

# Chronic Pain Management

## American Society of Anesthesiologists Closed Claims Project

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**Background:** The practice of chronic pain management has grown steadily in recent years. The purpose of this study was to identify and describe issues and trends in liability related to chronic pain management by anesthesiologists.

**Methods:** Data from 5,475 claims in the American Society of Anesthesiologists Closed Claims Project database between 1970 and 1999 were reviewed to compare liability related to chronic pain management with that related to surgical and obstetric (surgical/obstetric) anesthesia. Acute pain management claims were excluded from analysis. Outcomes and liability characteristics between 284 pain management claims and 5,125 surgical/obstetric claims were compared.

**Results:** Claims related to chronic pain management increased over time ( $P < 0.01$ ) and accounted for 10% of all claims in the 1990s. Compensatory payment amounts were lower in chronic pain management claims than in surgical/obstetric anesthesia claims from 1970 to 1989 ( $P < 0.05$ ), but during the 1990s, there was no difference in size of payments. Nerve injury and pneumothorax were the most common outcomes in invasive pain management claims. Epidural steroid injections accounted for 40% of all chronic pain management claims. Serious injuries, involving brain damage or death, occurred with epidural steroid injections with local anesthetics and/or opioids and with maintenance of implantable devices.

**Conclusions:** Frequency and payments of claims associated with chronic pain management by anesthesiologists increased in the 1990s. Brain damage and death were associated with epidural steroid injection only when opioids or local anesthetics were included. Anesthesiologists involved in home care of patients with implanted devices such as morphine pumps and epidural injections or patient-controlled analgesia should be aware of potential complications that may have severe outcomes.

CHRONIC pain is one of the most common and challenging medical problems facing our society.<sup>1</sup> The specialty of pain management has grown steadily in recent years, largely because of the recognition that multiple factors contribute to chronic pain.<sup>2</sup> Anesthesiologists have provided leadership in the development of the practice of pain management, with the application of nerve blocks and other technical procedures that are firmly linked to a biomedical model of pain.<sup>3,4</sup> Anesthe-

sia-based chronic pain medicine typically involves patient evaluation; provision and interpretation of diagnostic procedures; clinical pharmacology; and provision of alternative drug delivery methods, temporary or long-term neural blocks, and neuromodulatory techniques.<sup>5,6</sup>

The purpose of this study was to identify and describe issues and trends in chronic pain management liability for anesthesiologists. We compared injuries and liability characteristics in closed anesthesia malpractice claims arising from chronic pain management with those arising from surgical and obstetric anesthesia using the American Society of Anesthesiologists (ASA) Closed Claims Project database.

### Materials and Methods

The ASA Closed Claims Project is a structured evaluation of adverse anesthetic outcomes collected from the closed malpractice insurance claim files of more than 35 professional liability companies from throughout the United States. A detailed description of the data collection process for the ASA Closed Claims Project was reported previously.<sup>7,8</sup> In brief, a claim file typically includes narrative statements from the personnel involved, medical records, expert and peer reviews, deposition summaries, outcome reports, and the cost of settlement or jury award. Anesthesiologist-reviewers completed a detailed data form plus a narrative summary for each claim in which the sequence of events and nature of injury could be determined from the information available in the file. Claims for damage to teeth and dentures were excluded from data collection. All 86 anesthesiologist-reviewers were in active anesthesia practice; 62 were affiliated with academic institutions (38 academic practice and 24 private practice plus teaching affiliation) and 24 were in private practice. The reviewers followed detailed instructions in completing the data collection form and had access to reviews of plaintiff and defense pain management experts. The data form includes patient characteristics, surgical procedures, sequence and location of events, critical incidents, clinical manifestations of injury, appropriateness of anesthesia care, and outcome. Severity of injury is assigned by the on-site reviewer using the insurance industry's 10-point scale, ranging from 0 (no apparent injury) to 9 (death). Severity scores were grouped into three broad categories for analysis: temporary and non-disabling (score 0-5), permanent disabling injuries (score 6-8), and death (score 9). Appropriateness of

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care was rated as standard (appropriate), substandard, or impossible to judge on the basis of reasonable and prudent practice at the time of the event. The reliability of reviewer assessments of appropriateness of care has been found to be acceptable.<sup>9</sup> Payment amounts are recorded in actual dollars paid, unadjusted for inflation. Data for this report were derived from the current ASA Closed Claims Project database of 5,475 claims for events occurring between 1970 and 1999. These constitute all claims collected through December 2000.

