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The acute pain service after ten years: experiences of a Singapore public hospital

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ABSTRACT

Introduction: The management of postoperative pain is an increasingly important aspect of healthcare, leading to the establishment of acute pain services in major surgical centres worldwide. The acute pain service (APS) was established in most Singapore hospitals in the 1990s. We analysed data collected in our institution over a ten-year period (1998–2007), documenting our experiences, outcomes and complications encountered by our APS.

Methods: Data was chronologically divided into two groups for analysis: years 1998–2003 (3,248 cases) and 2004–2007 (2,466 cases). Analysis included a comparison of patient profiles, modalities of analgesia used, effectiveness of pain relief, adverse effects, complications and patient satisfaction. Results were also compared to published audits and proposed standards in medical literature.

Results: The patient profile served by the APS remained unchanged over the years, but a move away from central neuraxial blocks was noted with an increased utilisation of patient-controlled analgesia. There was no clinically significant change in pain scores over the two periods of analysis (0.9 vs. 1.0 at rest, 3.0 vs. 3.0 on movement). There were also no statistically significant changes in the prevalence of patients reporting severe pain while on the APS (1.5 percent vs. 1.6 percent at rest, p-value is 0.66; 8.5 percent vs. 9.4 percent on movement, p-value is 0.25). Complication rates remained well within international standards and no major complications were reported. Patient satisfaction remained high (94.3 percent vs. 94.6 percent, p-value is 0.6).

Conclusion: The move away from invasive and less targeted analgesic modalities has not compromised the quality of analgesia provided. Major morbidity remains extremely rare and incidence of complications has been reduced over the years. Patient satisfaction remains well in excess of 90 percent, and the side effects are largely well controlled. With further advancements in the provision of acute postoperative analgesia, the APS will continue to play an important role in the holistic convalescence of the surgical patient.

Keywords: acute pain service, analgesics, pain relief, patient satisfaction, postoperative pain

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INTRODUCTION

Postoperative pain management is an aspect of medical care that has become increasingly important in recent years, with greater awareness of the significant morbidity associated with inadequate analgesia.[1,2] Many measures are now widely in place to manage pain, such as focused physician education in modalities of analgesia, and the establishment of acute pain services (APS) in major surgical centres worldwide. This practice is in line with recommendations from the National Health and Medical Research Council (Australia) and the Agency for Health Care Policy and Research (United States).[3,4] Not only is the adequate management of pain a humane duty, it also prevents the adverse effects of uncontrolled pain, detailed well by Kehlet and Holte to include increased pulmonary, cardiac and thromboembolic complications.[1] The potential for progression to a chronic pain state if inadequately treated is worrying. Up to 20% of patients in a chronic pain clinic implicated surgery as a contributory cause of their pain.[5,6] In July 2000, the Joint Commission on Accreditation of Healthcare Organizations (JCAHO) introduced a new standard for pain management, declaring the pain level to be the "fifth vital sign".[7] The APS has been established in Singapore for slightly over ten years and last reviewed in 1997, separately by Wong and Boey,[8] and Shah.[9] There has not been a recent review of the APS despite changes in its practice and increased patient education and awareness. This paper audits and reviews how the APS has fared in our institution over a ten-year period and relates our experiences during this time.

Table I. APS patients by referring service.

Referred from	No. (%) in 1998–2003	No. (%) in 2004–2007
General surgery	2,058 (63.4)	1,632 (66.2)
Orthopaedics	934 (28.8)	695 (28.2)
Urology	210 (6.5)	125 (5.1)
Others (OMS / ENT / Plastics)	46 (1.4)	14 (0.6)
Total	3,248 (100.0)	2,466 (100.0)

Table II. Modalities of analgesia provided by the APS.

