

Requirements For Postoperative Analgesics In Patients Undergoing Video-assisted Thoracic Surgery

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Citation

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Abstract

We tried to determine the frequency of use and the doses of parenteral analgesics administered after video-assisted thoracic surgery.

The study group included 159 adult patients. Because patients received various opioids and non-steroidal anti-inflammatory drugs, we calculated an estimated parenteral "morphine equivalent" in which 75 mg meperidine, 1 mg oxymorphone, 0.1 mg fentanyl, and 30 mg ketorolac approximated 10 mg morphine. Doses of analgesics were expressed as mg/m² body surface area. The study period included the post anesthesia recovery stay and the following 24 hours. One hundred and fifty-seven patients (98.7%) received parenteral analgesics during the

post-anesthesia recovery stay or in the first 24 hours afterwards; 139 (87.4%) received parenteral opioids. The morphine equivalent of parenteral analgesics administered in the post anesthesia recovery and 24 hours following post anesthesia recovery was 25.8 ± 11.6 mg/m² (mean ± SD) (range 0-66.5). From the multivariate analysis, younger age, female gender, and use of patient controlled analgesia were found to be independent factors associated with higher doses of analgesics received.

Conclusion: Both the percentage of patients undergoing video-assisted thoracic surgery who require postoperative parenteral analgesics and the analgesic doses are higher than some reports in the literature would suggest.

INTRODUCTION

Video-assisted thoracic surgery (VATS) can be used in place of open thoracotomy to diagnose and treat various intrathoracic pathological processes.

Postoperative pain management following VATS includes administration of parenteral opioids and/or non-steroidal anti-inflammatory drugs (NSAIDs) and oral analgesics. Analgesic requirements lower than those following open thoracotomy have been reported (1,2,3). Allen et al. (4) compared 64 patients who underwent VATS to 64 patients who had open thoracotomy. They concluded that "postoperative analgesia requirements were less in the thoracoscopy patients", although the doses of analgesics given to either group were not reported.

Based on our clinical practice, we had the impression that patient undergoing VATS request a higher dose of analgesics than was reported in the literature. We are not aware of studies documenting analgesic doses after VATS. This retrospective study was designed to quantitate the

frequency of use and dose of parenteral analgesics administered to patients after VATS, and to identify factors associated with the analgesic doses.

METHODS

The medical records of all 290 patients who underwent VATS in our institution between January 1, 1992 and December 31, 1992 were reviewed. General data obtained included age, gender, height, weight, body surface area (BSA), and type of surgical procedure. Data regarding analgesics were collected for three distinct time periods: during surgery; during the post anesthesia care unit (PACU) stay; and during the first 24 hours after leaving the PACU. Exclusion criteria included progression to open thoracotomy, another concomitant surgical procedure, administration of analgesics (other than premedication) preoperatively, mechanical ventilation postoperatively, postoperative analgesia via epidural opioid infusion, and postoperative death within two days. Video-assisted thoracic surgery was performed as described previously (1) under balanced

general anesthesia (with fentanyl the only opioid used), with selective one lung ventilation.

Because patients received various opioids and NSAIDs to control postoperative pain, we calculated an estimated parenteral “morphine equivalent” (MOEq) as follows (5): 10 milligrams of morphine were estimated to be equivalent to 75 mg meperidine, 1 mg oxymorphone, 0.1 mg fentanyl, and 30 mg ketorolac (6) (the only NSAID administered parenterally). Morphine equivalents were expressed in mg/m² BSA.

Statistical analysis: The dose of parenteral analgesic administered (MOEq, mg/m²) in the combined period of PACU and 24 hours following PACU was compared for the factors listed in Table 1 using the rank sum test. Spearman rank correlation was employed to assess the association of age, dose of intraoperative fentanyl, and length of PACU stay, with the MOEq dose. To determine factors multivariately associated with this dose, a multiple regression analysis was performed using backward elimination of non-significant variables. In all cases, two-sided tests were used with p-values less than or equal to 0.05 considered statistically significant.

RESULTS

Of the 290 patients who underwent VATS in 1992, 159 (54.9%) qualified for inclusion in the study. A summary of the patient and procedural characteristics for the 159 study patients is shown in Table 1.

Figure 1

Table 1: Patient/procedural characteristics (N=159).

