INFLUENCE OF ANALGESICS ON PAIN INTENSITY
DURING LABOR

(WITH A NOTE ON "NATURAL CHILDBIRTH")

CARL T. JAUER, M.D., AND JAMES D. HARDY, PH.D.

New York, New York

Received for publication August 9, 1950

The effects of various analgesic agents on the pain intensity of normal patients during the first stage of labor are considered in this article. It continues a study previously published on the intensity of pain in childbirth (1), and represents the first clinical use of the Hardy-Wolff-Goodell (2) dolorimeter for such a purpose. This apparatus has heretofore been employed as an instrument to study pain thresholds of normal subjects receiving analgesia in the laboratory (3). Pains of different intensities were produced on the skin of the patients in labor for comparison with the actual labor pains. The practicability of this method was demonstrated in the first article (1) and is again observed in this study of patients receiving analgesia during labor.

Although the literature contains many clinical investigations on analgesia in childbirth, quantitative methods for the study of drug actions on obstetrical patients have not been employed in the past. Representative studies (4, 5, 6) appraise pentobarbital and scopolamine, demerol and scopolamine, and apomorphine and scopolamine, respectively, as 86, 72 and 90 per cent successful. These appraisals are based on patients' statements obtained after delivery as to the degree of amnesia produced by the drug, on the degree of analgesia (5) or by the recollection of incidents during labor (5, 6). Since a general anesthetic is often employed for the actual birth, it may contribute to the patient's inability to remember pain after the labor, making such clinical evaluation of drugs employed in the first stage of labor less reliable. Therefore, these statistics appraise an entire analgesic and anesthetic technique composed of several drugs and methods rather than any one of them. They have value in terms of amnesia and hypnotic effects but are not a true index of the amount of actual analgesia obtained during labor. The physician has tried to estimate this in terms of the patient's

* From the Departments of Obstetrics and Gynecology and Physiology, Cornell University Medical College, and the New York Hospital, New York, N. Y., and the Russell Sage Institute of Pathology.

† This work has been supported in part by funds from the Office of Naval Research of the United States Navy.

‡ Dolorimeter—an apparatus for the measurement of pain.
reaction, lacking more specific methods of analysis provided by dolorimetry.$

During the past century obstetricians have learned by trial and error to employ various amnestic, analgesic, hypnotic and anesthetic scopalamine, and sterile saline solution on pain intensity during labor. Certain methods have gained widespread popularity only to be discarded for newer technics. A voluminous literature must be omitted here since other publications include much information on the subject (7, 8, 9, 10, 11). Suffice it is to say that a time-honored regimen includes a combination of agents such as a preliminary dose of a barbiturate, repeated perhaps, followed by morphine and scopalamine when the pains are more severe, and inhalation anesthesia of some type for the delivery.

\[\text{Fig. 1. Pain intensity measured in dols on 26 patients during labor before induction of analgesia or anesthesia. For convenience, the first stage is divided into quarters. Approximately 100 values are plotted. Each one represents an average of several determinations.}\]

The purpose of this study was to measure the analgesic action of morphine, scopalamine, morphine and scopalamine, morphine and demerol, demerol, demerol and scopalamine, heroin, apomorphine and scopalamine, and sterile saline solution on pain intensity during labor. A statement is also included concerning pain experienced in “natural childbirth” (12, 22, 23) because the first article (1) was prompted by the observation of one obstetrician (12) that a large number of women had painless labors. His most recent publication (13) indicates that 50 per cent of 481 patients received no sedatives, analgesics or anesthetics, although the rest received such agents.

The preliminary paper (1) presented data on 13 patients who were studied before analgesia. Similar studies have been continued on 13

$\text{Dolorimetry—the science of measurement of pain threshold and pain intensity.}$
INFLUENCE OF ANALGESICS ON LABOR PAIN INTENSITY

additional patients, making 26 subjects whose pain intensity has been measured in childbirth, as shown in figure 1. All of these patients experienced a gradual increase in pain intensity from 0 to 10½ dols, which can be correlated with the increasing tempo of labor as determined by the greater duration of the uterine contractions, a decrease in the contraction interval, together with gradual dilatation of the cervix. The use of the dol scale as a quantitative measure of pain intensity has been discussed elsewhere (14, 15).

Early in the first stage of labor, the pain intensity is slight and equivalent to 1 or 2 dols. It gradually increases to the severity of menstrual cramps, 3 to 4 dols. Midway in labor the pain increases from 5 to 7 dols, or moderate severity, and the patient may utter short, low-pitched cries. When the cervix is fully dilated the pain intensity is approximately 8 to 9 dols. As the head dilates the perineum in the second stage, the pain is of maximum intensity, reaching 10½ dols and the patient’s cries become sharp and shrill. This is the “poena magna” of the early Romans, or the “great pain,” which is a ceiling pain.

The pain intensity of 26 patients in labor was measured before analgesia, and these data are presented in figure 1. Nineteen patients were subsequently given analgesia on request or when the obstetrician considered it to be indicated. These 19 patients constitute a group on whom the effectiveness and mode of action of various analgesic drugs in moderate doses were studied during labors, and form the basis for

†A dol is a unit of pain approximately equal to one-tenth of the greatest painfullness, or ceiling pain.
this article. Qualitative study of these drugs during labor, and not after its completion, represents a pharmacologic advance in obstetrics.

During a labor lasting eighteen hours a normal primipara may have more than 200 uterine contractions resulting in pains which increase in intensity with the dilatation of the cervix. In the second stage she may have 10 to 50 uterine contractions which, together with the stretching of the perineum, produce the "great pain." The thermal stimulus required to duplicate the intensity of 4 of these second stage pains resulted in second degree burns on the hand of Mrs. S. A. (fig. 2). It was the expressed wish of this patient to cooperate completely even though she had been warned in advance that blisters would occur. The doctor-mothers studied by Conrad (16) were almost unanimous in their praise of chloroform anesthesia given at this time.

It is not expected that dolorimetry will supplant careful clinical observations of the effects of an analgesic. Because of their tedious and difficult nature, these measurements can be carried out on only relatively few patients. They can, however, supplement and do orient the clinical investigation into the many-sided problem of obtaining the most suitable analgesic for the particular situation. For example, an obstetrical analgesic must be considered as to its effects on the infant, on the total duration of labor, on the blood loss, the incidence of operative delivery and so forth, in addition to the appraisal of its analgesic and amnesic properties.

