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Manipulation under anesthesia to restore normal articular motion occupies an important place in osteopathic therapeutics. Muscular spasticity or contraction is often of such a degree that mobilization of joints cannot readily be produced without the administration of an anesthetic. This method of treatment has been used in the Osteopathic Hospital of Philadelphia for the past ten years. The older school of medicine has also used joint mobilization under anesthesia, and a report of 200 cases of low back pain was presented in Pierson’s International Medical Clinics in 1938. In this series complete cures ranged from 94 to 97 per cent. These figures are in general agreement with our own results.

It should be pointed out here as a note of caution that the abolition of protective stabilizing function of the muscles which facilitates mobilization under anesthesia also creates a condition in which the mobilized joint can be easily traumatized if great caution is not exercised. It follows that anyone who undertakes to use this method must be a good diagnostician and a thoroughly competent technician. The importance of the technical ability of the physician cannot be overestimated, and we have seen a number of patients previously treated under anesthesia who had received no benefit or were made worse and in whom later mobilization under anesthesia by us resulted in improvement.

Selection of Cases

Some of the conditions in which mobilization under anesthesia has produced satisfactory results in our hands are chronic fibrosis, chronic productive arthritis, lumbarization, sacralization, selected cases of Paget’s disease, chronic disc changes, old compression fractures, intractable brachial, intercostal, or sciatic neuritis, acute traumatic joint lesions, chronic joint lesions, increased muscle tension, thickened ligaments, and traumatic torticollis. In all of these conditions, careful selection of cases is of the utmost importance. The contraindications are very definite. Under no circumstances should patients with the following conditions be subjected to this procedure: Malignancies, fractures, tuberculosis, acute inflammations (diffuse osteochondritis, acute arthritis, spinal cord inflammation), spinal cord tumors, malacic bone disease, primary bone tumors, acute changes in the intervertebral disc, and ankylosis. To this list should be added those cases of cardiac, renal, or other organic disease in which the shock incident to the procedure might prove injurious.

In general, patients selected for mobilization under anesthesia are those who have received regular osteopathic manipulative treatment over a long enough period of time to have produced results under average conditions, and in whom no improvement either symptomatic, or in char-
acter or range of articular motion has occurred. Failure to improve under ordinary osteopathic manipulative procedures can often be attributed to the splinting action of the muscles of the joint structure and the normal postural tonus resident in them. Temporary suspension of these factors of muscle function is desirable when, having been reflexly maintained in an increased state of action, they interfere with ordinary manipulative procedures. General anesthesia carried well into the surgical stage abolishes reflex response and removes an impediment to mobilization by manipulation. Under anesthesia there remains only ligamentous action to limit joint motion; this enables the operator freely to put an articulation through its normal range of motion providing restrictive adhesions are not developed to the point where they cannot be overcome.

Procedures

Before mobilization under anesthesia is carried out, the attempt should be made to produce articular mobilization without an anesthetic. This procedure should be routine. A complete history and physical examination should be made and a preoperative diagnosis established. When indicated, gynecologic, neurologic, cardiologic, myelographic, or other studies should be carried out.

Mobilization under anesthesia should be a hospital procedure exclusively. Preferably, the patient should be hospitalized the afternoon preceding the operation. General orders to be written include no breakfast, laboratory studies including urinalysis, complete blood count, and serologic tests for syphilis, radiographic study, if this has not been done, and physical examination including charting of all spinal lesions.

Procedures relating to anesthesia for this type of work have been described by Smith* who says that cyclopropane is the anesthetic of choice for correction of osteopathic lesions. The average adult patient is given morphine sulphate ¼ gr. and scopolamine 1/150 gr. one to two hours before the inhalation of cyclopropane. Cyclopropane is of such potency that it can be used to produce any depth of anesthesia and permit the use of oxygen in the anesthetic mixture. It is the combination of potency, rapidity of action, lack of irritation to the respiratory tract, and high oxygen content that makes cyclopropane-oxygen an ideal anesthetic in manipulative correction work. The usual objections of its explosive character and inability to use adrenalin with it ordinarily do not have to be considered in work of this type. The rapid induction, adequate relaxation, and rapid recovery with cyclopropane make it an ideal agent in cases such as this where the operative procedure is short but in which perfect relaxation is essential. Ether, so far as the relaxation is concerned, compares very favorably with cyclopropane, but from every other standpoint for this type of work, cyclopropane is to be preferred. The disadvantages

*Dr. F. J. Smith, Professor of Anesthesiology. Personal communications.
of the use of chloroform far outweigh the advantages in this type of work, and Smith sees no reason for using it.

Cyclopropane should never be given by other than one experienced in anesthesia, and only with apparatus built to deliver cyclopropane and oxygen. It can be readily appreciated, therefore, that the logical place to administer it is in a hospital where the patient may receive the benefits of a competent anesthetist, suitable apparatus, adequate consultation, etc. These facilities are rarely available in the office of a general practitioner.

