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INTRADERMAL ANESTHESIA DURING FIRST STAGE LABOR

by

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TABLE OF CONTENTS

INTRODUCTION	3
TECHNIQUE OF ADMINISTRATION	4
SELECTION OF CASES STUDIED	8
MECHANISM OF ACTION	10
EFFECTIVENESS OF ANESTHESIA	12
SUMMARY	18
OBSERVATIONS	20
CONCLUSIONS	21
SELECTED REFERENCES	23

INTRODUCTION

Intradermal anesthesia to obliterate pain at the site of reference during the first stage of labor was first used by David Rose (1) at the Boston City Hospital. He submitted a preliminary report to the New England Journal of Medicine in June 1928 on the use of local novocaine as an agent to break the pain reference arc in first stage labor. Rose was familiar with the work of Weiss and Davis (2) in using local intradermal anesthesia to obliterate the referred pain associated with visceral disease and was the first to apply this principal to obstetrical management.

In spite of Rose's enthusiastic article, there was no further mention of this technique in the literature until 1950 when Abrams (3) reported in the October 26th New England Journal of Medicine on a series of forty patients in which he used intradermal infiltration anesthesia to control pain during the first stage of labor.

Kovarick and Hegedus (4) have submitted a report for the University of Nebraska College of Medicine, Department of Obstetrics on the same topic to be published in the April 1951 Nebraska State Medical Journal.

All of these found intradermal infiltration anesthesia to be effective in reducing the pain of first stage labor and have attempted to call it to the attention of the medical profession for further evaluation.

TECHNIQUE OF ADMINISTRATION

During the contractions of the first stage labor, mothers complain chiefly of lower abdominal pain and pain in the region of the sacrum.

According to Cleland (5) this pain is chiefly made up of two components.

A. That due to uterine contraction which is transmitted by afferent fibers through the eleventh and twelfth thoracic roots.

B. That due to stretching of the birth canal transmitted through undetermined sacral roots.

Since the results of Cleland's discoveries concerning the sensory innervation of the uterus had not yet been published, Rose still believed that painful sensation from the uterus was transmitted by afferent fibers of the ninth through the twelfth thoracic, the first lumbar, and the third and fourth sacral nerve roots. He did not attempt to block the entire cutaneous distributions of these nerves but instead determined what he believed to be the definite areas of referral on the abdomen and experimentally developed his technique of infiltration.

Using 2% novocaine as an anesthetic, Rose obtained the best results when he infiltrated intracutaneously the following areas:-

1. A line from the height of the fundus to just above the umbilicus.

2. A line on the right side one inch medial to the anterior-superior iliac spine conforming to the curve of the uterine corpus and overlying the inguinal ligament curving medially downward terminating in the midline over the superior margin of the symphysis.

3. A third line similar to the second but on the left side.

Rose experimented using subcutaneous infiltration in the same areas and found this far inferior to intradermal infiltration.

Abrams, however, based his choice of areas for infiltration on the anatomical cutaneous distribution of the eleventh and twelfth thoracic and the sacral nerves. Anatomically, cutaneous branches of the eleventh and twelfth thoracic nerves supply the skin of the lower hypogastric area of the abdomen near the midline. The lateral cutaneous branch arising from the twelfth thoracic root reaches the skin a short distance above the iliac crest sending a filament medially along the iliac crest and then passes downward to the skin of the buttocks. Both the iliohypogastric and the ilioinguinal nerves communicate with the twelfth thoracic and supply the skin over the inguinal ligaments and the symphysis. The sacral nerves supply the cutaneous branches over the sacrum and the sacro-iliac joints. Abrams states, "Close questioning of patients in first stage labor reveals consistent reference of pain to the areas of the skin supplied by the nerves mentioned above."

In infiltrating the skin Abrams starts at the midline just above the symphysis pubis continuing the infiltration in a linear

fashion intradermally first to the left and then to the right above the inguinal ligaments out to the anterior-superior iliac spines and then up the midline of the abdomen for a distance of 7.5 cm. extending the infiltration laterally on each side 2.5 cm. When the patient complained of associated back pain, the skin area over the upper sacrum and sacroiliac joints were infiltrated also.

Abrams employed a solution of 1% novocaine with epinephrine 1:100,000 on a few cases; a solution of .1% pontocaine on a few others; but on most, he employed 1.5% metycaine with epinephrine 1:200,000 using approximately 30 cc in abdominal infiltration and about the same amount over the sacrum.

