



# Postoperative Use of Epidurally Administered Morphine in Children and Adolescents

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**Epidurally administered narcotics are increasingly used to provide relief of pain in adults after major surgical procedures. This report describes the use of epidurally administered morphine for postoperative analgesia in nine pediatric patients after 15 major surgical procedures. The mean dose of morphine was  $0.12 \pm 0.03$  mg/kg of body weight, and the mean duration of analgesia per dose was  $10.8 \pm 4.0$  hours. Catheters remained in place for a mean duration of  $50.3 \pm 16.0$  hours. Increasing the dose of morphine to more than 0.1 mg/kg did not prolong the duration of analgesia but it did increase the frequency of side effects. No complications from placement of the catheter and no serious side effects were encountered. The postoperative requirements for narcotics were significantly less in the patients who received morphine epidurally than in those who received narcotics parenterally. Epidurally administered morphine can provide reliable postoperative analgesia in pediatric patients. The potential benefits include improved quality of pain relief at low total requirements, improved pulmonary function, and early ambulation.**

A technique for postoperative analgesia in children which combines minimal side effects with effective, reliable relief of pain is lacking. Parenteral administration of narcotics is the conventional method of controlling pain postoperatively in pediatric patients. Nevertheless, respiratory depression and other undesirable side effects, as well as a fear of addiction, frequently limit the effective use of narcotics.<sup>1,2</sup> Alternative methods of analgesia include intercostal blocks,<sup>3-5</sup> epidural conduction blocks,<sup>6-8</sup> and epidural administration of narcotics.<sup>9,10</sup> The use of epidural narcotics for postoperative analgesia in adults has become widespread, but its use in children has been limited.<sup>11</sup>

This preliminary report evaluates the use of lumbar epidural morphine for postoperative relief of pain in selected children and adolescents who underwent thoracotomy or a surgical procedure on the upper part of the abdomen.

## MATERIAL AND METHODS

During a 9-month period, epidural morphine was used for postoperative analgesia in selected children and adolescents who underwent thoracic or abdominal surgical

procedures. Administration of the narcotic was discussed with the patients and their parents, and informed consent was obtained. At the conclusion of the operations, the patients, while still anesthetized, were placed in a lateral decubitus position. The lumbar area was prepared with povidone-iodine (Betadine) and draped in a sterile manner. From a midline approach, an 18-gauge Huestead needle was placed in the L3-4 or L4-5 interspace by using the loss-of-resistance technique. After the injection of 1 to 4 ml of sterile saline into the epidural space, a 20-gauge epidural catheter was inserted 1 to 2 cm in a cephalad direction and the needle was removed. Morphine sulfate, diluted in various amounts of sterile isotonic saline, was injected. The patients were sent to a pediatric intensive care unit, where they remained until the epidural catheter was removed. They did not receive parenteral narcotics while receiving epidural morphine, which was administered by anesthesia personnel only.

The cases were reviewed retrospectively to determine the dose of morphine, volume of injectate, duration of analgesia, duration of catheter placement, frequency of side effects, and complications. Duration of analgesia was defined as the time interval between doses of the narcotic. Administration of the epidural narcotic was at the request of the patients or their nurses and not according to a fixed schedule. Potential side effects included nausea, pruritus, urinary retention, hypotension, and

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Table 1.—Dose of Morphine, Duration of Analgesia and Catheter Placement, and Complications in Nine Pediatric Patients (15 Surgical Procedures)

Case	Age (yr)	Disease, procedure	Mean dose of morphine (mg/kg)	Mean duration of analgesia (h)	Duration of catheter placement (h)	Complications*
1	14	Cystic fibrosis, cholecystectomy	0.11	9.0	74	P, U
2	17	OGS,† thoracotomy	0.12	9.2	45	P, U
	17	OGS, thoracotomy	0.11	7.7	63	...
	18	OGS, thoracotomy	0.11	6.3	44	...
3	13	OGS, thoracotomy	0.13	9.0	20	...
	13	OGS, thoracotomy	0.09	10.6	30	N
4	14	OGS, thoracotomy	0.11	9.0	48	...
5	16	OGS, thoracotomy	0.10	17.5	60	P, U
	16	OGS, thoracotomy	0.08	18.0	65	...
6	16	OGS, thoracotomy	0.15	12.0	68	P
	16	OGS, thoracotomy	0.15	11.7	44	P, U
	16	OGS, thoracotomy	0.16	8.9	28	P
7	4	Rhabdomyosarcoma, thoracotomy	0.07	13.4	57	...
8	11	OGS, thoracotomy	0.11	13.5	44	P
9	9	Bronchiectasis, thoracotomy	0.13	13.3	64	P, N

\*N = nausea; P = pruritus; U = urinary retention.  
 †OGS = osteogenic sarcoma.

respiratory depression.<sup>12</sup> The duration of analgesia and the frequency of side effects were analyzed in relationship to the dose of morphine.