It should be pointed out that quantitative measurements of pain threshold-raising action of an analgesic in animals or in normal human subjects in the laboratory (3) do not necessarily compare with results obtained in the actual patient. Snyder (11) is not entirely justified in correlating the threshold-raising effects of analgesics as found by Wolff, Hardy and Goodell (3) working on normal subjects with the effects of these analgesics on patients in labor who are suffering from intrinsic pain caused by a contracting uterus and a dilating cervix. Measurements of pain intensity and the analgesic action of a drug administered to a patient actually suffering from pain are required when seeking data for accurate evaluation of the agent.

**Method**

Of the 26 carefully selected patients studied **before** analgesia, 19 form a group studied **during** analgesia. Five patients were studied in "natural childbirth" (12, 22, 23) and of these, 3 were given analgesics, in one of whom pain was evaluated thereafter. Finally, 3 other patients were studied before and after a hypodermic of sterile saline. Measurements of pain threshold and pain intensity were made chiefly during the first stage of labor. None of these patients had been studied in a previous labor. The entire study, however, has been in progress for nearly three years, and 2 patients (Mrs. F. and Mrs. H.) have re-
turned in a second pregnancy and have again consented to be studied during another confinement.

The 19 patients receiving analgesia had a total of 26 injections for evaluation, as will be described in illustrations and tables. Most of these were private patients keenly interested in the study. For the most part, primiparas were studied since their labors are generally longer, giving more time for observation, although 5 multiparas were included. All had normal pelves and normal antepartum courses. They were also selected during the antepartum period on the basis of intelligence and willingness to cooperate and included nurses, one doctor and several wives of physicians. These subjects had been carefully instructed in the procedure for making pain threshold determinations and for making comparisons between pains of different intensities.

Briefly, the method of testing was as follows: The painful sensation was induced by a three-second exposure of the skin of the subject to an intense thermal radiation. The stimulus was applied with the pain apparatus (2) and care was taken to check its calibration before studying each patient. The pain threshold was measured by increasing the intensity of the stimulus during a series of four or five exposures until the patient reported a barely perceptible pricking pain at the end of the three-second exposure. During labor, pain threshold determinations were always made between uterine contractions. Pain intensity was measured by asking the patient to compare the greatest intensity of pain during the uterine contraction with that produced by the heat applied to the skin. In spite of the longer duration of the labor pains, their different quality and locale from the test pain, reproducible comparisons could be made as the pains increased (or decreased) during labor, as shown in figure 1. Two tests agreeing within 1 dol were averaged to make one measurement. Wide variations in measurements of intensity on successive tests were encountered in one patient, and the patient remarked on the difficulty of comparing the labor pains with those induced by the pain machine. She commented that the labor pains were much longer than those due to the pain machine and that they did not "feel the same." This patient finally became so hostile that attempts at further measurements were abandoned. It was our feeling that this failure to obtain valid measurements was due mainly to an unwillingness on the part of the patient to cooperate. One patient resented the necessity of "feeling the pains twice." We found that previous instruction of the patient in the methods of making the pain measurements was important in insuring her cooperation throughout labor.

Comparisons of pain intensity made either between or during contractions yielded similar values, although some patients thought that the comparison could be made more easily if the test pain were presented during the height of the uterine contraction. The comparison consisted simply of asking whether test pain hurt more, or less or ap-
proximately the same as the pain caused by the contraction. It is important not to test the same skin area too frequently at high intensities of radiation since local hyperalgesia usually develops following one or two exposures to radiation of a 6 dol intensity. Pains greater than 8 dols were measured in only a few instances as the skin was usually blistered by thermal stimuli producing 8 dols (figs. 2 and 7).

Contraction interval and duration were measured by means of a water manometer and kymographic tracing in several patients and more often by manual palpation of the abdomen. These measurements were made in order to follow the changing tempo of labor before and after administration of the analgesic agents previously mentioned. Cervical dilatation was ascertained by rectal examination and checked by sterile vaginal examination as indicated. The latter provided an opportunity for manual stretching of the cervix, evoking 8 dol pains without uterine contractions in several patients.

Tests of recollection of the pain experienced during labor were made on 3 patients several days postpartum in the following manner. Pains of increasing intensity were induced on the back of the patient's hand until she reported the test pain as about as intense as the recalled labor pains. Every effort was made not to influence the patient's report and the observer was not informed of the intensity of the pain experienced in labor.

Clinical estimates of the effectiveness of the analgesics were made by questioning the patient during labor and postpartum, and by observing changes in the patient's actions (groaning, complaining, sleeping, smiling and so forth) following administration of the analgesic.

The investigating team consisted of one obstetrician, one physiologist, two trained technicians and a nurse. The time spent on the 26 patients in antepartum preparation, attendance during labor and for postpartum evaluation is calculated at over 1000 hours during a period of almost three years.

**Results**

Pain Threshold.—It was determined several times during the antepartum period, also several times during labor and, in some instances, postpartum, for a total of 300 determinations, which were remarkably uniform in the absence of analgesia. All of the obstetrical patients had a constant skin pain threshold. No deviations were observed indicating a "high" or "low" pain threshold, contrary to often expressed opinions in this regard.

Morphine and Scopolamine.—The effect of this combination was studied in 2 patients who received injections of morphine, 15 mg. and scopolamine, 0.4 mg. One patient, Mrs. H., had 3 injections, and a second patient, Mrs. B., received 1 injection. The chart of Mrs. H. (fig. 3) is presented because the actions of the analgesics are more clearly demonstrated in her case, although the tests on Mrs. B. showed similar
Influence of Analgesics on Labor Pain Intensity

Effects. The five measured variables, pain threshold, pain intensity, uterine contraction interval and duration, and the cervical dilatation, are plotted against the duration of labor in hours.