For the current analysis, claims were divided into three groups: acute pain management, chronic pain management, and surgical/obstetric anesthesia. Claims associated with treatment of pain in the immediate postoperative period were included in the acute pain management group. This group was excluded from analysis because of the small number of claims. Claims related to treatment of nonoperative, nonobstetric pain were included in the chronic pain management group if the complaint involved diagnosis or direct complications of the treatment of chronic pain. The chronic pain management group also included claims for complications arising from the postdischarge treatment of pain resulting from a previous surgical procedure. The third group (surgical/obstetric) consisted of all other claims in the database, including anesthesia for surgery or obstetric delivery (including labor analgesia). In addition, the third group included complications of general anesthesia, monitored anesthesia care, or sedation (such as airway management problems) during pain management interventions if there were no direct complications of the pain management intervention itself.

Chronic pain management claims were divided into two main categories based on the mode of treatment: *invasive procedures* and *noninvasive* pain management. *Invasive procedures* included nerve blocks, injections, ablative procedures, implantation or removal of devices, and maintenance of devices (including catheters). Some claims involved multiple interventions or other miscellaneous interventions that were not in the categories listed above. If multiple treatments occurred, the claim was categorized according to the treatment that was implicated in the complaint and alleged injury. If it could not be determined which treatment caused the injury, the claim was assigned to a category of "multiple procedures."

*Pain blocks* were defined as invasive procedures designed to temporarily interrupt nervous system activity. Temporary interruption of the nervous system was achieved by injection of local anesthetic agents. Other agents such as steroids may be injected simultaneously, but the procedure was classified as a block if the primary agent was local anesthetic. Blocks intended to temporarily interrupt the nervous system were classified according to the anatomic site of injection. Anatomic sites of injection included neuraxial (epidural, intrathecal);

axial (paravertebral, nerve root transsacral); peripheral nerve (intercostal, suprascapular, ilioinguinal, genitofemoral and others); autonomic (stellate ganglion, celiac plexus, lumbar sympathetic); upper extremity (brachial plexus, other); lower extremity (lumbar plexus, sciatic, other); and head and neck (occipital, glossopharyngeal).

*Pain injections* were defined as use of a needle technique intended to reduce inflammation around a nerve or neuraxis or to reduce myofascial, tendon, or joint pain. Examples of injections included epidural steroids, trigger point injections, dry needling, botulinum toxin, and tendon or joint injections. Claims involving use of steroids plus local anesthetics in the epidural space were classified as injections (rather than pain blocks), assuming that the primary intent was reduction of inflammation by steroids. For analysis of the role of steroids alone *versus* steroids with local anesthetics or opioids in the injection, an injection was classified as "steroid only" if there was no listing of additional agents (local anesthetic or opioid) on the data form or in comments in the narrative summary.

*Ablative procedures* were defined as invasive procedures that permanently interrupt nervous system activity and were grouped by the agent (alcohol or phenol) or technique (radiofrequency, cryoanalgesia) used for ablation.

*Implantation or removal of devices* included complications associated with either the insertion or removal of implantable pumps, catheters, and nerve stimulator devices. Implantable pumps included devices that continuously or intermittently deliver medications into the neuraxis. Catheters included those that were in place for days or longer to continuously or intermittently deliver medications into the neuraxis or nerve plexus. Nerve stimulator devices include dorsal column or peripheral nerve stimulators that were surgically implanted.

*Maintenance of devices* included postinsertion maintenance, programming, or refill of any type of neuraxial pump, nerve stimulator, or catheter.

*Other invasive procedures* included the injection of blood or saline into the epidural space and neurolysis of epidural adhesions (either by injection of hypertonic saline or by the use of specialized epidural catheters).

*Noninvasive pain management* was defined as diagnostic or therapeutic activities that did not require the use of needles or the insertion of catheters or devices. These included primarily systemic medication management and medical opinions or consultations. Behavioral modification therapy was also considered in this category.

