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Original Research Article

Postoperative analgesia following elective abdominal surgery: a prospective observational study

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ABSTRACT

Background: Laparotomy forms an important subset of general surgical operations. This study aimed at collecting the baseline information on postoperative analgesia, to detect deficiencies in current management of postoperative pain and to aid as a reference for future endeavours aimed at improving pain management following abdominal surgeries.
Methods: It was conducted as a prospective descriptive study in patients undergoing elective laparotomies in the Department of General Surgery of a tertiary care institute, for two years. The patterns of prescription and administration of analgesic drugs for postoperative pain after abdominal surgery, incidence and severity of postoperative pain, adverse effects of drugs and patient satisfaction were assessed.
Results: A total of 289 elective laparotomies were performed. Combinations of Non-steroidal anti-inflammatory drugs (NSAID) with opioids, epidural analgesia (EA) with supplemental intramuscular ketorolac and PCEA (Patient controlled EA) provided effective pain relief with high satisfaction score (3/4) and were associated with low sedation (1/3) and the least side effects. Patients receiving NSAIDs had higher pain score with lesser satisfaction score and lower sedation score. IV-PCA with morphine provided effective pain relief with high satisfaction score (3/4), with least side effects, but patients had high sedation score (2/3). Around 55 (55/289; 19.03%) patients experienced postoperative nausea and vomiting, which responded to antiemetic treatment.
Conclusions: A combination of NSAIDs with opioids provided effective pain relief, high satisfaction with less sedation and least side effects. Epidural analgesia with supplemental intramuscular ketorolac and PCEA also provided effective pain relief with high satisfaction and less sedation with least side effects.

Keywords: Laparotomy, NSAIDs, Opioids, Patient satisfaction, Postoperative pain

INTRODUCTION

Postoperative pain is one of the most common therapeutic problems in hospitals.[1] Abdominal surgeries constitute an important proportion of general surgical operations. Effective pain management is fundamental to the quality of care.[2] Pain significantly upsurges the morbidity after laparotomy due to a reduction in the effort to breathe and suppression of cough reflex and consequently delays ambulation and recovery of bowel function.[3] This culminates in prolongation of hospital stay and other complications. The role of a well-planned pain

management strategy in the immediate postoperative period is crucial to decrease the morbidity after abdominal surgery, aided by the availability of multitude of drugs, dosages and routes of administration today. For pain management to be effective, each hospital must designate who or which department will be responsible for all of the required activities.[4]

An improvement in postoperative pain relief has been observed with the introduction of a multidisciplinary team into a general hospital using simple techniques and simple instructions.[5] Routine audit of the quality of patient care has also been proposed. Determining the prevalence and severity of postoperative pain in the hospital setting is a contribution to the evaluation of health care and it constitutes a reference for the future evaluation of interventional measures to improve postoperative analgesia. Hence this study was undertaken to collect the baseline information regarding postoperative analgesia and to detect deficiencies and to improve pain management following elective abdominal surgeries.

METHODS

This was a hospital-based, prospective observational study, done in the Department of General Surgery, in a tertiary care institute in South India, performing around 300 elective abdominal surgeries a year, for a period of two years after obtaining clearance from the Institute Research Council and Ethics Committee.

All consecutive consenting patients undergoing elective laparotomies under general anesthesia (GA), more than 13 years of age, of either gender, belonging to the American Society of Anesthesiologists (ASA) classes I and II, were included in the study after obtaining a written informed consent.

The exclusion criteria were patients undergoing emergency laparotomy, inability to understand Visual Analog Score (VAS) or satisfaction score, contraindications to morphine, sensitivity to the anesthetic agent used or intolerance to the medications used and usage of steroids. Since it was an observational study, the sample size was not calculated.

