ORIGINAL ARTICLE

A Review of the Acute Pain Service in Hospital Kuala Lumpur

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Summary

This study is a review of the Acute Pain Service in Hospital Kuala Lumpur for the years 1998 to 2001. 5042 records from post-operative patients were analysed. The majority of patients (81.8%) had satisfactory pain control. Eighty-two percent of patients experienced only mild pain at rest on the first post-operative day. The highest pain score occurred on the first day in 68.3% of patients. Nausea or vomiting occurred in 23.2% of the patients. Eight patients had respiratory depression. The low pain scores recorded by most patients and the low incidence of side effects reflect the efficiency of the service provided.

Key Words: Post-operative pain, Acute Pain Service, Analgesic techniques

Introduction

Post-operative pain is the most common form of acute pain and is either the result of surgical procedures or the underlying pathological condition[1]. It is not a separate phenomenon but one of the body's responses to surgery and is integrated with several other complex networks such as autonomic response, protein catabolism, hypercoagulobility, increased vascular demand and immunosuppression [2].

Most patients expect to experience pain after a surgical operation but are willing to suffer the pain rather than complain about it, even though they expect their pain to be promptly treated [2,3]. Nurses and other medical staff may also have misperceptions about post-operative pain relief. Due to fear of side effects and narcotic addiction, nurses give less than sufficient analgesia to the patients [4]. Some nurses will only provide analgesia when the patient requests it, unaware that many patients are reluctant to request for analgesia [3]. Underestimation of the amount of analgesia required by the patient to maintain pain relief also occurs [5,6]. Physicians tend to overestimate the pain relief while underestimating the pain itself [7].

The advantages of a service catering specifically for post-operative pain relief had been shown 20 years ago [8]. Today, such services have been set up in many countries to facilitate post-operative care [8,9,10,11]. The role of the Acute Pain Service (APS) is to

This article was accepted: 10 November 2002

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improve the pain relief of patients through better management, quality control, and choice of analgesia in terms of drugs and methods of administration. Better pain relief will lead to reduced post-operative complications, hospital stay and costs [1,9,12]. The APS can provide post-operative pain relief using a wide range of analgesic techniques without endangering patient safety [13].

An Acute Pain Service requires a well-organised set-up. This includes the training of nurses and doctors, familiarity with the available equipment, together with the use of guidelines and protocols for safe operation. The effectiveness of the APS needs to be regularly evaluated in order to improve the service.

In Hospital Kuala Lumpur (HKL), an APS has been providing post-operative pain management since 1993. The aim of this study is to review the effectiveness and safety of the analgesic modalities managed by the APS in HKL.

Materials and Methods

The study is a retrospective review of patients under the care of the Acute Pain Service of Hospital Kuala Lumpur from 1998 to 2001. Records of post-operative surgical, gynaecology and orthopaedic patients were included in the study. Data from patients below the age of 12 years and records with missing vital information were excluded.

Data Collection

The data used was obtained from the APS record sheets (appendix I), which were completed by the APS staff during their twice-daily ward round. Pain scores were recorded hourly for the first 4 hours, and were subsequently recorded 4 hourly. From 1999 to 2001, the pain score (0 to 10) was obtained using the visual analogue scale (VAS). Pain scores were taken using the verbal descriptor scale in 1998, and were excluded from the analysis.

The period during which the patient was under the care of the APS was recorded as the duration of analgesia. Side effects such as pruritis, nausea and vomiting, respiratory depression, numbness and urinary retention were noted.

The analgesic techniques were grouped in the following fashion:

PCAM: Patient controlled analgesia with either morphine or pethidine

EPIDC: Epidural infusion of a mixture of bupivacaine and fentanyl.

EPIDP: Epidural infusion of morphine or pethidine either by continuous or patient controlled infusion

Others: Includes all other modalities not included in the above categories.

The data collected was entered into a computer using Microsoft® Access 2000 (9.0.2720). All VAS pain scores in the APS record sheets were rounded to the nearest whole number to facilitate data analysis. For each patient, the following parameters were derived:

Lowest pain score at rest:
Score at rest taken on the first visit by the APS staff, at least 6 hours after the analgesic technique was started.