Mode of analgesia	No. (%) in 1998–2003 (n = 3,248)	No. (%) in 2004–2007 (n = 2,466)
PCA (morphine/fentanyl)	1,665 (51.3)	1,895 (76.8)
Epidural analgesia	1,389 (42.8)	422 (17.1)
Peripheral nerve blockade	194 (6.0)	149 (6.0)
APS modality failure	26 (0.8)	15 (0.6)

METHODS

In our institution, the APS is a specialist-driven service with patients reviewed on a daily basis by a dedicated pain team (comprising a trained pain nurse and resident-level doctor, under the supervision of a specialist anaesthetist). Where manpower resources permit, a specialist is rostered to the pain round. Clinical support for the APS after office hours is provided by the in-hospital duty anaesthetist, hence coverage is available at all times. There was no change in this provision of care during the period of review. Pain scores were obtained daily on a verbal numerical rating scale (NRS) from 0 (no pain) to 10 (worst imaginable pain). Patients who are unable to quantify their pain with the NRS were asked to report their pain on a descriptive scale of no pain, mild, moderate or severe pain. These were then assigned pain scores of 0, 2, 5 or 8, respectively, corresponding to the middle score of each pain category (described by the National Institutes of Health, United States).[10] Data on adverse effects, complications and feedback are also obtained during the round and satisfaction ratings garnered when patients are discharged from the APS.

Data collected from patients on the APS from January 1998 to June 2007 was analysed. A large-scale review was last undertaken in our institution in 2004, based on data from 1998 through 2003. The APS was then restructured in 2004 to improve provision of care based on this data. Changes included:

(1) Establishment of pain monitoring in wards as a vital sign (leading to heightened staff awareness and earlier detection of inadequate analgesia);
(2) Increased physician and nursing education hospital-wide on pain and analgesia;
(3) Increased availability of patient-controlled analgesia (PCA) with the procurement of additional PCA pumps;
(4) Increased staffing of the APS with recruitment of an additional pain nurse; and
(5) Protocol-based (ordered unless cancelled specifically by anaesthetist) anti-emetic prescriptions (IV ondansetron 4mg tds or IV metoclopramide 10 mg tds) with PCA therapy. This had previously been left to the discretion of the attending anaesthetist.

Hence, data collected during the study period was compared to previous data from 1998 to 2003, so as to analyse changes in outcomes and complications. All data obtained was analysed by a blinded, institution-appointed statistician with no involvement otherwise in this review. The relevant statistical tests of significance were applied as appropriate; chi-square for non-parametric descriptive data and *t*-tests for parametric data. Calculations were performed on the Statistical Package for Social Sciences version 12.0 (SPSS Inc, Chicago, IL, USA).

RESULTS

The APS service population in our institution remained largely unchanged over the years, with the large majority being from the general surgical population (Table I). The modalities of analgesia provided by the APS are detailed in Table II. Of note, limited availability of PCA pumps in the earlier years resulted in a larger majority of patients receiving central neuraxial blocks (epidurals). Increased proliferation and availability of PCA pumps in recent years have witnessed the increased use of PCA as a modality of postoperative analgesia (76.8% vs. 51.3%). Concomitantly, there has been a decreased reliance on epidural analgesia, which had previously accounted for 42.8% of all patients on our APS. From 2004 to 2007, only 17.1% of our APS patients received epidural analgesia.

Patients remained on the APS for a mean period of 2.53 days (2004–2007) compared to 2.80 days previously (1998–2003). We statistically analysed pain scores for all patients during the first three days they were on the APS, since the majority of patients were discharged from the APS by the third day on the service. Static pain scores were obtained with the patient resting in bed without movement. Dynamic pain was scored based on getting out of bed, or in bedbound patients, turning or attempting to sit up in bed. There was no previous local data available from previous publications for this comparison. Pain scores of patients on the APS over the average three days were comparable (Table III), with no clinically significant change in pain scores despite the move away from epidural analgesia to increased reliance on PCA. No statistical analysis was performed for this

Table III. Pain scores on the APS at 24, 48 and 72 hours.

Time on APS (hours)	Mean ± SD in 1998–2003			Mean ± SD in 2004–2007		
	24	48	72	24	48	72
Mean pain score at rest	0.9 ± 1.6	0.4 ± 1.0	0.3 ± 0.8	1.0 ± 1.6	0.5 ± 1.2	0.4 ± 1.0
Mean pain score on movement	3.0 ± 2.2	2.2 ± 1.8	1.8 ± 1.6	3.0 ± 2.3	2.4 ± 2.0	2.0 ± 1.9

Table IV. Incidence of severe pain (NRS ≥ 7) in the APS population.

	Rate in 1998–2003 (%)	Rate in 2004–2007(%)	p-value
Static pain	1.5	1.6	0.66
Dynamic pain	8.2	9.4	0.25

Table V. Incidence of adverse effects / complications of analgesia.