In the ASA Closed Claims Project database, multiple outcomes were recorded for some claims (for example, headache plus back pain). These outcomes were assigned by anesthesiologist-reviewers from a preset list provided on the data collection form. For pain management claims, two of the authors (D.R.F., a board-certified

pain management physician, and K.L.P.) used content analysis of narrative summaries to develop additional outcomes not assigned to other claims in the ASA Closed Claims Project database. These additional outcomes included infection, retained catheter or fragment, and a category for increase or no relief of pain after treatment. These outcomes were not previously observed in the overall database in sufficient numbers to warrant inclusion on the data collection form.

### Statistical Analysis

For comparison of chronic pain management claims with surgical/obstetric anesthesia claims, differences in proportions were tested for statistical significance with the Z test.<sup>10</sup> Age differences were tested by *t* test. Payment amounts were compared for differences in their distribution by use of the Kolmogorov-Smirnov test, with two-tailed exact (permutation) tests to determine statistical significance at a value of  $P \leq 0.05$ .<sup>11</sup>

## Results

A total of 284 claims were associated with chronic pain management and 5,125 with surgical/obstetric anesthesia. Acute pain management, including blocks and intravenous patient-controlled analgesia, accounted for 66 claims. The numbers of these claims were insufficient for analysis, so they were excluded from further analysis. Claims related to chronic pain management increased over time, accounting for 2% and 3% of claims in the 1970s and 1980s, respectively, and 10% of all claims in the 1990s. Patients in chronic pain management claims were older than those in surgical/obstetric anesthesia claims (mean,  $48 \pm 15$  [SD] compared with  $41 \pm 20$  yr,  $P \leq 0.01$ ). There were no pediatric chronic pain management claims and 484 pediatric surgical/obstetric claims (9%). Women accounted for 60% of chronic pain management claims and 59% of surgical/obstetric claims.

Most chronic pain management claims resulted in temporary or nondisabling injuries (76% compared with 49% of surgical/obstetric claims). Nerve injury, pneumothorax, headache, and back pain were more common in chronic pain management claims, whereas death and brain damage were more frequent in the surgical/obstetric claims ( $P \leq 0.05$ , fig. 1). The proportion of permanent and disabling injuries (score, 6-8) was similar in chronic pain (20%) and surgical/obstetric claims (19%).

Anesthesia care was more likely to meet standards and less likely to be substandard in chronic pain claims compared with surgical/obstetric claims ( $P < 0.01$ , table 1). Compensatory payments were made in more than half of all claims (chronic pain management and surgical/obstetric, table 1). Payment amounts were greater in the surgical/obstetric claims than the chronic pain claims overall ( $P \leq 0.01$ , fig. 2). When analyzed by decade in

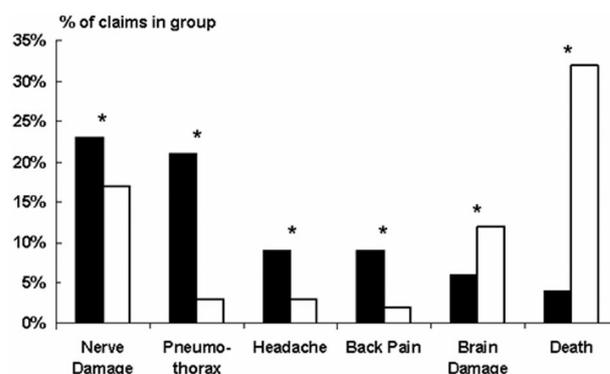


Fig. 1. Primary outcome in chronic pain management claims (solid bars) versus surgical/obstetric claims (open bars). \* $P \leq 0.05$ .

which the event leading to the claim occurred, payments in 1970-1989 chronic pain management claims (median payment, \$25,500) were lower than payments in surgical/obstetric claims (median payment, \$110,000). Payments in chronic pain management claims were higher in the 1990s than payments in chronic pain management claims in 1970-1989 ( $P \leq 0.05$ ). During the 1990s, there was no difference in size of payments between the chronic pain management and surgical/obstetric claims (fig. 2). Nearly one third (30%) of chronic pain management claims resulting in payment in the 1990s involved a permanent and disabling injury, an increase from 17% in 1970-1989 (not statistically significant). There was no difference in the proportion of chronic pain management claims with payment across decades.

