OBSTETRICS FOR THE ANESTHESIOLOGIST

BARNETT A. GREENE, M.D., AND MORRIS GOLDSMITH, M.D.

Brooklyn, New York

Received for publication February 9, 1948

The anesthesiologist who is interested in serving the patient in labor stands at the intersection of obstetrics and anesthesiology. It is inescapable that he learn a certain amount of obstetrics, especially the clinical and physiologic facts of parturition. It is as easy for the anesthesiologist to learn the required amount of obstetrics as it is for the obstetrician to acquire the skill and knowledge necessary for the administration of anesthesia.

The purpose of this article is to present the obstetrical information derived from our experience in the application of caudal or spinal methods for analgesia during labor and delivery in 1000 patients.† These remarks apply equally to spinal analgesia, even though for brevity we may refer only to caudal anesthesia. Spinal analgesia serves as well as, and at times better than, caudal. We have been able to obtain up to four hours of analgesia with mixtures of 0.5 per cent nupercaine, 10 per cent glucose, and 5 per cent ephedrine sulfate, and we have practically eliminated postspinal headache by the use of a 24 gauge spinal needle and attention to water balance.‡

The chief limitations to the increased use of caudal or spinal analgesia are the skills of the available personnel. The accoucheur who is not capable of performing expertly any of the simple maneuvers should not be provided with caudal or spinal analgesia.

Caudal or spinal analgesia is not applicable to every woman in labor even though there are no anatomical or pharmacologic contraindications. The mental or emotional attitude of the patient toward the "needle" and toward remaining conscious at the time of delivery may forbid its use. It should never be promised to any patient (1).

* From the Departments of Anesthesiology, Brooklyn Women's, Unity and Adelphi Hospitals, Brooklyn, New York.
† Our experience has increased 3000 obstetrical patients for caudal or spinal analgesia since this paper was submitted for publication. The principles of obstetric knowledge here presented have not required modification.
‡ The value and technique of using a 24 gauge spinal puncture needle and increasing water balance in the parturient have been described by Greene, Goldsmith and Lichtig (13). Better results with less need for forcing fluids have been obtained with a 26 gauge spinal puncture needle. This work will be published in ANESTHESIOLOGY at a later date.

110
I. Obstetrical Facts Relative to the Induction of Analgesia

The decision as to when to start must be made by the anesthesiologist. The patient always desires it as early as possible, almost always too early. The accoucheur usually errs in the same direction unless he has learned by experience that premature administration of the analgesia leads to a prolongation of the first stage of labor and a marked increase in complicated deliveries. The overenthusiastic attitude that attended the introduction of caudal analgesia created the erroneous belief that caudal should be started simply when the patient is in need of pain relief. When pain is the primary signal heeded, caudal analgesia must be expected to run an average of six and one-half hours (2) and abnormal presentations are encountered very often. If caudal analgesia were to be conducted in this fashion it would be so impractical and disadvantageous as to limit its use to a rare case. We cannot subscribe to Hodges' (3) statement, "all workers in this field are in accord that seven hours in the majority of patients is the maximum optimum time." Caudal analgesia that must run seven hours is one that has been started without consideration of the factors to be described. Our average caudal analgesia is about three hours in a primipara. "To those unfamiliar with caudal, a report of three hours' administration would indicate its use only in the terminal stages of labor . . . this three hours would lengthen into six or more if the method were not employed," (4). The marked contradictions of opinion as to the effect of caudal analgesia in shortening labor are due mainly to the varying starting points used by different workers in its administration. The inexperienced start too soon and encounter delayed labor, usually because they have failed to await or diagnose correctly the propitious station and presentation of the presenting part.

While there are no rigid rules, and experience must guide the selection of exceptions, we have found the following generalizations of great value:

The primiparous patient with an occiput anterior presentation should have (1) the vertex of the fetus one fingerbreadth below the level of the ischial spinous process, (2) uterine contractions recurring at least every five minutes, and (3) a cervix dilated to three fingerbreadths (6 cm.).

