

## More Modern Concepts of Anaesthesia in Childbirth

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In Part I contained in the Dalhousie Medical Journal of Spring 1962, the indications for the use of anaesthesia in childbirth were tabulated. Now I would like to describe some of the anaesthesia techniques used, suggesting the ones I find most suitable for the conditions described in Part I.

Whereas anaesthesia techniques have been devised and refined to meet the individual needs of most surgical procedures and are essentially very satisfactory, none have been found to be entirely satisfactory for obstetrics. In fact, as pointed out in Part I(1), very little improvement has been made in the last twenty years. We have merely attempted to adapt the techniques used in general surgery to the special circumstances found in obstetrics. There is urgent need to devise some method of anaesthesia to manage the problems faced in obstetrical anaesthesia.

What are the problems?

1. The obstetrical patient is seldom prepared for anaesthesia, either therapeutically or psychologically. She usually wishes to know when her child is born, yet she does not want to endure undue pain. Her stomach is usually full of undigested food. She is often exhausted, frightened, confused and apprehensive for her infant's well-being.

2. The obstetrical patient is really two patients, whose circulations intermix quite freely, as far as anaesthetic agents are concerned. And yet the aim of obstetrical anaesthesia is to put the mother to sleep while keeping the fetus fully awake. (Impossible, isn't it?)

3. The obstetrical patient is further divided into two parts where anaesthesia is concerned. That is, the uterus (and labour) must not be depressed or interfered with, while the rest of her is rendered more or less insensitive to the stress, strain and stretch of the uterus and birth canal.

Does one still wonder that some obstetricians, realizing these dilemmas, advocate Natural Childbirth? I don't—especially when it is realized that you future obstetricians and general practitioners may find yourselves in situations where anaesthetic facilities are, to say the least, not ideal. But (as stated in Part I) the fact must be faced that there are times when anaesthesia must be provided to enable the successful completion of the natural process 'Childbirth'. But it must also be realized that, although true obstetrical anaesthesia has not yet been discovered, anaesthesia as employed in other types of surgery has been considerably modified and adapted to meet the problems of obstetrics, and when properly administered, can be quite satisfactory; so much so that, in some centres, obstetricians prefer and labouring women demand the abolition of pain in childbirth.

For practical purposes obstetrical anaesthesia can be divided into two types:

A. Conduction anaesthesia. Where one attempts to interrupt the painful stimuli without interfering with the progress of labour.

