CONTINUOUS PERIDURAL ANESTHESIA FOR CESAREAN SECTION*

A Report of 121 Cases

CHARLES A. GORDON, M.D., F.A.C.S., F. PAUL ANSBRO, M.D., AND ROBERT E. GORDON, M.D., BROOKLYN, N. Y.

(From the Department of Obstetrics and Gynecology and the Department of Anesthesiology, St. Catherine's Hospital)

PERIDURAL anesthesia has many advantages for cesarean section. Our experience with it has continued to be so satisfactory that we now report 121 additional cases. The importance of anesthesia in cesarean section is obvious, yet the dangers have not been sufficiently recognized.

The General Problem of Anesthesia in Obstetrics

We have been slow to realize that anesthesia is one of the principal causes of maternal death, and for a good reason. No matter how precisely it is stated on the certificate of death that the actual cause was anesthesia, death is allocated statistically to the antecedent condition, or to the diagnosis for which the anesthesia was administered. It has never been otherwise.[1, 2]

Nor can the hazard of anesthesia be measured by reports from well-organized obstetric services. Only regional maternal mortality committees, reviewing case reports as well as certificates of death, can furnish reliable evidence. Even then it is difficult. Death on the delivery table may have been due to anesthesia, but this may not at once be apparent. If sudden death should be due to the toxic action of the agent itself, it is easier to be reasonably sure of it than when death occurs in the course of inhalation anesthesia. Aspiration is a fairly common occurrence, not always easy to recognize clinically, and unless autopsy is performed within an hour or two of death, alveolar pathology may not be distinguished from common postmortem changes.[3] Death may not be immediate, and anesthesia, in the absence of knowledge of aspiration, may not be thought of as the cause of pneumonic areas, even though their distribution may be typical of postanesthetic atelectasis. Aspiration does not always precede atelectasis, nor does it always cause death. Davis and Gready,[4] reporting 2 maternal deaths from anesthesia, neither due to aspiration, found some 45 instances of aspiration during inhalation anesthesia; 8 patients were seriously ill but all recovered.

Acken[5] reported 11 deaths in 1,245 casearean sections. Eight of these deaths, nearly 73 per cent, were due to anesthesia.

Thompson,[6] reviewing 75 cesarean section deaths which had occurred in Los Angeles hospitals, found that one-sixth were due to anesthesia.

*Presented at a meeting of the Brooklyn Gynecological Society, March 17, 1954.

Recently, in Bronx County, a significant increase in the number of maternal deaths due to anesthesia has been reported.[7]

Hartnett,[8] analyzing 25 maternal deaths which occurred in five of the better institutions in St. Louis during the past five years found that anesthesia was responsible for 11, or 40 per cent of them; 73 per cent of these deaths from anesthesia were hidden in the hospital files under diagnoses difficult to find.

Hellman and Hingson[9] state, "While anesthesia and analgesia technics have in recent years improved the quality of obstetric pain-relief tremendously, the dangers of serious complications have likewise risen."

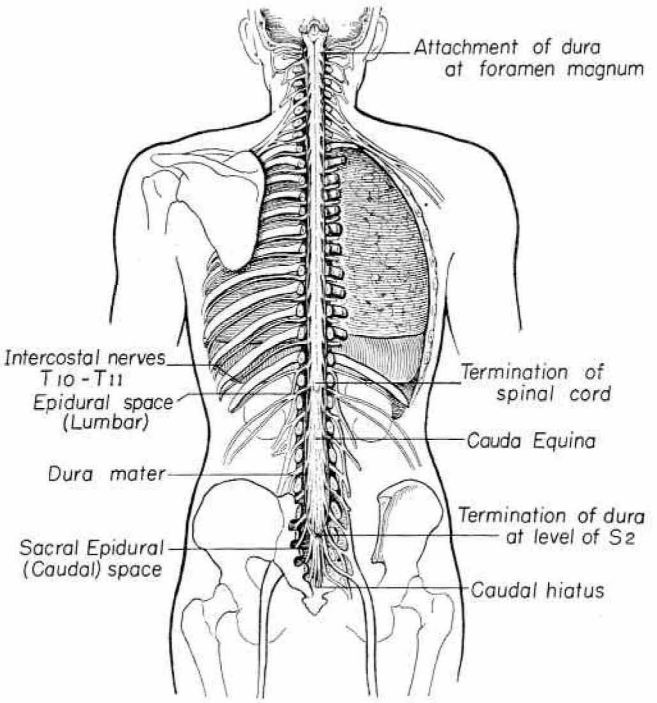

Fig. 1.—The peridural space extends from the foramen magnum at the base of the skull to the bottom of the sacrum. The spinal nerves traverse it on their way to their peripheral distribution. It varies from 3 to 6 mm. in size in different regions. (All figures from Ansbro and associates,[21] with permission of the *New York State Journal of Medicine.*)

