

Complications Associated With Eye Blocks and Peripheral Nerve Blocks: An American Society of Anesthesiologists Closed Claims Analysis

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Background and Objectives: Concern for block-related injury and liability has dissuaded many anesthesiologists from using regional anesthesia for eye and extremity surgery, despite many studies demonstrating the benefits of regional over general anesthesia. To determine injury patterns and liability associated with eye and peripheral nerve blocks, we re-examined the American Society of Anesthesiologists Closed Claims Database as part of the American Society of Regional Anesthesia and Pain Medicine's Practice Advisory on Neurologic Complications of Regional Anesthesia and Pain Medicine.

Methods: Claims with eye or peripheral nerve blocks performed perioperatively from 1980 through 2000 were analyzed. The liability profile of anesthesiologists who provided both the eye block and sedation for eye surgery was compared with the profile of anesthesiologists who provided sedation only. The injury patterns associated with peripheral nerve blocks and payment factors were analyzed.

Results: Anesthesiologists who provided both the eye block and sedation for eye surgery ($n = 59$) had more injuries associated with block placement ($P < .001$), a higher proportion of claims with permanent injury ($P < .05$), and a higher proportion of claims with plaintiff payment ($P < .05$), compared with anesthesiologists who provided sedation only ($n = 38$). Peripheral nerve blocks ($n = 159$) were primarily associated with temporary injuries (56%). Local anesthetic toxicity was associated with 7 of 19 claims with death or brain damage.

Conclusions: Performance of eye blocks by anesthesiologists significantly alters their liability profile, primarily related to permanent eye damage from block needle trauma. Though most peripheral nerve block claims are associated with temporary injuries, local anesthetic toxicity is a major cause of death or brain damage in these claims. *Reg Anesth Pain Med* 2008;33:416-422.

Key Words: Closed claims, Eye blocks, Liability, Peripheral nerve blocks, Regional anesthesia.

Although regional anesthesia is particularly suitable for eye and extremity surgery, many anesthesiologists are not adequately trained in these techniques,^{1,2} and may avoid it in these cases because of concern for inefficiency, inadequate analgesia, patient injury, and liability. However, many studies have demonstrated the benefits of regional anesthesia over general anesthesia with respect to decreased recovery time, superior pain control, decreased nausea and vomiting, and decreased postoperative cognitive deficits.³⁻⁶ To determine the

pattern of injuries and liability associated with eye blocks and peripheral nerve blocks, we re-examined the American Society of Anesthesiologists (ASA) Closed Claims Database as part of the American Society of Regional Anesthesia and Pain Medicine's (ASRA's) Practice Advisory on Neurologic Complications of Regional Anesthesia and Pain Medicine.

Methods

After approval by the Institutional Review Board at the University of Washington, claims from the ASA Closed Claims Database associated with regional anesthesia were analyzed. This database contains structured information on anesthetics with adverse outcomes obtained from the closed anesthesia malpractice insurance claim files of professional liability companies in the United States. Approximately 60% of practicing anesthesiologists are covered by the participating organizations. The process of data collection has been previously described

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in detail.^{7,8} Anesthesiologists reviewed closed anesthesia claims files at insurance company sites using detailed data instrument collection forms to record information on injuries (complications), and mechanisms of injuries (damaging events). They provided a narrative summary for each claim describing pertinent patient history; sequence of events; nature, evaluation, and outcome of injury; and standard of care.

Damaging events were divided into the following groups: cardiovascular events, respiratory events, regional block-related events, equipment problems, drug administration events, other anesthesia events, surgical events or patient condition, and none or unknown events. Claims with no identifiable adverse event during the anesthetic course were categorized as no damaging event. Complications were defined as the injury for which the patient was seeking compensation. Nerve damage was defined by the presence of objective clinical, anatomic, or laboratory findings consistent with spinal cord or peripheral nerve damage.⁹ Complications that could not be correlated with specific neuroanatomic lesions were categorized as other complications, and not nerve damage (e.g., low back pain).

The onsite anesthesiologist reviewer assigned a severity of injury score using the insurance industry's 10 point scale, where 0 = no injury and 9 = death. For this paper, severity scores were divided into 3 groups: (1) temporary injuries (severity score 0-4); (2) permanent injuries (severity score 5-8 including blindness); and (3) death (severity score 9). Standard of care was judged by reviewers as: (1) standard; (2) substandard; or (3) impossible to judge. Assessment of standard of care has been determined to have acceptable interrater reliability.¹⁰ Payment information was adjusted to 1999 dollars using the Consumer Price Index.

