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MALPRACTICE HAZARDS OF SPINAL ANESTHESIA

EDWARD M. SWARTZ*

INTRODUCTION

THE USE of anesthesia pervades modern medical and surgical practice. It is the necessary concomitant of nearly all surgery and of many major internal diagnostic procedures as well. Further, the use of anesthesia is not confined to the hospital operating theater. Anesthetic techniques adaptable to minor surgical procedures are widely used in hospital outpatient clinics and in the private offices of physicians and dentists.

The value of this widespread and ever-increasing use of anesthetic techniques has been established beyond dispute for nearly a century. Many different anesthetic agents and techniques are available today, but the ultimate intended effect of all of them is the same. The anesthetic agent causes loss of sensation in the area of the operation, and hence, relief from pain. The great majority of anesthetized patients have good reason to be thankful for the development of a medical speciality which has freed surgical and diagnostic procedures from the bonds of pain.

Nevertheless, the use of anesthesia carries with it serious and well-recognized risks of personal injury and death to the patient. The medical profession has recognized this risk, but it has justifiably concluded that the indispensable value of anesthesia to modern surgery demands that this risk be taken routinely. In certain occasional, though not too infrequent, cases the anesthesiologist measurably increases this risk through errors in judgment or faulty technique.

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On such occasions, when the anesthesiologist's conduct amounts to professional negligence, he is exposed to legal liability for his patient's injuries.

Although anesthesia has become the routine complement to surgery, the potential dangers of any major anesthetic technique often outweigh the dangers associated with all but the most complex and delicate surgical procedures. The intended consequences of most surgical procedures are localized about the operative site (although the surgery may cause generalized systemic side effects due, for example, to excessive blood loss or trauma to abdominal organs). But anesthesia of necessity interferes with three primary bodily functions: the nervous, respiratory, and circulatory systems. It is no wonder that the untoward adverse effects of anesthesia produce such dramatic and tragic consequences, for they strike at the very essence of humanity—man's ability to think, feel, and control his actions.

Several different alternative anesthetic techniques are practiced today. Which of these will be chosen for a given operation depends on a host of factors, including the nature of the operation to be performed, the condition of the patient, and the preference and experience of the anesthesiologist. The choice of an anesthetic technique for a given operation is a matter of judgment, and few physicians have ventured to assert that one technique is conclusively safer or more effective than another for all cases. The following outline¹ will serve to indicate the range of anesthetic techniques in use today:

- (1) General Anesthesia
 - (a) Inhalation
 - (b) Intravenous
 - (c) Absorption (rectal; oral; intramuscular)
- (2) Regional Anesthesia
 - (a) Topical (local)
 - (b) Peripheral Nerve Block
 - (c) Spinal (subarachnoid) Anesthesia
 - (d) Epidural (peridural) Anesthesia
 - (e) Caudal Anesthesia
- (3) Mixed or Balanced Anesthesia (combining general anesthetic agents or regional and general agents)

1. Freely drawn from 3 *LAWYER'S MEDICAL CYCLOPEDIA*, § 25.25 (1958).

This article proposes to discuss the most common adverse effects and complications of but one type of anesthetic technique—spinal anesthesia. The complications of this technique have *so frequently* given rise to medical malpractice litigation that many anesthesiologists believe spinal anesthesia to have been singled out for undue special attack by plaintiffs' attorneys. Even a cursory glance at the medical literature concerning spinal anesthesia reveals that anesthesiologists have become unusually sensitive to the threat of malpractice litigation in this area. In few other subject areas is reference to the hazards of legal liability so common:

In some areas of the United States, spinal anesthesia has suffered some atrophy of disuse. While courts do not wish to dictate to the physicians what techniques they may or may not use, physicians tend to draw such inferences from court decisions. After several adverse decisions against anesthesiologists, it became common knowledge that spinal anesthesia was an invitation to a suit in malpractice. Plaintiff attorneys have taken full advantage of a few adverse decisions, and many actions in malpractice were filed involving spinal anesthesia.²

Anesthesiologists have intimated quite bluntly that the risk of legal liability has deterred the more widespread adoption of spinal anesthesia, although they frequently over-estimate the extent to which the lay public is aware of the adverse complications of spinal anesthesia: "In many hospitals, spinal (subarachnoid) block is not administered for surgical or obstetric procedures for two principal reasons: (1) the complications, particularly headache and paralysis, are well known to the public; and (2) a lawsuit may result if a major complication occurs."³ Although much of the anesthesiologists' alarm may be traced to the fear that *res ipsa loquitur* may be applied to impose legal liability for neurological sequelae that physicians believe are not casually related to the use of spinal anesthesia,⁴ this fear is neither groundless nor without companionship. Hence this article will attempt to present the major medical and legal issues relevant to any consideration of injuries caused by spinal anesthesia. The intent of the article is twofold. It is worthwhile first to place the legal principles governing the use of spinal anesthesia

2. Wasmuth, *Medicolegal Aspects of Spinal Anesthesia*, 1 INT'L ANESTHESIA CLINICS 895-909 (1963).

3. Moore, *The Present Status of Spinal (Subarachnoid) and Epidural (Peridural) Block*, 47 ANESTHESIA AND ANALGOSIA 40-49 (1968).

4. "The doctrine of *res ipsa loquitur* has been applied to neurological complications following spinal anesthesia. The fact that a patient has had a spinal anesthesia and has developed a neurological deficit does not, however, in itself prove that the

within the context of general principles of medical malpractice law, and with particular emphasis on certain decisions which involve the professional negligence of anesthesiologists. Subsequent sections of this article will introduce the reader, through a structured sequence of current medical literature on spinal anesthesia, to the physician's viewpoint—to contemporary medical opinion on the major problems of spinal anesthesia, techniques of administration, special hazards, and the origins of paralysis and other neurological complications.

GENERAL LEGAL CONSIDERATIONS

The standard of due care relevant to the use of spinal anesthesia is, of course, identical to the standard traditionally established for medical malpractice cases in general. The traditional formulation is well known:

The physician is required to possess that degree of knowledge and skill, and to exercise that degree of care, judgment, and skill, which other physicians of good standing of the same school or system of practice usually exercise in the same or similar localities under like or similar circumstances.⁵

An individual licensed to practice medicine is presumed to possess that degree of skill and learning which is possessed by the average members of the profession in the community in which he practices, and that he has applied that skill and learning with ordinary reasonable care to those who came to him for treatment.⁶

Although the "locality rule" restriction on this malpractice standard is currently falling into disrepute, the above formulations must be the starting point for consideration of anesthesiologist's professional negligence in nearly every jurisdiction.⁷ In all jurisdictions the is-

deficit is due to the anesthesia, nor does it prove negligence in administration of the anesthetic. The application of the doctrine of *res ipsa loquitur* removes, however, the necessity for such proof and says, in effect, that any physician administering a spinal anesthetic places himself in a special Alice in Wonderland legal world where proof is no longer of any consequence. The doctrine of *res ipsa loquitur* in such cases becomes a travesty of justice." Greene, *Neurological Sequelae of Spinal Anesthesia*, 22 ANESTHESIOLOGY 682-98 (1961).

5. STETLER & MORITZ, DOCTOR AND PATIENT AND THE LAW 307 (4th ed. 1962); see, e.g., Lane v. Calvert, 215 Md. 457, 138 A.2d 902 (1958); Moeller v. Hauser, 237 Minn. 368, 54 N.W.2d 639 (1952); Derr v. Bonney, 38 Wash. 2d 678, 231 P.2d 637 (1951).