Characteristic	#	%	Median	mean± SD	range
Age			59	56.6± 16.3	16 - 90
<30	8	5.0			
30 - 49	44	27.7			
50 - 64	51	32.1			
≥65	56	35.2			
Gender					
Female	80	50.3			
Male	79	49.7			
Height, cm			167	169± 10.6	143 - 200
Weight, kg			70	72.2± 17.9	43 - 124
Body Surface Area, m ²			1.83	1.85± 0.27	1.36 - 2.60
PCA used	76	47.8			
Lung resection					
Total	101	63.5			
As only procedure	77	48.4			
Pleural resection or biopsy					
Total	50	31.4			
As only procedure	20	12.6			
Pleurodesis					
Total	33	20.7			
As only procedure	2	1.2			

Figure 2

Decortication					
Total	11	6.9			
As only procedure	6	3.8			
Other					
Total	10	6.3			
As only procedure	6	3.8			
Side of surgery					
Right	94	59.1			
Left	65	40.9			

PCA = patient controlled analgesia

Parenteral medications (opioids, ketorolac, or both) were administered to 112 patients (70.4%) in the PACU, 155 patients (97.5%) during the 24 hours following PACU, and 157 patients (98.7%) during PACU and/or 24 hours following PACU. Only two patients (1.3%) did not receive postoperative parenteral analgesics. Data on the dose of parenteral analgesics are shown in Table 2. The mean± SD MOEq of parenteral analgesics for the study period (PAR + 24 hours following PAR) was 25.8± 11.6 mg per m² of

BSA. Ketorolac and meperidine were the only medications administered intramuscularly (IM). One hundred and nineteen patients (74.8%) received IM injections (one to six) with most of the injections being given during the 24 hours following PACU.

Figure 3

Table 2: Parenteral analgesics received (N=159)

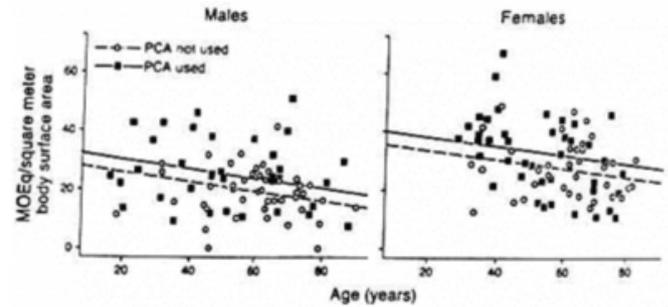
Characteristic	#	%	Median	mean± SD	range
PACU					
No parenteral analgesics	47	29.6			
Ketorolac only	1	0.6			
Opioids and ketorolac	8	5.0			
Opioids only	103	64.8			
Total dose, MOEq, mg/m ²			3.3	3.8± 3.7	0.0 - 15.9
24 hours following PACU					
No parenteral analgesics	4	2.5			
Ketorolac only	35	22.0			
Opioids and ketorolac	41	25.8			
Opioids only	79	49.7			
Total dose, MOEq, mg/m ²			21.4	22.0± 11.0	0.0 - 58.7
Total (PACU+24 hour)					
No parenteral analgesics	2	1.3			
Ketorolac only	18	11.3			
Opioids and ketorolac	63	39.6			
Opioids only	76	47.8			
Total dose, MOEq, mg/m ²			24.7	25.8± 11.6	0.0 - 66.5

PACU = post anesthesia care unit MOEq = morphine equivalent

The correlation between patient age and the dose of parenteral analgesics received in the time period was significant ($r = -0.26, p < 0.001$, Spearman rank correlation). Younger patients tended to receive higher doses of parenteral analgesics than did older patients (Fig 1). Female patients received a higher mean dose of parenteral analgesics than did male patients ($p < 0.001$) (Fig 1). Patient controlled analgesia (PCA) for intravenous administration of opioid was used for 76 patients during the combined period of PACU and 24 hours following PACU. Patients using PCA received higher doses of opioids than did patients not using PCA ($p = 0.003$) (Fig 1). A significant correlation also was found between the dose of fentanyl administered during surgery and the dose of parenteral analgesics administered in the combined period of PAR and 24 hours following PAR ($r = 0.17, p = 0.031$, Spearman rank correlation).

Figure 1: Results of multivariate analysis showing that age ($p = 0.002$), gender ($p < 0.001$), and use of patient controlled analgesia ($p = 0.016$) were predictors of the dose of analgesics administration.

Figure 4



Patients undergoing pleural resection or biopsy were found to receive lower doses of parenteral analgesics than patients not undergoing one of these procedures ($p = 0.028$) (Table 3). In addition, age ($p = 0.002$), gender ($p < 0.001$), and the use of PCA ($p = 0.016$) were found to be multivariate predictors of the dose of analgesics administered in the combined period of PACU and 24 hours following PACU. In this multivariate model, increasing age is associated with a decrease in dose at a rate of 1.6 MOEq (mg/m²) per decade, females receive an average dose which is 7.76 mg/m² higher than males, and patients using PCA receive an average dose which is 4.17 mg/m² higher than patients who did not use PCA (Fig 1).