Highest pain score:
Highest pain score during the whole post-operative period, including the first day.

Day of the highest pain:
Day the highest pain score was recorded.

Data Analysis

Data analysis was done using SPSS version 9.05 database software. Differences between proportions were compared using the χ^2 test. Differences between means were compared using Student's *t*-test and Analysis of variance as appropriate. When the distribution was not normal, Mann-Whitney U-test was used in place of the Student's t-test. Analysis of covariance and

logistic regression was used when several covariates and factors influenced the outcome. A value of $p < 0.05$ was considered significant.

Results

Patient data

The APS managed 5189 patients from 1998 to 2001. One hundred and forty-seven children below the age of 12 were excluded from the study. No patient was excluded due to incomplete or missing vital data.

Distribution of patients' age, weight and gender is shown in Table I. The APS managed more female than male patients in all of the 4 years reviewed. However, the male to female ratio was not significantly different between years ($\chi^2 = 3.56$, df = 3, $p = 0.32$). There was no significant difference between the mean ages of the patients in the four years under review ($F = 0.35$, $p = 0.79$). Mean weight was also not significantly different ($F = 1.77$, $p = 0.15$).

Analgesic technique

Most patients (61.3%) received PCAM for post-operative analgesia, followed by EPIDC (29.1%), EPIDP (9.2%) and others (0.4%). The proportion of techniques used were significantly different between the years ($\chi^2 = 248$, df = 6, $p < 0.01$). The proportion of patients managed with EPIDC increased while the proportion of patients having EPIDP declined.

Within the PCAM group, 22 patients (0.72%) had pethidine instead of morphine. All patients in the EPIDC group had a mixture of bupivacaine and fentanyl. In the EPIDP group, 4 patients (0.95%) had epidural morphine instead of pethidine. As less than 1% of patients were given PCA pethidine or epidural morphine, these patients were not analysed as separate groups.

Thirty-eight patients (8.2%) received patient controlled epidural analgesia (PCEA) with pethidine instead of a continuous epidural infusion. Of these patients, only 10 had pain scores which could be used in the analysis. As such, patients who received PCEA pethidine were considered a sub-group of EPIDP and where appropriate, further analysis was done with patients who received PCEA pethidine being a separate group.

The majority of the patients treated by the APS were from general surgery (39.7%) and gynaecology (26.7%), followed by orthopaedics (17.6%), urology (13.7%) and plastic & ENT surgery (2.3%). Most of the general surgical patients had abdominal or thoracic surgery. Table II shows the distribution of patients by technique and surgical discipline.

Pain Score

Pain scores in 1998 were obtained using a mixture of visual analogue and verbal descriptor scales. Thus, the pain scores for that year were excluded from the analysis. A total of 3333 (88.4%) records were complete with the highest pain score, of which 3266 (86.6%) recorded the day the highest pain score occurred. There were 3181 (84.4%) records available for analysis of the lowest pain score at rest.

A highest pain score of 6 or less during the entire post-operative stay was recorded in 81.8% of the patients. The highest pain score occurred on the first post-operative day in 68.3% of the patients. Resting pain score on the first post-operative day was 3 or less in 82.1% of the patients. Distribution of highest pain scores, day the highest pain score occurred and lowest pain scores at rest, in patients who had patient controlled or epidural analgesia, are shown in Figures 1 to 4.

Using univariate analysis, age, gender, analgesic technique and surgical discipline significantly influenced the highest pain score (Table III). Using analysis of covariance, age, analgesic technique and surgical discipline were found to be independent predictors. There were no

interactions between factors. The result of the analysis was not different when PCEA pethidine was considered as a separate analgesic technique.

Side Effects

The incidence of side effects attributed to patient controlled and epidural analgesia is shown in Table IV. Respiratory depression was a rare occurrence. There were only 8 cases reported out of 5021 patients.