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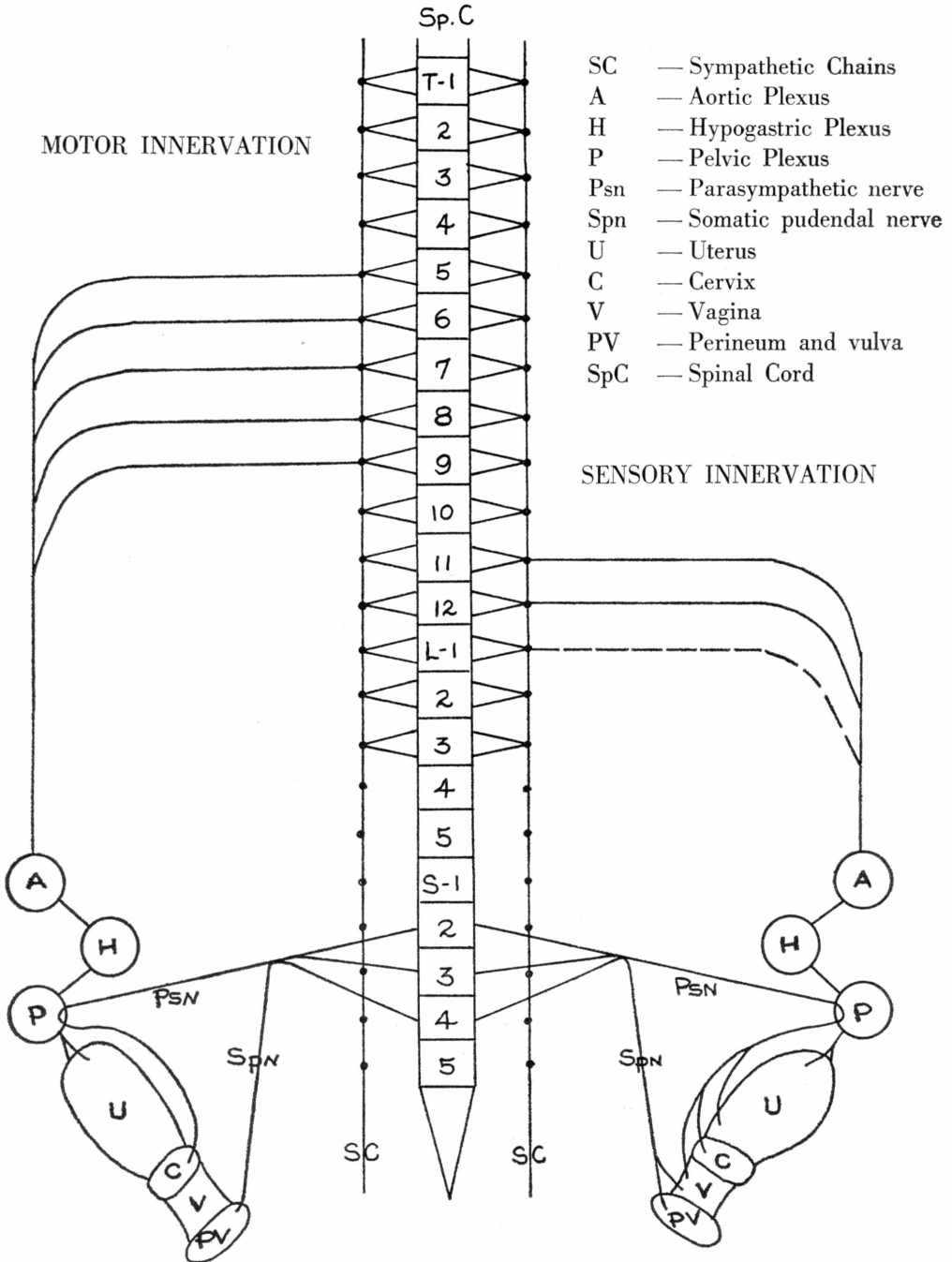


DIAGRAM OF THE PRINCIPAL INNERVATION OF THE FEMALE GENITAL TRACT

(from *A Practice Of Anaesthesia*, W. D. Wylie and H. C. Churchill, Davidson Yearbook Publishers Inc.)

B. General anaesthesia. Where one attempts to provide that level of anaesthesia which will provide just sufficient depression to the mother with absolute minimal fetal depression.

Both methods have their advantages and disadvantages and for both there are definite indications and contraindications. The results are not always what we hope for, but at least we do our best.

#### CONDUCTION ANAESTHESIA:

Conduction anaesthesia consists mainly of the following nerve blocks:

Pudendal

Cervical

Caudal

Lumbar epidural—

Spinal

} Single dose or continuous  
(that is, repeated doses via  
an indwelling catheter)

There are others, such as segmental spinal and epidural, sympathetic and parasympathetic blocks used in special cases, etc.; but these are too elaborate and specialized to be discussed here. Neither will I discuss the technique of each here. These can be learned much better during your rotation in the anaesthesia department.

Whenever relatively large quantities of an anaesthetic drug are used, its absorption may lead to C.N.S. stimulation or depression in both mother and fetus.

At this point it might be of value to review briefly the anatomy of the nerve pathways involved in labour (see diagram) (2). *The propulsive efforts* of the uterus, contributed largely by the longitudinal fibers of the corpus and fundus, are initiated by stimuli travelling via the sympathetic fibers whose central origin lies above the level of the tenth thoracic segment. The oncoming fetus is accommodated by active dilatation of the lower segment of the uterus, that is, by the circular fibers of the lower third of the corpus uteri and those of the cervix. The motor pathways by which this is effected are contained in the parasympathetic outflow from S. 2, 3 and 4. In addition, there is a hormonal factor of possibly equal importance in the control of myometrial activity.