Mrs. H., a physician's wife and former nurse on the obstetrical service, was a 25-year-old primipara with a negative medical history who volunteered to serve as a subject, and had received instructions in dolorimetry during her antepartum course. Pain studies were begun early in labor. She weighed 75 Kg. at term. The course of her labor is summarized in the chart and the results of the study were distinctly abnormal from the pain standpoint. A summary is as follows:

1. Following first injection of 15 mg. of morphine sulfate, 0.4 mg. of scopolamine:
   a. Pain threshold raised 10 per cent or 1 dol.
   b. Pain intensity reduced from 9 dols to 6 dols.
   c. Contraction duration which had been 30 seconds, shortened to 20 seconds.
   d. Contraction interval which had been 1 minute, lengthened to 2 minutes.
   e. Cervix showed no great change, being dilated 1 to 2 cm.
   f. Before receiving agent, patient was restless, groaning, sweating and complained of fatigue and backache, with pain extending into inner thighs. Following administration of agent patient was less restless, dozed between contractions, smiled and reported pains less intense.
2. Following second injection 4 hours later:
   a. Pain threshold raised 5 per cent or ½ dol.
   b. No effect on pain intensity.
   c. Contraction duration shortened from 40 seconds to 35 seconds.
   d. Contraction interval lengthened from 1 minute to 2 minutes.
   e. Cervix 2 to 3 cm. dilated.
   f. Patient reported pains as more intense, but was observed to doze
      between contractions; restlessness was slightly decreased but
      groaning and complaining were not reduced.
3. Following third injection 4 hours later and after artificial rupture
   of membrane:
   a. Pain threshold was raised 80 per cent above the normal, or 8 dols.
   b. Pains reduced from 10 to 7 dols.
   c. Contraction duration shortened from 50 seconds to 30 seconds.
   d. Contraction interval lengthened from 30 seconds to 45 seconds.
   e. Cervix dilated rapidly from 3 cm. to 10 cm. in 3 hours.
   f. Patient became very lethargic. Slept during contraction interval,
      appeared disoriented, confused and irrational.

Clinical impression: excellent analgesia and amnesia had been obtained. Length of labor, 26 hours; delivery by low forceps; baby cried
at once.

The patient was tested six months postpartum for her ability to recollect the intensity of pain during labor. She expressed doubts as

to whether she could remember the pain. Tests showed, however, that
she could do so with a good degree of amnesia for the early part of

TABLE 1
DEGREE OF POSTPARTUM AMNÉSIA SIX MONTHS AFTER MORPHINE AND SCOPOLAMINE

<table>
<thead>
<tr>
<th>Stage of Labor</th>
<th>Postpartum Recollection, dols</th>
<th>Pain Measured During Labor, dols</th>
<th>Difference</th>
</tr>
</thead>
<tbody>
<tr>
<td>1st stage early</td>
<td>2</td>
<td>6</td>
<td>-4</td>
</tr>
<tr>
<td>1st stage late</td>
<td>9</td>
<td>9</td>
<td>-3</td>
</tr>
<tr>
<td>2nd stage</td>
<td>10</td>
<td>10</td>
<td>-1</td>
</tr>
</tbody>
</table>

labor and very little for the most severe part of labor, as shown in
table 1. Conrad (16) pointed out that 131 doctor-mothers said that
the memory of the labor pains faded quickly but 61 said that this was
not so. The role of analgesia and anesthesia in provoking amnesia
can be inferred.

Further recollection of the labor by the patient indicated that it had
been an ordeal because of its length. She reported that she had never
experienced pains more severe than those of the second stage of labor
and that she appreciated the analgesia. From a quantitative as well as
a clinical standpoint the effect of the agents in achieving relief from
pain was excellent.
INFLUENCE OF ANALGESICS ON LABOR PAIN INTENSITY

Mrs. B., multipara, weighing 89 Kg., received one injection of 15 mg. of morphine and 0.4 mg. of scopolamine. Following this injection:

a. Pain threshold was unchanged.
b. Pain intensity reduced from 8 dols to 2 dols.
c. Contraction interval which had been 2 minutes lengthened to 3 minutes.
d. Cervix dilated rapidly.
e. Patient was less restless—drowsy, dozing between contractions.

Comment.—In the amounts given, one injection of morphine and scopolamine has little or no effect upon the pain threshold. This was true of both patients studied. The pain intensity, however, is reduced by as much as 3 to 6 dols. The conclusion which must be drawn from this is that at least one action of these agents is to reduce the cause of pain by lessening the uterine activity as well as to serve as an analgesic to make the patient less sensitive to pain. The reduction of the pain presumably results from a decrease in the frequency and intensity of the uterine contractions, indicating an action on the motor innervation. Further action on the autonomic sensory nerves must be inferred.

The threshold-raising effects of morphine and scopolamine were negligible since two administrations caused little if any true variation in Mrs. H., as shown in figure 4. Following the third injection, however, Mrs. H. had a decided rise in pain threshold (8 dols), although
only a moderate (3 dol) drop resulted in pain intensity. It is obvious that in this instance there were two factors combining to reduce the pain perceived by the patient; first, the action of the agent in reducing the strength of the uterine contractions, and second, the true analgesic effect of the agent on the central nervous system in raising the pain threshold. The net pain perceived by the patient then is the difference between the measured pain intensity and the pain threshold. The actual amount of pain perceived by the patient is shown as “true dols” by the dotted line in figure 4 and this is the total effect of the third injection of morphine in reducing labor pains. The term “anadol” is suggested to indicate the pain intensity after administration of analgesia to distinguish it from the true dols. The anadols and true dols are, of course, identical when the pain threshold is normal.

In addition to the pain-relieving effects of morphine and scopolamine, the agents have definitely beneficial actions on the behavior reac-

<table>
<thead>
<tr>
<th>Patient</th>
<th>Injection</th>
<th>Pain Threshold</th>
<th>Pain Intensity, dol</th>
<th>Contraction Interval, minutes</th>
<th>Cervical Dilatation</th>
<th>Length of Labor, hours</th>
<th>Condition of Baby</th>
<th>Reaction to Agent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mrs. C.</td>
<td>Before</td>
<td>Normal</td>
<td>4</td>
<td>4</td>
<td>23</td>
<td>Normal</td>
<td>Restless</td>
<td>Relaxed, drowsy</td>
</tr>
<tr>
<td>Primipara</td>
<td>After</td>
<td>Raised 1 dol</td>
<td>0</td>
<td>8</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Age—18</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wt.—60 Kg</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mrs. J.</td>
<td>Before</td>
<td>Normal</td>
<td>7</td>
<td>1</td>
<td>15</td>
<td>Depressed—Artificial respiration and caffeine</td>
<td>Restless, crying</td>
<td>Low restless</td>
</tr>
<tr>
<td>Primipara</td>
<td>After</td>
<td>Normal</td>
<td>5</td>
<td>1</td>
<td>15</td>
<td>Depressed—Artificial respiration and caffeine</td>
<td>Restless, crying</td>
<td>Low restless</td>
</tr>
<tr>
<td>Age—18</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wt.—58 Kg</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mrs. R.</td>
<td>Before</td>
<td>Normal</td>
<td>5</td>
<td>3</td>
<td>13</td>
<td>Normal</td>
<td>Restless, resentful</td>
<td>Relaxed, cooperative</td>
</tr>
<tr>
<td>Primipara</td>
<td>After</td>
<td>Lowered 2 dol</td>
<td>5</td>
<td>0</td>
<td>13</td>
<td>Normal</td>
<td>Restless, resentful</td>
<td>Relaxed, cooperative</td>
</tr>
<tr>
<td>Age—27</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wt.—64 Kg</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Morphine Sulfate.**—One injection of 15 mg. was given to each of 3 patients. The results are summarized in table 2.