Kovarik and Hegedus followed a technique similar to that of Abrams in infiltrating abdominal sites of pain referral. However, they routinely infiltrated the sacral area in all patients using the following method:- The patient was turned on one side and a wheal one finger's breadth in diameter was made intradermally at the base of Michael's rhomboid. The wheal was then extended in the shape of a "V" to the posterior-superior spines on each side. In infiltrating, they used either a solution of $1\frac{1}{2}$ % metycaine in saline or 1% novocaine in saline with adrenalin 1:250,000.

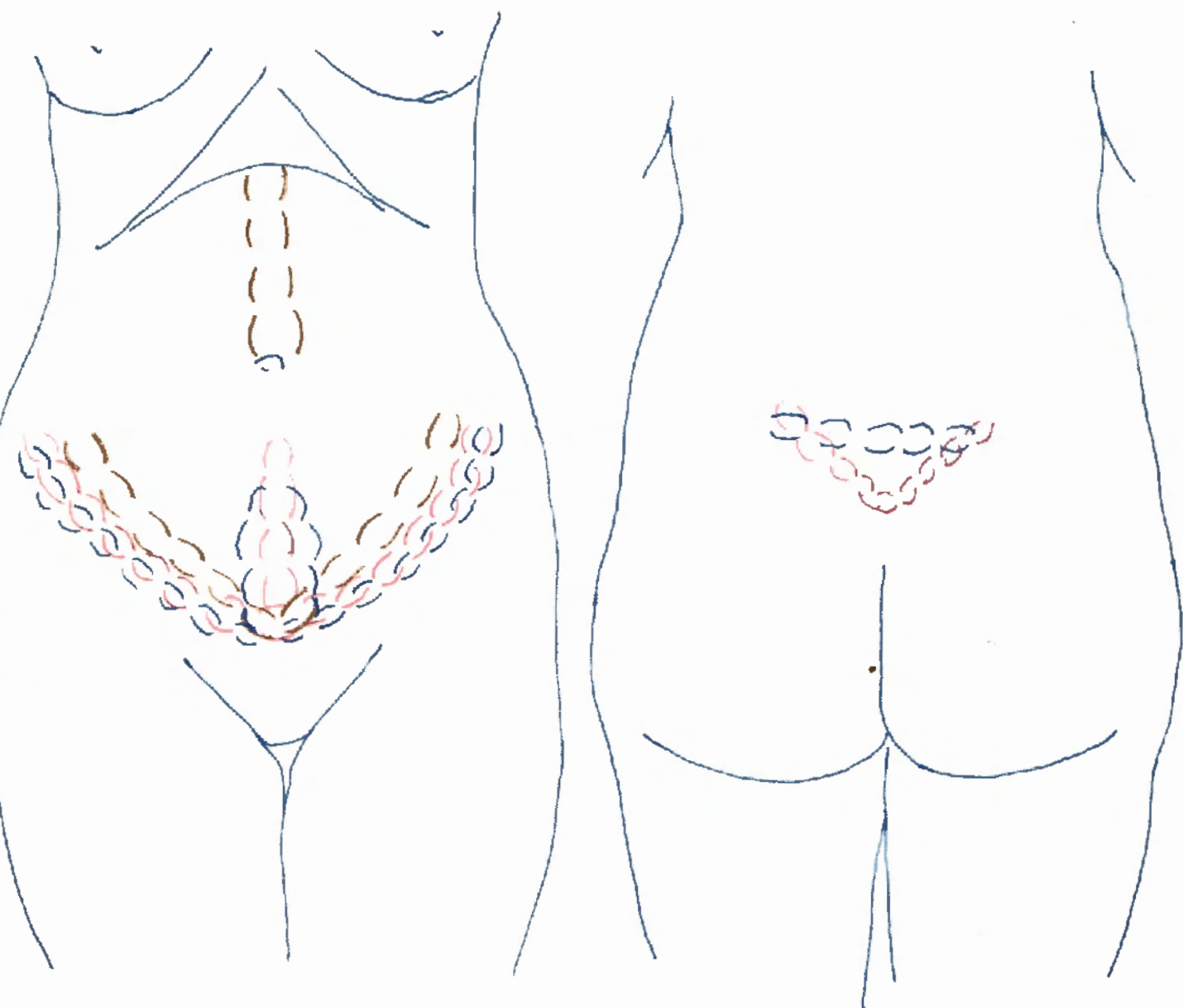


FIGURE I.

of wheals
 Distribution over abdomen and back as employed by Rose, Abrams,
 and Kovarik and Hegedus.