In Brooklyn,[10] where for fifteen years puerperal mortality rates have paralleled the national trend, cesarean section has been concerned in approximately one-fifth of the deaths, and 20 per cent of the deaths during or after cesarean section were due to anesthesia. Atelectasis occurred almost as frequently with spinal anesthesia as with inhalation; there were no deaths from aspiration in the course of spinal anesthesia.

The risk of anesthesia is due not so much to the condition for which the operation is performed as to the skill and experience of the operator and the anesthesiologist. Steady increase in the number of cesarean sections makes

constant search for the best anesthetic more important. We have no perfect anesthetic but perhaps the quest is not a vain one. Eastman[11] thinks that anesthesia for cesarean section is one of the most important problems in obstetrics today. The greatest source of danger is the anesthetic.

In general, inhalation and intravenous anesthetics readily pass the placental barrier. Ether excites bronchial secretion and invites uterine atony. With cyclopropane the margin of safety is narrow, cardiac irregularities not uncommon, and the operating room should be explosion proof. Local block, the safest, is not suited to every obstetrician and its advocates find it unsatisfactory for the repeat operations which steadily grow in number. Spinal anesthesia, still dangerous in the hands of the thoughtless and the unknowing,

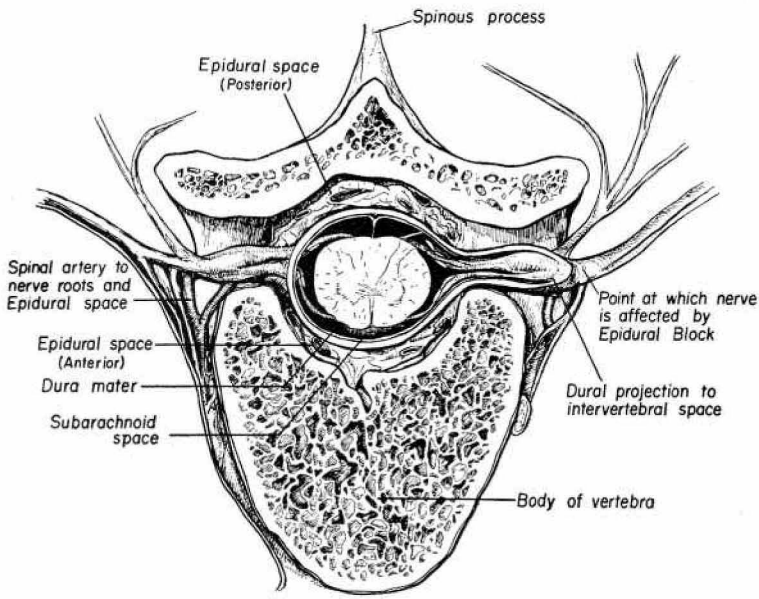

Fig. 2.—The peridural space. The envelope of dura covering the spinal nerves extends to the intervertebral space, at which point the anesthetic agent takes effect and blocks their afferent and efferent components.

has after many vicissitudes been rather widely accepted because of its advantages; yet it has been steadfastly rejected by Greenhill.[12] It is likely that reconsideration is again necessary, taking into account recent experience with saddle block.[13] Somewhat enigmatically it has been said[14] that "unless something is done, conduction anesthesia, in general, at least in the state of California, may have to be discarded."

Anesthesiologists who have made spinal anesthesia safer by use of oxygen, vasopressors, intravenous fluids, and control of the level of ascent have not been willing to discover and rely upon an anesthetic dose for cesarean section, small but calculated to be adequate for an operation performed for different reasons by all manner of operators. Continuous or fractional sub-

arachnoid block designed to meet this particular need should be safer, but is responsible for even more neurologic sequelae than single-dose spinal anesthesia and for more postspinal headaches.