In nearly two thirds (64%) of chronic pain management claims, the injury became apparent after discharge from the treatment facility, in contrast to surgical/obstetric claims in which the injury became apparent during anesthesia care in most claims (83%,  $P \leq 0.01$ ; table 1). The injury was judged preventable by better preanesthetic/preprocedure evaluation in 7% and preventable by better postoperative/postprocedure care in 12% of chronic pain management claims, percentages similar to those in surgical/obstetric claims (table 1). Documentation of appropriate informed consent was similar in chronic pain and surgical/obstetric claims (table 1).

### Procedures Leading to Chronic Pain Management Claims

Of the 284 chronic pain management claims, 276 (97%) were for invasive procedures. Blocks and injections together accounted for 78% of claims related to invasive pain management (table 2). Epidural steroid injections ( $\pm$  local anesthetic and/or opioids) accounted for 83% of injections and 40% of all chronic pain management claims. Peripheral blocks and autonomic blocks each accounted for 36% (72% total) of the 78 block claims (table 2). Of the 20 claims associated with maintenance of devices, 10 were associated with epidural

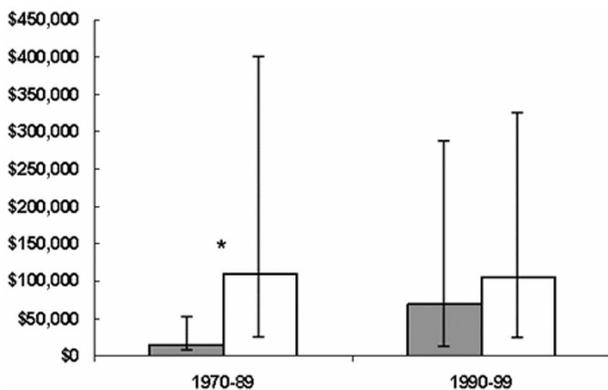
**Table 1. Payment, Standard of Care, and Prevention: Chronic Pain Management Versus Other Claims**

	Chronic Pain (n = 284)		Surgical/Obstetric (n = 5,125)		P
	No.	%	No.	%	
Payment made to plaintiff	142	53	2,777	59	NS
No payment	126	47	1,891	41	NS
Standard care	155	65	2,501	56	≤ 0.01
Substandard care	84	35	1,934	44	≤ 0.01
Injury became apparent in anesthesia facility	71	36	2,166	83	≤ 0.01
Injury became apparent after discharge	127	64	443	17	≤ 0.01
Complication preventable by better preanesthetic evaluation	15	7	395	9	NS
Not preventable by better preanesthetic evaluation	213	93	4,080	91	NS
Complication preventable by better postanesthetic care	26	12	431	11	NS
Not preventable by better postanesthetic care	195	88	3,592	89	NS
Appropriate informed consent documented	141	66	2,404	72	NS
Appropriate informed consent not documented	74	34	959	29	NS

Claims in which items could not be assessed were excluded from analysis on an item-by-item basis. P values were calculated by Z test. NS = not statistically significant.

catheters, 7 with implanted pumps, 2 with patient-controlled analgesia devices, and 1 with a plexus infusion.

The most common outcomes for all invasive procedures were nerve injury and pneumothorax (table 3). Outcomes differed by type of procedure. The most common complication of blocks was pneumothorax, accounting for 51% of all block claims (table 3). Pneumothorax was also the most common outcome of trigger point and other nonepidural injections. The most common outcomes of injections involving epidural steroids (± local anesthetics and/or opioids) were nerve injury, infection, and headache (table 3). Nearly half (47%) of the claims associated with ablative procedures involved unintentional nerve injury (table 3). Implantation or removal of devices more often resulted in infection or retained catheter fragments. The most common outcome of claims related to maintenance of devices was death or brain damage (45%, table 3).



**Fig. 2. Median payment over different time periods.** Bar heights indicate median payment (solid bars: chronic pain claims; open bars: surgical/obstetric claims); lines indicate 25th and 75th percentile payment ranges. Payment in chronic pain management claims was lower than payment in surgical/obstetric claims in 1970–1989. Payments between these groups did not differ in 1990–1999. \*P ≤ 0.01 between pain management and surgical/obstetric payments.