Anesthesia is carried to the second plane of the third stage.

The manipulative procedure is carried out on an ordinary straight type treatment table, and some of the basic techniques used by us are the following:

_Sacro-iliac Lesions_

**Left posterior rotation lesion**

The patient is placed in the right lateral recumbent position. The operator, standing behind the patient's pelvis, grasps the patient's left leg just below the patella with his left hand and places his right hand over the left posterior superior iliac spine. Mobilization is attempted by flexing, elevating, and extending the left leg and thigh while pressing slightly forward with the right hand.

The right posterior rotation lesion is corrected in the same relative manner with position reversed.

**Left anterior rotation lesion**

The same technique is used as in the posterior lesion except that the operator's right hand is placed over the sacrum just medial to the sacro-iliac articulation instead of over the posterior superior iliac spine.

The right lesion is corrected in the same relative manner.

_Lumbosacral Lesions_

**Left lateral flexion (left side-bending) lesion of the fifth lumbar vertebra**

The patient is placed in the right lateral recumbent position. The operator, standing in front of the patient, flexes the patient's legs to a right angle with the thighs, and the thighs to a right angle with the body. The operator's left forearm is placed anteriorly against the patient's left shoulder parallel to the patient's left arm with the left index finger to the left side of the spinous process of the fifth lumbar vertebra. The patient's legs, one resting on the other, are dropped over the side of the table, the operator's right hand being placed on the patient's left leg. Mobilization is attempted by pressing slightly backward with the left forearm while pressing downward with the right hand on the patient's left leg. This tends to cause separation of the left sacral facet from that of the fifth lumbar vertebra.

The right lateral flexion lesion is corrected in the same relative manner.
Bilateral extension of the fifth lumbar vertebra

The same technique as described above for the lateral flexion lesion is used for bilateral extension, mobilization being attempted bilaterally in the latter.

Bilateral flexion of the fifth lumbar vertebra

The patient is placed in the prone position, the abdomen and chest resting on a pillow. The operator, standing to one side of the table, places one hand over the spinous process of the fifth lumbar vertebra with fingers pointed toward the sacrum. Mobilization is attempted by using a springing pressure directed through the lesioned vertebra in a downward direction and toward the sacrum.

Left rotation of the fifth lumbar vertebra

The patient is placed in the Sims position. Standing behind the patient, the operator places the thenar eminence of his left hand lateral to the right side of the spinous process of the fifth lumbar vertebra, and reaching over the patient's right leg grasps the proximal end of the left leg with his right hand. An assistant presses downward on the patient's right shoulder locking the spine in rotation-flexion. Mobilization is attempted by flexing the legs and thighs, then elevating the thighs and at the same time applying pressure directed downward toward the spinous process of the fifth lumbar vertebra with the left hand.

Right rotation of the fifth lumbar vertebra is corrected in the same relative manner.

Lumbar and Lower Dorsal Lesions

The technique just described for rotation lesions of the fifth lumbar vertebra can be applied to as high as the ninth dorsal vertebra.

Third to Eighth Dorsal Lesions

The sixth dorsal vertebra will be used as an example.

Left lateral flexion (side-bending) lesion

The patient is placed in the prone position. The operator stands to the left side of the patient, places the hypothenar eminence of his right hand over the left transverse process of the sixth dorsal vertebra, and the thenar eminence of his left hand over the right transverse process of the same segment. Mobilization is attempted by simultaneously pressing downward and cephalad with the right hand and downward and caudad with the left.

Lesions on the right side are corrected in the same relative manner.

Left rotation lesion

The patient is placed in the prone position. The operator stands to the right side, places his left hand under the left anterior superior iliac spine, and the thenar eminence of his right hand over the left transverse
process of the sixth dorsal vertebra. Mobilization is attempted by elevating the pelvis with the left hand, while exerting pressure laterally and slightly cephalad with the right hand.

The right rotation lesion is corrected in the same relative manner.

**Bilateral flexion**

The patient is placed in the prone position. The operator, standing to the right of the patient, places his right hand over the spinous process of the sixth dorsal vertebra with the fingers directed toward the pelvis. Mobilization is attempted by leaning the body weight on the right hand, directing the pressure through the vertebra toward the pelvis.

**Bilateral extension**

The patient is placed in the prone position, and the operator stands to the right. The left hand is placed over the spinous process of the sixth dorsal vertebra with the fingers pointing cephalad. Mobilization is produced by exerting pressure by the left hand in a direction through the vertebra and cephalad.

**First and Second Dorsal Lesions**

The first dorsal vertebra will be used as an example.