	No. (%) in 1998–2003 (n = 3,248)	No. (%) in 2004–2007 (n = 2,466)	p-value
Nausea / vomiting	455 (14.0)	322 (13.1)	NS
Pruritus	134 (4.1)	60 (2.4)	0.03
Hypotension	112 (3.4)	22 (0.9)	0.001
Respiratory depression	2 (0.1)	2 (0.1)	NS
Sedation	73 (2.2)	71 (2.9)	NS

NS: no statistical significance

data given the lack of clinical significance. The analgesia provided, despite changing trends, was of sufficient quality to provide for control of both static and dynamic pain. In addition, the incidence of patients with severe pain (defined as a self-reported pain score on the NRS of 7 or higher) showed no statistically significant changes (Table IV). Most patients remained comfortable at rest, with only 1.6% (2004–2007) of all APS patients reporting severe pain, compared to 1.5% during 1998–2003 (p = 0.66). Dynamic pain remains adequately controlled, with 9.4% of APS patients describing severe pain on movement (getting out of bed, turning or sitting up) compared to 8.2% in the years before (p = 0.25).

Complications often result from the analgesic techniques themselves or the drugs utilised. We compared the incidence of complications from 2004 to 2007, with previous data from 1998–2003 (Table V). There were no reported major complications arising from an analgesic modality in our period of study. Major complications were taken to include:

(1) spinal cord injury or compression;
(2) meningitis;
(3) intravascular or intradural catheter migration;
(4) epidural abscesses;
(5) prolonged motor blockade (in peripheral nerve blockade [PNB]) or documented nerve injury; and
(6) over-sedation requiring intubation and respiratory support.

Sedation is assessed in our centre using the modified Ramsay sedation score as follows:

Score 0: Awake and alert
Score 1: Mild, occasionally drowsy, easy to arouse
Score 2: Moderate, frequently drowsy, easy to arouse
Score 3: Severe, difficult to arouse
Score 4: Unarousable

Patients were deemed over-sedated at a score of 3 and above. 2.9% of all APS patients experienced over-sedation in our analysis from 2004–2007 compared to 2.2% in 1998–2003. This difference, however, was not statistically significant.

Patient satisfaction remains the main benchmark by which one assesses success of a pain service. This remained high with the service provided by our APS (Table VI). 25.6% were "very satisfied", while 69.0% were "satisfied" with the analgesia provided (2004–2007). This is comparable to 26.3% and 68.1%, respectively, in our last period of review (1998–2003). Observed differences were not statistically significant. These findings compare favourably with data from other regional APSs, which report satisfaction rates of 78%–98%.[11,12]

DISCUSSION

The move away from more invasive blocks may be due to a variety of reasons. However, this review was not designed specifically to investigate reasons behind this observed trend. Further reviews or surveys among anaesthetists may be better placed to elucidate the causes for this obsevation. We believe that the reasons for the shift away from central neuraxial blocks may include:

(1) Increased patient awareness and education, coupled with increased ability to grasp the concepts involved in PCA.
(2) Increasing use of double antiplatelet agents (especially in patients with cardiac intervention performed).
(3) Use of low molecular weight heparins in deep vein thrombosis prophylaxis.
(4) Institution of early mobilisation and physiotherapy requiring early ambulation.

With the reduction in the use of epidural analgesia,

Table VI. Patient satisfaction rates.

Satisfaction rating	No. (%) in 1998–2003 (n = 3,248)	No. (%) in 2004–2007 (n = 2,466)	p-value
Very satisfied	853 (26.3)	631 (25.6)	0.58
Satisfied	2,211 (68.1)	1,701 (69.0)	0.47
Not satisfied	184 (5.7)	134 (5.4)	0.73

Table VIII. APS standards of care after major surgery.[13]

	Incidence of adverse effects associated with APS (%)	
	Standard*	2004–7
Nausea	25.0	} 13.1
Vomiting	20.0	
Sedation	2.6	2.9
Pruritus	14.7	2.4

* Dolin and Cashman[13]

its associated complications have decreased, without compromise to the quality of analgesia delivered. Events of hypotension have decreased almost four-fold to a current incidence of 0.9% (compared to 3.4% in 1998–2003). Recent developments and advances in PNB have also increased the popularity and frequency with which it is performed. This trend is not well reflected in our data as the move to more directed blockade has only recently taken off locally and in the anaesthetic community worldwide. An additional trend not evident in this study is the increasing use of catheter-based techniques for PNB.