Noninvasive procedures leading to claims included medication prescription or management (five claims), diagnosis (two claims), and cupping (one claim, table 2). Two of the five claims for medication prescription or management alleged addiction resulting from treatment. Another involved overdose and death in a patient who had not revealed a previous addiction to opioids. There

**Table 2. Procedures in Chronic Pain Management Claims (n = 284)**

	Claims	
	No.	%
Invasive procedures	276	97
Injections	138	49
Epidural steroids ± associated agents	114	
Trigger point	17	
Facet	4	
Other	3	
Blocks	78	27
Peripheral	28	
Stellate ganglion	19	
Other autonomic	9	
Neuraxial	9	
Upper/lower extremity	7	
Axial	4	
Head and neck	2	
Ablative procedures	17	6
Agent	13	
Technique	4	
Implantation or removal of devices	12	4
Implantable pump	5	
Nerve stimulator	4	
Catheter	3	
Device maintenance	20	7
Other interventions*	11	4
Noninvasive pain management	8	3
Medication prescription	5	
Opinion/diagnosis	2	
Cupping procedure	1	

Total does not sum to 100% because of rounding.

\* Includes three claims involving multiple procedures associated with complications. One of these claims involved invasive plus noninvasive pain management.

**Table 3. Primary Outcome for Invasive Pain Management Claims**

Outcome	All Invasive Procedures (n = 276)		Blocks (n = 78)		Injections (n = 138)				Ablative (n = 17)		Implant/Removal (n = 12)		Maintenance (n = 20)		Other/Multiple (n = 11)	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Nerve injury	63	23	14	18	28	25	2	8	8	47	2	17	4	20	5	45
Pneumothorax	59	21	40	51	0	0	18	75	1	6	0	0	0	0	0	0
Infection	35	13	2	3	24	21	0	0	0	0	3	25	4	20	2	18
Death/brain damage	26	9	4	5	9	8	0	0	1	6	0	0	9	45	3	27
Headache	21	8	1	1	20	18	0	0	0	0	0	0	0	0	0	0
Increased pain/no relief	21	8	7	9	10	9	0	0	0	0	2	17	1	5	1	9
Retained catheter	9	3	1	1	4	4	1	4	0	0	3	25	0	0	0	0
None	7	3	1	1	4	4	0	0	1	6	1	8	0	0	0	0
Other	42	15	8	10	18	16	3	13	6	35	1	8	4	20	2	18

Epidural injection of steroids ( $\pm$  local anesthetics and opioids) and injections, including trigger point, facet, and others, are listed separately, with percentage shown for each separate category. Otherwise, the percentage of claims implies the percentage in each invasive procedure group. Totals sum to more than 100% because of multiple complications in some claims.

were two claims for failure to diagnose by patients who consulted with the defendant anesthesiologist but followed up with another provider.

#### *Most Common Complications of Invasive Pain Management Procedures*

Nerve injury was the most common complication of invasive pain management procedures. Half ( $n = 32$ ) of these 63 nerve injury claims involved spinal cord injury. These included 14 after epidural steroid injections (6 resulting in paraplegia, 1 quadriplegia), 5 after blocks (2 with paraplegia), 3 after ablative procedures (1 with paraplegia), 1 after cervical facet injection, 2 after implantation or removal of devices (1 paraplegia, 1 quadriplegia), 4 after device maintenance (4 with paraplegia), and 3 after other invasive procedures (2 with paraplegia). Of the 18 claims for paraplegia or quadriplegia, 4 were associated with epidural abscess, 8 with chemical injury in which the anesthetic or neurolytic agent was injected into the spinal cord, and 4 with hematoma. Two of the claims for hematoma involved administration of epidural steroids in patients who received anticoagulants. Other nerve injuries associated with invasive pain management procedures included lumbosacral nerve root ( $n = 21$ ), sciatic nerve ( $n = 2$ ), and brachial plexus ( $n = 2$ ).

Of the 59 claims for pneumothorax, 40 involved pain blocks and 18 involved injections. Of the 40 pain blocks leading to pneumothorax, 23 were intercostal, 8 stellate ganglion, 3 suprascapular, 2 supraclavicular brachial plexus, 2 interscalene brachial plexus, and 2 were thoracic paravertebral. Of the 18 claims for pneumothorax associated with injections, 15 were trigger point, and 1 each was costochondral, thoracic facet, and interscalene botulinum toxin. In 31 (53%) of the 59 pneumothorax claims, it was explicitly stated that chest tubes were placed for treatment.