The sensory nerve supply is best described with an account of the course of labour. During the first stage of labour the lower abdominal discomfort is reflexly produced by stimuli arising in the body of the uterus. Afferent nerves from the latter travel via various plexuses of intervening fibers to their cell stations in the 11th and 12th thoracic ganglia of each sympathetic chain. From there the associated white rami communicantes travel via the appropriate dorsal nerve root to synapse in the 11th and 12th thoracic segments of the spinal cord. Pain is therefore referred to the areas supplied by the somatic afferent nerves arising from these segments. The 1st lumbar nerve may also be involved. The low backache component of early labour is associated with the start of cervical dilatation. Stimuli from the cervix are transmitted via the 2nd, 3rd and 4th sacral components of the parasympathetic system, and sensation is appreciated as coming from the site of distribution of appropriate somatic afferent fibers. At the end of the first stage of labour (the cervix being fully dilated), the pain due to the dilatation of the lower uterine segment disappears, while the pain of uterine propulsion continues, transmitted via T-11 and 12 and L-1.

The second stage is now progressing. The pain produced by the head descending on the pelvic floor, distending the vagina and vulva is again mediated by fibers having their central connections in the second, third and fourth sacral segments, but these are somatic rather than parasympathetic and are carried mainly by the pudendal nerve.

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	Relative Potency	Explosiveness	Crosses Placental Barrier	Depression of Uterus	Cardiac Effect		Depression of Respirat'n	Ease of Induction	Toxicity (Liver)	Special Characteristics
					Depression	S to A & O				
Analgesics (Morphine, etc.)			- - - - - -	- -	- -	- -	- - - - - -		-	Nalline and Lorfan are very effective antagonists.
Chloroform	- - - - - -	-	rapidly	- - - - - - - -	- - - - - - - -	- -	- - - - - -	very smooth	- - - - - -	Very useful in emergencies to relax uterus.
Ether (Light) (Deep)	- - - - - -	- - - - - - - -	rapidly	- - - - - -	- - - - - - - -	- -	- - - - - -	difficult	- - -	The old standby. Likely to cause vomiting.
Trichloroethylene (Light) (Deep)	- - -	-	rapidly	- - -	- -	- -	- - - - - -	smooth	- - -	Very useful as a self-administered analgesic. Contact with soda lime—toxic substance=trigeminal neuralgia.
Cyclopropane (Light) (Deep)	- - - - - -	- - - - - - - -	rapidly	- - -	- - -	- - -	- - - - - -	smooth	-	Very useful in emergency. May seriously depress fetus.
Nitrous Oxide	Analgesic only +	-	rapidly	-	-	-	-	very slow	-	Ideal analgesic in labour. Danger of anoxia from too high concentration.
Ethnothane (Light) (Deep)	- - - - - -	-	rapidly	- -	- -	- -	- - - - - -	smooth	- - -	Very potent, difficult to handle. Very useful to relax uterus. Danger of post-partum haemorrhage.
Barbiturates (Pentothal or Brietal)	Hypnotic	-	rapidly	- - -	- - -	-	- - - - - -	very smooth	- - -	Very useful for induction, in minimal dosage. Used in combination with N <sub>2</sub> O and O <sub>2</sub> and muscle relaxants.

to A and O—Sensitizes myocardium to adrenaline oxytocics.

Any pain during the third stage will be associated with strong uterine contractions (T-11 and T-12); vaginal discomfort due to the passage of the placenta is fleeting.

The pudendal block should really be part of "Natural Childbirth". It is usually performed by the obstetrician and is useful only during the second stage of labour when the vagina and perineum are being stretched by the oncoming head. It is perfectly satisfactory for episiotomy and even for very low forceps delivery, keeping in mind that it provides no relief for the discomfort from too forceful traction on the forceps, particularly when applied between contractions. **WARNING**—Always be extremely careful of the solution used for this procedure and for infiltration in the perineum. Too much vasoconstrictor agent in the solution can cause necrosis when infiltrated into the stretched, torn, devitalized perineal tissues. When a vasoconstrictor is wanted, it is safer to use solutions containing this substance, as supplied by the manufacturers, rather than to add adrenaline to the solutions.

Caudal and lumbar epidural blocks are essentially the same. In the former the needle is inserted into the end of the sacral canal, not too far from the anus, and with this procedure the mother is more prone to infection. There is always the danger of entering the dura resulting in a massive spinal anaesthetic, with cessation of labour and severe hypotension. Being technically rather difficult and time-consuming, these techniques are not very suitable in emergencies, but are ideal when started during the first stage by the continuous technique. Under such circumstances ideal anaesthesia without interference with labour or the fetus is provided, but requires prolonged supervision.