General Advantages of Peridural Anesthesia

The dangers to which we call attention seem to us so particularly significant that the possibilities of the peridural space for anesthesia should be explored. The space is approximately 3 to 6 mm. deep and the dura, with proper technique, is relatively safe from inadvertent puncture (Fig. 1). The catheter is in contact with no important neurological structures, and since the nerves in the intervertebral spaces are covered with dural sheaths, permanent nerve injury is highly improbable (Fig. 2). If dural puncture should occur, recognition is easy, and spinal anesthesia with an appropriate dose of the anesthetic agent is the worst that can happen to the patient.

Spinal nerve block at the intervertebral foramina outside the dura has been called epidural but in Europe where it steadily grows in favor it is called peridural. Dogliotti[14] has used it more than 25,000 times. Other thousands of cases have been reported.[15] Peridural anesthesia has been selected for cesarean section, however, in comparatively few cases. Crouch and Merry[16] have reported a few cases, Ruppert[17] 103 cases, and Dolff[18] 100 cases. In the United States, Flowers[19] has recorded 37 cases and Moore,[20] 100 cases.

Material

We[21] have already reported 125 cesarean sections performed under continuous lumbar peridural block with procaine and xylocaine.* We now report 121 additional cases with the hope that our satisfaction with this method will encourage others to study its practicability and safety and possibly make contributions to the perfection of its technique.

From 1952 to 1954, 139 cesarean sections were performed in St. Catherine's Hospital by twenty-one operators. All anesthetics were administered by the attending anesthesiologists and their residents. Peridural anesthesia was selected for all but 18 of these patients, who received local or general anesthesia for varying reasons.

The type of operation in the 121 cases performed under peridural anesthesia was: transverse lower segment (113), longitudinal lower segment (4), classical (3), and hysterectomy (1). In every case, abdominal incision was midline below the umbilicus. No preanesthetic drugs were administered to 36 patients. In 58 cases, Demerol, 50 mg., and atropine, 0.0004 mg., were administered and in 19 cases atropine only was given. In the other cases, sedation varied.

The indications for operations were now and then multiple as is so often the case. They are stated in Table I.

Technique for Peridural Anesthesia in Cesarean Section

An intradermal wheal with 2 per cent cyclaine† will determine any rare individual sensitivity. A 16 gauge, Huber-point needle is inserted directly in the midline between the second and third lumbar spinous processes with the bevel upward. With practice, the varying resistance to the plunger of the

*Lidocaine hydrochloride—Astra Pharmaceutical Products, Worcester, Mass.
†Hexylcaine hydrochloride—Sharpe & Dohme, Inc., West Point, Pa.

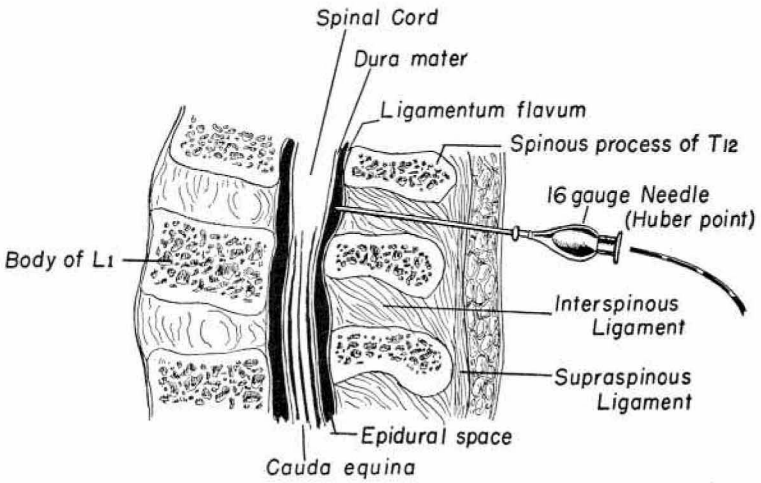

Fig. 3.—The ligaments of the spine and the coverings of the cord. Each spinal ligament has different density, and resistance to injection of air through it is the key to approach to the peridural space. The ligamentum flavum is the most dense and has the greatest resistance. After this ligament is traversed, all resistance ceases, indicating entrance into the peridural space.