Nausea and vomiting was common with 23.2% of the patients complaining of at least one episode. The incidence of nausea and vomiting between techniques was significantly different with patients managed with EPIDC having the lowest (20.0%). Nausea and vomiting was more commonly seen in women. The incidence was highest among gynaecology patients and lowest among general surgical patients. Age, duration of analgesia and pain scores were also significantly different between patients who complained of nausea and vomiting, and patients who did not. When subjected to logistic regression, gender, analgesic technique, surgical discipline, duration of analgesia and resting pain score were found to significantly affect the incidence of nausea and vomiting. The result of the analysis was not different when PCEA pethidine was considered as a separate analgesic technique.

Seventy-eight cases of pruritis were recorded and 58 cases involved patients using PCAM. However, the proportion of pruritis between PCAM, EPIDC and EPIDP was not significantly different (χ^2 = 5.54, df = 2, p = 0.063). Paraesthesia occured in 10.6% of patients who received EPIDC.

Other problems related to the APS are shown in Table VI. 194 patients had their analgesic technique changed at least once during their treatment period. Out of these, 122 patients started off with EPIDC while 56 EPIDP patients required a change of technique. Patients managed with PCAM required significantly less change of technique when compared with EPIDC and EPIDP (χ^2 = 255, df = 2, p < 0.01).

The most common catheter related problem was catheter slippage. Other catheter problems were blockage (6 cases), disconnection from bacteria filter (18 cases) and catheter contamination (1 case). Nine of the catheter related problem involved usage of PCAM, the most common being disconnection of the intravenous infusion in 5 cases. The other four cases were due to blockage and contamination. Catheter insertion site problems include bleeding or purulent discharge, inflammation and leakage of infusion fluid.

Twelve patient were either disoriented, confused or both and could not score their pain when asked by the nurse. Another 62 patients either refused to use the analgesic or ask to be taken off the machine. The 17 cases of machine error include power failure, programming error, syringe pump problem and other malfunction.

Table I: Distribution of Patients by Gender, Age and Weight

	Year				
	1998	**1999**	**2000**	**2001**	**Total**
Number of Patients	1271	1166	1402	1203	5042
Sex					
Male	546	523	602	554	2225
Female	725	643	800	649	2817
Age (years)					
Mean (SD)	47.0 (16.9)	46.6 (16.7)	47.1 (17.1)	46.6 (17.2)	46.8 (7.0)
Range	12 - 95	12 - 90	12 - 89	12 - 88	12 - 95
Weight (kg)					
Mean (SD)	59.5 (15.0)	59.6 (13.3)	60.1 (13.2)	60.9 (16.2)	60.0 (14.4)
Range	16 - 160	20 - 155	17 - 120	23 - 270	16 - 270
Technique					
PCAM	776	725	893	694	3088
EPIDC	300	266	418	484	1468
EPIDP	188	172	89	16	465
Others	7	3	2	9	21

Table II: Distribution of Patients by Surgical Discipline

	Discipline				
	Orthopaedics	**General Surgery**	**Gynaecology**	**Urology**	**Plastic & ENT Surgery**
Number of Patients	889	2000	1344	692	117
Year					
1998	201	554	351	140	25
1999	168	519	284	175	20
2000	271	532	392	181	26
2001	249	395	317	196	46
Technique					
PCAM	556	1289	790	377	76
EPIDC	279	513	390	252	34
EPIDP	50	189	160	61	5
Others	4	9	4	2	2

Table III: Factors and covariates influencing the highest pain score

Factor / Covariate	Pain score (mean ± SD)	Significance	
		Univariate Analysis	Analysis of Covariance
Gender			
Male	4.48 ± 2.44	t = 2.84,	F = 0.01,
Female	4.25 ± 2.26	p < 0.01	p = 0.92
Technique			
PCAM	4.54 ± 2.25	F = 18.8,	F = 5.06,
EPIDC	3.99 ± 2.51	p < 0.01	p < 0.01
EPIDP	4.19 ± 2.31		
Surgical Discipline			
Orthopaedics	4.28 ± 2.49		
Gen Surgery	4.62 ± 2.37	F = 13.3	F = 3.46
Gynaecology	4.05 ± 2.15	p < 0.01	p < 0.01
Urology	4.50 ± 2.33		
Plastic & ENT	3.18 ± 2.39		
Age (years)		r = -0.04, p = 0.02	F = 5.68 p = 0.02
Weight (kg)		r = 0.013, p = 0.53	-