**Left lateral flexion (side-bending) lesion**

The patient is placed in the left lateral recumbent position. Standing in front of the patient the operator supports the patient’s head with his right hand, and with his left axilla over the patient’s right arm places his left thumb to the right side of the spinous process of the first dorsal vertebra. Mobilization is attempted by first extending and then elevating the head and cervical column at the same time maintaining body weight downward through the patient’s right shoulder. The left thumb detects motion if produced.

**Bilateral extension lesion**

The same technique described above for the lateral flexion lesion is used bilaterally for the extension lesion.

**Left rotation**

The patient is placed in the prone position with the head and cervical column rotated to the right. Standing at the patient’s right, the operator places his right hand on the patient’s face to immobilize the cervical column, and the left thenar eminence to the right of the spinous process of the first dorsal vertebra or over the left transverse process of the first, whichever is more convenient. Mobilization is attempted by pressure exerted laterally through the spinous process, or downward, laterally, and cephalad through the transverse process.

**Bilateral flexion**

The patient is placed in the left lateral recumbent position.

The operator, standing facing the patient, places the left thumb and index finger against the occipital bone, the hypothenar eminence over the
TABLE

Results of mobilization under anesthesia in 110 patients as determined by examination one month after mobilization

<table>
<thead>
<tr>
<th>Areas Mobilized</th>
<th>No.</th>
<th>Improvement in Motion Range</th>
<th>Improvement in Symptoms</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>no.</td>
<td>per cent</td>
</tr>
<tr>
<td>Single Areas</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sacroiliac</td>
<td>3</td>
<td>2</td>
<td>67</td>
</tr>
<tr>
<td>5th lumbar</td>
<td>10</td>
<td>9</td>
<td>90</td>
</tr>
<tr>
<td>Lumbar and lower dorsal</td>
<td>19</td>
<td>18</td>
<td>95</td>
</tr>
<tr>
<td>1st and 2nd dorsal</td>
<td>4</td>
<td>4</td>
<td>100</td>
</tr>
<tr>
<td>Cervical</td>
<td>2</td>
<td>1</td>
<td>50</td>
</tr>
<tr>
<td>Combined Areas</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>General (entire spine)</td>
<td>17</td>
<td>15</td>
<td>88</td>
</tr>
<tr>
<td>Sacroiliac and lumbosacral</td>
<td>19</td>
<td>17</td>
<td>89</td>
</tr>
<tr>
<td>Sacroiliac and lumbars</td>
<td>12</td>
<td>11</td>
<td>92</td>
</tr>
<tr>
<td>Sacroiliac and lower dorsals</td>
<td>8</td>
<td>8</td>
<td>100</td>
</tr>
<tr>
<td>Cervical and upper dorsals</td>
<td>6</td>
<td>5</td>
<td>83</td>
</tr>
<tr>
<td>Sacroiliac, lumbosacral, and lower dorsals</td>
<td>3</td>
<td>2</td>
<td>67</td>
</tr>
<tr>
<td>Sacroiliac and upper dorsals</td>
<td>2</td>
<td>2</td>
<td>100</td>
</tr>
<tr>
<td>Lumbars and cervicals</td>
<td>2</td>
<td>2</td>
<td>100</td>
</tr>
<tr>
<td>Cervical and lower dorsals</td>
<td>1</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Lumbar and upper dorsals</td>
<td>1</td>
<td>1</td>
<td>100</td>
</tr>
<tr>
<td>Lumbars, 2nd dorsal, and atlas</td>
<td>1</td>
<td>1</td>
<td>100</td>
</tr>
<tr>
<td>Totals</td>
<td>110</td>
<td>98</td>
<td>89</td>
</tr>
</tbody>
</table>

spinous process of the first dorsal vertebra, and his right hand against the frontal bone. Mobilization is attempted by using an extension or backward pressure with the right hand, transmitted through the left hand, and through the first dorsal vertebra, which causes this segment to glide backward and downward.
Cervical Lesions

General cervical mobilization

The patient is placed in the right lateral recumbent position. The operator stands in front of the patient, places his left hand under the right side of the patient’s face and his right axilla over the patient’s left arm to control the dorsal vertebral column. The head and cervical column are held in the neutral or slightly flexed position. Mobilization is attempted by a combination of elevation (left side-bending) right rotation, and an exaggeration of these movements with traction added.

Postoperative Management

Great care should be exercised in moving the patient from the table to the carrier and from the carrier to the bed to prevent additional lesioning. At least three persons should do the lifting and this should be carried out in such a manner as to maintain as nearly as possible a fixed relationship of all spinal areas.

The average length of hospitalization is about seventy-two hours.

No manipulation of any kind is given for a period of one month following correction under anesthesia as it is felt that tissue readjustments taking place after the operative procedure require this time and should be undisturbed. Hot compresses are applied three times daily for one-half hour duration if necessary.