6. Fritz v. Horsfall, 24 Wash. 2d 14, 163 P.2d 148 (1945).

7. Annot., 53 A.L.R.2d 142 (1957), Malpractice: duty and liability of anesthesiologist, at 144, presents a compendium of cases applying the general malpractice formulation to anesthetic injury cases.

sue of negligence is determined by comparing the defendant anesthesiologist's conduct with the ordinary and customary conduct practiced by other physicians. Rare indeed is the decision where conformity to customary medical practice will not suffice to decide the issue of negligence, and where the jury is permitted to find that due care requires a more strict standard of performance than does customary medical practice.⁸

The traditional malpractice formulation requires that the conduct of defendant physicians be compared with that of physicians of like schools of practice, training and degree of specialization. The general practitioner who administers anesthesia in his office *may not* be held to the standards applicable to board-certified anesthesiologists. The converse is equally true—the anesthesiologist, who is expert in the administration of anesthesia, is held to that degree of skill and care employed by other specialists in anesthesiology.⁹ Similarly, one who holds himself out as possessing special knowledge and skill in

8. One potentially revolutionary decision is *Oberlin v. Friedman*, 1 Ohio App. 2d 499, 205 N.E.2d 663 (1965). The plaintiff suffered paraplegia after the use of caudal anesthesia in a hemorrhoid operation. He claimed that the physician negligently injected neurotoxic alcohol instead of the anesthetic agent. The alcohol and the anesthetic were the same color and were kept on the same tray. It was undisputed that this was standard and customary practice nationwide. The appellate court, reversing because it felt a jury instruction embodying the traditional malpractice formulation was erroneous, held that the issue of negligence must not be decided solely on the basis of customary medical practices. These standards are only part of the total picture and must be "weighed and considered with other circumstances in determining whether or not ordinary care has been exercised." In effect the court permitted the jury to find the physician negligent if he conformed to customary medical practice which the jury found to be negligent. Whether or not the confusion caused by placing two similar looking vials on the same tray is negligent practice is, of course, an issue which a lay jury may evaluate without medical expertise. *But see* *Hallinan v. Prindle*, 17 Cal. App. 2d 656, 62 P.2d 1075 (1936); *Bugden v. Harbour View Hospital* 2 D.L.R. 338 (Nova Scotia 1947); *Steinert v. Brunswick Home, Inc.*, 259 App. Div. 1018, 20 N.Y.S.2d 459 (1940), *app. denied* 260 App. Div. 810, 22 N.Y.S.2d 822 (1940); *Evans v. Bannock County*, 59 Idaho 442, 83 P.2d 427 (1938). The conceptual implications of the *Oberlin* decision, that the law may hold the medical profession to an independently determined standard of care stricter than customary practice, strikes at the very essence of malpractice law. It is important to remember that this is not an evidentiary decision. It does not hold that the jury may dispense with expert testimony in deciding that the physician's conduct was negligent. It is instead substantively oriented—the jury itself may decide the proper standard of due care, finding that the defendant, and incidentally the whole medical profession, failed to meet it.

9. *Baker v. Hancock*, 29 Ind. App. 456, 63 N.E. 323, (1902); *Thompson v. Lillehei*, 164 F. Supp. 716 (1958); *Annot.*, 59 A.L.R. 1071 (1928), Standard of skill and care required of specialist.

anesthesiology (even if he is not, in fact, a specialist in anesthesiology) is held to the duty to exercise the degree of knowledge, skill and care exercised by true specialists in anesthesiology.¹⁰

Decisions involving anesthesiologists have been in the vanguard of the current trend toward the breakdown of the locality rule. Perhaps this is tacit recognition that anesthesiology in general and the use of spinal anesthesia in particular is a speciality of comparatively recent development, in which similar practices have been in nationwide use from the start, and in which the concept of parochial geographic variations in practice never had any meaning.

The locality rule in its strictest and earliest formulation required that the physician be judged by the customary medical practices in his home community. It has been broadened in part in many jurisdictions by the extension to "the same or similar localities."¹¹ The present trend is to discard any geographical limitation both in determining the standard of care and in determining whether expert witnesses are qualified to testify as to customary practice.¹² The size and character of the community is merely one factor which the jury must weigh in determining the general professional standard.

It is elementary that anesthesiologists, like all other physicians, are not insurers or guarantors of a favorable outcome of their services.¹³ The mere fact that injury occurs will not of itself subject the anesthesiologist to liability. Recovery must be based either on proof of negligence (for which *res ipsa loquitur* may occasionally be a substitute) or on the complex of duties which the law subsumes under the categories of assault and battery, informed consent, and failure to warn.

The opportunities for negligence in the administration of anesthetic agents are many, and the reported decisions reflect the diversity of factual situations in which anesthetized patients have

10. *Avers v. Parry*, 192 F.2d 181 (3d Cir. 1951).

11. See Leff, *Medical Devices and Paramedical Personnel: A Preliminary Context for Emerging Problems*, 1967 WASH. U. L. Q. 397-99, which presents a complete nation-wide compendium of the status of the locality rule formulations; see also RESTATEMENT (SECOND) OF TORTS § 299A (1938).

12. *Brune v. Bilenikoff*, 235 N.E.2d 793 (Mass. 1968); *Pederson v. Dumouchel*, 72 Wash. 73, 431 P.2d 973 (1967); *Douglas v. Bussabarger*, 73 Wash. 476, 438 P.2d 829 (1968).

13. Annot., 53 A.L.R.2d 142 (1957), 2a, n. 16 presents a compendium of cases so holding.

suffered personal injury. The one *caveat* to be recognized by the practicing attorney is that several older decisions arise from medical practices which are outmoded and in disfavor today. As a result, many of the older cases present examples of conduct so clearly considered negligent by modern standards that they are no longer practiced anywhere. Failure to sterilize the hypodermic needle used for administering the anesthetic agent is an excellent example of conduct which is today universally condemned. In addition, the practice of sterilizing anesthetic equipment in germicidal solutions (so-called "cold sterilization") has been sharply criticized, because the germicidal solution is itself neurotoxic and may remain in the syringe to contaminate the anesthetic agent when it is injected into the subarachnoid space.¹⁴ The result is that the vast majority of anesthesiologists consider cold sterilization dangerously negligent and cold sterilization has given way to autoclaving (sterilization under heat and pressure). The point to remember is that precedent rarely keeps pace with current medical practice. Decisions involving failure to sterilize should be a dead issue, and decisions in which the use of germicidal solutions were held to constitute due care should be highly suspect today. The attorney who wishes to determine whether a given course of conduct may give rise to negligence liability would do well to consult recent medical literature long before he turns to the law reporters.

Several fact situations have given rise to malpractice litigation, at least as reflected in the reported case literature. This list will of necessity be selectively representative rather than exhaustive. It must be remembered that most cases involving clearly negligent conduct remain unreported, because they are settled or tried to a conclusion without appeal. In a sense the reported appellate decisions are not wholly representative, because they tend to involve fact situations where it is genuinely in dispute whether or not the anesthesiologist's conduct was negligent.¹⁵ It is apparent that many other potential

14. Moore, *supra* note 3. Moore, *Spinal (Subarachnoid) Block*, 195 J.A.M.A. 907-12 (1966); Renegar, *Preparation and Sterilization of Drugs and Equipment*, 1 INT. ANESTHESIA CLINICS 757-87 (1963); Joseph, *Spinal Anesthesia, Arachnoiditis and Paraplegia*, 168 J.A.M.A. 1330-33 (1958). The standards for non-negligent autoclaving are sterilization at 255-260 F. under 18-20 pounds pressure for 30 minutes.