Table IV: Incidence of side effects

Side Effect:	Technique			
	PCAM	EPIDC	EPIDP	Total
	n = 3088	n = 1468	n = 465	n = 5021
Respiratory Depression	5	1	2	8
Pruritis	58	15	5	78
Nausea and Vomiting	756	294	116	1166
Urinary Retention	2734	1335	426	4495
Hypotension	-	5	1	6
Death	8	3	3	14
Giddiness	125	30	23	178
Numbness	1	156	3	160
Sedated	19	3	3	25
Headache	5	4	2	11
Other	4	1	-	5

Table V: Factors and covariates influencing the incidence of nausea and / or vomiting

Factor / Covariate	Patients with nausea / vomiting	Patients with no nausea / vomiting	Significance	
			Univariate Analysis	Logistic Regression
Gender				
Male	326	1899	χ^2 = 162,	p < 0.01
Female	842	1975	p < 0.01	
Technique				
PCAM	756	2332	χ^2 = 14.2,	
EPIDC	294	1174	p < 0.01	p < 0.01
EPIDP	116	349		
Others	2	19		
Surgical Discipline				
Orthopaedics	189	700		
Gen Surgery	309	1691	χ^2 = 180,	p < 0.01
Gynaecology	474	870	p < 0.01	
Urology	167	525		
Plastic & ENT	29	88		
Age (yr) (mean ± SD)	44.5 ± 15.6	47.5 ± 17.3	t = 5.27, p < 0.01	p = 0.063
Weight (kg) (mean ± SD)	60.0 ± 14.4	60.0 ± 14.4	t=-0.11, p = 0.91	-
Duration of analgesia (hr) (median [range])	2 [1 - 9]	2 [1 - 13]	U = 2004976, p < 0.01	p = 0.011
Pain score at rest (median [range])	2 [0 - 10]	1 [0 - 10]	U = 853065, p < 0.01	p < 0.01
Highest pain score (mean [range])	4.5 [0 - 10]	4.3 [0 - 10]	t = -2.01, p = 0.045	p = 0.13
Day of highest pain (median [range])	1 [0 - 5]	1 [0 - 17]	U = 1696455, p < 0.01	p = 0.64

Table VI: Other problems encountered by the APS

Problem:	Number of Cases
Scoring Related Problem	88
Catheter Related Problem	152
Catheter Insertion Site Problem	52
Machine Error	17
Patient Changing Analgesic Technique	194
Usage Related Problem	77

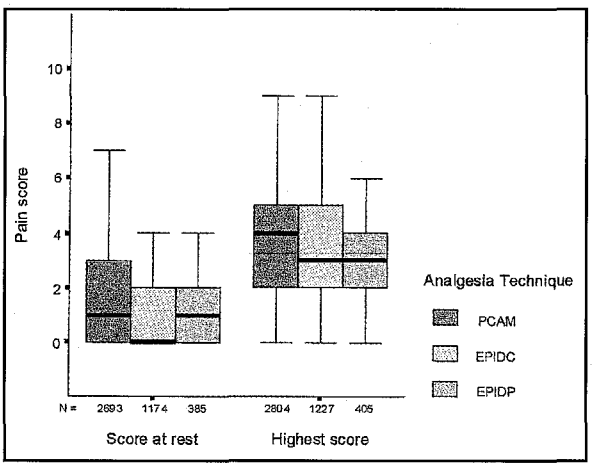

Fig. 1: Box and whicker plot showing distribution of lowest pain scores at rest and highest pain scores. The dark line represents the median while the box represents the inter-quartile range.
Number of records analysed = 3757