(1) If the examining finger in the rectum can readily feel the ischial spine or the sacrospinous ligament on each side, the fetus is still too high. Of all the criteria, the most dependable is the finding that the vertex is below the "spines" during the interim between uterine contractions. It is not sufficient that the vertex descend below the "spines" with a "pain." The forces which send the head down may be a vigorous contraction of the diaphragm and abdominal wall supporting the uterine contraction; the removal of these extra-uterine
forces by caudal or spinal analgesia may then be followed by the recession of the head to a level above the "spines" and prolongation of the stage of cervical dilatation. Therefore, a proper rectal examination by the anesthetist must include palpation between, as well as during, uterine contractions.

(2) The next important criterion is the frequency of uterine contractions. The timing should not be that reported by the patient, who is likely to feel that they are more frequent than they really are. The finger should remain in the rectum for the time required to diagnose accurately the frequency, duration and force of uterine contractions. If the head is more than "one finger" below the "spines", the "pains" need not be more frequent than every five minutes. If, however, the level or position of the head cannot be accurately determined, the anesthetist should wait for "pain every three minutes" before instituting relief.

(3) The cervical dilatation is the most difficult to learn of all the physical signs required by the anesthetist. The presence of a tense forebag of amniotic fluid, wrinkled membranes or a large caput succedaneum can deceive the most educated finger. Therefore, during rectal palpation of the cervix, the fundus of the uterus should be pressed downward or the patient made to bear down during a uterine contraction. At times the situation may be so doubtful, especially if it is clouded by uncertainty of the diagnosis of the presentation, as to warrant a sterile vaginal examination by the obstetrician before starting analgesia. The cervix dilated "3 fingers" (6 to 7 cm.) between "pains" marks the proper time to start the analgesia (5). If, however, the head is more than one fingerbreadth below the "spines" and the "pains" are every three minutes, the caudal or spinal may be initiated even if the cervix is dilated only two and a half fingerbreadths. If cervical dilatation cannot be measured accurately the guiding signs should be the frequency of contraction and the level of the vertex.

The multiparous patient should be relieved of her pain at an earlier point in the first stage of labor. When the presentation is occiput anterior the physical signs of readiness for caudal analgesia should be (1) a cervix two to two and a half fingerbreadths (4 to 5 cm.) dilated, (2) uterine contractions recurring every five minutes, and (3) the vertex at the level of the ischial spines or sacrospinous ligaments.

(1) Inasmuch as the cervix of the multipara sometimes is two fingerbreadths open before she is in active labor it is important to be sure that the patient is in active labor by checking the regularity and frequency of labor contractions.

(2) "Pains" every five minutes should be accurately timed to be certain that labor is definite and progressive. When the "pains" are recurring every three minutes, one should watch continuously for rapid dilatation of the cervix. With "three minute pains" we start
the caudal even though the cervical os is only one to one and a half fingerbreadths wide. If, in addition, the vertex is below the "spines," the regular recurrence of pain at intervals of five minutes or less is the signal to start the caudal anesthesia, regardless of the fact that the cervix may be less than two and a half fingerbreadths dilated.

(3) The vertex need be only at the "spines" and not as low as it must be in the case of a primipara. If the cervix is three or more fingerbreadths dilated, the "pains" are every three minutes and the fetal head is being held above the "spines" by a bulging forebag of amniotic fluid, the caudal or spinal anesthesia may be started. The expectation here is that once the amniotic sac has ruptured the head will come down rapidly and the cervix will disappear. If one waits for the vertex to descend under these circumstances the patient often labors painfully to the very end.

A transverse vertex presentation at the time of engagement occurs normally in 60 per cent of deliveries, a posterior in 24 per cent (6). The position at engagement is generally maintained until a low level before anterior rotation occurs (6). During the late first stage and the early second stage an occiput posterior presentation may be found in about 20 per cent of all cases (7). In the absence of caudal or spinal analgesia spontaneous rotation occurs in about 90 per cent of cases. Only 1.6 per cent of all normal deliveries present an occiput posterior at the end of the second stage (7). Under the changes wrought in the forces of labor by caudal or spinal analgesia during the first stage, 55 per cent of occiput posterior presentations persist, and therefore 11 per cent of all deliveries are posteriors requiring manual or forceps rotation (7). This is to be expected largely because of the relaxation of the levator ani, the chief counterforce responsible for the flexion of the head and the anterior rotation of the occiput during descent. An additional factor, especially if the woman has a pendulous abdomen, is the falling forward of the body of the fetus during labor in the lateral position. This favors a pronounced or persistent anterior asynclitism (8), a known cause of persistent occiput posterior presentation. The earlier in labor spinal or caudal analgesia is regularly started the more frequent is the occurrence of transverse and posterior presentations at delivery.