Regional anesthesia data for this paper were obtained from a database of 6,122 claims from 1980 through 2000, and is presented in part elsewhere.^{9,11,12} Inclusion criteria for eye blocks included claims associated with an eye block under monitored anesthesia care (MAC). Blocks performed by both anesthesiologists and ophthalmologists were included to better evaluate complications related to the performance of the eye block, as well as the sedation administered both during and after the block. Claims where the initial plan was for general anesthesia without an eye block were excluded. The ASA Closed Claims Database includes only claims in which an anesthesiologist was named. Claims against ophthalmologists for block needle trauma or other damaging events in which an anesthesiologist was not involved are not in-

cluded in this database. Thus, these data cannot be used to compare incidence of damaging events by provider. Claims related to patient movement and/or block needle trauma were classified by 2 of the authors (L.A.L., K.L.P.). Inclusion criteria for peripheral nerve blocks included any block performed perioperatively, for surgical anesthesia or postoperative pain management. Peripheral nerve blocks performed for chronic pain management were excluded from this analysis.

Statistical analysis was performed using the z test to compare proportions with a *P* value < .05 required for statistical significance.

Results

Eye Block Claims

Liability profile for anesthesiologists performing eye blocks with MAC compared with anesthesiologists providing MAC only. There were 97 claims associated with eye blocks in the ASA Closed Claims Database from 1980 through 2000. The anesthesiologist performed the eye block and provided MAC in 59 of 97 claims and over three-quarters of these claims were from the 1990s. Anesthesiologists provided MAC only (i.e., ophthalmologists performed the eye block), in 38 claims. The mean age was similar between groups, but there was a significantly lower proportion of ASA physical status III-V claims in the eye block + MAC group compared with the MAC only group (*P* ≤ .05; Table 1).

There was a significantly higher proportion of peribulbar blocks performed in the eye block + MAC group compared with the MAC only group (*P* = .01; Table 1). Damaging events in the eye block + MAC group were almost exclusively block-related (88%) compared with only 11% in the

Table 1. Demographics and Block Type for Claims With Eye Blocks 1980-2000

	Anesthesia Care		<i>P</i>
	Eye Block With MAC (n = 59)	MAC Only (n = 38)	
Age, mean ± SD (y)	67 ± 12.4	68.5 ± 13.4	
ASA			
I-II (%)	70	38	.008
III-V (%)	30	62	.008
Gender (% female)	60	61	
Type of block (%)			
Retrolbulbar	69	97	<.01
Peribulbar	24	3	<.01
Unknown	7	0	.04

NOTE. Claims with missing data (age, ASA, gender) were excluded from the above analysis.

Abbreviations: ASA, American Society of Anesthesiologists physical status; MAC, monitored anesthesia care.

Table 2. Damaging Events for Claims With Eye Blocks 1980-2000*

	Anesthesia Care		P
	Eye Block With MAC (n = 59)	MAC Only (n = 38)	
Block-related			
Block needle trauma (without patient movement)	42 (71)	2 (5)	<.001
Block needle trauma (with patient movement during block)	6 (10)	1 (3)	NS
Wrong side block	3 (5)	1 (3)	NS
Other	1 (2)	0	
Not block-related			
Patient movement intraoperatively	2 (3)	8 (21)	.01
Inadequate oxygenation/ventilation	2 (3)	6 (16)	.051 (NS)
Cardiovascular events	0	7 (18)	.016
Peripheral intravascular line	0	2 (5)	NS
No damaging event	1 (2)	7 (18)	.005
Miscellaneous events†	0	4 (11)	.016
Unknown event	2 (3)	0	NS

NOTE. Data are given as n (%).

Abbreviations: NS, not significant; MAC, monitored anesthesia care.

*Incidence of damaging events by group cannot be compared as the database lacks denominator data and collects only closed malpractice claims in which an anesthesiologist is involved. This table reflects liability profiles for anesthesiologists when performing both the eye block and sedation, or only providing sedation for the operation; e.g., claims associated with block needle damage by the ophthalmologist performing the block, and in which the anesthesiologist is not named as a defendant, are not included in the ASA Closed Claims Database. Consequently, the incidence of block needle damage by health care provider cannot be determined.

†Miscellaneous events (n) include bronchospasm (1), inadequate anesthesia/analgesia (2), and adverse drug reaction (1).