Rose ()

Abrams ()

Kovarik and Hegedus ()

SELECTION OF CASES STUDIED

Rose's report includes 100 patients which he states were unselected but were done as time and circumstances permitted. Most were clinic patients at the Boston City Hospital. A few were done in the author's private practice. At the time the anesthetic was administered the average cervical dilatation was 2 to 3 fingers. Of the 100 cases 43 were primiparas and 57 were multiparas.

Abrams also states that the cases in his series were unselected. The only criterion for administration of the medication was the presence of painful contractions. His report covers 40 cases, 20 of which were ward patients and 20 private patients. Ward patients were not informed as to what was being done or what was hoped to be accomplished by the injection. Private patients were informed in detail about the procedure and only those who expressed a desire for this type of anesthesia received it. Eighteen patients were primiparas and twenty-two multiparas.

Kovarik and Hegedus studied 29 patients; 12 in private practice and 17 on the University service. Cases were selected early in the first stage of labor without premedication. Criteria for selection included:-

1. Normal pelvis
2. Longitudinal presentation
3. Presenting part above the ischial spines
4. Contractions regular and painful
5. Dilation progressing but not complete

Contraindications included:-

1. History of previous sensitivity to local anesthetic
2. Abnormal presentation or contracted pelvis
3. Dermatitis or the presence of skin infection including pilonidal cysts.

Private patients were informed of the purpose and objective of the injection just before it was given. Ward patients were given no information. Eleven patients were primiparas and 18 were multiparas.

MECHANISM OF ACTION

The nature and mechanism of true and referred visceral pain have been extensively studied and discussed and are still highly controversial subjects. A thorough consideration of these lies beyond the scope of this paper. However, in order to evaluate the findings of those who have worked with intradermal infiltration anesthesia in the control of pain during first stage labor a limited discussion of these subjects is necessary.

Though Cleland's work with paravertebral anesthesia did much to clarify our understanding of the sensory innervation of the uterus there remains much to be learned about the mechanism of pain referral from its site of origin in the uterus and birth canal to certain circumscribed cutaneous areas.

This problem has been the subject of much study since 1763 when Haller (5) declared that visceral pain did not exist. Head (6) in 1893 stated that there are two forms of visceral pain - - direct and referred. Lennander (7) in 1901 stated that abdominal pain was due to stimulation of somatic nerve terminals in the parietal peritoneum on the root of the mesentery - and therefore, that true visceral pain was impossible. Hurst (8) in 1911 showed that true visceral pain does exist but that this pain requires an "adequate stimulus" for it to be elicited. Tansion rather than cutting or burning provides the necessary stimulus. In 1920 Mackenzie (9) published the following theory suggesting

the mechanism involved in producing referred pain. Irritation of a viscus produces a parade of nervous impulses which pass from the irritated viscera along the splanchnic nerves to certain segments in the cord. Perpetual bombardment of this cord segment with visceral impulses gives rise to an "irritable focus" in the cord. Normal afferent impulses arising from skin, muscle and peripheral structures which traverse this segment now enter a cord region which is abnormally irritable, and are transmitted via cord pathways centrally where they are interpreted as pain in the peripheral structures from which the normal impulses spring.

It is difficult to correlate the phenomena of relief of pain from uterine contraction by intradermal anesthesia at the site of reference entirely with the findings of any one of the above. Apparently the forceful contraction of the uterina ordinarily provides the adequate stimulus to produce pain only when it is reinforced by normal cutaneous stimuli which traverse the same cord segment. Perhaps rather than an "irritable focus" in the cord, the two groups of impulses, visceral and cutaneous, converge on the same secondary afferent neuron with sufficient intensity to exceed the threshold necessary for impulses to be transmitted centrally and interpreted in the brain as pain.

EFFECTIVENESS OF ANESTHESIA

Rose states that his patients usually pointed out the areas of pain by sweeping a hand over the abdomen from the fundus of the uterus down to the symphysis and laterally over each of the inguinal ligaments. Then a hand would be placed over the small of the back. After a line of skin had been infiltrated from fundus to umbilicus, pain was felt in only the two lower quadrants and back. Then when the area over the right inguinal ligament had been infiltrated, pain was felt over the left lower quadrant and back. When the area over the left inguinal ligament was also infiltrated the patient declared herself to be free of abdominal pain. The pain referred to the back was least successfully relieved by novocaine.