All patients eligible for the study were included the day before surgery. A standard anesthesia protocol was used for all the patients. Pain was evaluated on a 10-point VAS, at admission into the surgical ICU and at 6, 12 and 24 hours postoperatively. Patients were educated preoperatively as to how much pain can be expected following the surgery. This was used to assess patient satisfaction to analgesia, by comparing the pain actually experienced in the postoperative period against the expected pain. Details regarding analgesic drugs, their routes of administration and their dosage schedules in the first 24-hour postoperative period were recorded. The respiratory rate was checked at regular intervals during the first 24 hours. A respiratory rate of <8 was considered respiratory depression and opioids were skipped or changed to non-narcotic drugs. The degree of sedation was objectively assessed using a sedation score (0-fully awake; 1-easy to arouse; 2-constantly drowsy; 3-severely somnolent). Other adverse effects, in the form of nausea, vomiting, pruritus and urinary retention were also recorded. After 24 hours of postoperative analgesia, the patients were asked to assess satisfaction to analgesia on an objective 4-point numeric rating scale (1-poor, 2-Fair, 3-Good, 4-Excellent). Epidural anesthesia was administered by the anesthetists in the surgical ICU.

The primary outcome variables were the type of postoperative analgesia used, the drugs, their dosages and dosage schedules and their routes of administration. The secondary outcome variables were details of surgery, types of incisions, visual analogue pain scores (VAS) at specific time intervals, incidence and severity of adverse effects like sedation using sedation score, respiratory depression using respiratory rate, postoperative nausea and vomiting (PONV), pruritus and urinary retention and patient satisfaction with the analgesia achieved.

Statistical analysis

Statistical analysis was performed using SPSS version 13 for Windows (SPSS, Chicago, Illinois, USA). The variables were summarized using mean, standard error, median, interquartile range and percentages based on the characteristics of the variables. Chi-square test and Fischers' exact test was used for non-parametric variables. Factors significant on univariate analysis were then subjected to stepwise logistic regression analysis. Non-significant independent variables were excluded in a backward stepping manner. The P value of <0.05 was considered statistically significant.

RESULTS

Two hundred and eighty-nine consecutive patients undergoing elective laparotomy during the study period were included. The most common surgical procedures were gastric (147/289; 50.87%), hepato-pancreatico-biliary and splenic (57/289; 19.72%), bowel resection (56/289; 19.38%) and 29 (29/289; 10.03%) non-therapeutic laparotomies owing to extensive metastases. The mean age of the patients was 49±13.94 years and most of our patients were between 41-50 years (91/289; 31.49%). Males predominated with a male: female ratio of 2.01:1.

In majority of patients, laparotomy was performed by a midline incision - upper midline in 66.09% (191/289) patients, lower midline in 22.15% (64/289) patients, subcostal in 10.38% (30/289) patients and right paramedian in 1.38% (4/289) patients. Among patients with upper midline incision, those receiving epidural analgesia and a combination of morphine and ketorolac groups experienced effective pain relief, high satisfaction,

less sedation and least side effects (Table 1). In patients with lower midline incision, those receiving a combination of morphine and tramadol had effective pain relief, high satisfaction, less sedation and least side effects (Table 2). The remaining 34 patients in whom incisions other than midline were used could not be analyzed due to the smaller sample size.

Table 1: Analysis between upper midline incision and various scores.

Group	Drug	No. of patients	VAS at 6-hour Median	VAS at 12-hour Median	VAS at 24-hour Median	Satisfaction score Median	Sedation score Median
1	Epi-morphine	10	1.00	1.50	0.50	4.00	1.00
2	Epi-mor + ketorolac IM	28	1.00	2.00	1.00	3.00	1.00
3	Epi-mor + morphine IM	3	2.00	1.00	1.00	3.00	1.00
4	Ketorolac IM	5	5.00	4.00	5.00	2.00	1.00
5	Morphine IM + Ketorolac IM	58	1.00	1.00	2.00	3.00	1.00
6	Morphine IM	15	2.00	5.00	3.00	2.00	1.00
7	Morphine-IM + Tramadol IM	28	1.00	2.00	2.00	3.00	2.00
8	PCA IV Morphine	29	1.00	1.00	1.00	3.00	2.00
9	PCEA	15	1.00	1.00	1.00	3.00	1.00
P Value			0.05	0.05	0.05	0.05	0.05

Table 2: Analysis between lower midline incision and various scores.