MAC group ($P < .001$; Table 2). There was a significantly lower proportion of claims associated with death in the eye block + MAC group compared with the MAC only group (7% and 37%, respectively, $P < .01$). Three of 4 deaths in the eye block + MAC group, and 5 of 14 deaths in the MAC only group suffered a cardiorespiratory arrest shortly after retrobulbar block placement with sedation. Only 1 of these 8 claims with arrest after block placement with sedation was designated as block-related. The remaining claims with an outcome of death were associated with an intraoperative arrest without a clear temporal relation to block placement ($n = 5$), or postoperative cardiac events ($n = 5$). Permanent injuries accounted for a higher proportion of eye block + MAC claims compared with the MAC only group (75% and 50%, respectively, $P < .05$).

Although the standard of care was judged similarly by reviewers between the eye block + MAC group and the MAC only group, payment was made

to the plaintiff in a significantly greater proportion of claims in the former group (73% and 49%, respectively, $P \leq .05$; Table 3). The median and range of payments was not significantly different between groups.

Peripheral Nerve Block Claims

Peripheral nerve blocks for surgical anesthesia were associated with 159 claims in the 1980s and 1990s excluding chronic pain claims, out of a database of 6,894 claims. Mean age of patients was 46 years \pm 16 SD, and the majority were ASA physical status I-II (81%). The gender associated with these claims was evenly split (48% female: 52% male). Axillary blocks were the most common peripheral nerve blocks used (40%) followed by interscalene blocks, intravenous regional blocks, supraclavicular blocks, and miscellaneous blocks (Fig 1).

Outcome severity for peripheral nerve blocks was associated with death in 8% of claims, with permanent injuries in 36%, and with temporary injuries in 56%. The mechanism of injury (damaging event) was designated as block-related in 51% of all peripheral nerve block claims. Damaging events for claims associated with death or brain damage ($n = 19$) were block-related in 9 claims, of which 7 claims were associated with signs of local anesthetic toxicity caused by unintentional intravascular injection ($n = 3$), or wrong dose/adverse drug effect with seizures or arrhythmias without clear evidence of intravascular injection of local anesthetic ($n = 4$). Regional techniques utilized for the claims with unintentional intravascular injections were axillary ($n = 2$), and interscalene ($n = 1$). The other block-related events were direct injection of local anesthetic into the cervical spinal cord ($n = 1$),

Table 3. Payment Factors for Claims With Eye Blocks 1980-2000

	Anesthesia Care		P
	Eye Block With MAC (n = 59)	MAC Only (n = 38)	
Substandard Care	22%	18%	
Payment Made to Plaintiff	73%	49%	.0104*
Payment in 1999 (US \$)†			
Median	126,900	124,312	
Minimum	2,325	3,100	
Maximum	1,666,000	1,181,735	

NOTE. Claims with missing payment data were excluded from the calculation of the statistics.

Abbreviation: MAC, monitored anesthesia care.

*z test statistical analysis.

†Payment adjusted to 1999 US \$ using the Consumer Price Index.

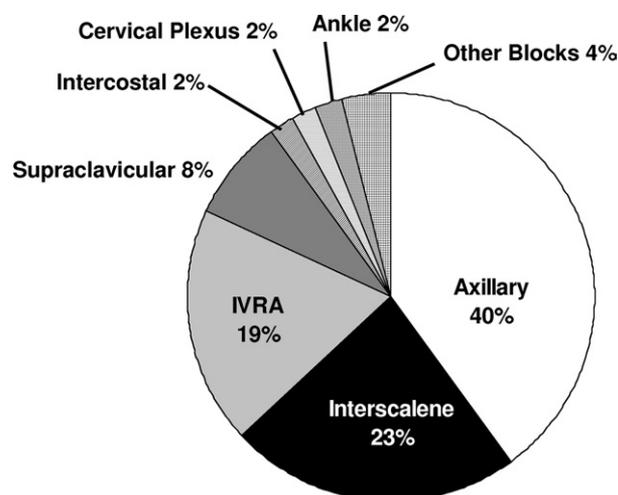


Fig 1. Percentage, according to type of block, associated with peripheral nerve block claims. IVRA, intravenous regional anesthesia.

and unintentional intrathecal injection ($n = 1$). Regional blocks associated with other block-related events were: interscalene block ($n = 4$), intravascular regional ($n = 1$), and intercostal blocks ($n = 1$). Nonblock-related events included respiratory events ($n = 4$), adverse/allergic reaction ($n = 1$), wrong drug ($n = 1$), surgical event ($n = 1$), unexplained cardiovascular event ($n = 1$), unspecified or unknown event ($n = 1$), and no event ($n = 1$).