In 34 (58%), the pneumothorax was diagnosed after the patient had left the pain treatment facility. In 15 of those cases, the patient presented at an emergency department for diagnosis and treatment.

Infection was cited in 13% of all claims arising from invasive pain management procedures. Most of these infections were associated with epidural steroid injections (table 3). The most common infections associated with these injections were meningitis ( $n = 12$ ), epidural abscess ( $n = 7$ ), and osteomyelitis ( $n = 3$ ). Two claims involved both meningitis and epidural abscess, with one of the two also involving lumbar osteomyelitis. Six of the seven epidural abscesses required surgical drainage; one of the seven resulted in permanent lower-extremity motor deficits. Other infections were associated with implantation, removal, or maintenance of implanted devices (table 3).

Death or brain damage resulted from epidural steroid injections ( $n = 9$ ) and device maintenance ( $n = 9$ ). Injection of opioids, local anesthetic, or both occurred in 61% of the 114 epidural steroid injection claims. Death or brain damage occurred only in epidural steroid injection claims that involved local anesthetics with or without opioids in the injection (fig. 3). This difference in severe outcome (death or brain damage) between epidural steroid injections with *versus* without associated agents was statistically significant. Six of the severe injuries occurred shortly after local anesthetic administration with either an unintended intrathecal injection ( $n = 5$ ) or allergic reaction ( $n = 1$ ). A documented test dose was given in only two of these six patients. In one patient, cardiovascular collapse and respiratory depression developed after inadvertent intrathecal injection of 6 ml of local anesthetic during attempted thoracic epidural steroid injection. Three severe outcomes were the

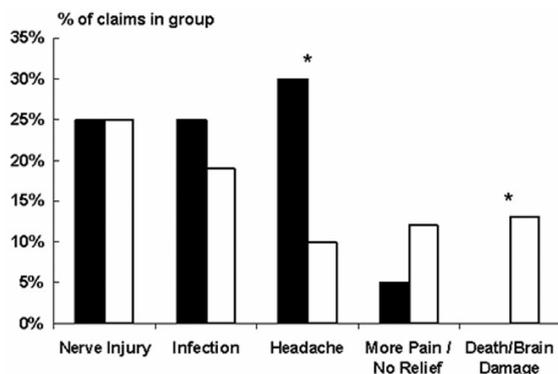


Fig. 3. Most common outcomes in epidural injections. Solid bars represent injections with steroids only. Open bars indicate injections in which local anesthetic or opioid (or both) were added to the steroid. \* $P \leq 0.05$  between proportion of injection group with that outcome.

result of a delayed respiratory depression from epidural morphine administered along with the steroid.

Death ( $n = 4$ ) or brain damage ( $n = 5$ ) associated with maintenance of devices involved implanted pumps ( $n = 4$ ), epidural injections ( $n = 3$ ), and patient-controlled analgesia ( $n = 2$ ). All nine claims involved the use of opioids (morphine [ $n = 8$ ], hydromorphone [ $n = 1$ ]), and most (eight of nine) involved administration of the wrong dose of opioid. In four patients, the overdose arose from a pump programming error when the concentration of opioid was changed. The programming errors involved either a failure to recalibrate with a more concentrated solution of morphine ( $n = 2$ ) or recalibration for lower concentration of morphine, with failure to recognize greater strength of solution that remained in the catheter ( $n = 2$ ). The other cases of overdose involved drug interactions with concomitant use of other central nervous system depressants ( $n = 2$ ) or intrathecal migration of an epidural catheter ( $n = 2$ ). One obese patient had sudden cardiac death while on appropriately dosed morphine patient-controlled analgesia, with autopsy revealing severe coronary artery disease. Seventy-eight percent (seven of nine) of the claims for death or brain damage related to maintenance of devices were judged by reviewers to represent substandard care. Payments were made in eight of nine of these claims, and the payments were high (median, \$309,129; range, \$29,999 to \$1,600,000).

## Discussion

Claims arising from chronic pain management increased over time, accounting for 10% of anesthesia malpractice claims in the 1990s. Although nerve injury and pneumothorax were the most common outcomes in pain management claims, serious injuries involving brain damage and death occurred. Specific areas of concern include epidural steroid injections with local anesthetics

and/or opioids, maintenance of implantable devices, and procedures complicated by a pneumothorax.