15. Failure to conduct physical examination or take patient's history: *See Walker v. Distler*, 78 Idaho 38, 296 P.2d 452 (1956); *Levy v. Vaughn*, 42 App. D.C. 146 (1914); *Updegraff v. Gage-Hall Clinic*, 125 Kan. 518, 264 P. 1078 (1928); *Van*

opportunities for negligence are not represented in this compendium. For example, negligence may be based on the anesthesiolo-

Sant v. Overstreet, 261 Ky. 58, 86 S.W.2d 1008 (1935); Cross v. Albee, 250 Mass. 170, 145 N.E. 45 (1924); Butler v. Layton, 266 Mass. 117, 164 N.E. 920 (1929); Vartana v. Berman, 311 Mass. 249, 40 N.E.2d 867 (1942); Bakker v. Walsh, 144 Mich. 622, 108 N.W. 94 (1906); Spain v. Burch, 169 Mo. App. 94, 154 S.W. 172 (1913); Wood v. Wyeth, 106 App. Div. 21, 94 N.Y.S. 360 (1905); Jackson v. Mountain Sanitarium & Asheville Agriculture School, 234 N.C. 222, 67 S.E.2d 57 (1951), *reh. denied*, 235 N.C. 758, 69 S.E.2d 29 (1952).

Explosions (gaseous inhalation anesthetic agents only): See Dierman v. Providence Hospital, 31 Cal. 2d 290, 188 P.2d 11 (1947); Andrepont v. Ochsner, 84 So. 2d 63 (La. 1955); Wilt v. McCallum, 214 Mo. App. 321, 253 S.W. 156 (1923); Philipp v. Shaw, 280 App. Div. 999, 116 N.Y.S. 2d 889 (1952).

Contamination of anesthetic agent: See Hall v. United States, 136 F. Supp. 187 (W.D. La. 1955), *aff'd.* 234 F.2d 811 (5th Cir. 1955) (cold sterilization in formaldehyde). See also Lippard v. Johnson, 215 N.C. 384, 1 S.E.2d 889 (1939); Loveland v. Nelson, 235 Mich. 623, 209 N.W. 835 (1926).

Substitution of toxic chemical for anesthetic agent: See Costley v. United States, 181 F.2d 723 (5th Cir. 1950); Hallinan v. Prindle, 17 Cal. App. 2d 656, 62 P.2d 1075 (1936); Evans v. Bannock County, 59 Idaho 442, 83 P.2d 427 (1938); Steinert v. Brunswick Home, Inc., 259 App. Div. 1018, 20 N.Y.S.2d 459 (1940); Oberlin v. Friedman, 1 Ohio App. 2d 499, 205 N.E.2d 663 (1965).

Breakage of hypodermic needle: See Walter v. England, 133 Cal. App. 676, 24 P.2d 930 (1933); Robinson v. Ferguson, 107 Ind. App. 107, 22 N.E.2d 901 (1939); Erhan v. Crofwell, 272 Mass. 172, 172 N.E. 73 (1930); Williams v. Chamberlain, 316 S.W.2d 505 (Mo. 1958); Ingram v. Poston, 260 S.W. 773 (Mo. App. 1924); Kelly v. Stern, 4 N.J. Misc. 180, 132 A. 234 (1926), *aff'd.*, 103 N.J.L. 196, 134 A. 918 (1924); Mandelbaum v. Weil, 208 App. Div. 409, 203 N.Y.S. 289 (1924); Noonan v. Dessloch, 289 N.Y. 620, 43 N.E.2d 838 (1942); Bernstein v. Greenfield, 281 N.Y. 77, 22 N.E.2d 242 (1939); Wiley v. Wharton, 68 Ohio App. 345, 41 N.E.2d 255 (1941); Houston Clinic v. Busch, 64 S.W.2d 1103 (Tex. Civ. App. 1933); Tennant v. Barton, 164 Wash. 279, 2 P.2d 735 (1931).

Faulty lumbar puncture technique (including incorrect needle placement): See Hall v. United States, *supra* within this note; Seneris v. Saas, 45 Cal. 2d 811, 291 P.2d 915 (1955); Huber v. Protestant Deaconess Hospital Assoc., 127 Ind. App. 565, 133 N.E.2d 984 (1956); Zink v. Besham, 164 Kan. 456, 190 P.2d 203 (1948); Herbert v. Travelers Indemnity Co., 250 La. 365, 193 So.2d 330 (1967); Porter v. Paryear, 258 S.W.2d 182 (Tex. Civ. App. 1953).

Failure to produce total anesthesia: See Colvin v. Smith, 275 App. Div. 1018, 91 N.Y.S.2d 713 (1949); Clark v. Gibbons, 58 Cal. Rptr. 125, 426 P.2d 525 (1967).

Excessive anesthetic administered: See Cavero v. Franklin General Benevolent Society, 36 Cal. 2d 301, 223 P.2d 471 (1950); Forbis v. Holzman, 5 Cal. 2d 407, 55 P.2d 201 (1936); Hair v. Sorensen, 215 Iowa 1229, 247 N.W. 651 (1933); Harris v. Wood, 214 Minn. 492, 8 N.W.2d 818 (1943); Boucher v. Larochelle, 74 N.H. 433, 68 A. 870 (1908); Sirochman v. Watson, 88 Pittsb. Leg. J. 545 (Pa. 1940); Bogle v. Winslow, 5 Phila. 136 (Pa. 1863).

Toxic properties of anesthetic agent: See Ayers v. Parry, 192 F.2d 181 (3d Cir. 1951) (cauda equina neuritis); Crews v. Munroe, 355 P.2d 637 (Ore. 1960) (caudal arachnoiditis).

Cardiac Arrest: See Kolesar v. United States, 198 F. Supp. 517 (S.D. Fla. 1961), *modified on appeal*, 313 F.2d 835 (5th Cir. 1963); Erban v. Kay, 342 Mass. 779, 174 N.E.2d 667 (1961); Quintal v. Laurel Grove Hospital, 41 Cal. Rptr. 577, 397 P.2d 161 (1964); Mitchell v. Atkins, 36 Del. 451, 178 A. 593 (1935).

gist's failure to monitor the patient properly during the operation, or his failure to administer adequate oxygen or vasopressor drugs to maintain adequate oxygenation and circulation during the operation which are important causal elements in cardiac arrest cases and in cases where neurological damage has been caused by thrombosis (where a blood clot blocks blood flow in the vessel) or ischemia (inadequate blood supply to tissues). The anesthesiologist and/or the treating physician may also be found negligent in failing to perform certain diagnostic tests or failing to take corrective measures once the adverse effects of the anesthesia have been discovered. It is necessary, therefore, for attorneys to develop a thorough understanding of the medical details involved in the administration of spinal anesthesia.

In the majority of medical malpractice cases the proximate causes of the plaintiff's injuries will not reduce themselves to simple acts which the lay juror or the medically untutored attorney can appreciate as negligent. The causes of a given adverse effect are frequently subtle, multiple, interrelated, and indirect. This is especially true for the two most dramatic sequelae of spinal anesthesia: cardiac arrest, often with attendant brain damage, and paralysis caused by neurological damage to the spinal cord and nerve roots. Frequently acknowledged experts in spinal anesthesiology will admit, in their professional literature, that the causes of neurological sequelae remain puzzlingly uncertain.