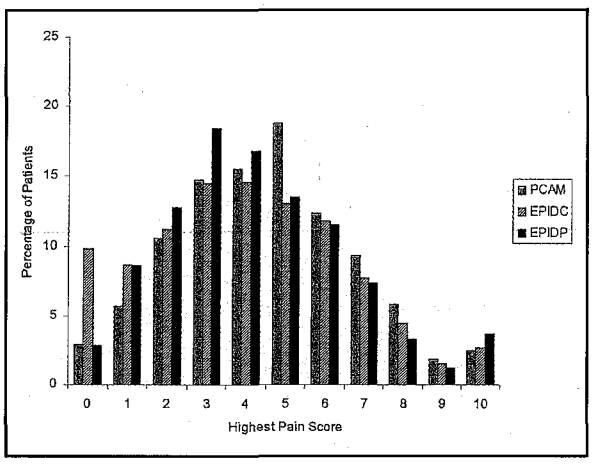

Fig. 2: Distribution of highest pain scores
Number of records analysed = 3326

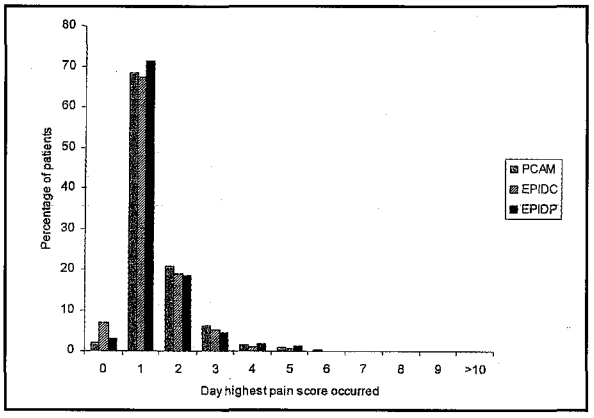

Fig. 3: Day on which the highest pain score occurred
Number of records analysed = 3260

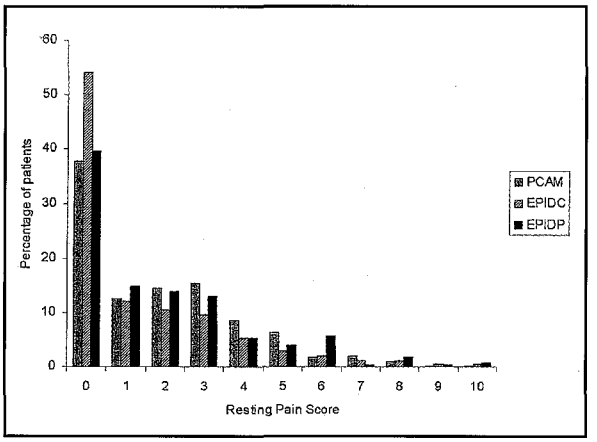

Fig. 4: Distribution of the lowest pain score at rest
Number of records analysed = 3174

Discussion

Pain Assessment

Pain is a subjective experience and it is difficult to objectively quantify it. Assessment of a patient's pain depends on the patient's overt communication, both verbal and behavioural [14]. As pain assessment requires translation of a subjective quality into an objective one, the pain scores commonly in use may not necessarily reflect the patient's pain. In spite of this, the Visual Analogue Scale (VAS) is a useful tool for the statistical study of pain. The VAS is useful in assessing both pain intensity and pain relief [7].

During the APS rounds in HKL, patients were asked to indicate their level of pain along a scale of 0 to 100 mm. However, most values recorded by the APS team was in whole numbers and in order to standardise the reported values, the VAS was converted to a discontinuous numerical rating scale for the purpose of this review. Each number of the numerical scale is assumed to represent a proportional increase in pain intensity. We then correlated the numerical scale to the verbal descriptor scale in the following manner [15]:

Numerical Rating Pain Score	Verbal Descriptor Scale
0	No pain
1 - 3	Mild pain
4 - 6	Moderate Pain
7 - 9	Severe Pain
10	Worst Possible Pain

The highest pain score occurred mostly on the first post-operative day. This indicates that most patients felt that the pain on the first post-operative day was most painful regardless of the magnitude of the pain. In spite of this, the first day resting pain scores were low and are comparable to other studies [10,16,17,18,19,20,21].