### Methodologic Issues

Before the results can be interpreted, it should be emphasized that closed claims analysis has a number of well-described limitations.<sup>8</sup> The Closed Claims Project database can provide only an indirect assessment of the safety and liability risks of anesthesiology-based pain management practice in the United States. In particular, it cannot estimate the relative frequency of claims in pain management compared with other areas of anesthesia because of the lack of denominator data. Closed claims are biased by the presence of more severe and costly injuries, because plaintiff attorneys are unlikely to pursue claims with an estimated financial recovery for damage of less than \$50,000.<sup>12</sup> Other limitations of the analysis of closed claims include the absence of rigorous comparison groups and partial reliance on data from direct participants rather than impartial observers. Claims spanned a period of time during which practice patterns changed. The analysis also evaluated only the information in the database that was transcribed to the data sheet by the reviewer, who depended on the information contained in the insurance company file. Specific, detailed information regarding signs and mechanism of injury may therefore be incomplete compared with a prospective study. The retrospective case review studies included in the database were also selected in a nonrandom fashion, without control over geographic balance. Closed claims analysis for pain management is useful for generating hypotheses about the mechanism and prevention of pain management injury, but it cannot be used for testing those hypotheses. As a retrospective study, it cannot establish a cause-and-effect relationship between previous events or between changes in claim experience.

### Chronic Pain Management Liability

Given the prevalence of pain management, particularly during the 1990s, it is not surprising that the overall percentage of chronic pain management claims has increased from 2-3% in the 1970s and 1980s to 10% in the 1990s, when they were on a par with obstetric anesthesia claims. The majority of pain claims involved invasive procedures such as blocks, injections, ablative procedures, and insertion and/or removal of implantable pumps or stimulators, probably reflecting the risks inherent in these techniques compared with those inherent in medical management. Nerve damage, pneumothorax, headache, and back pain were more common in chronic pain management claims, whereas death and brain damage were more frequent in the surgical/obstetric claims (fig. 1). However, the proportion of permanent and disabling injuries were similar in chronic pain and surgical/obstetric claims, demonstrating that signif-

icant injury can also occur with pain management interventions. Nerve injury occurred in 23% of pain management claims, and death or brain damage occurred in 10% (fig. 1).

Although overall payment in chronic pain claims seems to be lower than surgical/obstetric claims, there was no difference in payments made to the plaintiff for chronic pain claims and surgical/obstetric claims in the 1990s (fig. 2). The trend toward increasing payment amounts in pain management claims is particularly important because payment totals in pain claims generally are made on behalf of a single defendant and therefore do not include payments made on behalf of other practitioners (e.g., surgeons and obstetricians) or hospitals that are often part of the total payment amount in the surgical/obstetric claims in the Closed Claims Project database.<sup>7</sup> Because payment is influenced primarily by severity of injury,<sup>7</sup> these data may reflect an increasing severity of injury from chronic pain management claims. This is of concern to pain management anesthesiologists, particularly as newer and more invasive procedures are developed.

#### *Epidural Steroid Injections*

Epidural steroid injections have been used to treat spinal and radicular pain for more than 40 yr, with the majority of injections performed by anesthesiologists.<sup>13</sup> Epidural steroid injection is reputed to be a very safe procedure with a very low infectious complication rate.<sup>14</sup> Abram and O'Connor<sup>15</sup> reviewed complications associated with epidural steroid injections under the headings neurologic dysfunction (arachnoiditis, aseptic meningitis, others), infections (meningitis, epidural abscess), steroid side effects and complications, technical complications (postdural puncture headache, hematoma), and minor side effects. The authors concluded that there was little risk of serious complications associated with the use of epidural steroid injections. In particular, aseptic meningitis and bacterial meningitis seemed to be uncommon but real risks. In contrast, our study found that 40% of all chronic pain claims were associated with the injection of epidural steroids, which may reflect the frequency of these procedures. Serious infectious complications (epidural abscess, meningitis, and osteomyelitis) were observed in 20 of 114 epidural steroid claims. Hypothetically, injection of steroids into the epidural space may result in local immunosuppression with possible infectious consequences in predisposed individuals. In addition, significant nerve injury (with seven claims of quadriplegia/paraplegia) was also observed in 28 epidural steroid claims. Two of the three claims for hematoma from epidural steroids were in patients who received anticoagulants. Likewise, claims for spinal cord injuries increased in the 1990s, perhaps because of neuraxial blocks in patients who received anticoagulants.<sup>16</sup>