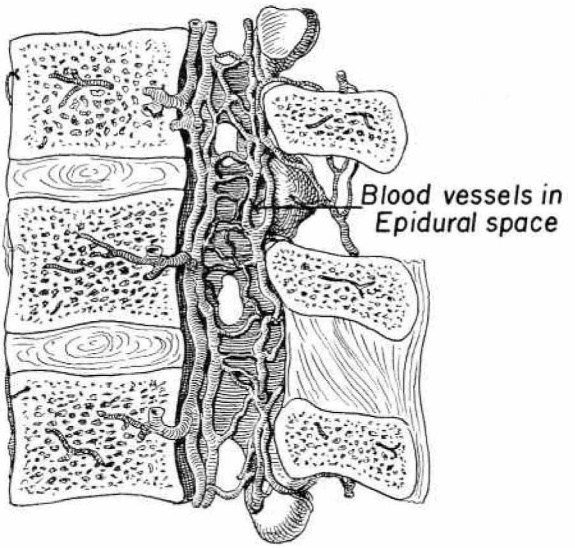

Fig. 4.—Dense vascular plexuses in the peridural space are likely to rupture if traumatized. Toxicity of the anesthetic agent must be low because of rapid absorption from this highly vascular area.

syringe attempting to inject air through the needle as it makes it way through the spinal ligaments—the supraspinous and interspinous ligaments, and the ligamentum flavum—is the key to successful block (Fig. 3).

With almost absolute resistance at the ligamentum flavum the needle is cautiously advanced for 4 to 5 mm. Sudden loss of resistance to pressure of the plunger will indicate that the needle has traversed the yellow ligament and is in the peridural space. Absence of spinal fluid is, of course, essential in ruling out inadvertent dural puncture. If penetration has occurred, the procedure must be converted to continuous spinal anesthesia. Obviously, the amount of anesthesia would not be safe for subarachnoid block. A Tuohy catheter (3.5 F. ureteral), without stylet, is now passed through the length of the needle (10 cm.) following which it is advanced upward for no more than 5 cm., lest fine blood vessels in the peridural space be ruptured (Fig. 4). If frank bleeding should occur, the procedure should be abandoned.

A test dose of 1.5 c.c. of 2 per cent cyclaine (30 mg.) is then administered. From three to five minutes later the patient's legs are tested for numbness, motor weakness, and elevated temperature. The needle is then removed, leaving the catheter in place in the peridural space. The exposed part of the catheter is strapped to the patient's back and she is returned to the supine position. A 17 gauge needle is inserted into a vein for administration of glucose solution and 1 per cent Neo-Synephrine drip is begun slowly.

Once again it is made certain that the patient does not have subarachnoid block. Then, the patient having already received 40 mg. of cyclaine peridurally in the test dose, injection of the anesthetic agent through the catheter is begun. Cyclaine (15 c.c. of 2 per cent) is injected slowly over a period of five to seven minutes. The patient is now ready for operation.

TABLE I. INDICATIONS FOR PERIDURAL ANESTHESIA

INDICATION	NO. OF CASES
Previous cesarean section	62
Disproportion and inertia	17
Elderly primipara	8
Breech	5
Abruptio placentae	3
Placenta previa	5
Myomas	4
Previous pelvic surgery	3
Fetal distress	2
Abnormal presentation	5
Face 1	
Brow 1	
Transverse 1	
Diabetes	3
Pre-eclampsia	3
Rectovaginal fistula	1

Results

There were no maternal deaths or complications. Neonatal death occurred three times. In no case, so far as could be determined, was death due to anesthesia. One fetus with marked hydrocephalus lived but a few minutes; another (1,672 grams), associated with abruptio placentae, died of infectious bronchopneumonia; and the third death, attributed to atelectasis, followed cesarean section on a diabetic mother.

There were no massive spinal anesthesias due to inadvertent puncture of the dura. In three cases, however, which have not been included in this

series, the planned peridural procedure was converted to continuous spinal anesthesia when the dura had been penetrated by the stylet in the catheter. The stylet is no longer used.

In five cases anesthesia was not completely satisfactory, possibly because the anesthetic agent had been deposited in a spinal ligament and not in the peridural space. Local, inhalation, or intravenous anesthesia had to be added.

Sympathetic blockade of necessity accompanies peridural anesthesia; hence, hypotension occurs in every instance. Since the sympathetic block is gradual, however, and segmental, both hypotension and hypertension are easily controlled and of no consequence. Hypotension is never sudden or great as with spinal anesthesia. There were no neurological symptoms, and not a single headache in the entire series.