Of 100 patients 94 had moderate to complete relief of abdominal pain following intradermal infiltration lasting two hours or more. Six patients had little or no relief. The latter group includes those who had less than two hours of analgesia exclusive of the cases who delivered within two hours of the time of infiltration. Of the six failures four received no analgesia from the infiltration, Rose states that on these the lines and technique of infiltration were apparently correct, that the patients were not neurotics and that no adequate explanation for the poor results can be shown. Of the two other failures one was a highly neurotic patient who bore pain very badly. The other achieved slight relief only and

investigation disclosed faulty infiltration.

On five patients reinfiltration was attempted in an effort to extend the period of analgesia after the effect of the first infiltration had worn off. This was moderately successful achieving from two hours and fifteen minutes to three hours and forty-five minutes additional analgesia. In two of these, uterine contractions had ceased for an unstated period of time after the first infiltration but before the second had begun again.

The maximum period of analgesia obtained from a single infiltration was six hours. The average period of analgesia for the entire series was two hours and fifty-four minutes. This was sufficient time to maintain continuous analgesia throughout first stage labor on 5% of the cases.

Rose remarks, "As a rule the patient is decidedly cooperative. She complains of no pain, merely a sense of pressure and a feeling that something wants to come out." However, she further states that the infiltration does not attempt to relieve any of the back pain that is concomitant with the progress of labor. He believes that the back pain is due not only to the stretching of the cervix but also to direct pressure on the sacral plexus concluding that although infiltration blocks the skin reflexes it can have no effect on the plexus itself which he states is the seat of the difficulty. He continues to remark that he does not claim this technique to be a panacea for the pain of the first stage of labor but that it does produce considerable relief.

Abrams found that pontocaine and novocaine anesthesia produced analgesia for two to three hours, whereas metycaine offered relief from pain for as long as six hours.

Of the forty patients in Abrams series, twenty-two had complete relief of cutaneous pain in both the abdominal and back regions. Fifteen continued to have sufficient backache to cause the patient to mention but did not require further analgesia. Two continued to have painful backache requiring additional medication as labor progressed. One patient had little or no relief of either abdominal or back pain. Her labor was extremely active and her cervix dilated rapidly.

Though the back pain was relieved in only slightly more than half of his patients, Abrams states that following infiltration those in which it persisted described it voluntarily as an ache. Some of these patients complained of back pain early in labor before the presenting part had become engaged. Abrams also observed that at a dilatation of $3\frac{1}{2}$ - 4 fingers most of his patients complained of deep pelvic pain or pressure which in some cases radiated down the anterior surface of the thighs. The latter he attributed to the stretching of the tissues surrounding the birth canal and to direct pressure upon the nerve roots of the sacral plexis.

Abrams points out that the effectiveness of this anesthesia is simultaneous with its administration, which in no way causes an alteration of the uterine tone or the frequency,

intensity or duration of uterine contractions.

Abrams also felt that this series of cases in general showed evidence that the actual process of labor for many patients was shorter than in those he has observed under conventional methods of pain control. He further states, "One thing that must be stressed as occurring uniformly in this group is the spontaneity with which the infants cried and the pinkness of their color immediately upon birth".

His patients received an average of three hours and nine minutes analgesia from the infiltration. This was sufficient to maintain 28 or 70% throughout the first state of labor without the benefit of additional analgesia. However, he routinely administered second stage anesthesia in the form of either a single caudal injection, saddle block, pudendal block or nitrous oxide, oxygen, and ether when dilatation of the cervix had reached $3\frac{1}{2}$ to 4 fingers.

Kovarik and Hegedus report that of 29 patients 24 (83%) achieved partial to complete relief of pain. In most of the failures labor had progressed to complete dilation of the cervix before the injection was completed. The maximum duration of analgesia obtained was two hours and forty-five minutes.

	DURATION OF ANALGESIA			
	Failure	1 Hr.	2 Hrs.	Over 2 Hrs.
U. of Nebr. Hosp.	3	5	4	5
Private	1	2	4	5

In many instances when the patient complained of a return of painful contractions the cervix was completely dilated with the presenting part well down in the pelvis. In other cases when the injection was made very early in labor examination after the recurrence of pain showed that though the cervix had progressed to only 2-3 fingers of dilation the presenting part had descended well below the ischial spines.

The average length of labor in multiparas was 6.21 hours and in primiparas, 13.5 hours. It was the author's impression that labor was shortened following infiltration.

Three of these were premature deliveries. Only one showed evidence of respiratory difficulty.