Despite the increasing use of opioid-based PCA techniques as the modality of choice in many of today's pain services, we found that rates of nausea and vomiting, unpleasant but common side-effects, are not significantly raised. The reasons for this are likely multifactorial and may include increased awareness, early and aggressive treatment of nausea / vomiting, changes in opioid consumption patterns, as well as administration of prophylactic antiemetics. However, we noted that incidence of sedation (2.9% vs. 2.2%) has increased slightly with more common opioid use. This difference, however, was not statistically significant and is comparable to reported figures in the literature. A review of published literature by Dolin and Cashman in 2005 showed incidences of sedation rates ranging from 0% to 25.7% in patients using PCA, and 0% to 46% when receiving epidural analgesia.[13] In a review of publications specifically related to the use of PCA in an APS setting, sedation rates varied from 0% to 7%.[14] Published literature and audits also estimate a 0.25% incidence of respiratory depression rates in patients utilising PCA opioids, though a range from 0.1% to 0.8% has been reported.[15,16] However, when concurrent background infusions for intravenous opioids are utilised, the incidence of respiratory depression rises to a reported range of 1.1%–3.9%.[16] In our centre, respiratory depression remained rare (0.1% of all patients on the APS) and background concurrent opioid infusions were rarely prescribed to patients receiving PCA.

We did not encounter any report of major adverse effects or complications arising for an APS modality in our period of study. This is in line with previously-reported data in which the incidence of significant morbidity from the APS is low. Werner et al reviewed published APS data and reported (in patients receiving epidural analgesia) only one case of cauda equina syndrome (n = 5,602), two cases of meningitis (n = 2,287), three cases of intravascular catheter migration (n = 4,958) and five cases of intradural migration (n = 4,958).[14] Given the reduction in placement of epidural catheters in our institution, the absence of major morbidity was not unexpected. Over-sedation is the mainstay of major morbidity in PCA opioid use. None of our patients required intervention in reversal of opioid-induced sedation.

While there are no definitive guidelines or figures by which to judge performance of an APS, numerous audits and publications have documented the potential adverse effects and complications associated with the provision of acute postoperative analgesia. To this end, Dolin and Cashman in a review of over 800 original papers and reviews, suggested standards of care to which an APS should aim for.[13] These are detailed in Table VII, with comparative figures from our APS. While sedation rates appear slightly higher than the suggested standard, all other incidences fall well below the standards suggested by Dolin and Cashman.

Future trends in the provision of acute perioperative analgesia point toward a more targeted and less invasive means of providing analgesia. Continuous PNB involves the placement of in-dwelling catheters in the vicinity of peripheral nerves to provide intense analgesia spanning for several days, while avoiding the complications of neuraxial blocks. Placement may be facilitated by the use of more recently-developed stimulating catheters. However, the clinical benefits of using stimulating catheters remain inconclusive when endpoints such as pain scores or opioid consumption are measured.[17-19] The increasing availability of ultrasound imaging in the operating theaters may also encourage the placement of such blocks by allowing visualisation of the target nerve and reducing complications, such as intraneural injections or direct nerve puncture.[20]

Transdermal fentanyl PCA is a novel means of opioid administration that has come to prominence recently with promising results.[21,22] Involving a needle-free non-invasive

system, fentanyl hydrochloride is driven on demand into the skin and subcutaneous tissue by iontophoresis, before diffusing into the systemic circulation. This results in fast onset, patient demand-driven analgesia. It may also offer logistical advantages to patients, nurses and allied health staff by avoiding the need for invasive venous access, complex programming of pumps and manipulation of unwieldy pumps and cables.[15,22]

In conclusion, while providing a controlled and effective means of perioperative analgesia, the move away from more invasive and less targeted modalities in the APS, e.g. epidurals, does not appear to have compromised quality of care. Major morbidity remains extremely rare and incidence of complications and adverse effects have reduced over the years. Patient satisfaction remains in excess of 90% and common side effects largely well-controlled. With further advancements in the provision of acute postoperative analgesia, the APS is likely to continue to play an important role in the holistic convalescence of the surgical patient.

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