**Comment.**—Morphine alone had essentially the same action as morphine and scopolamine, although somewhat less reduction in pain intensity was obtained. The principal effect of the agent was that of reducing the pain intensity rather than raising the pain threshold. The lengthening of the contraction interval as the pain intensity was reduced, without appreciable change in threshold, indicates that the re-
Influence of Analgesics on Labor Pain Intensity

Reduction in pain was brought about partly by slowing action on the uterine contractions. Hensen (18) found no effect on the contractions after moderate doses of morphine. Murphy (19) and Dodek (24) observed a reduction in the frequency of contractions and concluded that morphine may or may not increase their magnitude. Bourne and Burn (20) stated that morphine lessens the frequency of contractions as recorded by an intra-uterine balloon. From the standpoint of pain reduction and from the general clinical viewpoint, morphine is a more satisfactory obstetrical analgesic when used in combination with scopolamine than when used alone.

Scopolamine.—Three injections of 0.4 mg. of scopolamine were given to 2 patients. Mrs. B., a multipara weighing 65 Kg., received the first injection when the cervix was dilated 2 cm. and the pain intensity had increased to 4 dols. The pain intensity remained at that level, increasing to 5 dols in the first hour after the injection, and in the second hour decreased to 3 dols. The patient reported that the contractions were less painful although little effect was noted on their interval or the duration. She felt more at ease and dozed between contractions. At the end of two hours the injection was repeated when the cervix was 3 cm. dilated. After the second injection several readings of 6 dols were obtained, but the patient became very drowsy, confused and irrational so that the data were not considered to be accurate. The total duration of labor was seven hours.

Mrs. G., an 18-year-old primipara weighing 68 Kg., received 0.4 mg. of scopolamine when the cervix was 3 to 4 cm. dilated and the pain intensity was 3 to 4 dols. At first the dols rose to 5 and then gradually dropped to 3, rising gradually to 4 after several hours of observation. Delivery occurred three hours later, after fourteen hours of labor. The injection had little if any effect on the uterine contractions. It was difficult, however, to maintain contact with the patient who tended to doze off and be disoriented, for which reason the studies were discontinued.

Comment.—The first dose of scopolamine had a moderate but definite analgesic effect on each patient. Little noticeable change occurred in the frequency and duration of the uterine contractions and the cervix dilated gradually. There was a slight decrease in pain threshold corresponding to the decrease in the pain intensity. This had not been observed when scopolamine was used in combination with morphine, demerol and apomorphine. The greatest effect was on the patients who became drowsy, confused and irrational. The dissociation was particularly marked in Mrs. B. after the second injection. This drug had a considerable psychic effect which seemed to be greater when used alone than in combination with morphine, demerol and apomorphine.

Morphine Sulfate and Demerol.—A single injection of these agents was given in combination, in amounts of 10 mg. of morphine sulfate and 100 mg. of demerol, to 6 patients, one of whom (Mrs. G.) is dis-
cussed under "Natural Childbirth," and another (Mrs. L.) under injection of sterile saline solution. The results are presented in table 3 and in figure 5, before and after the injection.

Comment.—In the amounts given, this combination of agents did not raise the skin pain threshold in any of the patients although the pain intensity was considerably reduced in all. The relief from pain is achieved by reduction of the uterine activity in the same manner as observed after morphine and scopolamine. The amount of the pain-reducing effect, the drowsiness, euphoria and the anxiety-relieving action of morphine and demerol appeared equal to that obtained from morphine and scopolamine. No appreciable pain threshold-raising actions (true analgesia) were observed in the amounts given. From a pain-

![Diagram](image)

**Fig. 5.** Pain intensity before and after administration of morphine and demerol to 5 patients.

relieving and from a clinical standpoint, it may be said that morphine and demerol together make a good obstetrical analgesic, not unlike heroin. In spite of the reduction of the intensity and frequency of the uterine contraction, the cervix seems to dilate as rapidly after administration of the agents. This points to an increase in the efficiency of the uterine contractions as well as a relaxing effect, which alternately permits the accomplishment of full cervical dilatation in a shorter period of time.

This combination seemed so satisfactory that it was given further clinical application, and 46 primiparas and 21 multiparas were given these drugs. Of the 67 patients, 48 had only one injection, the remainder had two or more. As a rule the dosages were 10 mg. of morphine and 50 mg. of demerol. In obese patients some 15 mg. and 100
TABLE 3
EFFECTS OF 10 MG. OF MORPHINE SULFATE AND 100 MG. OF DEMEROL

<table>
<thead>
<tr>
<th>Patient</th>
<th>Injection</th>
<th>Pain Threshold</th>
<th>Pain Intensity, dols</th>
<th>Contraction Interval, minutes</th>
<th>Cervical Dilatation</th>
<th>Length of Labor, hours</th>
<th>Condition of Baby</th>
<th>Reaction to Agent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mrs. A. Primipara</td>
<td>Before</td>
<td>Normal</td>
<td>7</td>
<td>2½</td>
<td>Slow</td>
<td>18</td>
<td>Normal</td>
<td>Relaxed</td>
</tr>
<tr>
<td>Age—23</td>
<td>After</td>
<td>Normal</td>
<td>4</td>
<td>4½</td>
<td>Rapid</td>
<td>18</td>
<td>Normal</td>
<td>Relaxed</td>
</tr>
<tr>
<td>Wt.—68 Kg.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mrs. B. Primipara</td>
<td>Before</td>
<td>Normal</td>
<td>6</td>
<td>2</td>
<td>Slow</td>
<td>12</td>
<td>Relaxed</td>
<td></td>
</tr>
<tr>
<td>Age—24</td>
<td>After</td>
<td>Normal</td>
<td>1</td>
<td>3½</td>
<td>Rapid</td>
<td>12</td>
<td>Relaxed</td>
<td></td>
</tr>
<tr>
<td>Wt.—62 Kg.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mrs. N. Primipara</td>
<td>Before</td>
<td>Raised ½ dol</td>
<td>3½</td>
<td>3</td>
<td>Slow</td>
<td>20</td>
<td>Relaxed</td>
<td></td>
</tr>
<tr>
<td>Age—23</td>
<td>After</td>
<td>Normal</td>
<td>1</td>
<td>1 dol</td>
<td>Slow</td>
<td>20</td>
<td>Relaxed</td>
<td></td>
</tr>
<tr>
<td>Wt.—70 Kg.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mrs. S. Primigravida</td>
<td>Before</td>
<td>Normal</td>
<td>5</td>
<td>6</td>
<td>Slow</td>
<td>47</td>
<td>Relaxed</td>
<td></td>
</tr>
<tr>
<td>Age—32</td>
<td>After</td>
<td>Normal</td>
<td>1</td>
<td>6</td>
<td>Slow</td>
<td>47</td>
<td>Relaxed</td>
<td></td>
</tr>
<tr>
<td>Wt.—66 Kg.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

mg. of each were employed. Labor averaged twelve hours in primiparas and seven hours in multiparas. Asphyxia of the newborn was not increased in patients delivered under local or spinal anesthesia, but it was definitely higher when nitrous oxide and ether were used for delivery (34).