The diagnosis of a transverse or posterior vertex presentation is important to the decision as to when the caudal or spinal analgesia is to be started. The finding of the large fontanelle at the anterior end of the sagittal suture is often difficult to elicit. Therefore, we have paid increased attention to certain suggestive data: undue amount of pain in the lower back during the first stage; location of the cervical os on the posterior surface of the fetal head instead of the usual position at the vertex or on the anterior surface of the head a small distance away from the vertex; finding on rectal palpation that the head seems to be crowding the symphysis pubis and the anterior portion of the
pelvic cavity while there seems to be plenty of space posteriorly between the head and the sacrum; observing that the head remains above the ischial "spines" while the cervical os dilates beyond three fingerbreadths, especially if the lack of descent cannot be attributed to weak "pains" or a large forebag of amniotic fluid. When any one of these suggestive observations is noted we try repeatedly to detect the definitive textbook signs of a posterior or transverse vertex presentation by abdominal and rectal examination.

With a posterior or transverse vertex presentation the caudal analgesia is withheld until the vertex descends definitely below the "spines." This advice holds even if the patient is a multipara and the "pains" are recurring every three minutes. The vertex may not descend below the "spines" until the cervix is fully dilated. Caudal analgesia may therefore be contraindicated until relatively late in labor. It is unfortunate that this situation must exist because the parturient with an occiput posterior presentation usually labors long, hard and painfully— the very type of labor for which this analgesia would be best suited. Demerol or morphine sulfate with scopolamine, pentobarbital sodium or seconal are useful in almost every case, and especially in posterior presentations, to tide the patient over the uncomfortable period prior to the institution of caudal analgesia. General analgesia and sedation may be quite liberal in view of the fact that the final hours of labor are to be conducted under regional analgesia, which has no effect on the respirations of the fetus.

Breech presentations are frequently associated with slow and difficult labors. Caudal or spinal anesthesia should not be initiated until the maximum transverse diameter of the breech is below the "spines." At this time the cervix is often fully dilated and the bottom of the breech is at or near the perineum. In a footling presentation there is a difference of opinion as to the propriety of caudal or spinal analgesia because of the possibility of favoring prolapse of the umbilical cord, owing to the incomplete and imperfect filling of the cervical os by the footling breech. This has not happened in our three instances of this presentation but it is a caution that has been published by Hingson and Lull (8).

Our experience with these less common presentations proves, contrary to some over enthusiastic reports, that caudal or spinal analgesia even only to the tenth thoracic neural level decreases the forces of labor. Although the caudal or spinal analgesia may be at just the proper level and the proper intensity, the extra-uterine muscular forces are made less effective because of loss of the kinesthetic sense and the "bearing down" reflex and because even a purely sensory block markedly decreases the tone of voluntary muscles.

Caudal and spinal anesthesia up to the tenth thoracic level does not decrease the forces of uterine contractions. In fact uterine contractions become more effective in producing descent of the fetus because of lessened resistance by the relaxed cervix and pelvic floor. Uterine
activity alone, however, is a force sufficient for completion of the first stage and the descent of the head to the perineum only when the conditions are favorable, that is, the presentation is occiput anterior, the pelvis is ample for the fetal head, the uterine contractions are strong, regular and frequent, and the line of resultant force of uterine contraction is directed downward along the proper axis. If the pelvis is tight for the presenting part caudal analgesia must be used with caution, if at all, and with the recognized possibility that it may have to be discontinued. If the pelvic measurements indicate a possible disproportion between fetus and pelvis, caudal or spinal should not be used except for terminal anesthesia. If the uterine force is less than normal, caudal will be required for too many hours. In a posterior or transverse presentation labor is slow and long even with all forces normal and strong. Caudal analgesia should not be applied here until late. The anesthetist must be careful in applying caudal analgesia to the parturient whose uterus is quite protuberant and whose abdomen is very pendulous. If the patient lies on her side the line of uterine force may be inefficient for downward propulsion of the fetus along the axis of the birth canal. A tight abdominal binder and a technic of caudal or spinal anesthesia which permits the patient to lie on her back help to avoid difficulty on this score.