Nerve damage was associated with 59% of peripheral nerve block claims and was evenly split between temporary and permanent injuries (Table 4). The brachial plexus was the most common location injured permanently, followed by median and ulnar nerves (Table 4), presumably from block needle damage or intraneural injection of local anesthetic. The most common type of block associated with permanent nerve injuries was axillary, followed by interscalene and supraclavicular blocks (Table 5). Pneumothorax occurred in 10% of claims and was most commonly associated with supraclavicular and interscalene blocks (Table 5).

Peripheral nerve block claims were associated with substandard care in 21% of claims, with payment made in 45% of claims. Median payment was \$58,800 with a range of \$630 to \$2,380,000.

Discussion

Limitations of the ASA Closed Claims Database

The ASA Closed Claims Database is a collection of adverse events from the medicolegal system with

data collected after claims have been settled. Interpretation of these data must be done with knowledge of its limitations.^{7,10,13-15} As few as 1 in 25 adverse events may result in a malpractice claim being filed, and there is a tendency for higher severity injury claims to be filed, compared with no or low severity/temporary injuries. Consequently, incidence of complications cannot be determined because there is both an incomplete numerator for specific adverse anesthetic outcomes, and an incomplete denominator for all anesthetics administered in the United States. Some data collected may rely on direct participants in the adverse outcome, and therefore, may be biased in the description of events with retrospective data collection. The determination of standard of care may be influenced with the knowledge of severity of outcome, and as practice patterns change over time with the introduction of new monitors and research. Lastly, the data analyzed for this study will not necessarily reflect current practice over the last 5 to 7 years with improved use of monitors, increased use of topical anesthesia and sub-Tenon's blocks for eye surgery, introduction of ultrasound-guided regional anesthesia, increased use of lower extremity blocks, and increased use of indwelling catheters for regional anesthesia. However, with recognition of these limitations, the ASA Closed Claims Database does provide useful information on rare adverse events that are difficult to study prospectively, and it provides an overview of the medical liability for anesthesiologists for the time period studied.

Data for this manuscript were abstracted from the ASA Closed Claims Database on regional anesthesia claims. Portions of these data have been previously

Table 4. Nerve Injuries Associated With Peripheral Nerve Block Claims ($n = 159$)

	Temporary Injury n (% of 46 claims)	Permanent Injury n (% of 48 claims)
Brachial plexus	15 (33)	21 (44)
Median nerve	16 (35)	12 (25)
Ulnar nerve	9 (20)	7 (15)
Radial nerve	4 (9)	2 (4)
Femoral nerve		1 (2)
Sciatic nerve		2 (4)
Epidural/spinal		5 (10)
Phrenic	1 (2)	2 (4)
Other*	3 (7)	3 (6)

NOTE. Total may sum to >100% due to multiple nerve injuries in some claims.

*Other nerve injuries include: temporary accessory and facial nerve injury, reflex sympathetic dystrophy; and permanent obturator and suprascapular nerve injury, and reflex sympathetic dystrophy.

Table 5. Type of Block Associated With Most Common Complications for Peripheral Nerve Block Claims

	Temporary Nerve Injury (n = 46) (n, % of 46)	Permanent Nerve Injury (n = 48) (n, % of 48)	Pneumothorax (n = 16) (n, % of 16)	Death/Brain Damage (n = 19) (n, % of 19)
Axillary	27 (59)	25 (52)	2 (13)	4 (21)
Interscalene	9 (20)	13 (27)	6 (38)	7 (37)
Intravascular	7 (15)	2 (4)	0	3 (16)
Regional				
Supraclavicular	1 (2)	4 (8)	7 (44)	1 (5)
Other	2 (4)	4 (8)	1 (6)	4 (21)

NOTE. Percentages may not sum to 100% due to rounding.

published,^{9,11,12} but are included herein because of specific value to the ASRA Practice Advisory. Previous publications utilized different years of damaging events to study, different inclusion and exclusion criteria, and had different numbers of claims in the ASA Closed Claims Database at the time of analysis, thus accounting for the differences in cohort numbers.