![Graph](image)

**Fig. 6.** Progress of labor in a patient after two injections of demerol and scopolamine.
Demerol.—Two patients were measured before and after the administration of 100 mg. of demerol. Mrs. V. was a “natural childbirth” patient and her case is discussed later. The other was a primipara who received the agent two hours before full dilatation. No effect on pain threshold, pain intensity or on contraction interval could be observed. There was also no appreciable release from tension or any drowsiness produced by the agent.

Comment.—This single test does not constitute a basis for the evaluation of demerol as an effective obstetrical analgesic. All that can be said is that the agent in 100 mg. amounts is apparently more effective when used in combination with morphine.

Demerol and Scopolamine.—Two injections of this combination of agents in doses of 100 mg. of demerol and 0.4 mg. of scopolamine were given to one patient. Mrs. O. was a multipara weighing 58 Kg. at term, whose labor lasted eleven and a half hours. She received the first injection four and a half hours before delivery (fig. 6) and the second injection one and a half hours later.

1. First injection:
   a. Caused no change in pain threshold.
   b. Reduced pains originally 8 dols to 6 dols.
   c. Had little effect on contraction interval.
   d. Contraction duration was shortened from 60 to 40 seconds.
   e. Cervix did not dilate during period in question.
   f. Patient complained of the inability of analgesics to help her.
2. Second injection:
   a. Had no effect on pain threshold.
   b. Produced no immediate change in the 8 dols of pain. At this time the patient asked that the studies be discontinued as she did not wish to feel the pains “twice.”
   c. Contraction interval change from 3 to 2 minutes.
   d. Contraction duration was unchanged.
   e. The patient complained bitterly that the two injections were worthless.

Nine days postpartum the patient was tested for memory of the pain experienced during her labor. Table 4 contains her postpartum estimate and the pain intensity value measured during labor. Recollection of the severest pains in the second stage of labor produced 10½

<p>| TABLE 4 |</p>
<table>
<thead>
<tr>
<th>DEGREE OF POSTPARTUM AMNESIA NINE DAYS AFTER DEMEROL AND SCOPOLAMINE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stage of Labor</td>
</tr>
<tr>
<td>----------------</td>
</tr>
<tr>
<td>1st stage early</td>
</tr>
<tr>
<td>1st stage late</td>
</tr>
</tbody>
</table>

Downloaded from anesthesiology.pubs.asahq.org by guest on 01/25/2019
dols of pain and this amount of thermal radiation caused a second degree burn on the forearm of this patient, which is shown in figure 7 (compare with figure 2). She had been warned of this possibility and nevertheless requested the test be made.

![Graph showing progress of labor after three injections of apomorphine and scopolamine. Note pronounced reduction in uterine contraction interval and duration.](image-url)
Comment.—The combination of 100 mg. of demerol with 0.4 mg. of scopolamine has no observable pain threshold-raising action and only minimal pain-reducing effect. Restlessness and anxiety were not reduced and amnesia was not effected. In this patient and in the amounts tested, these agents did not constitute a satisfactory obstetrical analgesic. Schuman (5) reported 79 per cent analgesia based on patients' inability to remember the pains. This percentage may be a measure of amnesia.

*Apomorphine and Scopolamine.*—This combination of agents has had a thorough clinical test at the Boston Lying-In Hospital by Hershenson and Brubaker (6). Their study led to the conclusion that these agents, in combination, serve as an effective analgesic. Neither apomorphine nor scopolamine, however, has been demonstrated to have any pain threshold-raising action, and it was with surprise that it was learned that they provided satisfactory obstetrical analgesia. To study the effect of these agents on the pains of childbirth, three injections were given to one patient weighing 80 Kg. The results of these tests can be seen in figure 8 and briefly are as follows:

1. First injection, 0.65 mg. of apomorphine and 0.4 mg. of scopolamine:
   a. Caused no change in pain threshold.
   b. Reduced the pain intensity from 5 dols to 1 dol.
   c. Contraction duration shortened from 45 to 35 seconds.
   d. Contraction interval lengthened from 3 minutes to 5 minutes.
   e. Cervical dilatation unchanged.
   f. Caused nausea, dry mouth, drowsiness, sleeping between contractions.

2. Second injection, 0.65 mg. of apomorphine and 0.4 mg. of scopolamine:
   a. Caused no change in pain threshold.
   b. Reduced pain intensity from 8 dols to 1 dol.
   c. Contraction duration shortened from 50 to 35 seconds.
   d. Contraction interval lengthened from 2 minutes to 5 minutes.
   e. Cervix dilated very slowly.
   f. Caused drowsiness.

3. Third injection, 0.65 mg. of apomorphine and 0.4 mg. of scopolamine:
   a. Caused no change in pain threshold.
   b. Reduced pain from 8 dols to 3 dols.
   c. Contraction duration shortened from 45 to 35 seconds.
   d. Contraction interval lengthened from 4 minutes to 6 minutes.
   e. Cervix dilated slowly, reaching 4 cm. when the study was stopped.
   f. Slight nausea, drowsiness, sleeping between contractions.

A test for amnesia was made on the patient five days postpartum. She reported that her weakest pains had been of about 2 dols intensity.
and the strongest almost 9 dols. She thought that most of the pains were at about a 6 dol level but that the periods following the injections were "blank."

Comment.—These observations support the statement (6) that apomorphine and scopolamine, when used in the amounts given, are effective obstetrical analgesics. As was the case with the other agents studied, apomorphine acted directly to cause a reduction in uterine activity and thereby a reduction in pain. The principal unpleasant action was the slight nausea. Scopolamine contributed by assisting in the production of drowsiness and slight analgesia. Of all the agents tested, apomorphine and scopolamine had a very pronounced effect in reducing uterine activity.