Recheck of the condition is made at the end of one month; and if motion has been maintained, the patient is discharged.

Results

The results of mobilization under anesthesia in 110 patients are shown in the table. It will be seen that at the end of one month following mobilization there was maintained improvement in joint motion in 89 per cent of all cases. It is of interest to note that there were some patients in whom symptomatic relief was obtained despite the fact that joint mobilization was not maintained at the one month recheck period. Ninety-four per cent of all cases evidenced symptomatic improvement.

Summary

Mobilization of spinal joints under anesthesia in selected cases has a definite place in osteopathic manipulative procedures.
Selection of cases is presented.
Mobilization under anesthesia is a hospital procedure.
Cyclopropane-oxygen is the anesthetic of choice.
Manipulative techniques are described.
Results in 110 cases indicate 89 per cent improvement in joint motion, and 94 per cent improvement symptomatically one month after manipulation.
COMPARATIVE STUDY OF THE SEGMENTAL INCIDENCE OF INDIVIDUAL SPINAL PALPATORY FINDINGS IN DISORDERS OF CERTAIN THORACIC, UPPER ABDOMINAL AND PELVIC ORGANS

GUY S. DEMING

Associate in Research

In previous reports from this laboratory on the general subject of the relation of spinal changes to various disorders, individual studies of the incidence of spinal palpatory findings in disorders of the gastrointestinal tract and of certain thoracic and pelvic organs have been presented. The purpose of this report is to analyze the relationship of these individual spinal palpatory findings recorded in uncomplicated disorders of certain thoracic, upper abdominal, and pelvic organs. This topographical segregation of visceral disorders into these three groups follows the generally accepted allocation of somatic reflex association areas of the spine. The thoracic group comprises disorders of the heart, aorta, bronchi, and lungs, for which the generally recognized somatic reflex associations extend from the second cervical to the fifth or sixth thoracic segmental level. The upper abdominal group, made up of disorders of the stomach, duodenum, and gallbladder, is generally considered to have reflex somatic associations extending from the fifth to the ninth or tenth thoracic segmental level. The pelvic group reported comprises disorders of the female genital organs for which the generally accepted somatic reflex association area extends from the tenth thoracic to the fourth sacral segmental level. If this distribution of somatic reflex association areas—for which there is no serious overlap of segmental innervation—be accepted, the preponderant incidence of spinal palpatory findings for each group of disorders selected might be expected to fall within the designated areas. In this report wherever the terms thoracic, upper abdominal, and pelvic organs are used, they refer to the particular organs mentioned in each group.

Selection of Cases

Two hundred sixteen case records from the outpatient clinic of the Philadelphia College of Osteopathy were selected from approximately 4500 on file in the Research Department. Of these, 86 were records of uncomplicated disorders of thoracic organs, 29 of uncomplicated disorders of upper abdominal organs including 12 cases not previously reported on, and 101 were records of uncomplicated disorders of pelvic organs. All case records accepted for this study included a final diagnosis, an osteogram made prior to the institution of any treatment, and recorded no complicating disorder. The distribution as to age and sex of the patient, and as to location of the disorders is given in table 1.
TABLE I
Age and Sex in Relation to Location of Disorders

<table>
<thead>
<tr>
<th></th>
<th>Thoracic</th>
<th>Upper Abdominal</th>
<th>Pelvic</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Heart and Aorta</td>
<td>Stomach, Duodenum, &amp; Gallbladder</td>
<td>Female Genitals</td>
</tr>
<tr>
<td></td>
<td>no. av. age</td>
<td>no. av. age</td>
<td>no. av. age</td>
</tr>
<tr>
<td>Males .......</td>
<td>56  42.5</td>
<td>25  50.5</td>
<td>18  35.8</td>
</tr>
<tr>
<td>Females ....</td>
<td>160 40.9</td>
<td>31  53.1</td>
<td>12  27.8</td>
</tr>
<tr>
<td>Totals .......</td>
<td>216 41.0</td>
<td>56  51.6</td>
<td>30  32.6</td>
</tr>
</tbody>
</table>

Method of Study

The description of the spinal palpatory findings, the symbols employed, the method used in recording findings on the osteogram, and the mathematical procedures followed in determining the statistical significance of individual findings, have all been explained in a previous paper. On the histograms, figures 1 to 7, the dotted base lines designate the lowest incidence percentage necessary for an observation to have statistical significance considering the number of cases included in each group, and the differential significance of any given finding is indicated by solid black of the graphs of preponderance.

Results

Figure 1 shows that statistically significant findings of abnormal vertebral position (P) occurred at the sacral segmental level in thoracic cases, and at the second and third cervical segmental levels in pelvic cases. The preponderance of these cervical findings in pelvic over upper abdominal cases is statistically significant.