Figure 5

Table 3: Factors associated with total parenteral analgesics received

Characteristic	N	Total parenteral analgesic received, mg/m ²			
		median	mean± SD	Range	p-value*
Gender					
Female	80	29.1	29.8± 11.5	10.2–66.5	<0.001
Male	79	21.3	21.8± 10.4	0.0–51.2	
Side of surgery					
Right	94	25.3	25.8± 10.9	1–48.7	NS
Left	65	23.0	25.9± 12.7	0.0–66.5	
PCA					
Yes	76	28.2	29.1± 12.7	7.6–66.5	0.003
No	83	21.3	22.9± 9.7	0.0–48.7	
Lung resection					
Yes	101	25.9	27.1± 12.4	1–66.5	NS
No	58	23.7	23.6± 10.0	0.0–45.9	
Pleural resection or biopsy					
Yes	50	23.0	22.9± 10.3	6.2–58.7	0.028
No	109	26.1	27.2± 12.0	0.0–66.5	

Figure 6

Decortication					
Yes	11	20.2	19.7± 8.9	1– 31.8	NS
No	148	24.8	26.3± 11.7	0.0–66.5	
Age, years					
< 60	80	27.0	28.1± 12.5	1– 66.5	0.018
> 60	79	22.3	23.5± 10.2	0.0–51.2	
Intraoperative fentanyl, m g/m ²					
< 166.7	80	22.4	24.7± 11.8	6.2–66.5	NS
> 166.7	79	27.3	27.0± 11.5	0.0–58.7	
Length of PACU stay, hour					
< 1.25	85	24.0	24.7± 12.4	1– 58.7	NS
> 1.25	74	25.2	27.2± 10.7	10.1–66.5	

*two-tailed rank sum test, NS=non significant (p > 0.05)

PACU = post anesthesia care unit, PCA = patient controlled analgesia

DISCUSSION

This study shows that the percentage of patients undergoing VATS receiving parenteral opioids and NSAIDs to control their postoperative pain is higher than previous studies have suggested (1,3,7). The calculated mean MOEq was 25.8 mg/m² for the PACU and the first 24 hours afterwards. These results seem to differ from the report by Durtschi (8)

that only 3 of 18 patients undergoing thoracoscopy complained of moderate or severe pain. Neither the percent of patients receiving opioids nor the dosages were reported, however.

Anesthetic technique can affect postoperative analgesic requirements (9). Because the patients in our study received balanced general anesthesia, including intravenous fentanyl, it is unlikely that the anesthetic technique used contributed to the postoperative differences in analgesic requirements. The statistically significant correlation noted between the dose of fentanyl during surgery and the use of analgesics during the study period would correlate with longer surgical procedures and associated greater tissue trauma.

Our study is compatible with previous reports demonstrating an inverse correlation between age and requirements for analgesics after surgery (10) due to pharmacokinetic factors (11), and addresses specific characteristics for patients undergoing VATS.

The reasons for the increased analgesic doses administered to females in this study are not clear. As noted in Figure 1, there is a great deal of overlap in analgesic doses received by both males and females. There are conflicting reports regarding the association between analgesic requirements and gender. While Glynn (12) suggested an increased tendency amongst females to rate their pain as more intense, two other small studies (20 and 10 patients, respectively) found no significant differences between the analgesic requirement of males and females (13,14). In a more recent study of 100 patients, Burns et al (10) demonstrated that males received significantly higher doses of morphine via PCA to control postoperative pain. Intravenous administration of opioids by PCA provides good analgesia with lower opioid doses than are required using IM injections, and permits the patient to titrate their opioid dose according to need (15). The higher doses of analgesics received by the patients who utilized PCA for some of their intravenous administration of opioids therefore, may be a better reflection of actual opioid requirements in the patients in this retrospective study for whom comfort level scores were not available. Only 6 patients (3.8%) received PCA as the sole mode of analgesia, however, so it is difficult to make a valid conclusion regarding PCA alone versus non-PCA.

We were surprised that patients who had pleural resection or biopsy received less analgesics compared to those who did not have this procedure, because more postoperative pain

might be expected in patients undergoing procedures involving the highly innervated pleura. It is possible that piercing the parietal pleura with the surgical instruments is enough to cause pain, which is not substantially intensified by further manipulation of the pleura. Also, because lung procedures tend to be longer in duration and involve several insertions and extractions of instruments in order to resect lung tissue, tissue trauma potentially can occur in these procedures. The parietal pleura, the rib periosteum and the skin could be sources of pain following VATS. Chest tube location commonly is considered to be a source of postoperative pain, although studies have not demonstrated that it is more painful than other incisions in VATS. Ketorolac potentially is helpful in managing pleural-type pain and was administered to 81 (50.9%) patients. Some reports suggest that, for postoperative analgesia, IM administration of 30mg ketorolac is comparable to 10mg of morphine either by IM administration (16) or via PCA (17), or to 100 mg of meperidine (18). Dose requirements for morphine can be reduced in patients receiving ketorolac postoperatively (16).

CONCLUSIONS

Pain following VATS may be greater than previous literature reports suggested. The combination of opioids and NSAIDs are effective, but higher opioid doses than previously anticipated may be required to control the pain postoperatively. Physicians should be aware of the substantial need for analgesics in these patients and provide appropriate treatment.

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