Group	Drug	Number	VAS at 6-hour Median	VAS at 12-hour Median	VAS at 24-hour Median	Satisfaction score Median	Sedation score Median
1	Epi-morphine	2	1.50	1.50	1.50	3.00	1.00
2	Epi-morphine + ketorolac IM	8	1.00	2.00	1.00	3.00	1.00
4	Ketorolac IM	1	5.00	3.00	5.00	2.00	1.00
5	Morphine IM + Ketorolac IM	30	1.00	2.00	1.00	3.00	1.00
6	Morphine IM	5	2.00	2.00	5.00	2.00	1.00
7	Morphine-IM + Tramadol IM	9	1.00	1.00	1.00	3.00	1.00
8	PCA IV Morphine	5	2.00	1.00	1.00	3.00	1.00
9	PCEA	4	2.00	2.00	1.00	3.00	1.00
P Value			0.076	0.858	0.080	0.019	0.007

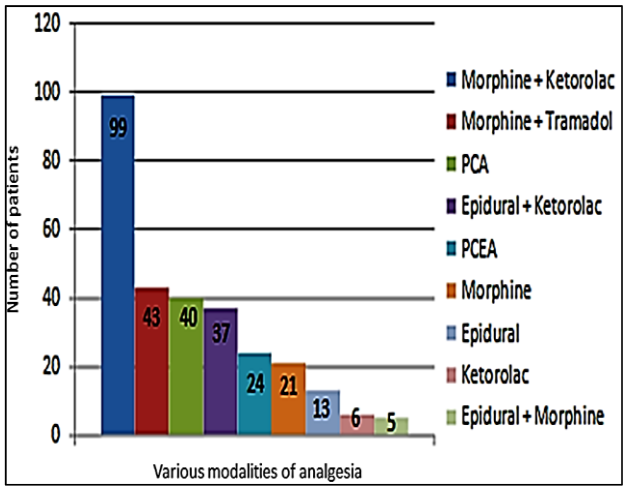

Figure 1: The distribution of various modalities of analgesia.

The most commonly used analgesics in our study were a combination of intramuscular morphine and ketorolac (99/289; 34.25%), followed by intramuscular morphine and tramadol (43/298; 14.87%), epidural analgesia (79/289; 27.6%), intramuscular morphine alone (21/289; 7.27%) and intramuscular ketorolac alone (6/289; 2.08%) (Figure1).

PCEA and IV PCA were the exclusive modes of analgesia in 24 (24/289; 8.3%) and 40 (40/289; 13.84%) patients respectively. In this study opioids were frequently administered in combination with non-opioids and morphine was the most commonly used opioid (Table 3). The median VAS scores were higher in patients who received ketorolac alone or morphine alone. Patients who received a combination of ketorolac and morphine had lower VAS scores. Intermediate VAS scores were observed in patients receiving a combination of EA and ketorolac (Table 4).

High satisfaction was noticed in patients receiving a combination of NSAIDs and opioids. Satisfaction score was low in those receiving intramuscular morphine or ketorolac alone (Table 5). Sedation score was higher in the IV-PCA morphine group and morphine with tramadol group (Table 5).

Table 3: Routes of administration.

0 – 24 hours	Morphine, N	Ketorolac, N	Tramadol, N	Fentanyl + Bupivacaine, N
Intramuscular	168	142	43	0
Epidural bolus	55	0	0	0
IV PCA	40	0	0	0
PCEA	0	0	0	24

Note: Total number of patients exceeds 289 due to usage of more than one route in many patients

Table 4. Visual analogue pain scores in various modalities of analgesia.

