore so that its potential benefits can be realised for more surgical patients.

ACKNOWLEDGEMENT

The authors are indebted to Dr Leela Nair, the secretarial staff of the Department of Anaesthesia & Surgical Intensive Care, Singapore General Hospital and all the post-operative surgical nurses for making the APS a reality.

REFERENCES

1. Cohen FL. Post surgical pain relief: patients' status and nurses' medication choices. Pain 1980; 9:265-74.
2. Weis OF, Sriwatanakul K, Alloza JL, Weintraub M, Lasagna L. Attitudes of patients, housestaff, and nurses towards post-operative analgesic care. Anesth Analg 1983; 62:70-4.
3. Donovan M, Dillon P, McGuire L. Incidence and characteristics of pain in a sample of medical-surgical inpatients. Pain 1987; 30:69-78.
4. Bonica J ed. Postoperative Pain. In: The management of pain. 2nd Edition. Philadelphia: Lea & Febiger, 1990; 461-80.
5. Cuschieri RJ, Morran CG, Howie JC, McArdle CS. Post-operative pain and pulmonary complications: comparison of three analgesic regimens. Br J Surg 1985; 72:495-8.
6. Rawal N, Sjostrand U, Christoffersson E, Dahlstrom B, Arvill A, Rydman H. Comparison of intramuscular and epidural morphine for post-operative analgesia in the grossly obese: influence on post-operative ambulation and pulmonary function. Anaesth Analg 1984; 63:583-92.
7. Rutberg H, Hakanson E, Anderberg B, Vorfeldt L, Martensson J, Schildt B. Effects of the extradural administration of morphine or bupivacaine on the endocrine response to upper abdominal surgery. Br J Anaesth 1984; 56:223-8.
8. Marks RM, Sachar EF. Undertreatment of medical inpatients with narcotic analgesics. Ann Intern Med 1973; 78:173-81.
9. Cousins MJ, Mather LE. Intrathecal and epidural administration of opiates. Anesthesiology 1984; 61:276-310.
10. Harmer M, Rosen M, Vickers MD. Patient-controlled analgesia. Oxford: Blackwell Scientific Publications, 1985:134-87.
11. Yeager MP, Glass DG, Neff RK, Brinck-Johnsen T. Epidural anaesthesia and analgesia in high-risk surgical patients. Anesthesiology 1987; 66:729-36.
12. Ready LB. Loper KA, Nessly M, Wild L. Post-operative epidural morphine is safe on surgical wards. Anesthesiology 1991; 75:452-6.
13. Ready LB, Oden R, Chadwick HS, Benedetti C, Rooke GA, Caplan R et al. Development of an anesthesiology-based post-operative pain management service. Anesthesiology 1988; 68:100-6.
14. Cartwright PD, Helfinger RG, Howell JJ, Siepmann KK. Introducing an acute pain service. Anesthesia 1991; 46:188-91.
15. Wheatley RG, Madej TH, Jackson IJB, Hunter D. The first year's experience of an acute pain service. Br J Anaesth 1991; 67:353-9.
16. Zimmermann DL, Stewart J. Post-operative pain management and acute pain activity in Canada. Can J Anaesth 1993; 40:568-75.
17. Armstrong PJ, Berston A. Normerperidine toxicity. Anesth Analg 1986; 65:536-8.
18. Owen H, McMillan V, Rogowski D. Post-operative pain therapy: A survey of patients' expectations and their experiences. Pain 1990; 41:303-7.
19. Kuhn S, Cooke K, Collins M, Jones JM, Mucklow JC. Perceptions of pain relief after surgery. Br Med J 1990; 300: 1687-90.
20. Fleming BM, Coombs DW. A survey of complications documented in a quality-control analysis of patient-controlled analgesia in the post-operative patient. J Pain Symptom Manage 1992; 7:463-9.
21. McIntyre PE, Runciman WB, Webb RK. An acute pain service in an Australian teaching hospital: the first year. Med J Aust 1990; 153:417-20.
22. McKenzie R. Patient-controlled analgesia. Anesthesiology 1988; 69:1027.
23. Miller RR, Greenblatt DJ. Drug effects in hospitalised patients. New York: John Wiley and Sons, 1976:151-2.
24. Loper KA, Ready LB. Epidural morphine after anterior cruciate ligament repair: A comparison with patient-controlled intravenous morphine. Anaesth Analg 1989; 68:350-2.
25. Rapp SE, Ready LB, Greer BE. Post-operative pain management in gynaecologic patients utilizing epidural opiate analgesia and patient controlled analgesia. Gynaecol Oncol 1989; 35:341-4.
26. Smythe M, Loughlin K, Schad RF, Lucarroti RL. Patient-controlled analgesia versus intramuscular analgesic therapy. Am J Hosp Pharm 1994; 51:1433-40.
27. Koh P, Thomas VJ. Patient-controlled analgesia (PCA): does time saved by PCA improve patient satisfaction with nursing care? J Adv Nurs 1994; 20:61-70.