However, in post-operative patients, it is a better to measure pain on movement rather than pain at rest [22]. We found that 18.3% of patients had at least one episode of severe pain (VAS 7 - 10) and another 31.2% had at least one episode of moderate pain (VAS 4 - 6) during the post-operative period. The high percentage of patients reporting moderate to severe pain might be misleading because it is based on a single highest pain experienced by the patient during the whole post-operative period. Such episodes of moderate or severe pain could have occurred once or a few times.

In the United Kingdom, it was proposed in 1997 that less than 20% of patients should experience severe pain following surgery [15]. While the incidence of severe pain in our study is high, it is still within the above limit.

In this review, patients treated with PCAM had higher pain scores than patients given EPIDC or EPIDP. While it is likely that the epidural techniques are more effective than intravenous PCA, the difference in pain scores, though significant, were not very great (Table III). Similarly, while there was significant correlation between age and highest pain scores, the variation with age was small. Mean pain score for patients aged 20 to 30 years was 4.57 while patients aged 60 to 70 years scored 4.36.

General surgical and urology patients generally had higher pain scores. This can be expected from the site and nature of the operations. Gynaecology patients, whose procedures were confined mainly to the lower abdominal region, had slightly lower pain scores. Patients who underwent spine surgery generally had higher pain scores, thus increasing the mean score in orthopaedic patients as a whole. Again, while the mean pain scores were statistically different, the mean highest pain scores for these four groups fell within the 4.0 to 4.7 range.

The only group with significantly lower pain scores than all others were patients who had plastic & ENT surgery. Most of these patients had head and neck surgery.

Analgesic techniques

In our study, we found PCAM was more often used than the epidural techniques. This could be because of the simplicity of an intravenous PCA system. In addition, epidural analgesia is not suitable for operations involving the head, neck and upper limbs.

We also found a decline in the use of epidural pethidine during the period covered by this review. During this period, the pethidine solution used for epidural infusion could only be kept for three days, after which it needed to be discarded. This meant that when it was planned to start a patient on an epidural pethidine infusion post-operatively, the APS needed to be informed a day earlier. Very often, it was not easy to do so, as the time of the pre-operative visit by the anaesthetist was very variable. This led to patients being given local anaesthetics rather than pethidine for analgesia.

The proportion of patients changing analgesic techniques differed significantly between techniques. Patients on epidural analgesia (either EPIDC or EPIDP) were changed to PCAM for a variety of reasons, including inadequate analgesia and problems related to the epidural catheter.

Side effects and other problems

In this review, only two of the reported side effects had an incidence of over 5%. The incidence of respiratory depression, sedation, hypotension and pruritis were lower than the corresponding values reported in other studies [10,13,16,18,23,24,25].

There was a high incidence of nausea and vomiting in the patients managed by the APS, comparable to the results of other studies [10,25]. Logistic regression revealed that gender, analgesic technique, surgical discipline, duration of analgesia and resting pain score significantly influenced the incidence of nausea and vomiting. However, there were interactions between gender, analgesic technique and surgical discipline.

It was found that female patients were twice as likely to have nausea and vomiting than male patients (30% vs. 15%). Patients treated using EPIDC, and patients with lower pain scores had a lower incidence of nausea and vomiting. This could be because these two groups of patients received less opioids for analgesia. On the other hand, a lower duration of analgesia was associated with a higher incidence of nausea and vomiting. These patients were likely to be those who were not as ill, and were able to ambulate early. Female gender, opioid analgesics and movement are known factors associated with post-operative nausea and vomiting [26].

Most patients were catheterised in the post-operative period. Whether the catheterisation was because of the analgesic technique or the operation is not certain.

With the epidural technique, numbness and catheter slippage were common problems. Numbness over the lower limbs occurred almost exclusively in patients given EPIDC. Epidural catheter slippage occurred in 6.1% of patients. The incidence of these two problems was similar to other studies [10,16].