The law's response to the complexities and uncertainties inherent in proving negligence or proximate cause in an anesthetic injury case has followed the traditional pattern of malpractice cases generally. With the exception of the few decisions applying *res ipsa loquitur*, discussed below, courts have required expert testimony to establish the standard of care, the departure therefrom, and the causal connection between the negligent departure and the plaintiff's injury. Courts have regularly, and justifiably, held that such matters involve specialized medical knowledge beyond the experience of a lay jury.¹⁶

16. *Avers v. Barry*, 192 F.2d 181 (3rd Cir. 1951); *Louden v. Scott*, 58 Mont. 645, 194 P. 488 (1920); *Remley v. Plummer*, 79 Pa. Super. 117 (1922); *Roberts v. Parker*, 121 Cal. App. 264, 8 P.2d 908 (1932); Annot., 81 A.L.R.2d 597 (1962), *Necessity of expert evidence to support malpractice action against physician*; *Fritz v. Horsfall*, 24 Wash. 2d 14, 163 P.2d 148 (1945).

It is acknowledged that many plaintiffs' attorneys have found it difficult or virtually impossible to obtain expert medical testimony—yet such testimony is often essential if plaintiff is to reach the jury at all. This “conspiracy of silence” on the part of the medical profession has been loudly bewailed, and it has prompted several different attempts to avoid the requirement that expert testimony be produced. Indeed it may be said that the issue most frequently argued on appeal in malpractice cases is the quantum and nature of proof required by the plaintiff to sustain his case in the absence of expert testimony. The expert testimony requirement is the source of much of the tension and distortion in contemporary medical malpractice doctrines. There lies at the heart of the abolition of the locality rule the scarcity of cooperative local expert testimony. The use of medical texts, commonly on cross-examination but occasionally (as in Massachusetts) to establish a *prima facie* case, represents a modest palliative at best. The same may be said for a recent decision permitting the plaintiff to cross-examine the defendant not only about his own conduct, but also to cross-examine him as an expert witness in order to establish the community standard of care.¹⁷ Such attempts to lessen the harsh requirements of the expert testimony rule by tinkering with evidentiary matters have been inadequate. However, two significant pathways around the expert testimony requirement have been attempted: (1) *res ipsa loquitur*, and (2) several concepts labeled assault and battery, informed consent, and failure to warn. All too often these informed consent cases are characterized by singularly unusual distortions of fact and misplaced emphases, in an attempt to adapt the case to an ill-fitting mold where expert testimony may be unnecessary.

The general principles governing informed consent actions are simple. If injury results from the administration of spinal anesthesia, the defendant anesthesiologist will be held liable (even in the absence of proof of negligent administration) if the spinal anesthesia was given without the patient's consent. The only issues to be resolved are: (1) whether the battery or intentional touching implicit in the administration of the anesthesia was authorized or consented to, and (2) whether the administration of the spinal anesthesia was the proximate cause of the complained injury. It is clear that

17. *Oleksiw v. Weidener*, 2 Ohio St. 2d 147, 207 N.E.2d 375 (1965).

expert testimony will still be required to prove the second issue. At least, however, the expert witness is not called upon to evaluate the negligence of a colleague.

In certain cases, proof of the absence of informed consent is quite simple. In *Woodson v. Huey*,¹⁸ the patient informed her treating physician unequivocally that she refused to be subjected to spinal anesthesia. The physician entered this in the hospital record, but the anesthesiologist (who apparently had not personally visited the patient before the operation, which is in itself a departure from recommended practice) nevertheless administered spinal anesthesia. Plaintiff was paralyzed after the operation, and successfully recovered from the anesthesiologist on a theory of battery without consent.

However, the administration of spinal anesthesia without securing consent is not a sure pathway to recovery. Consider *Chambers v. Nottenbaum*,¹⁹ where plaintiff, who had first been given general anesthesia in an operation for acute appendicitis, went into convulsions. Emergency spinal anesthesia was given and the general anesthesia discontinued. Plaintiff suffered paralysis of one leg. In order to recover he was compelled to prove that the paralysis was the result of the spinal anesthesia, and was able to prove on the defendant's own testimony that the situation was not such an emergency as to excuse the trespass of the unconsented spinal anesthetic administration. Compare *Chambers* with *Hall v. United States*,²⁰ where the court held that the defendant was justified in using spinal anesthesia without obtaining the patient's specific consent thereto.

Today, it is customary practice in nearly every hospital to secure the patient's signature on a blanket consent statement at the time of his entry into the hospital. Often the patient is given no explanation by his physician or the anesthesiologist as to the nature of the anesthetic procedure and the risks involved. At this point we reach the crux of the informed consent doctrine. Just how much explanation of the potential risks of spinal anesthesia need be given the patient so that his consent is truly informed and not merely per-

18. 261 P.2d 199 (Okla. 1953).

19. 96 So.2d 716 (Fla. App. 1957).

20. *Halt v. United States*, *supra* note 15.

functory? It is clear that the medical profession itself recognizes that certain practices will not yield a truly informed consent: (1) consent obtained in the operating room after the patient has been dulled by premedication sedatives²¹ and (2) attempts to mislead the patient into accepting spinal anesthesia by disguising it under substitute words such as "nerve block" or "subarachnoid block."²²

Aside from these clearly deceptive practices there is little agreement on what constitutes informed consent. The ideal is perhaps represented by physicians who believe that full disclosure of the technique, together with explanation of the risks and reassurances of the essential safety of the procedure, is the soundest policy:

The most important aspect in the care of the aged patient who is to undergo surgery is the preoperative visit and preparation. . . . The aged are apprehensive and afraid that they may not awaken from their anesthetic. Reassurance by the anesthesiologist will materially aid in minimizing this fear. It should be explained explicitly just what is planned and how the block will be performed. They should be told what they may feel or experience during the operation.²³

Conversely, many anesthesiologists believe that the lay public is unduly apprehensive about the use of spinal anesthesia, and that they assume it to be far more dangerous than the statistical incidence of adverse consequences would indicate. The result all too often is that the anesthesiologist, fearing that he may add to the patient's apprehensions, and misconceptions about spinal anesthesia, decides not to give the patient an intelligent explanation of the procedure and its complications, and gives bland and deceptive reassurances instead. The problem with the informed consent lawsuit at this point is that prevailing medical opinion supports the physician's discretion to choose whether or not to give the patient an intelligent explanation of what he will undergo. This aspect of the doctor-patient relationship is considered a matter of pure judgment and personal preference, based on the character of the patient and the physician's evaluation of the seriousness and frequency of the risks involved.

In effect then we have come full circle. Courts, realizing that the degree of information that must be given to produce informed consent is essentially a question of sound medical judgment, have gen-

21. *Supra* note 17.

22. Wasmuth, *supra* note 2.

23. Lorhan, *Spinal Anesthesia for the Aged*, 1 INT'L ANESTHESIA CLINICS 829-35 (1963).

erally required expert testimony to prove that the physician has not given the patient sufficient explanation for informed consent. On such a discretionary issue physicians have been even more reluctant to testify than on questions of surgical and anesthetic technique.

This attempt to avoid the dilemma posed by the requirement for expert medical testimony and the resulting "conspiracy of silence" has led to the increasing use and misuse of *res ipsa loquitur*, and this in turn has raised serious alarm among anesthesiologists,²⁴ to the point where medical authors quite candidly attribute a decline in the use of spinal anesthesia to hostile court decisions.²⁵ The fear of the medical profession is that *res ipsa loquitur* will prove to be but a thinly disguised rationale for the imposition of strict liability without fault. Anesthesiologists, and even certain attorneys, have failed to keep clearly in mind that *res ipsa loquitur* properly applied should be merely an evidentiary doctrine, requiring the physician to prove he was free from negligence, or that the injury was not proximately caused by the administration of the anesthetic, or that the injury may occur in the absence of negligence. If the defendant anesthesiologist succeeds in providing any of these elements, he will be free from liability.