Claims Associated with Eye Blocks

Eye blocks performed by anesthesiologists were significantly more common in the 1990s compared with the 1980s. Claims where the anesthesiologists performed both the eye block and MAC were associated almost exclusively with block-related events, had a significantly higher proportion of claims associated with permanent injury, and had a higher proportion of claims with payment to the plaintiff, compared with the claims where the anesthesiologist only provided MAC. These data cannot be used to compare the incidence of block-related injuries between anesthesiologists and ophthalmologists because the ASA Closed Claims Database does not collect claims where only the ophthalmologist is named. However, it does highlight the change in liability for anesthesiologists if they choose to perform the eye blocks themselves, despite large prospective studies citing a low incidence of block-related injuries.¹⁶⁻¹⁹ The distinction between block needle trauma and surgical trauma may be difficult as the potential complications between the 2 procedures may overlap. Moreover, training for ophthalmologic blocks is not a requirement of anesthesia residency training in the United States, and some anesthesiologists may have inadequate experience.^{1,2}

It is unclear as to why the significant difference exists in the ASA status of patients having their block performed by an anesthesiologist vs. an ophthalmologist. It may reflect the fact that the damaging events that occur without regional anesthesia (performed by the anesthesiologist) may be more likely to occur in the older, sicker patient—e.g.,

cardiac events, oversedation with inadequate oxygenation/ventilation, etc. The lack of denominator data for each group and lack of access to ophthalmologists' closed claims, may create an artificial difference in ASA status between the 2 groups. Presumably, given the cited lack of anesthesiology training for ocular anesthesia blocks, the group that only has MAC anesthesia from the anesthesiologist has a much greater "n" in the denominator than the group where the anesthesiologist performs both the block and the MAC anesthetic.

There are many other potential catastrophic complications other than blindness that can occur with eye blocks. "Spread" of the local anesthetic along the optic nerve sheath into the subarachnoid space and central nervous system has been reported to cause cardiorespiratory arrest in many case reports, and retrospective and prospective studies.^{17,18} This database contains only 1 claim with cardiorespiratory arrest designated as block-related. An additional 7 claims had respiratory or cardiac arrest shortly after block placement, but the concurrent use of sedation made the etiology of the arrest unclear. The elderly may also be exquisitely sensitive to the commonly used narcotics, benzodiazepines, and induction agents for eye block placement, and have slow circulatory times, increasing the possibility of respiratory depression. Though anesthesia for cataract and other eye surgery may seem "trivial" to some physicians, the need for standard monitoring and vigilance when eye blocks are placed, with or without sedation, is essential.

Recent studies have advocated the use of the sub-Tenon's block as a safer alternative to retrobulbar and peribulbar eye blocks,¹⁹ but given the overall low rate of complications with eye blocks in prospective and retrospective studies,¹⁶⁻¹⁸ large randomized controlled studies would be needed to answer this question. Another trend in cataract surgery toward using topical anesthetics may have a more profound effect on improved patient safety with anesthesia for eye procedures.

Peripheral Nerve Block Claims

Overall, over half of the injuries associated with peripheral nerve block claims were temporary injuries. Pneumothorax was associated with approximately one tenth of all peripheral nerve block claims and occurred primarily with supraclavicular and interscalene blocks. Permanent nerve injuries occurred in approximately one third of the peripheral nerve block claims, and were most commonly associated with axillary and interscalene blocks, with most injuries to the brachial plexus location, followed by median and ulnar nerves. The use of ultrasound to identify nerves and their surrounding structures (e.g., vessels, bone, lung) is being promoted as a safer, quicker, and more reliable way to perform peripheral nerve blocks, similar to the introduction of ultrasound for central venous access,^{20,21} but data to support this claim are lacking. Unintentional intravascular injection and/or signs of local anesthetic toxicity were associated with one third of the 19 claims with death or brain damage. Test doses with epinephrine and incremental injection of the local anesthetic have been advocated in the past as a means of reducing the risk of unintentional intravascular injection. Although ultrasound-guided regional anesthesia may decrease the incidence of this complication as well, outcomes from this potentially lethal complication may be improved with the recent successful introduction of 20% intralipid, as a rescue agent in the clinical setting of unintentional intravascular injection of bupivacaine and ropivacaine.²²⁻²⁴

In summary, claims associated with eye blocks performed by anesthesiologists were significantly increased in the 1990s compared with the 1980s. The liability profile for anesthesiologists who provide both the eye block and MAC for eye surgery had significantly more claims associated with the block placement, had a significantly higher proportion of claims associated with permanent injury, and had a significantly higher rate of payment to the plaintiff compared with that of anesthesiologists who provided MAC only. Because both the local anesthetic and the sedation provided for the eye block can cause cardiorespiratory arrest, standard monitoring and vigilance are essential for patient safety. Peripheral nerve blocks were primarily associated with temporary injuries, but local anesthetic toxicity was a major cause of death and brain damage.

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