Four patients received supplemental analgesia either after the intradermal analgesia had worn off or if the infiltration was not effective. The authors listed three principle objections to this procedure:-

1. Ecchymotic areas form at the line of the injections. These may take several weeks to disappear and in some patients were still present as darkly pigmented areas six months after the injection (11).

2. Patients complain of considerable discomfort during the infiltration.

3. Duration of analgesia is relatively short.

In a personal communication, Dr. L. D. Odell, Chairman of the Department of Obstetrics at the University of Nebraska

Hospital, mentioned that a large number of the patients in this series showed evidence of a moderate degree of excitement following infiltration. Many of them seemed disturbed at ^{the}sudden loss of pain and would remark accusingly, "You've stopped my pains!" Since the infiltrating solution contained adrenalin this phenomenon may represent a mild adrenalin reaction.

SUMMARY

The technique of intradermal infiltration with a local anesthetic agent for control of pain during first stage labor has been studied clinically by three different groups of workers - Rose, Abrams, and Kovarik and Hegedus.

The technique employed varied slightly among each of the groups. The best results were obtained by Abrams who achieved moderate to complete relief of pain in 97.5% of his cases. Of Rose's series 94% secured moderate to complete analgesia, while Kovarik and Hegedus report 83% success in moderate to complete relief. The latter series was much smaller than the first two perhaps partially explaining the variation in results.

The maximum duration of analgesia in the series of Kovarik and Hegedus was two hours and forty-five minutes. Rose and Abrams report a maximum duration of analgesia of six hours. The average duration reported by Rose was two hours and fifty-four minutes; by Abrams, three hours and nine minutes.

A total of 169 cases were studied. Moderate to complete analgesia was attained in 93% of these.

Both Kovarik and Hegedus, and Abrams report the impression that following infiltration, labor was shortened. All three groups observed that following a labor conducted under this management infants cry readily at birth and suffer no depressive effect.

Kovarik and Hegedus listed three principle objections to this method;

1. Ecchymotic areas form at the site of the infiltration requiring weeks to months to disappear.

2. During infiltration patients complain of considerable discomfort.

3. Duration of analgesia is relatively short.

OBSERVATIONS

It is interesting to note that most of Abrams' patients complained of deep pelvic pain at a dilatation of $3\frac{1}{2}$ to 4 fingers. He attributes this sensation to the stretching of tissues surrounding the birth canal and to direct pressure upon the roots of the sacral plexus. Perhaps, instead, this is the true visceral pain demonstrated by Hurst. Tension produced by the pressure of the presenting part at the cervical os might well provide the adequate stimulus. Why it is felt at the site of origin rather than being referred to a somatic structure remains a question.

The lack of success in relieving back pain suggests that it may have more than one component. Since it was relieved in about 50% of Abrams' cases a part of it is apparently referred from uterus to skin. A second part possibly originating due to pressure on the sacral plexus may be referred to deeper structures making cutaneous infiltration less effective.

CONCLUSIONS

The advantages and disadvantages of intradermal anesthesia during first stage labor established in this paper follow:-

- ADVANTAGES.
1. Safety and ease of intradermal infiltration.
 2. Effective relief of pain in 93 percent of the cases studied.
 3. Relief of pain simultaneous with administration of medication with no alteration of uterine tone or the frequency, intensity and duration of uterine contractions.
 4. Elimination of depressant analgesic drugs.
 5. Apparent shortening of the length of the first stage of labor.

- DISADVANTAGES.
1. Ecchymoses at the site of infiltration.
 2. Discomfort to patient during infiltration.
 3. Relatively short period of analgesia.

With these in mind it appears that the judicious use of the technique under discussion deserves a place in the armamentarium of every doctor who engages in the practice of obstetrics. Its chief indication is the presence of painful contractions in cases where either mother or child is in a debilitated condition making the use of a systemic analgesic or depressant agent inadvisable. As suggested by Abrams, parturient patients with cardio-vascular-renal disease, impaired liver function or blood dyscrasias might best be relieved of

pain in labor in this manner. In cases of prematurity or Rh incompatibility with evidence of sensitization this technique promises to be especially valuable.

At present this procedure is being used by the Johns Hopkins University Department of Obstetrics with a new type of hypodermic needle devised especially for intradermal infiltration which does away with most of the discomfort of the infiltration itself. Perhaps with further use and improvement in technique the disadvantages mentioned above may be greatly reduced enhancing the value of intradermal anesthesia as a major tool in controlling the discomfort associated with child birth.

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