The use of *res ipsa loquitur* as a substitute for plaintiff's expert medical testimony is considered under the following criteria:

- (1) The accident is of a kind which ordinarily does not occur in the absence of someone's negligence;
- (2) the apparent cause of the accident is such that the defendant would be responsible for any negligence which did take place; and
- (3) the possibility of contributory negligence by the plaintiff is eliminated.²⁶

In general, courts have been reluctant to apply *res ipsa loquitur*

24. Greene, *supra* note 4.

25. The principal culprit seems to be *Seneris v. Haas*, 45 Cal. 2d 811, 291 P.2d 915, 53 A.L.R.2d 124 (1955). The decreasing use of spinal anesthesia in California in the decade following *Seneris* was directly traced to anesthesiologists' apprehensions that they would be subjected to liability without fault for all adverse neurological sequelae of spinal anesthesia. See Wasmuth, *Court Dictation of Anesthesia*, 6 CLEV. MAR. L. REV. 461 (1957), wherein the author stated, at 470: "Complications under general anesthesia frequently offer no legal threat whereas those related to spinal anesthesia are extremely hazardous in that respect." Anesthesiologists perceive that their patients are more conscious of the dangers of spinal anesthesia, and are more litigation-conscious as a result.

26. Leff, *supra* note 11, at 332-99; PROSSER, TORTS § 39, at 218 (3rd ed. 1964); 2 HARPER & JAMES, TORTS, §§ 19.6-19.9 (1956).

widely to some anesthetic injury cases.²⁷ The principal reason behind this reluctance is the first of the above criteria—“*Res ipsa loquitur* does not apply in malpractice cases where the injury is one which may occur even though the proper care and skill are exercised.”²⁸ Both cardiac arrest and spinal cord paralysis, the most dramatic and litigious sequelae of spinal anesthesia, may occur in the absence of conduct amounting to negligence. The non-negligent conduct of the anesthesiologist or surgeon, taken together with pre-existing disease conditions and the stresses on normal body physiology attendant on any surgical procedure, may proximately cause the adverse sequelae. The anesthetic agent itself may cause injury (*i.e.* toxic arachnoiditis or neuritis) in a small but significant minority of cases, all in the absence of negligence.²⁹

It is nevertheless worthwhile to examine the storm center of the *res ipsa loquitur* controversy as applied to anesthesia cases. *Seneris v. Haas*,³⁰ presents a typical case of neurological damage following spinal anesthesia, although the reported opinion does not discuss in detail the symptomology of plaintiff's paralysis. The crux of the case turned on the site of injection. Defendant testified that he administered the spinal anesthetic at L4-L5 (the interspace between the fourth and fifth lumbar vertebrae). Expert witnesses for the defendant stated that the paralysis was due to “cord damage” (a vague term, presumably meaning direct needle trauma to the cord here) and that it was impossible to damage the cord by injecting the anesthetic at L4-L5, because the spinal cord terminates at L1-L2. The plaintiff's attorney turned this expert testimony adroitly to his own advantage. He argued that the spinal anesthesia needle was in fact inserted between T12 and L1 (between the twelfth thoracic and first lumbar vertebrae, where the spinal cord is still present), and that by the defendant's own expert testimony the paralysis could be caused *in no other way*. The mere fact that paralysis occurred was evi-

27. Annot., 82 A.L.R.2d 1262-1351 (1962), Physicians and surgeons: *res ipsa loquitur*, or presumption or inference of negligence, in malpractice cases.

28. *Avers v. Parry*, 192 F.2d 181 (3rd Cir. 1951).

29. This was precisely the reason for denying the application of *res ipsa loquitur* in *Avers v. Parry*, *supra*, because plaintiff's expert witness stated that a toxic reaction to the anesthetic caused cauda equina neuritis from T11 to S5, and testified that the risk of toxic reaction could not be predetermined and was thus unavoidable.

30. 45 Cal. 2d 811, 291 P.2d 915 (1955).

dence that the defendant had negligently inserted the needle too high. The appellate court reversed a trial court verdict for the defendant, holding that: (1) there was direct evidence of negligence, since the defendant had given the anesthesia hurriedly, and (2) *res ipsa loquitur* supplied enough evidence of a negligent injection site to take the case to the jury. In *Seneris v. Haas*, the plaintiff succeeded in meeting the first of the *res ipsa loquitur* criteria discussed above. His own expert testimony eliminated the possibility that the paralysis was caused by toxic arachnoiditis. The court was apparently satisfied that negligent needle insertion causing direct trauma to the spinal cord was the only remaining alternative.

Turning from these legal considerations to an examination of the medical literature concerning proper techniques and adverse effects of spinal anesthesia, one can see why a case like *Seneris v. Haas* has caused such a *furor medicus*. Physicians may or may not worry about the implications of *res ipsa loquitur* as a forerunner of strict liability but they *do* worry about insurance rates and the inconvenience and embarrassment of a malpractice suit. Anesthesiologists are disturbed by the courts' willingness to accept simplistic solutions to questions of negligence and proximate cause. The anesthesiologist's reaction to *Seneris v. Haas* is to accept as true the defendant's testimony that he injected the anesthesia at L4-L5. For the anesthesiologist knows that such spinal cord injury may be caused in several other ways, all consistent with the exercise of due care by the defendant. Such possible etiologies of neurological damage would include:

- (1) Hemorrhage caused by unavoidable needle trauma to a blood vessel in the subarachnoid space.
- (2) The immediate toxic effect of a contaminant in the anesthetic agent (the hospital's responsibility).
- (3) Ischemic death of spinal cord tissue in an area of anatomically poor circulation, caused by a complex of factors involving some or all of the following: pre-existing arteriosclerosis or vertebral abnormalities; trauma during surgery to blood vessels feeding the cord; the normal operative hypotension, stasis (pooling) and possible thrombus formation due to decrease in blood pressure caused by normal sympathetic nerve blockade; the use of vasopressors to prolong the duration of anesthesia, which incidentally contract the blood vessels leading through the subarachnoid space into the cord.

Such medical explanations are often complex and difficult to understand, but the attorney who wishes to rest secure in the trial of

an anesthesia malpractice case *must* learn to feel at home with just these issues. Occasionally a case of neurological damage or cardiac arrest will turn on simple problems—an overdose of anesthesia, faulty needle insertion technique, failure to monitor, and the like. But the trial attorney must not seek such simple answers to the questions of negligence and proximate cause, for few malpractice lawsuits turn on such simple issues. His duty is to study the complex medical problems attendant upon spinal anesthesia and to accept the intricacies of current medical science upon the physician's terms. This attitude alone will earn the respect and cooperation of the medical profession.

The remainder of this article will be devoted to a survey of the major medical problems associated with spinal anesthesia techniques and complications, for it is with the medical literature, itself, that any useful study of the malpractice problems of spinal anesthesia must commence.