Groups	N	Mean			Median			Std. Deviation		
		6h	12h	24h	6h	12h	24h	6h	12h	24h
Epi-morphine	14	0.92	1.84	0.92	1	2	1	0.663	1.573	0.862
Epi-mor + ketorolac IM	37	0.94	1.70	1.37	1	2	2	0.743	1.469	1.209
Epi-mor + morphine IM	5	1.00	1.2	1.00	1	1	2	1.000	0.752	1.224
Ketorolac IM	6	4.33	4.16	4.83	5	4	5	1.549	1.095	0.408
Morphine IM + Ketorolac IM	99	1.47	1.63	1.57	1	2	1	0.861	1.054	1.074
Morphine IM	21	2.28	3.23	3.42	2	4	4	1.814	1.946	1.599
Morphine-IM + Tramadol IM	43	1.32	1.76	1.76	1	2	2	0.837	0.868	0.971
PCA IV Morphine	40	1.35	1.50	2.00	1	1	2	0.700	1.198	1.195
PCEA Fentanyl+ Bupivacaine	24	1.50	1.70	1.37	2	2	1	0.722	0.690	0.710

Table 5: Satisfaction and sedation scores in various modalities of analgesia.

Groups	No. of patients		Mean		Median		Standard Deviation	
	Satisfaction score	Sedation score	Satisfaction score	Sedation score	Satisfaction score	Sedation score	Satisfaction score	Sedation score
Epi-morphine	14	13	3.50	1.00	3	1	0.519	0.000
Epi-mor + ketorolac IM	37	37	3.32	1.03	3	1	0.626	0.164
Epi-mor + morphine IM	5	5	3.60	1.20	4	1	0.548	0.447
Ketorolac IM	6	6	2.17	1.00	2	1	0.408	0.000
Morphine IM + Ketorolac IM	99	99	3.07	1.02	3	1	0.410	0.141
Morphine IM	21	21	2.38	1.05	2	1	0.498	0.218
Mor-IM + Tramadol IM	43	43	3.02	1.05	3	2	0.344	0.213
PCA IV Morphine	40	40	3.10	1.10	3	2	0.441	0.304
PCEA Fentanyl+ Bupivacaine	24	24	3.08	1.13	3	1	0.282	0.338

In the early postoperative period, many patients experienced PONV, which responded to antiemetic treatment. Five patients experienced pruritus following IV PCA morphine, which responded to chlorpheniramine maleate.

Two patients developed hypotension - one patient received epidural morphine and the other received PCEA-fentanyl with bupivacaine and both patients responded to IV fluid management. None of the patients receiving morphine (IV, IM, epidural) developed respiratory depression. No comment could be made on postoperative urinary retention as most of our patients were catheterized for laparotomy.

DISCUSSION

Pain is not an unavoidable consequence of surgery.[1] Postoperative pain after abdominal surgery is excruciating, due to the damage to muscles and peripheral nerves. Pain control is an essential component of postoperative care and is often regarded the fifth vital sign.[5] It is well documented that inadequate pain relief is deleterious and can lead to a number of complications in the postoperative period.[6] The importance of pain relief is well-recognized but it is most often seen that pain control is inadequate.

Abdominal surgery is performed using a variety of incisions. Upper midline incision has been found to be more painful than a transverse incision for gall bladder surgery.[7] The detrimental effect on pulmonary function caused by a midline incision appears to be greater than that caused by a transverse incision, although this does not appear to increase the likelihood of pulmonary complications or other recovery parameters.[8] No significant differences were observed between upper midline and transverse incision groups with respect to pain, satisfaction and sedation scores. A significant difference between upper and lower midline incisions with respect to pain, satisfaction and sedation was observed. Lower abdominal incisions are usually associated with lesser pain and respiratory disturbances when compared to upper abdominal incisions. Mimica et al also found significantly lower pain scores and lower opioid need in lower abdominal incisions.[9]