![Graph](image)

Fig. 9. The pain intensity in a physician-mother who was indoctrinated for "natural childbirth" and on asking for analgesia received first an injection of saline solution, then two injections of heroin.

**Heroin.**—This agent was tested on 2 patients who received three injections. Mrs. W., who weighed 57 Kg., was given a single injection of 5 mg. with the following results:

a. No effect on pain threshold.

b. Reduction of pain intensity from 7 dols to 3½ dols.

c. Contraction interval lengthened from 1 minute to 2 minutes.

d. Cervix dilated rapidly.

e. Induced euphoria, dizziness, drowsiness.

Mrs. H., a 26-year-old primigravida weighing 78 Kg., and a physician, had similar effects from 5 mg. of heroin. She is also discussed under "Natural Childbirth." When 10 mg. of the same drug was administered there was a dramatic drop from 7 dols to 1 dol. These changes are presented in figure 9. Delivery was spontaneous after
a twelve hour labor, using local infiltration of procaine for the episiotomy. The patient experienced little pain from the uterine contractions after the episiotomy had been made. The child cried at once. The moderate rise in pain threshold in a reading taken just before delivery, in the second stage of labor, may be noted. It did not return to normal until two and a half hours after delivery, or six hours after the second injection.

Comment.—In the triple test this agent afforded a most satisfactory pain-relieving action. Euphoria was somewhat marked as others (21) have recorded. In many respects the effects resemble those obtained with morphine and demerol in combination.

Injection of Saline Solution.—Seldom does a clinical appraisal of obstetrical analgesia include the placebo. The latter was administered to 3 patients, Mrs. D., Mrs. L., and Mrs. H., in the form of an injection of 1 cc. of sterile saline solution, with little effect on pain threshold, pain intensity or uterine activity. The results on Mrs. L. are graphed in figure 10. After the saline injection, the pain intensity did not decrease, but actually increased with the tempo of labor. The patient observed no effect whatsoever. After the injection of morphine, 15 mg., and demerol, 50 mg., there was a dramatic reduction in pain intensity from 7 to 3 dols with a corresponding decrease in uterine activity. The patient commented on the marked decrease in pain after the second injection.

Mrs. H., whose case is also commented on under "Heroin," and under "Natural Childbirth," was given an injection of sterile saline solution when she asked for analgesia. It produced little effect on the pain intensity, as indicated in figure 9. An hour later 5 mg. of heroin

![Diagram](image-url)
was administered. She was asked to compare the two injections, and she unerringly stated that the first was a placebo and the second was an excellent analgesic. She was even more definite in her praise when 10 mg. of heroin was given.

"Natural Childbirth."—Some physicians contend that the pains of labor are trivial and soon forgotten and that the pain served to increase the joys of motherhood. Goodrich and Thoms (22) stated that labor is important in order to condition the mother to love her child. Read (12) has stated that a large number of labors are virtually painless, adding (13) that there is no physiologic evidence that childbirth should be painful. He stated that fear-tension-pain syndrome can be eliminated by exercises during pregnancy and labor. These have been outlined by Heardman (23).

A study of the effects of prenatal and parturitional instructions and exercises for "natural childbirth" is underway and, as a preliminary statement, we include here a report of measurements on 5 patients who have been prepared for it. The first was Mrs. F. who did not have complete indoctrination because of the premature onset of labor. She had read Read’s book (12) however, and did not wish analgesia and was, therefore, given much personal instruction, attention and assurance during the entire labor. She experienced pain intensity of about the same magnitude as any other patient without analgesia. When seen two and a half years later she said that never before had she suffered as much; that she would never do it again, and felt that she had been greatly deceived. Her recollection of the labor was such that for a long time she avoided coitus and simply could not bring herself to have another baby. Recently she was delivered with analgesia and anesthesia at her own request.

Mrs. V. was carefully coached in her antepartum period and during her entire labor by her private nurse. When the cervix was 8 cm. dilated the pain intensity was 7 dols. Yet, the patient remained stoic and registered no emotional reaction. Finally, when the pain reached 8 dols, she requested an analgesic and was given 100 mg. of demerol. She refused any additional medication for the episiotomy or the delivery which occurred after eighteen hours of labor.

Mrs. G., a professional psychologist, had received expert instruction and considered herself well prepared for labor. Measurements of her pains during the latter half of the first stage of labor showed a progressive increase in intensity from 5 dols to 8 dols. At this time she asked that the study be discontinued and that an analgesic be given. Morphine and demerol were administered. After an hour in the second stage she requested anesthesia with the pains. It was also used to complete the delivery of twins. She had severe after pains which were not relieved by relaxation.

Mrs. H. had received excellent instruction. As a matter of fact, three days before delivery she was admitted in false labor, convinced
that she was in true labor because the contractions did not hurt at all! Her point of view was particularly valuable in view of Conrad's (16) findings that most of the doctor-mothers felt that antepartum instruction would do little to mitigate the pain in labor. Mrs. H. experienced the same degree of pain recorded for other patients without antepartum preparation. When the cervix was 3 to 4 cm. dilated, the uterine contractions occurred at five minute intervals and the pain intensity reached 6 dols, the patient requested analgesia. She expressed great disappointment in that she had been unable to control the pain by her own efforts. She received heroin, 5 mg., which reduced the pain intensity to 2 dols as shown in figure 9.

The pain intensities of the foregoing 4 primiparous patients and one other, Mrs. D., a multipara who required no analgesia, are shown in figure 11. Additional studies will be reported (34).

![Diagram](image)

**Fig. 11.** Pain intensity in 5 patients having "natural childbirth." Compare with figure 1.

*Comment.*—These measurements show that preparation for labor by the antepartum and parturitional instructions in "natural childbirth" did not greatly alter the pattern of pain intensity perceived by these patients as compared with those shown in figure 1. They were more serene, however, and had a reaction pattern equal to, or better than, those who had not been indoctrinated. Read (12, 13) believed that fear increases muscle tone and resistance in the circular muscles of the lower uterine segment and cervix. By inducing relaxation of these muscles an effect comparable to that obtained by analgesia should be expected. Yet, his primiparas had an average duration of labor of eighteen hours, whereas the primiparous patient having analgesia had a duration of twelve hours (6, 19), an actual saving of many contractions.
The pain of the first stage of labor is caused by the uterine contractions and by the dilatation of the cervix. These pains can be relieved by most analgesic agents such as morphine, morphine and scopolamine, morphine and demerol, heroin, and apomorphine which serve to reduce uterine activity presumably by action on the nervous system (31) serving to prolong the contraction interval and to reduce the magnitude of the contractions. Dodek (24) also found that morphine and scopolamine exerted such action. They are relieved by sacral anesthesia (17, 24) which produces a marked decrease in the magnitude of the uterine contractions. This evidence suggests that the parasympathetics are predominantly motor while the sympathetics are predominantly sensory to the uterus (31). In the second stage of labor the pain is caused in part by the uterine contractions, dilatation of the vagina and also by the marked stretching, tearing and dilatation of the perineum, producing the "great pain" of 10½ dols intensity. This can be relieved either by episiotomy under pudendal block and local anesthesia, or by general and spinal anesthesia.