NEUROLOGICAL COMPLICATIONS OF SPINAL ANESTHESIA

The incidence of neurological complications associated with spinal anesthesia—most dramatically paralysis and loss of sensation—has given the technique a slightly sinister reputation among physicians and has even more seriously alarmed the lay public:

Lastly, we are limited in the use of spinal anesthesia by public resistance. As long as the lay press sees fit to publish only the glamorous adverse effects of this technic, no matter how rare they might be, and never mentions the tens of thousands of spinal anesthetics given without any neurologic complications, the public obviously gets a biased point of view. . . . Since it is impossible to guarantee that neurologic problems will not arise from a spinal anesthetic, we should not use this technic without the patient's full acceptance. Behind all this of course is the fear that should something go wrong, legal action might follow. . . .³¹

The response of the medical profession has been somewhat contradictory. On one hand, the consensus among leading anesthesiologists is that the acceptance of spinal anesthesiology as an inherently safe technique ought to be promoted throughout the specialty:

In conclusion, it is our definite impression from the study of 20,000 consecutive spinal anesthetics that this is the safe and recommended technique for administration of necessary anaesthesia for surgical conditions below the level of the diaphragm and where definite contraindications to this technique, neurological conditions, cen-

31. McKechnie, *Limitations and Contraindications to Spinal Anesthesia*, 54 So. MED. J. 36-38 (1961).

tral nervous system lues, and so on, do not exist. Irresponsible rumour mongering and blaming of the technique for complications caused by extraneous conditions have been responsible for condemnation of spinal anaesthesia. We feel that this valuable technique has been much maligned in the past and deserves a better reputation than it now enjoys in some quarters. We shall continue to employ it as we have in the past, and we believe that it will continue to give us equally good results.³²

The corollary of this view is that the neurological complications following spinal anesthesia must fall into two categories: (1) those causally unrelated to the administration of the spinal, and (2) those caused by errors in technique. "Indeed, many of the so-called 'complications of spinal anesthesia' might be termed more accurately 'complications of the spinal anesthetist'".³³ Ironically, the defenders of the safety of spinal anesthesia become the theoretical allies of the plaintiff's attorney, for both insist that neurological damage is caused by the anesthesiologist's departure from standards of due care and safe practice, and not by risks inherent in the very use of spinal anesthesia which are beyond the control of the anesthesiologist.

Nevertheless, it cannot be denied that significant dangers are present in a procedure where the anesthesiologist is given so many opportunities to err. These very opportunities make spinal anesthesia a risky procedure. The best that can be said is that, once the spinal anesthetic technique was perfected and the principal dangers recognized, it has proven statistically no more dangerous than other accepted anesthetic procedures.

The sequential checklist presented should indicate the major causes of neurological damage attendant upon spinal anesthesia. Whether these may be properly labeled "hazards of spinal anesthesia" or "hazards of the improper administration of spinal anesthesia" is not just a question of semantics. Recovery in the personal injury lawsuit is based on the negligence and fault of the anesthesiologist. It therefore, becomes important to realize that many, though not all, of the causes of neurological damage may be traced to human error. The difficulties are twofold: (1) It is often difficult to establish a causal connection between the physician's conduct and a given neurological complication, because so many possible etiologies

32. Sadore, *Neurological Complications of Spinal Anesthesia*, 8 CAN. ANAESTH. SOC. J. 405-16 (1961).

33. Fabian, *Techniques and Complications of Spinal Anesthesia*, 1 J. MISS. ST. MED. ASS'N 129-36 (1960).

exist (an uncertainty which is reflected in the medical literature); and (2) although it may be determined that the anesthesiologist's error proximately caused the complication, his brethren will consider the error excusable rather than negligent. Anesthesiologists realize that their specialty is, lamentably, not an exact science. The risk of traumatic lumbar puncture, for example, is increased by faulty puncture technique, but even the use of meticulously correct technique will not eliminate the risk of trauma to blood vessels or nerve roots in the subarachnoid space. Similarly, the risk of ischemic damage to spinal cord tissue during periods of operative hypotension (which is caused by the anesthetic blockade of the sympathetic nervous system) is recognized but essentially immeasurable. The anesthesiologist can not avoid some degree of sympathetic blockade, nor can he prevent thrombus formation induced by hypotension-caused blood stasis. Such thrombosis may seriously diminish the blood supply to the spinal cord, causing ischemic necrosis (death) of cord tissues. but the anesthesiologist has no way of knowing that this has occurred until the neurological damage is clinically manifest—that is, when the patient awakens paralyzed.

The conclusion to be drawn, therefore, is that anesthesiologists are willing to attribute any of the dangers of spinal anesthesia to human error, but in many cases they find this error to be blameless and unavoidable.³⁴

If the plaintiff's attorney is to prove proximate cause effectively, he must develop a thorough understanding of the causal relationship between the anesthesiologist's allegedly negligent act and the subsequent neurological damage. He is in effect compelled to become a student of neurological differential diagnosis. The attorney will then discover that certain superficially attractive arguments are medically quite unsound. A few examples will suffice.

34. For a general survey of neurological complications see Lund, *Modern Trends in Spinal Anesthesia*, 15 CAN. ANAESTH. SOC. J. 118-34 (1968); Moore, *supra* note 3; Marinacci, *Electromyogram in Evaluation of Neurological Complications of Spinal Anesthesia*, 168 J.A.M.A. 1337-45 (1958); Courville, *Untoward Effects of Spinal Anesthesia on Spinal Cord and its Investments*, 34 ANESTHESIA AND ANALGESIA 313-33 (1955); White, *Major Morbidity of the Central Nervous System Following Spinal Anesthesia*, 57 SO. MED. J. 343-47 (1964); Sadone, *supra* note 32; Greene, *supra* note 4; Weaver, *Techniques for Preventing Complications During and After Spinal Anesthesia*, 39 ANESTHESIA AND ANALGESIA 141-48 (1960). See also SMITH, *PATHOLOGICAL PHYSIOLOGY FOR THE ANESTHESIOLOGIST*, 426-39 (1966); LUND, *PERID-*

(1) The risk of direct needle trauma to the cord is extremely remote, unless the anesthesiologist is utterly ignorant. The anesthetic is injected into the subarachnoid space, never into the cord, and blocks nerve impulses in the nerve roots rather than in the cord itself. It is injected at L3-L4-L5, since the spinal cord ends about L1 in normal adults.

(2) Isolated neurological deficit, for example the "foot drop" caused by peroneal nerve damage, is unlikely to be caused by the administration of the anesthetic, but rather by faulty positioning of the patient during the operation, for which the surgeon should be liable.

(3) Neurological damage which is widespread and becomes apparent several weeks after the operation presents a classic picture of arachnoiditis,³⁵ which may be caused by a toxic adhesive reaction to the anesthesia or to a contaminant therein. Unless the anesthesiologist is legally responsible for the preparation of the anesthetic, arachnoiditis can not be traced to his conduct.

(4) Widespread bilateral paralysis extending downward from a certain dermatome level can rarely be linked to trauma to nerve roots during lumbar puncture, since it would be impossible for the needle itself to damage multiple nerve roots. Lumbar puncture may be implicated if there is evidence of hemorrhage into the subarachnoid space.³⁶ But such evidence, a bloody tap, commonly occurs without serious sequelae. There may well be no way to avoid contact with blood vessels or nerve roots during lumbar puncture.³⁷

(5) If the clinical picture is one of paralysis and sensory loss from T5 (the level of the breasts) downwards, ischemic damage³⁸ to the cord at T8 is strongly suggested,

URAL ANALGESIA AND ANESTHESIA, 287-308 (1966); KEATING, ANAESTHETIC ACCIDENTS, 174-207 (1956).

