

per minute) we assume that the possibility of dural penetration is eliminated. The further possibility of a subcutaneous injection is now determined by making pressure with the palm of the hand over the sacrum proximal to the needle. Pressure will stop a subcutaneous flow, but a caudal flow is unimpeded. If the criteria for caudal injection are satisfied, the saline solution is shut off and the needle is taped down securely in the median raphe. The patient is turned on her back and the procaine reservoir is released. . . . One per cent procaine hydrochloride is allowed to drip in at the rate of about 30 drops per minute for twenty minutes. After twenty minutes the rate is slowed to 15 drops per minute. This rate of flow is usually sufficient to maintain even anesthesia. In a few cases a slightly higher rate than 15 drops per minute was found necessary. The level of anesthesia must be carefully watched. . . . We have used the revised method for labor and delivery in 61 cases. . . .

"The continuous drip technic was also applied to obstetric surgical procedures. Five cesarean sections, two abdominal hysterotomies, two Pomeroy sterilizations with appendectomy and two curettages were done. In order to apply the method to abdominal operations, a few revisions in technic were required. The anesthesia should be started forty-five minutes prior to the incision, and 1 per cent procaine hydrochloride is allowed to drip in at the rate of 30 drops a minute for thirty minutes. The inflow is then reduced to 20 drops a minute and the solution allowed to run at that rate throughout the operation. No inhalation anesthesia or auxiliary analgesics were needed. The patients experienced no pain and their postoperative conditions were excellent. All the babies delivered by cesarean section cried spontaneously. There were no serious complications. Two patients who

underwent cesarean section had a pronounced fall in blood pressure but responded promptly to ephedrine sulfate $\frac{1}{4}$ grain (0.05 Gm.). We now are giving ephedrine sulfate routinely in all cases of abdominal surgery preoperatively when continuous caudal anesthesia is to be used. . . . Continuous caudal anesthesia has been a very satisfactory technic in our hands. Certain highly dangerous complications are possible and therefore it should be given only in well equipped hospitals by persons experienced in the technic."

J. C. M. C.

HAMMES, E. M.: *Neurological Complications Associated with Spinal Anesthesia (Eight Cases)*. Minnesota Med. 26: 339-345 (Apr.) 1943.

"A wide variety of neurological complications, either immediate or remote, mild or severe, may follow spinal anesthesia. . . . In a thorough review of the literature, comprising over 60,000 cases of spinal anesthesia, Light and his coworkers listed as sequelae: (1) headaches; (2) sensory disturbances; (3) cranial nerve involvement, especially the 6th; (4) impaired bladder and rectal function. They also noted other more serious spinal root and cord disturbances. Preexisting disease of the central nervous system is given as a definite contraindication to spinal anesthesia. It is a well-recognized fact that cerebral trauma of variable degree may precipitate, aggravate or accelerate the degenerative process of general paresis or cerebral arteriosclerosis. Organic diseases of the spinal cord may be similarly affected. Spinal anesthesia may likewise precipitate or aggravate a preexisting spinal cord disease. . . . A history of a previous organic central nervous system disease or a careful neurologic examination revealing any cerebral or spinal cord disease is a definite contraindication. The following five cases are illustrative:

"Case 1 (combined sclerosis of the spinal cord).—A. N., female, aged forty-eight . . . had suffered from pernicious anemia for five years. . . . At the time of operation for a benign ovarian tumor, the hemoglobin was 82 per cent; red blood count 4,200,000. The neurological examination was negative except for moderately increased knee-jerks. . . . The operation was uneventful and was performed under spinocaine spinal anesthesia at the third lumbar interspace. She stated that at the time of the injection it felt as if the needle was piercing some nerves. . . . On the third postoperative day, she developed a dull aching pain in both legs and some numb sensations in her hands. This continued and eleven days later, when she attempted to get up, she was unable to walk without assistance. . . . She has been unable to walk without assistance since that time. She also developed some bladder disturbances. . . . There was no further improvement under liver therapy. Legal action was instituted by the patient and a settlement was made out of court. . . .