The anesthetic agent is important. In our first series of 125 cesarean sections, convulsive movements occurred twice in 41 cases in which 2 per cent xylocaine had been used. In this series of 121 cases xylocaine was used in 64 cases and cyclaine in 57 cases. No convulsions were observed. Difference in toxicity of these two anesthetic agents appears to be marked. In a total of 931 peridural and peripheral nerve blocks for general surgery in which 2 per cent xylocaine had been used, convulsions occurred in 10 cases (an incidence of 1.07 per cent) and in 262 cases in which 2 per cent cyclaine was the anesthetic agent, there were no convulsions. In our opinion, cyclaine is the better agent for peridural anesthesia. We now use cyclaine only. It satisfies these requisites for an agent used in peridural anesthesia; namely, (1) low absolute and relative toxicity, (2) high potency, (3) short latent period, (4) prolonged effect, and (5) high diffusability.

Summary

1. One hundred twenty-one cesarean sections under continuous peridural anesthesia are added to 125 previously reported by us.

2. Hypertension is not a contraindication to peridural anesthesia, nor is hypotension, unless due to hemorrhage or shock. Peridural anesthesia should not be elected in any case of severe anemia.

3. The exacting technique required for entering the peridural space should restrict this procedure to the trained anesthesiologist. The comparative simplicity of subarachnoid block is perhaps the principal reason for widespread administration of spinal anesthesia by others.

4. Safety, no neurological sequelae, no spinal shock are obvious advantages of peridural anesthesia.

5. Complete freedom from spinal headache is a comfort for the patient, the obstetrician, and the anesthesiologist.

References

1. World Health Organization: Manual of the International Statistical Classification of Diseases, Injuries, and Causes of Death, Geneva, Switzerland, 1948.
2. Bureau of Census: Manual of the Joint Causes of Death, ed. 4, 1939, Washington, D. C., 1940, U. S. Department of Commerce.
3. Irons, E. E., and Apfelbach, C. W.: J. A. M. A. **115**: 548, 1940.
4. Davis, M. E., and Gready, T. G., Jr.: Am. J. Obst. & Gynec. **51**: 492, 1946.
5. Acken, H. S., Jr., Waelsch, R., and Ray, J. H.: New York J. Med. **51**: 2499, 1951.
6. Thompson, W. B., and Krahulik, E. J.: Proc. Third American Congress on Obst. & Gynec., St. Louis, Mo., 1947.
7. Klein, M. D., Clahr, J., Tamis, A. B., and Solkow, M. L.: New York J. Med. **53**: 2861, 1953.

8. Hartnett, L. J.: In discussion of Fitzgerald, J. E., and Webster, A.: AM. J. OBST. & GYNEC. **65:** 536, 1953.
9. Hellman, L. M., and Hingson, R. A.: New York J. Med. **52:** 1770, 1952.
10. Gordon, C. A.: AM. J. OBST. & GYNEC. **63:** 284, 1952.
11. Eastman, N. J.: Obst. & Gynec. Surv. **7:** 677, 1952.
12. Greenhill, J. P.: Anesthesiology **2:** 283, 1950.
13. Rosenbaum, H. E., Long, F. B., Jr., Hinchey, T. R., and Trufant, S. A.: A. M. A. Arch. Neurol. & Psychiat. **68:** 783, 1952.
14. DeCarle, D. W.: J. A. M. A. **154:** 545, 1954.
15. Ciocatto, E.: Anaesthesist **2:** 25, 1953.
16. Crouch, O. M. G., and Merry, E.: Brit. J. Anaesth. **20:** 24, 1946.
17. Ruppert, H.: Geburtsh u. Frauenh. **11:** 438, 1951.
18. Dolff, C.: Geburtsh u. Frauenh. **10:** 915, 1950.
19. Flowers, C. E., Jr., Hellman, L. M., and Hingson, R. A.: Anesth. & Analg. **28:** 181, 1949.
20. Moore, D. C., Bridenbaugh, L. D., Owen, K., MacDougall, M. P., and Carruthers, H. C.: West J. Surg. **61:** 459, 1953.
21. Ansbro, F. P., Gordon, C. A., Bodell, B., and Latteri, F. S.: New York J. Med. **52:** 1901, 1952.
22. Blundell, A. E., Bodell, B., Andorko, J. E., Sweeney, J. C., and Ansbro, F. P.: (To be published.)

32 REMSEN STREET, BROOKLYN
544 EAST 43RD STREET, BROOKLYN