Different modalities of analgesia are available for pain relief in the postoperative period. Analgesia was administered through various routes of administrations like IV, IM, epidural PCA and PCEA. NSAIDs are associated with complications like peptic ulcer and bleeding, inhibition of platelet aggregation, bronchospasm, renal impairment and allergy. No NSAID related complications were observed, as also observed by Tsui et al.[10] Opioids are potent analgesic agents, commonly used after laparotomy. Respiratory depression, sedation, constipation (prolonged ileus), and pruritus are the associated side effects. A reduction in opioid-related side effects ensues with alternate administration of NSAIDs and opioids. It was also observed that a combination of opioids and NSAIDs was preferable for postoperative pain relief. But Vallano et al and Tsui et al observed that non-opioid analgesics were the preferred drugs for the treatment of postoperative pain.[5,10] Majority of patients in this study received analgesia through intramuscular route and it was observed that narcotics were administered mainly on demand, even when it was prescribed to be given at regular intervals. Vengatesh et al demonstrated PCA morphine to be safe, effective and superior to conventional parenteral opioids for postoperative analgesia in patients undergoing abdominal operations and also that PCA reduced the work burden on the nursing staff.[11]

PCEA, though effective, is invasive and is associated with some risks. However, patients receiving EA had an earlier return of peristalsis as compared to narcotics. According to a Cochrane review, epidural analgesia is superior to IV PCA with narcotics.[12]

Also, EA can lead to significant reduction in pulmonary and cardiac morbidity. Epidural anesthesia for upper abdominal surgery has been found to provide better postoperative analgesia.[13] Out of the 27.6% of the patients receiving EA, hypotension responding to IV fluids, was observed in two patients. None of them had epidural catheter related complications like technical failure, abscess, displacement of catheter and meningitis. Failure of EA and hypotension have been observed by some authors.[13,14]

PONV is an important postoperative complication following laparotomy. Tsui et al and Werner et al reported PONV to be more in patients receiving opioids.[10,15] Many (55/289; 19.03%) of patients experienced PONV. PONV in both opioid and non-opioid groups was observed. PONV depends not only on opioid use, but is also related to the type of surgery and anesthesia. The overall incidence of severe postoperative pain, reported in the literature is 11%.15. It was observed that 9.65% of our patients suffered severe pain (VAS $\geq$5) during the immediate postoperative period, despite effective analgesia.

Satisfaction to analgesia is complex and is probably contributed by many aspects of postoperative care, including effectiveness of analgesia and perceived safety of analgesic technique and side effects of treatment. Satisfaction was high in patients receiving a combination of opioid and NSAIDs. Myles et al and Dolin et al observed patient satisfaction to be high in spite of experiencing moderate to severe pain and the reasons for this are complex.[16,17]

Pain relief is as important as patient safety and comforts. With clear protocols for each analgesic technique and multimodality monitoring, it is possible to provide an effective and safe acute pain service. Coleman et al in their study observed that PCA and epidural infusion

analgesia were effective in the treatment of postoperative pain.[18]

These are widely acknowledged techniques, being provided at many centers. Vallano et al and Aguilera et al observed an improvement in postoperative pain relief with the introduction of a multidisciplinary team into a general hospital using simple techniques and simple instructions.[5,19]

Chanvej et al observed that nurses may have inadequate knowledge regarding pain, pain assessment and documentation, and may not have direction and guidance for assessment and documentation (i.e., lack of pain record forms, protocol).[20] Attempts to initiate change for individual nurses and clinical settings should be developed in order to overcome such problems, as pain management cannot be affectively undertaken without effective pain assessment and documentation.

Determining the current practices and prevalence and severity of postoperative pain constitutes a database, based on which interventional measures may be devised to improve postoperative analgesia.

The limitation of this study was that it was an open labeled study with potential patient and investigator bias. This study also could not assess the cost versus benefit of one technique over the other, which is an important consideration in practice. Inclusion of patients in the 13-18-year age-group in the study population is a limitation because the type of analgesic techniques may be likely to be different from adult population.

CONCLUSION

A combination of NSAIDs and opioids provide effective pain relief, high satisfaction and lesser sedation with least side effects following elective abdominal surgeries. Using these baseline data, the efficacy of interventions like routine pain assessment and documentation, the role of standard analgesia protocols and education of the residents and nursing staff managing postoperative patients can go a long way in improving the quality and safety of postoperative pain relief.

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