The experiments reported are directly concerned with the action of analgesic drugs during the first stage of labor. Five important effects of the analgesics can be listed as follows:

1. Reduction of Anxiety (Psychologic Control).

Various patterns of reaction can be observed in the patient in labor. Some show little reaction even to pains of 8 dols intensity, whereas others moan, exhibit great restlessness and weep copiously with pains no greater than 2 dols. Thus it is that by reassuring the patient and teaching her to relax (as in "natural childbirth") some (12, 22) have been led to believe that labor pains can be greatly reduced or eliminated. Many methods have been used successfully to reassure the over-anxious patient, for example, the presence of the husband or physician, knitting, towel-pulling, music, suggestion and so forth. To this list can be added the obstetrical analgesics which have powerful effects toward inducing feelings of well-being and of detachment. Even in small therapeutic amounts demerol, scopolamine, heroin and morphine produce these desirable effects. The analgesics are also valuable as pre-anesthetic medicants by reducing the excitement stage of the anesthesia.

2. Inducing Sleep and Amnesia.

Fatigue and loss of sleep are two common complaints of the patient in labor which can be controlled by the use of analgesics. Demerol and scopolamine in therapeutic amounts are most effective in producing drowsiness and dozing between contractions. The rest afforded the
patient by these short naps was of noticeable benefit in the group reported on, especially when labor occurred at night.

Amnesia was difficult to effect even though the patient appeared confused and disoriented during her labor. Portpartum tests showed that scopolamine in single doses of 0.4 mg. had only slight amnesia action, but when given two or three times in combination with a good analgesic such as morphine it had a greater effect.


The effect of morphine varies with different species (25) constricting the pupil in one and dilating it in another. A comprehensive review (25) of the pharmacology of opium alkaloids indicates varying effects on the uterus of various animals as well as individuals of the same species. Therefore, we have made reference only to studies on the human uterus, although some of these are at variance with each other.

Clinical experience as well as the studies presented indicates that morphine, demerol, heroin and apomorphine, with and without scopolamine, have similar effects on the uterus, namely, to lengthen the contraction interval. Scopolamine alone has little apparent effect on the uterine contractions. The effects of some of these agents have been studied by external and internal hysteroscopy. Dodek (24) noted a prolonged interval with an external hysterosgraph after morphine alone and after morphine and scopolamine. Murphy (19) noted depression of uterine activity with the Lorand tocograph with a reduction in the frequency of contractions, while the magnitude remained the same or was actually improved. Bourne and Burn (20), using an intra-uterine bag, found that morphine prolonged the contractions and decreased their frequency and amplitude so that the work done by the uterus is as great or even greater than before the injection. Rucker (17) observed that morphine and scopolamine increased the force of the uterine contractions as the labor progressed while using the Voorhees bag. Barker (26) was one of the first to observe that morphine relaxed the cervix, and today it is generally accepted that the cervix dilates as fast or faster after moderate doses of analgesics than before. A paradoxical situation occurs in which the uterus accomplishes more useful work with less effort. How can this be explained? A recent authoritative study on uterine physiology does not clarify the issue (27). Others (28, 29) have observed painless labors progress normally when cord lesions have destroyed communication with the higher centers. Spinal anesthesia exerts a slowing effect on uterine contractions (17, 24). The judicious use of morphine and demerol in 69 patients has been found to reduce the average length of labor of primiparas from eighteen hours to twelve hours and that of multiparas from twelve to seven hours. Hershenson and Brubaker (6) observed average labors eleven
and six hours respectively in primiparas and multiparas following use
of apomorphine and scopolamine. This means the achievement of an
actual reduction in the total number of contractions from about 200 to
150 for a primiparous labor. This in itself, together with the marked
reduction in pain intensity, justifies the careful use of analgesics in
healthy women, not to mention the possible benefits to the child. These
observations contradict the older concept that the use of analgesics
prolongs labor. Is it not possible that the patients of a former day
who had long labors from various causes received, as a result, consid-
erable amounts of analgesics and thus created the erroneous impres-
sion that analgesics themselves prolong the labor? It is nevertheless
true that anesthetics and analgesics administered early in labor will
stop the contractions of the uterus. Given at a later time when the
labor is well established the same agents have the effect of hastening
the dilatation of the cervix.

Sun (30) was able to demonstrate contractions of the human uterine
muscle strip in vitro. Using a similar technic (31), all the analgesics
studied in this investigation were also studied as to their effects on the
contraction of pregnant human uterine muscle strips suspended in
Krebbs solution. Scopolamine had no observable effect, whereas mor-
phine, heroin and apomorphine slowed the contractions and decreased
their duration and in some instances their amplitude. Demerol in-
creased the muscle tone and greatly decreased the amplitude of con-
traction. This evidence, like that quoted above for the studies in hys-
terography, is conflictting, and it is thus that we have sought to explain
the results upon a differential effect of the analgesic upon the contrac-
tions of the uterine musculature.

Most textbooks on obstetrics, physiology and pharmacology discuss
the longitudinal, spiral and circular muscle fibers of the uterus. The
predominance of muscles in the cervix has been questioned recently
(32). Whether or not the longitudinal and circular muscle fibers have
separate innervations, parasympathetic and sympathetic respectively,
is not definitely known. Von Basch and Hoffman (33) advanced a the-
ory in 1877 that the nervus erigens (parasympathetic) was excitatory
to the longitudinal muscle fibers of the fundus and cervix, and inhibi-
tory to the circular fibers, and that the hypogastric (sympathetic)
nerves were inhibitory to the longitudinal and excitatory to the cir-
cular fibers. If, then, the agents such as morphine, in small amounts,
cause an increase in the muscular effort of the longitudinal muscles
and at the same time relax the circular fibers of the cervix, more rapid
dilation of the cervix would occur with less total effort (31).