"Case 2 (multiple sclerosis).—C. L., female, aged twenty-nine, had her first attack of diplopia on September 20, 1937. . . . A diagnosis of multiple sclerosis was made. . . . She remained well until March, 1939, when she had a recurrence of her previous symptoms with diplopia, numbness of her left hand and vertigo. . . . She remained well until January 12, 1942 (almost three years), when she had an attack of acute appendicitis. An appendectomy was performed under spinal anesthesia. Novocaine crystals 130 mg. in 2 cc. spinal fluid were injected in the third lumbar interspace. . . . On the fourth postoperative day she complained of diplopia, weakness and numbness of both lower extremities and difficulty in voiding. . . . Her condition has remained the same, with

very little change in the clinical picture. . . .

"Case 3 (tabes).—F. B., male, aged thirty-seven . . . was admitted . . . with an acute abdomen. Within a few hours a gangrenous appendix was removed under spinal anesthesia, 150 mg. novocaine in 3 cc. of spinal fluid at the third lumbar interspace being used. . . . On May 2, the fifth postoperative day, the patient complained of numbness and severe shooting pains in both lower extremities, with some impairment of bladder control. . . . Under antiluetic treatment, he made satisfactory improvement, so that after four months he was able to return to his occupation as a clerk. He continued treatment and the tabes has become stationary.

"Case 4 (general paresis).—C. M., male, aged fifty-nine years. . . . His personal history was negative except for marked alcoholism, until 1939, and a right inguinal hernia of six years' duration. The neurological examination was negative except that both pupils were irregular in outline. . . . On January 21, 1942, at 9:45 a.m. a right inguinal herniorrhaphy was done, under spinal anesthesia. Novocaine crystals, 150 mg. in 2 cc. of spinal fluid, were injected at the level of the third lumbar interspace. . . . He was normal mentally until about 6 p.m., eight hours postoperative. He then became irrational, noisy, disoriented and extremely restless. . . . His psychosis progressed and within six weeks he presented a dementing type of general paresis. . . .

"Another interesting organic neurological patient, who was examined last winter, developed further neurological complications following spinal anesthesia. This man, aged seventy, had an apoplectic attack, with a left hemiplegia, eighteen months previously. After a prostactomy under metycaine spinal anesthesia, he developed a se-

vere radiculitis with a flaccid paraplegia. The following three cases did not manifest any preoperative neurological symptoms or signs.

"Case 5 (chronic adhesive arachnoiditis, with probable ascending myelitis).—M. J., female, aged twenty-one. . . . She had had repeated attacks of right lower abdominal pain accompanied by a low grade temperature and a leukocytosis around 9,500. On October 15, 1941, she was given a spinal injection of 0.5 cc. of 20 per cent metycaine diluted in 3.5 cc. spinal fluid in the third lumbar interspace. The spinal fluid was normal in color. Within ten minutes her respiration ceased. Artificial respiration was resorted to and an intravenous injection of 3 cc. of metrazol was administered. After forty-five minutes she appeared normal. She complained of numbness and weakness of the left leg and some difficulty in starting the flow of urine. This gradually improved. On October 20, under nitrous oxide and ether anesthesia, a subacute appendix and a large cystic and degenerated ovary were removed. The surgical progress was uneventful. Numbness and weakness of the left leg continued for several weeks, with absent knee and ankle jerk. . . . On January 30, she sustained a third degree burn over her sacral region, without any pain or discomfort. The weakness in her left leg gradually became more pronounced and she again developed difficulty in starting her urine. . . . On May 15, 1942, she was operated on by Dr. G. S. Baker, Mayo Clinic, who kindly submitted the following report.

" "There was complete anesthesia for all forms of stimuli below the 8th thoracic segment and we were unable to obtain any cerebrospinal fluid, as the lumbar spinal canal was entirely dry. The spines and laminae of the 7th, 8th and 9th thoracic vertebrae were removed and when the dura was opened we found that it was quite ad-

herent to the arachnoid, and the cord itself, for the entire distance which we explored. Adhesions had formed all about the cord tissue. A small specimen of the arachnoid was removed for pathologic diagnosis and the tissue showed chronic fibrous arachnoiditis, with evidence of old blood pigment in the tissue.'