Figure 2 shows that restricted intervertebral motion (R) is statistically significant at the occipital and sacral segmental levels in the thoracic cases, that there are no statistically significant findings in the upper abdominal cases, and that the findings at the occipital, fifth cervical, seventh cervical,
Fig. 1—Comparison of the segmental incidence of the spinal palpatory finding abnormal vertebral position (P) between thoracic and upper abdominal organs, and between upper abdominal and pelvic organs.

and fourth and fifth lumbar segmental levels are statistically significant in the pelvic cases. None of the differences shown on the graphs of preponderance is statistically significant.

Contracted paravertebral musculature (C), shown on figure 3, is the most frequent finding in all the groups presented in this study. All three histograms show a similar general pattern. All observations in the thoracic and pelvic groups are statistically significant. All but four observations in the upper abdominal group also have statistical significance. The concentration of incidence frequency in the thoracic and pelvic groups is found in the areas of recognized somatic reflex association. However, it is to be noted that this is not true for the upper abdominal group in
Fig. 2—Comparison of the segmental incidence of the spinal palpatory finding restricted intervertebral motion (R) between thoracic and upper abdominal organs, and between upper abdominal and pelvic organs.

which the lowest concentration of incidence frequency occurs from the third to the tenth thoracic segmental level, and that the incidence at the sixth, seventh, eighth, and ninth thoracic levels falls short of being statistically significant. The preponderance of pelvic over upper abdominal incidence is shown at the tenth thoracic segmental level.

Figure 4 shows the findings abnormal vertebral position (P), and restricted intervertebral motion (R), occurring in combination (PR). The incidence frequencies having statistical significance in the thoracic group are found at the first, second, and third thoracic segmental levels as might be expected, and at the sacral level. None of the findings in the upper abdominal group has significance, but in the pelvic group statistically
Fig. 3—Comparison of the segmental incidence of the spinal palpatory finding contracted paravertebral musculature (C) between thoracic and upper abdominal organs, and between upper abdominal and pelyic organs.
significant incidence frequencies are found at the second and third cervical, the second thoracic, and the sacral segmental levels. None of the differences shown on the graphs of preponderance has statistical significance.

Figure 5 shows the findings abnormal vertebral position (P) and contracted paravertebral musculature (C) occurring in combination (P.C.). The incidence frequencies are statistically significant in the thoracic group at the first, second, third, fifth, and seventh cervical segmental levels, and from the first through the eleventh thoracic levels. In the upper abdominal

![Graphs showing incidence frequencies for different segments and organs](image)

*Fig. 4—Comparison of the segmental incidence of the spinal palpatory finding abnormal vertebral position (P), and restricted intervertebral motion (R) occurring in combination (PR) between thoracic and upper abdominal organs, and between upper abdominal and pelvic organs.*
Fig. 5—Comparison of the segmental incidence of the spinal palpatory finding abnormal vertebral position (P), and contracted paravertebral musculature (C) occurring in combination (PC) between thoracic and upper abdominal organs, and between upper abdominal and pelvic organs.
Fig 6—Comparison of the segmental incidence of the spinal palpatory finding restricted intervertebral motion (R), and contracted paravertebral musculature (C), occurring in combination (RC) between thoracic and upper abdominal organs, and between upper abdominal and pelvic organs.
Fig. 7—Comparison of the segmental incidence of the spinal palpatory finding abnormal vertebral position (P), restricted intervertebral motion (R), and contracted paravertebral musculature (C), occurring in combination (PRC) between thoracic and upper abdominal organs, and between upper abdominal and pelvic organs.

In figure 6 the concentration of statistically significant incidence frequency of restricted intervertebral motion (R) and contracted paravertebral musculature (C) occurring in combination (RC), falls within the area of recognized somatic reflex association in each of the three groups. Most of the observations are statistically significant, but none of the differences shown on the graphs of preponderance has statistical significance.

Figure 7 is a graph showing abnormal position (P), restricted intervertebral motion (R), and contracted paravertebral musculature (C), occurring in combination (PRC). In the thoracic group the concentration of incidence frequency is from the first to seventh thoracic segmental level and is statistically significant. In the upper abdominal group the corresponding concentration is from the seventh to twelfth thoracic seg-
mental level but is without statistical significance. In the pelvic group, the concentration of incidence frequency is less marked than in the thoracic group but is in the same area—from the first to the seventh thoracic segmental level. None of the differences shown on the graphs of preponderance is statistically significant.

**Comment**

The incidence of seven individual spinal palpatory findings has been analyzed and reported for uncomplicated disorders of three groups of topographically separated organs. A distinct somatic spinal reflex association area is generally accepted for each of these groups. In this study only three of the seven individual spinal palpatory findings have statistically significant preponderance. These are: Abnormal vertebral position (P) occurring alone, contracted paravertebral musculature (C) occurring alone, and these two findings occurring in combination (PC). These are shown respectively on figures 1, 3, and 5. On the evidence of this and of previous studies in the same field made in this laboratory, it is indicated that spinal palpatory findings, even when determined and recorded by trained technicians, should be used with extreme caution in the differential diagnosis of visceral diseases.