A second possible explanation is that the analgesic causes a de-
crease in the activity of all the uterine muscles but affects least the
longitudinal muscle fibers of the fundus. As has been shown by Rey-
nolds (27) labor is most effective when the contractions in the middle
and lower uterine segments are minimal and those of the fundus vigorous.

As the amounts of the agents used to evoke the effects described are small it is concluded that their action upon the uterus is by way of its nerve supply. Also, it is probable that its motor nerves are those most affected. Moreover, it is necessary to assume that the analgesics produced large changes in the pain threshold for the autonomic sensory nerve endings of the cervix while not affecting the pain threshold in the skin. This possibility cannot be excluded on the basis of the present experiments, and will form the basis for a subsequent report.

4. Reducing Pain Intensity.

It is evident from the preceding data that all of the analgesics except scopolamine had, as their chief effect, the reduction of the uterine activity. It is believed that this is the result of action on the uterine muscle innervation which may be parasympathetic. There was a concomitant reduction in pain intensity, presumably because of action on the muscles of the fundus and cervix, supplied by sensory fibers by way of the sympathetics. This study indicates that a reduction of uterine activity does not slow the rate of dilatation of the cervix, but indeed may hasten it. It would thus appear that the total work done by the uterine musculature in effacing and dilating the cervix by projecting the head of the child through it is actually less when an analgesic is given.

The reduction of the pain intensity with each contraction and the reduction in the total number of contractions per hour permit the patient to sleep for longer periods and thereby avoid excessive fatigue. It is also likely that beneficial effects may be expected in the infant upon whom this work is being done.

Reduction of pain intensity from 6 or 8 dols to 2 or 3 dols was often observed after the administration of heroin, morphine and demerol, morphine and scopolamine, and apomorphine and scopolamine without a rise in the pain threshold.

5. Raising the Pain Threshold of the Skin.

An action of the various drugs on the central nervous system must be considered (25). Moderate amounts, however, failed to raise the pain threshold, indicating little direct action on the sensory components of the central nervous system, except to cause drowsiness, euphoria and sleep. Only 2 patients had true analgesia observed in any significant degree, that is, following the third injection of 15 mg. of morphine sulfate and 0.4 mg. of scopolamine, as shown in figure 4, and after 5 and 10 mg. of heroin as shown in figure 9. It is likely that the central nervous system plays a definite role in the control of pain in labor with analgesics having euphoric properties. The pharmacologist,
attempting to discover new and better analgesics by studies of pain threshold-raising effects of agents in animals or normal subjects, will find the data presented herein discouraging. On the other hand, if some appreciable pain threshold-raising effect could be added to the other desirable actions of drugs already in use in obstetrics, a great gain would be made. It is evident, however, that measurements of pain intensity and test of pain threshold-raising effects must be made on the woman in labor. If an agent could be found with a pain threshold-raising action of 6 dols, pain during the first stage of labor could be almost entirely eliminated.

The pain threshold of the uterus and especially of the cervix should be determined since it may be different from that of the skin. It is proposed to investigate the pain threshold of this organ in nonpregnant women before and during analgesia. It is readily accessible to external manipulation at the time of the pelvic examination.

**SUMMARY AND CONCLUSIONS**

Pain in labor was studied for the first time by a quantitative method during analgesia, using the Hardy-Wolff-Goodell dolorimeter. Measurements were made of pain threshold and of pain intensity as expressed in "dols." Twenty-six patients were studied before analgesia; 21 primiparas and 5 multiparas. After several hundred preliminary measurements, 19 patients were given 26 injections of various analgesics: a) morphine, b) morphine and scopolamine, c) scopolamine, d) demerol, e) morphine and demerol, f) demerol and scopolamine, g) heroin, and h) apomorphine and scopolamine.

The effects of these agents were comparable but varied somewhat in degree as follows: (1) lengthening of the uterine contraction interval, (2) shortening of the duration of the contractions, (3) accelerating the rate of cervical dilatation, (4) reduction in pain intensity often without change in skin pain threshold, (5) relaxation, drowsiness and, to a small degree, amnesia.

Without analgesia, the pain intensity with uterine contractions increased steadily and reached 10 to 10½ dols in the second stage of labor, which is a ceiling pain. Dilatation of the cervix in the first stage and stretching of the perineum in the second stage account for much of the pain in labor.

Moderate doses of these analgesic agents reduced pain in the first stage of labor. The intensity was reduced from a level of 6 to 8 dols to a level of 2 to 3, without appreciable change in the pain threshold.

Large doses of morphine and scopolamine, in combination, and heroin raised the skin pain threshold, thereby signifying true analgesia.

Some of the pain-reducing effect of analgesics employed in the first stage of labor is the result of a reduction of uterine activity as indicated by an increased interval between contraction. There was no evidence that this slowed cervical dilatation or prolonged the labor.
The quantitative studies on 6 patients and clinical impression with 69 patients indicate that the combination of morphine and demerol is a satisfactory obstetrical analgesia resembling heroin. The duration of labor was shortened and there was no significant asphyxia of the newborn delivered under local or spinal anesthesia.

The skin pain threshold was not raised or lowered during the antepartum period, in labor or in the puerperium. Constant levels were determined at these times when no analgesia was given. The pain threshold of the cervix was not investigated in these patients for obvious reasons. However, it is planned to do so on non-pregnant women.

In moderate doses, the analgesic agents studied in labor had little pain threshold-raising action. Although many analgesics have been studied in animals and normal human subjects, the best therapeutic test is to study their action on patients suffering from pain. For this purpose quantitative measurements of pain threshold and pain intensity are possible using the dolorimeter.

Five patients having "natural childbirth" experienced pain intensity similar to those receiving no analgesia. One, a multipara, succeeded in completing labor without analgesia or anesthesia.

REFERENCES

5. Schumann, W. R.: Demerol (S-140) and Scopolamine in Labor; Study of 1,000 Cases, Am. J. Obst. & Gynec. 47: 93–104 (Jan.) 1944.

POSTGRADUATE EDUCATION COURSE OF THE MASSACHUSETTS SOCIETY OF ANESTHESIOLOGISTS

The sixth meeting of the Postgraduate Education Course of the Massachusetts Society of Anesthesiologists will be held in the Bigelow Auditorium of the Massachusetts General Hospital on April 7, 1951, from 2:30 p.m. to 5:00 p.m. The following program will be presented:

Chairman: Henry K. Beecher, M.D.

Symposium: "Some Problems of Anesthesia Deaths."