Interestingly, death or brain damage was observed in our study only when local anesthetics or opioids (morphine) were injected concomitantly with the epidural steroid. Failure to appropriately manage cardiovascular depression from epidural or intrathecal local anesthetics or delayed respiratory depression from epidural morphine accounted for these poor outcomes. Therefore, ASA Closed Claims Project data demonstrate that serious injuries can occur with epidural steroid injections when combined with local anesthetics and opioids. However, we are unable to determine the incidence of injuries with epidural steroids because of the limitations of the closed claims methodology. Because of the lack of denominator data, it is not clear whether these injuries are a result of more blocks being performed, a more litigious population, or other factors. Our data suggest that patient safety may be improved by excluding typical epidural doses (volumes in excess of intrathecal test doses) of local anesthetics and/or opioids from epidural steroid injections.

#### *Implantable Devices*

Complications related to implantable devices occur and may place patients at risk for injury.<sup>17</sup> In a prospective study, Follett and Naumann<sup>18</sup> noted that the frequency of procedure-related complications underscored the need for physicians performing implantations to use careful surgical technique and follow implant guidelines. In our study of surgical-type procedures (implantation/removal of devices), complications such as nerve injury (17%) or infection (25%) featured prominently (table 2). Clearly, when anesthesiologists perform procedures in which issues such as infection, bleeding, nerve injury, or pneumothorax may potentially occur, management strategies should be incorporated into after-procedure care plans. Although inflammatory mass lesions have been associated with long-term, high-dose, and high-concentration intrathecal infusions of morphine and hydromorphone,<sup>19</sup> this complication was not observed in our series.

Advances in technology, particularly during the 1990s, such as implantable therapy (infusion pumps, spinal cord stimulators) and ambulatory infusion devices, have facilitated the transition of traditional hospital treatments of pain to the home environment.<sup>20-23</sup> Some authors<sup>21,24</sup> have suggested that opioid administration (neuraxial, patient-controlled analgesia) may be achieved effectively and safely in the home environment. In our analysis of 20 claims associated with maintenance of devices, 45% were associated with death or brain damage when events such as pump programming errors, drug overdose, and concomitant use of other central nervous system depressants were implicated in the injury. This might suggest an area for increased awareness of potential problems for anesthesiologists involved in home care of patients with implanted devices such as morphine pumps and epidural injections and with patient-controlled analgesia.

### *Pneumothorax*

Twenty-one percent of claims were related to pneumothorax, which was associated primarily with intercostal nerve blocks, trigger point injections, and stellate ganglion blocks. Of the 59 claims for pneumothorax, many involved delay in diagnosis and treatment and/or insertion of chest tubes for treatment. The actual occurrence of these aggravating factors in pneumothorax claims may be higher, because these data were not itemized on the data collection form. There may be additional claims with delayed treatment or chest tubes in which the on-site reviewer did not explicitly state these factors in the narrative. The occurrence of iatrogenic pneumothorax may be associated with significant morbidity and mortality,<sup>25</sup> with some authors recommending chest tube drainage if the volume of the pneumothorax is greater than 20% of the pleural space.<sup>26</sup> Although pneumothorax is a recognized complication of procedures such as intercostal,<sup>27</sup> brachial plexus,<sup>28</sup> and stellate ganglion blocks,<sup>29</sup> the occurrence of pneumothorax for procedures such as trigger point injections may be somewhat surprising to many anesthesiologists, because this complication is not often reported with this procedure.<sup>30</sup> Our data suggest that it is important to establish a monitoring system for pneumothorax and to instruct patients as to the symptoms and signs of a pneumothorax after intercostal nerve blocks, stellate ganglion blocks, trigger point injections, and brachial plexus blocks.

### Conclusion

In summary, the proportion of claims and compensatory payment related to chronic pain management claims in the ASA Closed Claims Project database increased in the 1990s. Nerve injury and pneumothorax were the most common outcomes of invasive pain management claims. Severe injuries involving brain damage or death occurred with epidural steroid injections with local anesthetics and/or opioids and maintenance of implantable devices.

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