Grateful acknowledgment is made of the assistance rendered by Doctor Barbara Redding in the preparation of this report.

**References**


THE EFFECT ON BLOOD PRESSURE AND PULSE RATE IN NON-CLINICAL SUBJECTS OF ACTIVE SOFT TISSUE MANIPULATION COMBINED WITH SUDDEN SPINAL JOINT MOBILIZATION IN THE ENTIRE SPINAL REGION

Guy S. Deming

Associate in Research

and

Viola C. Krueener

Assistant in Research

Throughout recent years there has been published a series of experiments showing the effects of manipulation on blood pressure and pulse rate in non-clinical subjects. These experiments were designed to determine the effect of sudden spinal joint mobilization alone, of soft tissue manipulation alone, and of soft tissue manipulation combined with sudden spinal joint mobilization in specific, segregated spinal regions—cervical, thoracic, and lumbar. In order to round out this series of experiments, the effects on systolic and diastolic blood pressure, and on pulse rate in non-clinical subjects of soft tissue manipulation combined with sudden spinal joint mobilization in the entire spinal region are reported here.

Sixty male students were chosen from the freshman and sophomore classes of the Philadelphia College of Osteopathy, thirty of whom served as subjects for this experiment and thirty as controls. The average age of the subjects was 23.5, with a range from 20 to 33 years, that of the controls was 23.8, with a range from 21 to 29 years. Each participant was informed of the nature of experiment and what the procedure was to be.

The experiments were performed on one subject and one control at a time in a well-ventilated room kept at even temperature. Most of the experiments were carried out between the hours of 10:00 A.M. and 12:00 M. A uniform amount of clothing was worn by subject and control, and all constricting bands were released before the experiment began. There was no conversation between subject and control during the experiment, and rarely between the two operators. The cuff of a mercury type sphygmomanometer was applied to the left arm, and the auscultatory method of determining blood pressure employed. The pulse rate was determined by counting the radial pulse at the left wrist for one-half minute.

Procedure

Subject and control rested supine for 10 minutes at the end of which
time the initial blood pressure and pulse rate were determined. Subsequent to this, the detailed manipulative procedure was as follows: The subject assumed the prone position with his face turned toward the operator standing at the subject's left side. The operator placed the thenar eminence and extended thumb of his right hand to the right of, parallel to, and just lateral to the subject's spinous processes in the upper thoracic area. His left hand was placed on top of his right. Maintaining his hands in this relative position, the operator slowly exerted firm pressure downward and laterally away from the subject's spinous processes, followed by a gradual release of pressure. This was repeated rhythmically for five minutes so that pressure was applied at successive spinal levels from and including the first thoracic vertebra to the fifth lumbar vertebra. Following this the same procedure was applied to the subject's left paravertebral musculature for five minutes. The subject then turned to the left lateral position, the under arm was drawn forward, the right knee drawn and flexed to a position resting on the table in front of and above the left knee. Forward pressure was applied to the right hip and backward counter pressure to the right shoulder. When the limit of motion was reached, sudden mobilizing force was brought to bear on the lumbar and lower thoracic spine. The subject then turned slowly to the opposite side and the procedure was repeated. The subject then turned on his back, and clasped his hands behind his neck, with his elbows approximating in front. The operator stood on the subject's right, grasped the subject's elbows, and produced flexion and right rotation of the thoracic spine. The operator's folded right hand was placed under the mid-thoracic spine on both sides of the spinous processes and the subject was brought vertically over the operator's hand with flexion still maintained. Sudden mobilization of the mid-thoracic spine was produced by maintaining downward pressure on the subject's elbows and at the same time allowing the spine to fall into extension. This procedure was repeated with the operator's hand at a higher spinal level to mobilize the upper thoracic vertebrae. Then, with the subject supine, the operator stood to the right of the subject's head and manipulated the posterior cervical soft tissue on the opposite side by repeatedly stretching the cervical muscles by forces exerted at right angles to their direction. The force was applied by the operator's fingers starting just lateral to the spinous processes and working laterally around the posterior cervical region extending from the suboccipital region to the seventh cervical vertebra. This was continued for two and one-half minutes and then the opposite side was manipulated for two and one-half minutes in the same manner. The operator then established a fixed point by placing his index finger against one side of the subject's neck posterolaterally at the level of the third cervical vertebra. Rotation of the subject's head and cervical spine was produced away from the side of fixation, combined with slight extension and side-bending toward the fixed side. Rotation was carried to its limit and sudden mobilization of the cervical vertebrae was produced by a slight thrust with the index finger
TABLE 1

Original systolic and diastolic blood pressures, and pulse rates in 30 subjects and 30 controls used in study of the effects of the combination of soft tissue manipulation and sudden spinal joint mobilization in the entire spinal region.