For comparison, the 12 previous consecutive children who had undergone 15 thoracotomies at our institution were retrospectively reviewed. Postoperatively, these patients received parenteral narcotics on request and not according to a fixed schedule. Patients in both groups were cared for by the same surgical team. The duration of stay in the intensive care unit, the duration of the postoperative hospital course, and the narcotic requirements during the first 24 and 48 hours postoperatively were determined for both groups. The patients who received narcotics parenterally were given either morphine or meperidine. For this reason, the doses of meperidine were converted to morphine equivalents when the total narcotic requirements were calculated. Morphine was assumed to be 10 times more potent than meperidine.<sup>13</sup> Because of the wide range in the ages and weights of the patients, the doses were analyzed on the basis of milligram per kilogram of body weight. The Student *t* test for independent samples was used to compare the two groups.

**RESULTS**

Epidural morphine was used for analgesia after 15 major surgical procedures in nine patients (Table 1). The mean dose of morphine per injection was 0.12 ± 0.03 mg/kg of body weight or 0.03 ± 0.01 mg/cm of body height. The

mean volume of injectate was 0.06 ± 0.01 ml/cm of body height. The concentration of morphine varied from 0.17 to 2.0 mg/ml (mean, 0.59 ± 0.24 mg/ml). The mean duration of analgesia per epidural dose was 10.8 ± 4.0 hours, and the mean duration of catheter placement was 50.3 ± 16.0 hours. Increasing the dose of morphine did not prolong the duration of the analgesia (Table 2). The quality of pain relief was judged to be excellent by the patients, parents, and care providers. Four patients with osteogenic sarcoma who had had a previous thoracotomy and parenteral narcotics for the relief of pain believed that the epidural morphine provided superior analgesia. The patients with osteogenic sarcoma who had a subsequent thoracotomy requested epidural analgesia.

No complications resulted from placement of the epidural catheter. One catheter dislodged within the first 24 hours and was replaced. Side effects that may have been related to epidural morphine included pruritus (in 11 of 74 doses), nausea (in 3 of 74 doses), and urinary retention. Seven patients had urinary catheters inserted

Table 2.—Effect of the Dose of Morphine on the Duration of Analgesia and the Frequency of Side Effects

Dose of epidural morphine (mg/kg)	Duration of analgesia (h)	Frequency of side effects (%)
≤0.1	12.1	0
>0.1-<0.15	10.1	29
≥0.15	11.2	54

preoperatively. In the remaining eight patients, four required catheters to treat urinary retention. There were no episodes of delayed respiratory depression or hypotension. The frequency of side effects was directly related to the dose of morphine (Table 2). No side effects were present if the dose was 0.1 mg/kg or less.

The mean age in both groups of patients was 14 years (Table 3). The difference in mean body weight between the groups was not significant. The narcotic requirements during the first 24 and 48 hours postoperatively were significantly lower in the patients who received epidural morphine. The mean duration of stay in the intensive care unit and the mean duration of postoperative hospitalization were similar between the two groups. One patient who received parenteral narcotics had pneumonia postoperatively, and one patient who received epidural morphine had persistent atelectasis of the nonoperated lung for 72 hours postoperatively.

Table 3.—Comparison of Patients Who Received Narcotics Parenterally With Those Who Received Morphine Epidurally

Factor	Group*		P value
	Parenteral (N = 12)	Epidural (N = 9)	
Age (yr)	14	14	NS†
Weight (kg)	48.5	41.9	NS
Time in intensive care unit (h)	65	62	NS
Time in hospital postoperatively (days)	5.5	5.5	NS
Narcotic requirements postoperatively (mg of morphine equivalents/kg of body weight)			
First 24 hours	0.54‡	0.32	0.03
First 48 hours	0.93‡	0.54	0.05

\*Fifteen surgical procedures in each group.