We also noted 62 patients either refused to use the analgesic technique prescribed, or asked to be taken off the infusion pump. This could be because of the patients' fear of a high blood level of opioid, as well as insufficient information on the correct usage of the PCA device [27]. Another patient perceived disadvantage is the fear that too much analgesia will lead to loss of contact with the nurses [28].

Comparison with previous reports from 1995 to 1997

Results from this study were compared with data obtained from the annual reports of the APS in 1995 to 1997. During that period, subcutaneous morphine was the technique managed by the APS in 14.9% of patients. However, the individual surgical units now manage patients on subcutaneous morphine. Between 1995 to 1997,

62.1% of patients had PCAM while 22.6% had epidural analgesia. While the proportion of patients receiving PCAM did not differ greatly between 1995-1997 and 1998-2001, the difference in usage of epidural techniques between the two periods was about 15%. This reflects an increased tendency to use regional analgesia in the current practice.

Sixty-eight percent of patients reported no or mild pain on the first postoperative day in 1996 and 1997. This is lower than the current percentage, and reflects an improvement in the service. The incidence of nausea and vomiting has not changed, with 23.4% of patients in 1996 and 1997 complaining of this side effect.

Conclusions

From this review, we conclude that:

1. The pain relief achieved in post-operative patients managed by the APS in HKL is comparable to that reported by other investigators.
2. Patient controlled intravenous analgesia remains the most popular choice of analgesic technique.
3. The low incidence of side effects and problems related to the APS reflects the safety of the service.

Areas of improvement include:

1. Better patient education to reduce the incidence of severe pain, and reduce patient refusal of the prescribed analgesic technique.
2. Adaptation of anaesthetic techniques and use of antiematics to decrease the incidence of nausea and vomiting.
3. The analgesic techniques in use could be improved. This includes:

a. Proper siting of the epidural catheter to ensure the correct spinal segments and nerve roots are blocked. This would improve the efficiency of the technique and at the same time reduce the dosage and adverse effects.

b. The use of combination techniques where one technique can supplement another without a concomitant increase in side effects.

Acknowledgements

The authors would like to thank Dr. Azian Syed Othman, staff nurse Rosemary Kinajil and staff nurse Annusuey Mariappan for their help and advice with the collection of data for this review. The authors would also like to thank the Director General of Health of Malaysia for permission to publish this article.

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Appendix 1

HOSPITAL KUALA LUMPUR ACUTE PAIN SERVICE RECORD SHEET

Name : .....
RN : .....
IC No : .....
Age : ..... Sex : .....
Diagnosis/Operation : .....

APS Record No : .....
Ward : .....
Weight : .....kg
Unit : .....
Incision : .....

APS Technique : .....
Date started : .....
Date end : .....

APS Technique : .....
Date started : .....
Date end : .....

Epidural Level : ..... Skin Marking : .....cm Inserted by : Dr .....

Oral Analgesic : Drug : ..... Dose : ..... Date started : .....

Date							
Time							
Seen by							
Technique -							
Total drug used since last review (mg or ml)							
Pain* (rest)							
Pain* (movement/cough)							
Complications**							
- respiratory							
- pruritus							
- nausea/vomiting							
- urinary retenion***							
- epid cath/cannula site							
- giddiness							
- others							

Technique- SCM = Subcutaneous Morphine
PCAM = PCA Morphine
EPIDC = Epidural Cocktail
SCP = Subcutaneous Pethidine
PCAP = PCA Pethidine
EPIDP = Epidural Pethidine

*Pain Score : 0 = no pain, 1 = Slight pain, 2 = moderate pain, 3 = severe pain, 4 = worst pain imaginable
(Record pain score at time of review)

**Complications score : 0 = mild, no treatment needed, 2 = moderate. helped by treatment
3 = severe, despite treatment

***Urinary retention, 3 = needed to be catheterised, "CBD" if catheter in situ

Level of Satisfaction (tick one)
Excellent ☐ Good ☐ Satisfactory ☐ Poor ☐