Placenta previa is a definite contraindication to the use of caudal or spinal analgesia. If free bleeding during labor suggestive of this condition should occur during caudal, the latter must be terminated promptly. The vasodilatation produced by the sympathetic block of the caudal or spinal analgesia tends to increase the degree of blood loss and the severity of the circulatory depression associated with marked blood loss. Furthermore, caudal or spinal anesthesia interferes with the effectiveness of the usual treatment of marginal placenta previa, the type commonly associated with active labor. Inasmuch as the preferred method of staunching the bleeding is to rupture the membranes and permit the fetal presenting part to act as a tampon against the placenta, it is clear that caudal or spinal removal of the extra-uterine forces of labor decreases the efficacy of the tamponade.

The anesthetist may sometimes be requested to institute caudal analgesia in a case of cervical dystocia even though the signs do not indicate that the patient is ready for it. The trial is justified because the softening and relaxing effect of caudal or spinal anesthesia enables many patients with cervical dystocia who formerly would have been considered candidates for cesarean section to be delivered from below (9).

Toxic, hypertensive, nephritic and cardiac patients are among those for whom caudal analgesia is of greater value than just the relief of pain. It greatly improves the chance of maternal as well as fetal survival. These patients, however, require extra care during the induction of analgesia. The increased tendency toward primary
shock and its greater hazard in such patients dictate the need for cautious, slow and small additions of anesthetic solution. In these cases, too, the administration of caudal anesthesia may be started earlier than usual to obtain the marked benefits of the caudal other than its analgesic value. This advice is especially valuable for the pre-eclamptic or eclamptic patient who does not respond to routine therapy and for the cardiac patient who should be spared every removable burden of labor.

II. Obstetrical Facts Relative to the Course of Labor and Analgesia

The conduct of labor under regional analgesia by the anesthetist eliminates the tedious waiting formerly the inevitable lot of the obstetrician. A delivery becomes a semi-selective procedure because the fetus and parturient can await the accoucheur, if necessary, without harm for a reasonable period of time. Precipitate deliveries are almost entirely prevented.

The continuous supervision of labor by the obstetrically educated anesthetist removes the uncertain quality of care that affects an obstetrical service from time to time. Observation of the rate and rhythm of the fetal heart and, if the membranes are ruptured, noting the presence of meconium in the vaginal drainage act as guides to the need for urgency. A fetal rate of less than 100 or greater than 180 or a fetal arrhythmia unrelated to uterine contractions indicates an urgent call for the obstetrician while 100 per cent oxygen is administered to the mother for its possible benefit to the fetus (10). The appearance of meconium in drainage amniotic fluid may be a sign of impending danger to the fetus, except in breech presentations when meconium usually is the obvious result of compression of the presenting part. Abnormalities of the fetal heartbeat may warn of knotting, tight looping about the fetal neck or compression of the umbilical cord during fetal descent. Such indirect advantages of caudal anesthesia owing to the constant presence of an interested and trained observer may account in part for the decreased stillbirth rate under caudal analgesia. Furthermore, these fetal accidents are much less likely to happen under caudal analgesia because of the absence of the “bearing down” forces.

The fetal oxygenated blood supply varies directly with the difference between the maternal uterine arterial pressure and the pressure of the uterine muscular contraction. Any fall of maternal blood pressure below normal, just as any increase of uterine contractions above normal, diminishes the effective head of pressure supplying oxygenated blood to the maternal side of the placenta. Intra-uterine fetal asphyxia is a likely sequel to a persistent maternal blood pressure of 80 mm. or less.