†NS = not statistically significant.

‡Patients in parenteral group received either morphine or meperidine; thus, the doses of meperidine were converted to morphine equivalents to calculate the total requirements.

## DISCUSSION

In adults, parenteral narcotics have been shown to be less effective than epidural conduction block<sup>8</sup> or epidural narcotic analgesia<sup>14</sup> in providing relief of pain and preventing pulmonary complications postoperatively. In children, however, experience with postoperative epidural analgesia is limited. Russian authors reported favorable effects on respiration in 160 children who received peridural conduction blockade.<sup>15</sup> Meignier and associates<sup>7</sup> used epidural bupivacaine for postoperative analgesia in seven children with respiratory disability or insufficiency. They encountered no complications or difficulties in placement of the epidural catheters. Anal-

gesia was satisfactory and allowed effective pulmonary physiotherapy to be performed. They concluded that epidural conduction block is a feasible and reliable method of postoperative analgesia in children with pulmonary disease. To our knowledge, the use of lumbar epidural narcotics for postoperative analgesia in children has not been reported.

The potential benefits of epidural narcotics include an improved quality of pain relief, decreased total requirement of narcotics, improved pulmonary function, and early ambulation. The quality of analgesia between the patients who received parenteral narcotics and those who received epidural narcotics was not objectively compared. Nevertheless, the four patients who had previously received parenteral narcotics after thoracotomy believed that the epidural technique provided superior analgesia. Patients, parents, and care providers found epidural morphine to be an acceptable method of providing excellent postoperative analgesia. These results were obtained with a total dose of narcotics that was 40% less than that required by children who received parenteral narcotics after similar operative procedures. Potentially, the lower narcotic requirement may decrease the frequency of undesirable side effects (that is, respiratory depression, depressed cough reflex, and sedation), although this finding was not demonstrated in our small series.

In 28% of the injections, doses between 0.06 and 0.1 mg/kg provided satisfactory pain relief. The duration of analgesia was not prolonged by increasing the dose of morphine to more than 0.1 mg/kg, but the frequency of side effects markedly increased. More than half of the doses greater than 0.15 mg/kg produced side effects. Until controlled studies can be performed, 0.06 to 0.1 mg/kg seems to be an effective dose of epidural morphine in children. This dose can be expected to provide 10 to 12 hours of satisfactory analgesia with minimal side effects. In our practice, a morphine concentration of 0.5 mg/ml at the lumbar epidural level provides reliable analgesia for thoracotomy and surgical procedures on the upper part of the abdomen.

Theoretically, the epidural technique may be more difficult in children than in adults because of a narrow epidural space. No difficulties were encountered, however, in placement of the catheter in our patients. In fact, placement was surprisingly easy because the vertebral interspaces were readily palpable and there was no vertebral calcification to interfere with passage of the needle. Penetration of the ligamentum flavum and the loss of resistance when the epidural space was entered were impressively obvious. Isotonic saline, which was injected upon loss of resistance, may have widened the

epidural space and provided protection against dural puncture. There were no cases of dural puncture or inadvertent intrathecal injections in this small series.

Side effects of the epidural narcotic were similar to those reported in adults.<sup>12</sup> Urinary retention that necessitated a catheter was the most disturbing side effect and occurred in 50% of the patients who did not have a catheter inserted preoperatively. Only one patient required treatment for pruritus, and in no patient was pruritus a persistent problem. The serious side effects of delayed respiratory depression, hypotension, and epidural abscess did not occur. The reported incidence of delayed respiratory depression and epidural abscess in adults, however, is small. A much larger series than ours is needed to define the incidence of these complications and to determine the benefit-risk ratio of epidural narcotics in children. Because of the seriousness of delayed, insidious respiratory depression after epidural administration of narcotics, patients should be monitored in an intensive care setting for at least 12 hours after the last dose of an epidural narcotic.

In conclusion, we have shown that epidural lumbar morphine can provide reliable postoperative relief of pain in children and adolescents after thoracotomy and surgical procedures on the upper part of the abdomen. Children who are prone to respiratory difficulties or those likely to be subjected to multiple surgical procedures may particularly benefit from the postoperative use of epidural morphine. Before the routine use of epidural narcotics can be recommended in children, controlled studies that compare the benefits and risks to those of conventional methods of pain relief are necessary.

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