<table>
<thead>
<tr>
<th></th>
<th>Subjects</th>
<th>Controls</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>average</td>
<td>range</td>
</tr>
<tr>
<td>Systolic</td>
<td>113.7</td>
<td>90-132</td>
</tr>
<tr>
<td>Diastolic</td>
<td>76.8</td>
<td>66-90</td>
</tr>
<tr>
<td>Pulse</td>
<td>67.5</td>
<td>54-78</td>
</tr>
</tbody>
</table>

**Fig. 1**—Average systolic blood pressures before soft tissue manipulation combined with sudden spinal joint mobilization in the entire spinal region (A), immediately after manipulation (B), and five minutes after manipulation (C). Based on findings in 30 subjects and 30 controls.
at the third cervical vertebral level and counter force by the operator's hand placed on the opposite side of the subject's head. This procedure was repeated on the opposite side. This completed the manipulative procedures applied to the subject. The control was carried through all the maneuvers of the subject and assumed all the positions taken by the subject but was not manipulated in any way.

**Results**

Table 1 records the mean value and range of blood pressures and pulse rates following the initial ten minute rest period before manipulation.

![Graph](image)

*Fig. 2—Average diastolic blood pressures before soft tissue manipulation combined with sudden spinal joint mobilization in the entire spinal region (A), immediately after manipulation (B), and five minutes after manipulation (C). Based on findings in 30 subjects and 30 controls.*
Fig. 1 shows the changes which occurred in the average systolic blood pressure immediately following manipulation, and five minutes after manipulation. Both subject and control showed an immediate and a later decrease in average pressure. This decrease is without statistical significance.

Fig. 2 shows the changes which occurred in the average diastolic blood pressure at corresponding periods. The graph for subjects and controls shows an immediate rise and later drop. The changes have no statistical significance.

Fig. 3 shows the average pulse rate changes. The graphs for subjects show a drop immediately after manipulation and a later rise. Those for controls show a progressive drop. The changes are without statistical significance.

*Fig. 3—Average pulse rates before soft tissue manipulation combined with sudden spinal joint mobilization in the entire spinal region (A), immediately after manipulation (B), and five minutes after manipulation (C). Based on findings in 30 subjects and 30 controls.*
TABLE 2
Average and maximum changes in systolic blood pressure in 30 subjects receiving a combination of soft tissue manipulation and sudden spinal joint mobilization in entire spinal region, and corresponding data in 30 controls. Figures based upon comparison with original values before manipulation was carried out.

<table>
<thead>
<tr>
<th></th>
<th>Immediately After Manipulation</th>
<th>5 Minutes After Manipulation</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>no.</td>
<td>per cent</td>
</tr>
<tr>
<td>Subjects</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(Increase)</td>
<td>10</td>
<td>33.3</td>
</tr>
<tr>
<td>(Decrease)</td>
<td>10</td>
<td>33.3</td>
</tr>
<tr>
<td>(No change)</td>
<td>10</td>
<td>33.4</td>
</tr>
<tr>
<td>Controls</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(Increase)</td>
<td>8</td>
<td>26.7</td>
</tr>
<tr>
<td>(Decrease)</td>
<td>14</td>
<td>46.6</td>
</tr>
<tr>
<td>(No change)</td>
<td>8</td>
<td>26.7</td>
</tr>
</tbody>
</table>

TABLE 3
Average and maximum changes in diastolic blood pressure in 30 subjects receiving a combination of soft tissue manipulation and sudden spinal joint mobilization in entire spinal region, and corresponding data in 30 controls. Figures based upon comparison with original values before manipulation was carried out.

<table>
<thead>
<tr>
<th></th>
<th>Immediately After Manipulation</th>
<th>5 Minutes After Manipulation</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>no.</td>
<td>per cent</td>
</tr>
<tr>
<td>Subjects</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(Increase)</td>
<td>17</td>
<td>56.7</td>
</tr>
<tr>
<td>(Decrease)</td>
<td>8</td>
<td>26.7</td>
</tr>
<tr>
<td>(No change)</td>
<td>5</td>
<td>16.6</td>
</tr>
<tr>
<td>Controls</td>
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<td></td>
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<tr>
<td>(Increase)</td>
<td>15</td>
<td>50.0</td>
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<tr>
<td>(Decrease)</td>
<td>7</td>
<td>23.3</td>
</tr>
<tr>
<td>(No change)</td>
<td>8</td>
<td>26.7</td>
</tr>
</tbody>
</table>
TABLE 4

Average and maximum changes in pulse rate in 30 subjects receiving a combination of soft tissue manipulation and sudden spinal joint mobilization in entire spinal region and corresponding data in 30 controls. Figures based upon comparison with original values before manipulation was carried out.