Spinal anaesthesia (single dose technique) is an ideal anaesthetic for the second stage of labour. Technically it can be difficult, as the level of anaesthesia may be difficult to control. The risks of slowing or stopping labour and of hypotension are greater than with careful epidural anaesthesia, and there is the ever-present possibility of post-spinal headaches. Both spinal and epidural anaesthesia tend to increase the tone of the uterus and are therefore contraindicated in all cases where the fetal circulation appears to be impaired.

#### GENERAL ANAESTHESIA:

The only drugs used in general anaesthesia or analgesia which do not cross the placental barrier in significant concentration are the muscle relaxants. All other agents enter the fetal circulation at varying rates but eventually reach a similar concentration in the maternal and fetal circulations. The capacity of a drug to reach the fetus depends not only on its ability to pass through the placenta, which is determined by its molecular structure, but also on the route by which it is administered

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to the mother, or the speed at which it is broken down and at which it is distributed to the mother's tissues. Breakdown and elimination of a drug takes longer in the fetus than in the adult so that the passage backward may be slow (3).

Space does not permit discussion of all the general anaesthetic agents used in obstetrics. The accompanying table attempts to summarize some of the actions of the most commonly used agents and drugs.

A few points may be emphasized:

1. The danger of using an anaesthetic machine employing CO<sub>2</sub> absorption after the patient has received trichlorethylene.
2. The danger of using adrenaline and like drugs, or oxytocic agents with such anaesthetics as cyclopropane and fluothane.
3. The danger of prolonged uterine relaxation after chloroform and fluothane anaesthesia.
4. Neither nitrous oxide nor the barbiturates can be considered as anaesthetic agents when used alone.
5. The fact that the depression produced by the analgesic drugs (Demerol, etc.) is readily reversed by the use (intravenously) of the antagonists, Nalline or Lorfan.

However, the greatest anaesthetic hazard to the mother is from aspiration of stomach contents. The passage of food through the stomach is extremely variable during labour. With uterine inertia there is often a progressive paralytic ileus, and abstention from taking fluids by mouth will not prevent the stomach filling up with the typical "pond water" fluid.

The management of such cases is most difficult, and many recommend emptying the stomach before starting anaesthesia. This can be accomplished by passing a large bore stomach tube which is most unpleasant and almost invariably produces emptying by vomiting, or by the administration of apomorphine to induce vomiting (4). Three milligrams (1/20 gr.) of apomorphine is diluted with 10 c.c. of sterile water and just sufficient of this is injected intravenously to cause efficient emptying of the stomach. Once vomiting starts, atropine should be given as an antidote and to prepare the patient for anaesthesia.

Even more insidious and dangerous is the aspiration of extremely small amounts of acid gastric secretions. This can occur when one believes the stomach to be empty. It occurs during induction and may produce relatively little disturbance at the time, but several hours later the patient becomes severely ill, with cyanosis, dyspnea and tachycardia, and may succumb (Mendelson's Syndrome) (5). Treatment is rather unsatisfactory, consisting of the administration of oxygen, antispasmodics or anti-histaminics and possibly bronchoscopy. Housman and Lund, 1955 (6), considered that suprarenal deficiency explains the particular proneness of obstetric patients to this condition and suggested the administration of large doses of hydrocortisone (now up to 400 mgm. are given intravenously within a few hours).

The greatest danger to the fetus is anoxia. Kingston and Hellman, 1956 (7), gave five physiological factors as necessary for maintaining adequate oxygenation of the fetus. These are: adequate maternal oxygenation and blood pressure, adequate placental attachment and circulation through the cord, and sufficient relaxation of the uterus.

The blood pressure in the placenta is the difference between the maternal systolic blood pressure and the intrauterine pressure, to which both uterine and abdominal wall muscles contribute. Contractions during labour impel blood from the placenta

to the inferior vena cava and thus improve circulation, but during actual contraction the circulation is held up and sustained uterine tone impedes the blood supply to the fetus.

Therefore, the anaesthetist must have well in mind the probable state of fetal oxygenation and the effect of his procedure upon it, for interference with it may be more harmful than the effects of moderate sedation. Chloroform, ether and fluothane produce marked uterine relaxation while nerve blocks (epidural and spinal) increase uterine tone, and muscle relaxants have no effect.

Evans and Gray (3) state that from the data available the anaesthetist chooses the technique that best suits the case, according to *his individual experience and predilections*.

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