The first suspicion of the presence of a posterior presentation may appear to the “caudalist” when the patient continues to complain of
lower back pains in spite of excellent relief of the abdominal pain. In posterior presentations the back pain is so severe that caudal analgesia may be penetrated by the great intensity of the painful stimulus. In 15 per cent of cases Ellis and Sheffery (9) have noted a return of pain, more commonly in posterior positions and usually when the cervix was fully dilated; 50 per cent of the patients who had incomplete analgesias required supplementary anesthesia. The relatively high incidence of these unsatisfactory experiences is attributable in part to their policy of starting a caudal when a primiparous cervix is only 3 to 4 cm. dilated or a multipara is "in active labor and complaining, regardless of the condition of the cervix." Renewed relief may be obtained then only by adding epinephrine hydrochloride to the anesthetic solution to form a dilution of 1:200,000 or by supplanting the caudal with a spinal analgesia.

During his continuous observation of the patient under regional analgesia, the anesthesiologist may aid the progress of labor and help to avoid complications. (1) If the patient lies on her side while under caudal analgesia it may be noted that the cervix dilates more on its lower aspect. Turning the patient so that she lies on her other side then aids dilatation of the previously sluggish part of the cervix. (2) Descent of the head may be obviously delayed by a large forebag of amniotic fluid. The best time for the membranes to rupture is when the cervix is completely dilated (11). Rupture of this sac under sterile conditions, with the permission of the obstetrician, is an easily learned function of the anesthetist. (3) Delay in the progress of dilatation and descent may be overcome by directing the patient to "bear down" when requested by the anesthetist palpating a uterine contraction. The extra-uterine muscular forces, though diminished, may be helpful in shortening the first and second stages of labor, especially in multiparae. (4) Distention of the anesthetized bladder is favored by the free intake of fluid during comfortable labor and should be avoided by catheterization every two hours.

III. Obstetrical Facts Relative to Delivery

When the patient arrives in the delivery room the blood pressure should be checked again because shifting the anesthetized patient from bed to stretcher to delivery table is often followed by a fall in blood pressure. Intravenous or intramuscular injection of ephedrine sulfate or neosynephrin hydrochloride may be indicated. If used, the anesthetist should make certain that the oxytocic soon to be ordered by the obstetrician does not contain the vasopressor factor found in whole extracts of the posterior pituitary gland, for example, pituitrin, infundin, posterior pituitary extract. By suggesting the use of pitocin or ergonovine or both, the anesthetist can prevent an acute and severe rise of blood pressure and, at least, a violent headache which may last hours after the hypertensive has disappeared. 'Synergism between
the vasopressor factor in posterior pituitary extract and ephedrine or neosynephrin has produced so marked a hypertension as to cause an immediate cerebral hemorrhage and permanent hemiplegia. The case was a cesarean section during which the surgeon injected 10 units of whole posterior pituitary extract into the uterus without informing the anesthetist who had given ephedrine just a few minutes earlier to treat spinal hypotension.

The obstetrician may be obliged to bring down one or both legs of a breech or to perform an internal version. The anesthetist then should prepare to administer ether to relax the uterus and facilitate the intra-uterine manipulation which is difficult or impossible under caudal or spinal anesthesia even when the obstetrician attempts to work between contractions.

The fetus usually does not need attention from the anesthetist but occasionally the newborn aspirates blood, mucus and amniotic fluid before its nose and mouth are free of these fluids. This is likely to occur slightly more frequently in a series of deliveries under caudal or spinal anesthesia because of the absence of any narcotic depression of the fetal respiratory system.

CONCLUSION

Greenhill (12) has stated, "There is no doubt that when this procedure (continuous caudal analgesia) is properly performed without any misstep, there is no more satisfactory and pleasant type of analgesia in obstetrics." The safety and analgesic value of caudal and spinal methods depend on the knowledge of anesthesia of the anesthesiologist. The obstetrical advantages obtained by such analgesia depend on the obstetrical knowledge of the anesthesiologist and the skill of the accoucheur. To avoid "any misstep" it is important that the anesthesiologist widen his horizon to include the relevant clinical and physiologic facts of parturition, with especial emphasis on the changes wrought by caudal and spinal analgesia.

REFERENCES


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