35. For a discussion of toxic arachnoiditis see Joseph, *supra* note 14; Bridenbaugh, *Is Heat Sterilization of Local Anesthetic Drugs a Necessity?* 168 J.A.M.A. 1334-37 (1958); Seaman, *Myelographic Appearance of Adhesive Spinal Arachnoiditis*, 10 J. NEUROSUR. 145-53 (1953); Greene, *supra* note 4, at 684-85; Schwarz, *Paraplegia Following Spinal Anesthesia*, 10 ARCH. NEURO. 308-21 (1964); Woods, *Progressive Adhesive Arachnoiditis Following Spinal Anesthesia*, 75 CAL. MED. 98 (1951); Greenfield, *The Pathology of Paraplegia Occurring as a Delayed Sequela of Spinal Anesthesia*, 119 J. PATH. BACT. 95-107 (1955); Haynes, *Cervical Arachnoiditis Occurring After Spinal Anesthesia*, 3 ANESTHESIOLOGY 444-47 (1942). For a discussion of peripheral nerve damage see Moore, *Spinal (Subarachnoid) Block*, 195 J.A.M.A. 910 (1966); Marinacci, *supra* note 34, at 1341; Marinacci, *Peripheral Nerve Complications in General Surgical Procedures*, 22 BULLETIN OF THE LOS ANGELES NEUROLOGICAL SOCIETY 20-27 (1957).

36. For a discussion of needle trauma to blood vessel causing hemorrhage into subarachnoid space see Fabian, *supra* note 33; King, *Spinal Subarachnoid Hemorrhage Following Lumbar Puncture*, 80 ARCHIVES OF SURGERY 574-77 (1960).

37. For a discussion of needle trauma to nerve roots during lumbar puncture see Finch, *Isolated Neurologic Deficit Following Spinal Anesthesia*, 28 ANESTHESIOLOGY 785-86 (1967); Dripps, *Hazards of Lumbar Puncture*, 147 J.A.M.A. 1118-21 (1951); Vandam, *Long-Term Follow-Up of Patients Who Received 10,098 Spinal Anesthetics*, 172 J.A.M.A. 1483-87 (1960); Kennedy, *Grave Spinal Cord Paralysis Caused by Spinal Anesthesia*, 91 SURGERY, GYNECOLOGY AND OBSTETRICS 385-98 (1950); Greene, *supra* note 4.

38. For a discussion of ischemic spinal cord necrosis see Sun, *Vascular System of the Human Spinal Cord*, 41 ARCHIVES OF NEUROLOGY AND PSYCHIATRY 659-77

because of the poor circulation to the spinal cord at this level. Such generalized neurological deficit may be caused by widespread tissue necrosis at T8 if the blood supply to the cord is seriously curtailed, by hypotension,³⁹ stasis and thrombus formation. Any attempt to link such symptoms with negligent lumbar puncture technique is foolish. If the anesthesiologist is negligent at all, it will be for failure to correct prolonged hypotension during the operation,⁴⁰ or for failure to discover conditions affecting blood supply to the cord,⁴¹ e.g. arteriosclerosis, spinal abnormalities. In such cases the possibility of surgical trauma to the lumbar artery, which leads to the blood vessels supplying the cord, should be explored.

It is clear, then, that the trial presentation of spinal anesthesia neurological complications demands a medically sophisticated approach which rejects simple arguments such as direct needle trauma to the spinal cord.⁴² It can not be seriously questioned that an approach which accepts complex medical realities is far more likely to win the respect and cooperation of the medical profession, whose expert testimony is the foundation of effective malpractice trial presentation.

CONCLUSION

The medico-legal implications of the complications of spinal anesthesia have been a fertile source of ill will and misunderstanding among both anesthesiologists and trial attorneys. Some anesthesiolo-

(1939); Wesliam, *Discussion on Vascular Disease of the Spinal Cord*, 51 PROC. ROY. SOC. MED. 540-50 (1958); You, *Vascular Supply of Spinal Cord*, 16 UNI. HOS. BULL. ANN. ARBOR 333-45 (1950).

39. For a discussion of hypotension see Ward, *Epidural and Subarachnoid Anesthesia: Cardiovascular and Respiratory Effects*, 191 J.A.M.A. 275-78 (1965); Defalque, *Compared Effects of Spinal and Extradural Anesthesia on Blood Pressure*, 23 ANESTHESIOLOGY 627-30 (1962); Ward, *Atropine and Vasopressors for the Treatment of Hypotension of High Subarachnoid Anesthesia*, 45 ANESTHESIA AND ANALGESIA 621-29 (1966); Scarborough, *Spinal Anesthesia from the Surgeon's Standpoint*, 168 J.A.M.A. 1324-26 (1958); Mannheimer, *Hypotension in the Operative Period*, 54 So. MED. J. 30-32 (1961).

40. For a discussion of the use of vasoconstrictors in anesthetic solution see Adriani, *Intrathecal Vasoconstrictors*, 1 INT'L. ANESTHESIA CLINICS 789-96 (1963); Moore, *Prolongation of Spinal Blocks with Vasoconstrictor Drugs*, 123 SURGERY, GYNECOLOGY AND OBSTETRICS 983-86 (1966); Moore, *supra* note 35.

41. For a discussion of exacerbation of pre-existing neurologic disease see Vandam, *Exacerbation of Pre-Existing Neurologic Disease after Spinal Anesthesia*, 255 N. ENG. J. MED. 843-49 (1956).

42. See GREENE, *PHYSIOLOGY OF SPINAL ANESTHESIA*, (1958); ADRIANI, (ed.), *LABAT'S REGIONAL ANESTHESIA*, (3d ed. 1967); MOORE, *REGIONAL BLOCK*, (4th ed. 1965); SMITH, *PATHOLOGICAL PHYSIOLOGY FOR THE ANESTHESIOLOGIST*, (1966). See also DeJong, *Physiology of Regional Anesthesia*, 1 INT'L ANESTHESIA CLINICS 803-10 (1963); Lund, *supra* note 34; Suh, *Vascular System of the Human Spinal Cord*, 41 ARCHIVES OF NEUROLOGY AND PSYCHIATRY 659-77 (1939); Woolam, *supra* note 38.

gists have come to believe that certain attorneys and courts apply to spinal anesthesia injury cases simplistic theories which run contrary to all sound and accepted medical opinion. The trial attorney, on the other hand, knows that medical malpractice cases are notoriously difficult, anesthesia cases perhaps most of all. Yet often the plaintiff's attorney is compelled to prepare and try his case without the benefit of expert medical testimony.

Adequate trial presentation demands that the attorney study critically a medical specialty of baffling complexity, and that he come to understand the relevant medical literature on its own terms. Often the attorney is entirely on his own, with few opportunities for effective communication with physicians about the medical problems inherent in the anesthesia injury case. The trial attorney needs, therefore, as many guideposts as possible through this unfamiliar medical world. This article has attempted to provide one such structured approach—an organized, sequential introduction to current medical thought about the techniques and complications of spinal anesthesia.

APPENDIX

A CHECKLIST OF SPINAL ANESTHESIA PROCEDURES

It would be difficult within the narrow confines of this article to present a detailed narrative account of the many and often complex procedures involved in the administration of spinal anesthesia. Even were this to be done, space limitations would soon reduce the account to a misleadingly simple and incomplete paraphrase of a subject which is properly characterized by methodical attention to medical and technical detail. The soundest and most comprehensive introduction to spinal anesthesia practice is to be obtained from direct contact with the medical literature itself. Medical texts and journal articles written for the practicing physician are indisputably authoritative—far more so than the simplified encyclopedic articles written for the trial attorney.

To this end is included a checklist of spinal anesthesia procedures. The outline presented below traces the course of the typical spinal anesthesia administration. It attempts to represent in organized fashion the major steps the anesthesiologist must take, and to indicate the problems he may encounter as well as the more common professional errors and the hidden

risks inherent in spinal anesthesia technique, which of course are the cause of the typical neurological complications associated with spinal anesthesia.