"Dr. Baker suggested that it is quite possible that the patient had an intraspinal hemorrhage which could account for the entire syndrome. At the time of her discharge there was no change from the preoperative findings. . . . Another case of chronic arachnoiditis was observed a few months ago in a patient seventy-one years old. . . . His symptoms developed quite rapidly for forty-eight hours postoperative, after which time they became stationary. . . .

"Case 6 (toxic psychosis).—M. F., male, aged sixty-one. . . . A ruptured gangrenous appendix was removed and a generalized peritonitis was found. The operation was performed under spinal anesthesia, 2 cc. of spinocaine in 2 cc. of spinal fluid, in the second lumbar interspace. . . . The following day he was confused and disorientated. . . . His mental status gradually changed . . . and he developed a characteristic Korsakoff's psychosis. This case presents a typical syndrome of a toxic psychosis secondary to the acute abdominal infection. This would have developed regardless of the type of anesthesia employed. . . .

"Five cases of preoperative organic neurological disorders were aggravated following spinal anesthesia. A complete personal history and a thorough preoperative neurological examination will assist in eliminating this unnecessary risk. Although no definite conclusions can be drawn as to the causative relationship, these cases definitely demonstrate that the chemotoxic effect of the various spinal anesthetics aggravate preexisting neurological dis-

eases. Serious complications in individuals neurologically normal are relatively infrequent and in properly selected cases spinal anesthesia still holds an important place in the surgeon's armamentarium." 31 references.

J. C. M. C.

ADAMS, W. B.: *The Prevention and Treatment of Postoperative Pulmonary Atelectasis by the Stir-up Regimen and Tracheobronchial Toilet*. J. Indiana M. A. 36: 299-301 (June) 1943.

"In order to prevent atelectasis during anesthesia, and in the immediate postoperative period, from the rapid absorption of anesthetic gases, the anesthetist adds to the mixture some inert gas, such as helium or nitrogen, which is slowly absorbed, and presses gently on the rebreathing bag during inspiration to force gases to the more distant alveoli. It is easier to prevent atelectasis than to cure it. Another method for prevention of atelectasis in the postoperative period is the stir-up regimen so widely advocated by Dr. Waters. This consists of three simple points: 1. The patient must radically change his position. 2. He must cough vigorously. 3. He must take several deep breaths. . . . Unquestionably bronchoscopic drainage is the treatment of choice for atelectasis and bronchial obstruction. . . .

"The patient may sit or recline in bed; usually some elevation of the head of the bed is helpful. Twenty minutes is spent in carefully and progressively spraying an anesthetic solution on the nose, base of tongue, fauces, pharynx and vocal cords. . . . Select the endotracheal tube to be used, choosing the largest one which will pass readily through the nostril if that route is decided upon—a slightly larger size may be used for direct insertion. . . . Lubricate the tube well with an oint-

ment containing 1 per cent nupercaine or diothane to reduce the sensitivity of the vocal cords. When introducing the tube according to the method of Magill, insert it slowly, convexity upward, into the more spacious nostril. By adjusting the degree of flexion and rotation of the head, and by having the patient pant as the tube nears the cords, the tube will usually enter the glottis. . . . A spray from the nebulizer directed into the tube during inhalation reduces the sensitivity of the tracheal mucosa. The aspirating catheter should be size fourteen to eighteen, French, and should have six to eight perforations near the tip. Lubricate the catheter with a thin layer of grease and attach it to the suction machine. Now insert the catheter full length into the endotracheal tube. Violent coughing, which marks the contact of the catheter with the tracheal and bronchial mucosa, squeezes out any fluid or mucus present and dislodges many bronchial plugs. Move the catheter gently in and out, twisting it, and change the position of the patient from side to side so that it will enter both main bronchi. . . . Withdraw the catheter and the endotracheal tube and terminate the procedure when no more secretion can be obtained." 5 references.

J. C. M. C.

BEECHER, H. K., AND CRAIG, F. N.: *Tissue Metabolism following Shock Induced by Hemorrhage*. J. Biol. Chem. 148: 383-392 (May) 1943.

"In the many years surgical shock has been studied by laboratory methods, a considerable body of data has accumulated to show that gross metabolic abnormalities, understandably enough, accompany the development of shock; these increase as shock persists. . . . In all of these previous considerations of metabolic abnormalities in shock we find no detailed studies of the