More importantly, there is included a series of references to medical articles relevant to each aspect of the checklist. These articles are well worth reading in the original. A knowledge of their contents is essential for effective presentation of a malpractice case involving neurological complications of spinal anesthesia. Several articles have been listed for most of the outline topics, in part so that the reader may obtain therefrom an appreciation of the general consensus of medical opinion on any given issue.

- I. BASIC CONSIDERATIONS.⁴²
 - A. Anatomy of spine, spinal cord, subarachnoid and epidural spaces.
 - B. Blood supply of spinal cord.
 - C. Physiology of nerve impulses.
 - D. Physiologic effects of regional anesthetic agents.
 - E. Surgical procedures for which spinal anesthesia recommended—operations below the level of the diaphragm.
 - F. Comparison with alternative anesthetic techniques—general inhalation anesthesia, epidural anesthesia, caudal anesthesia.
- II. PRE-ANESTHETIC PATIENT EVALUATION.⁴³
 - A. Personal visit by anesthesiologist.
 - B. Explanation to patient of spinal anesthesia technique.
 - C. Secure informed consent.
 - D. Complete history and physical examination of patient—arteriosclerosis, neurological disease, spinal abnormalities.
 - E. X rays of spine.
 - F. Contraindications to use of spinal anesthesia.
 - G. Pre-medication and sedation.
- III. ANESTHETIC AGENTS.⁴⁴
 - A. Choice of agent—pontocaine, procain, nupercaine, etc.
 - B. Preparation of anesthetic agents—hyperbaric, hypobaric and isobaric solutions—risk of excessive anesthesia concentration.

43. See ADRIANI, *supra* note 42; Moore, *supra* note 42. See also Dillon, *Indications and Contraindications for the Use of Spinal Anesthesia*, 1 INT'L ANESTHESIA CLINICS 757-87 (1963); LeTard, *Preparation of the Patient for Spinal Anesthesia*, 1 INT'L ANESTHESIA CLINICS 769-74 (1963); Lorhan, *supra* note 23; Lund, *supra* note 34; Scarborough, *Spinal Anesthesia from the Surgeon's Standpoint*, 168 J.A.M.A. 1324-26 (1958); McKechnie, *Limitations and Contraindications to Spinal Anesthesia*, 54 So. MED. J. 36-38 (1961); Vandam, *supra* note 41; Vandam, *supra* note 37.

44. See Eggers, *Choice of Agents for Spinal Anesthesia*, 1 INT'L ANESTHESIA CLINICS 775-87 (1968); Adriani, *supra* note 40; Moore, *Prolongation of Spinal Blocks with Vasoconstrictor Drugs*, 123 SURGERY, GYNECOLOGY AND OBSTETRICS 983-86 (1966); Lund, *supra* note 34; Moore, *supra* note 35; Moore, *supra* note 3; Featherstone, *Pharmacology of Compounds Used to Produce Spinal Anesthesia*, 168 J.A.M.A. 1327-30 (1958); Keown, *The Choice of Agents for Spinal Anesthesia*, 54 So. MED. J. 33-35 (1961); Greene, *supra* note 4.

- C. Prepackaged anesthetic agents.
 - D. Mislabeling.
 - E. Sources of bacterial or chemical contamination.
 - F. Mixed anesthesia—spinal anesthesia together with inhalation anesthesia.
 - G. Use of vasopressor drugs (Vasexyl) to prolong duration of anesthesia.
- IV. STERILIZATION OF ANESTHESIC AGENTS AND INSTRUMENTS.⁴⁵
- A. Autoclaving—sterilization by heat and pressure.
 - B. Cold sterilization with germicidal solutions—risk of contamination.
 - C. Gas sterilization.
- V. LUMBAR PUNCTURE TECHNIQUE.⁴⁶
- A. Positioning the patient.
 - B. The level at which the needle should be inserted.
 - C. Level of anesthesia determined by the volume injected and speed of injection.
 - D. Pin-pricking or other tests to determine level of loss of sensation.
 - E. High spinal, total spinal, and risks of respiratory failure and cardiac arrest.
 - F. Bloody taps—needle trauma causing hemorrhage of blood vessels in subarachnoid space.
 - G. Needle trauma to individual nerve roots.
 - H. Repeated attempts at lumbar puncture.
 - I. Patient's complaints of pain and burning sensation during injection.
- VI. MANAGEMENT DURING THE OPERATION—MONITORING AND SUPPORTIVE MEASURES.⁴⁷
- A. Importance of anesthesia chart.
 - B. Effect of spinal anesthesia on circulation and respiration.
 - C. Effect of surgical procedures on circulation and respiration.

45. Renegar, *supra* note 14; Moore, *supra* note 35; Bridenbaugh, *supra* note 35; Joseph, *supra* note 35; Fabian, *supra* note 33; White, *supra* note 34; Greene, *supra* note 4.

46. See ADRIANI, *supra* note 42; MOORE, *supra* note 42. See also Fabian, *supra* note 33; Allen, *Spinal Anesthesia for Surgery of Lower Abdomen and Pelvis*, 1 INT'L ANESTHESIA CLINICS 809-10 (1963); Egbert, *Respiratory Failure During Total Spinal Anesthesia*, 1 INT'L ANESTHETIC CLINICS 869-75 (1963); White, *supra* note 34; Vandam, *supra* note 37; Dripps, *Hazards of Lumbar Puncture*, 147 J.A.M.A. 1118-21 (1951); Greene, *supra* note 4; King, *supra* note 36; Weaver, *supra* note 34.

47. See ADRIANI, *supra* note 42; MOORE, *supra* note 35; SMITH, *PATHOLOGICAL PHYSIOLOGY FOR THE ANESTHESIOLOGIST* (1966); Allen, *supra* note 46; Lund, *supra* note 34; Ward, *supra* note 39; Ward, *supra* note 39; Patterson, *Stethoscope Monitoring During Anesthesia*, 45 ANESTHESIA AND ANALGESIA 572-75 (1966); Cullen, *Monitors and Clinical Judgment*, 102 AMER. J. SURG. 300 (1964); Nicholson, *Cardiac Monitoring in Clinical Anesthesia: Current Status*, 43 ANESTHESIA AND ANALGESIA 109 (1964); Moore, *supra* note 3; Mannheimer, *supra* note 39; Sadore, *supra* note 32.

- D. Blood pressure and pulse—correction of hypotension—vasopressors.
- E. Administration of oxygen—assisted respiration.
- F. Detecting and preventing the onset of cardiac arrest.

VII. SURGICAL CONSIDERATIONS.⁴⁸

- A. Improper positioning may cause peripheral nerve damage simulating anesthetic injury.
- B. Blood loss.
- C. Abdominal manipulations cause respiratory depression.
- D. Abdominal surgery may cause trauma to lumbar artery and other blood vessels supplying spinal cord.

VIII. DIFFERENTIAL DIAGNOSIS OF ADVERSE SEQUELAE.⁴⁹

- A. Complete neurological physical examination.
- B. Diagnostic lumbar puncture for spinal fluid.
- C. Myelography.
- D. Electromyography.

48. See Scarborough, *supra* note 39; Lund, *Prevention of Complications*, 2 INT. ANESTHESIA CLINICS 585-90 (1964); Moore, *supra* note 35.

49. See Marinacci, *supra* note 34; Marinacci, *supra* note 35; Greene, *supra* note 4; Marinacci, *Neurological Aspects of Complications of Spinal Anesthesia with Medicolegal Implications*, 25 BULL. L. A. NEURO. SOC. 170 (1960); Schwartz, *supra* note 35; SMITH, *supra* note 47.