<table>
<thead>
<tr>
<th>Subjects</th>
<th>Immediately After Manipulation</th>
<th>5 Minutes After Manipulation</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>no.</td>
<td>per cent</td>
</tr>
<tr>
<td>(Increase)</td>
<td>6</td>
<td>20.0</td>
</tr>
<tr>
<td>(Decrease)</td>
<td>18</td>
<td>60.0</td>
</tr>
<tr>
<td>(No change)</td>
<td>6</td>
<td>20.0</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Controls</th>
<th>Immediately After Manipulation</th>
<th>5 Minutes After Manipulation</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>no.</td>
<td>per cent</td>
</tr>
<tr>
<td>(Increase)</td>
<td>5</td>
<td>16.7</td>
</tr>
<tr>
<td>(Decrease)</td>
<td>19</td>
<td>63.3</td>
</tr>
<tr>
<td>(No change)</td>
<td>6</td>
<td>20.0</td>
</tr>
</tbody>
</table>

Tables 2, 3, and 4 show individual variations in systolic pressure, diastolic pressure, and pulse rate immediately after and five minutes after manipulation.

Table 2 shows that the systolic pressure was increased in a greater proportion of subjects than controls, and was decreased in fewer subjects than controls immediately after manipulation. The same holds true for the observations made five minutes after manipulation.

Table 3 shows that the diastolic pressure was altered in a slightly greater proportion of subjects than of controls immediately following manipulation, but five minutes later it was altered in a slightly greater proportion of controls than of subjects.

Table 4 shows that the pulse rate was altered in the same proportion of subjects as controls immediately after manipulation, and was altered in a slightly higher proportion of subjects than of controls five minutes after manipulation.
Thirty male students of the Philadelphia College of Osteopathy were studied to observe the effects of soft tissue manipulation combined with sudden spinal joint mobilization in the entire spinal region on the systolic and diastolic blood pressures and the pulse rates. Thirty male students were used as controls. There were no statistically significant results in this experiment.

References

Sudden, unexpected death is an exceedingly frequent occurrence. The task of trying to explain these deaths is indeed a hazardous one. Throughout the history of medicine various explanations have been in vogue and too often they have been explanations without too secure a foundation. Status thymicolymphaticus has long been one of these explanations; yet when its mechanism is examined, we find it most difficult to establish.

Status thymicolymphaticus is said to be a constitutional defect characterized by lymphoid hyperplasia, enlargement of the thymus, and hypoplasia of the gonads, the cardiovascular system, and the adrenals. The heavy infant or youngster that fond parents boast about is a likely candidate. Overweight in infancy and childhood is just as pathological as a similar manifestation in adults.

Recently, Boyd quoting Greenwood and Wood said, “After a most careful statistical investigation status thymicolymphaticus is a good example of the growth of medical mythology, in which a nucleus of truth is buried beneath a pile of intellectual rubbish, conjecture, bad observations, and rash generalizations, . . . ”

The attitude of the Pathological Society of Great Britain and Ireland would seem to be that there is “no evidence that so-called status thymicolymphaticus has any existence as a pathological entity.”

Yet we are still confronted, from time to time, by cases of sudden death in which this “nucleus of truth buried beneath a pile of intellectual rubbish” is the only possible explanation. Some of us, however, would far rather admit on occasion that even after an autopsy we do not know what caused death. The following case brings to light these problems.

A-43-315
Died: 12-8-43, 10:00 p.m.
Autopsy: 12-9-43, 9:00 a.m.

Clinical Data

A three year old male child appeared quite well in the early evening of December 8th. He had complained of some catarrhal discharge from the nose and also there had been some looseness of the bowels. However,
from all outward appearances to his mother and father, both of whom are doctors, the boy appeared quite well. In the absence of the mother and father during the evening the child was in the care of a girl about sixteen years old, a practice which is quite common in the community. On returning home later in the evening the parents found the child dead. The girl related that she had heard peculiar noises in the boy’s room, thought he was having an epileptic seizure, and took him to the bathroom to administer what aid she could, but the youngster was evidently dead before she thought.

External Examination

The body was that of a young male, said to be three years old. The length was 31½ inches. The head was well covered with hair. There were no marks of violence anywhere on the body and no suggestions of caustic poisoning. A peculiar jaundice-like discoloration was noted on the trunk; there was none of this change on the extremities. The extremities and face were pale, but there were no petechial hemorrhages, no areas of edema, no lymphadenopathy, and no eruptions.

Internal Examination

The thymus gland was comparatively small extending barely over the upper reaches of the pericardium. There were some petechial hemorrhages into the gland and one area of hematoma, probably produced by an intracardial injection of adrenalin used as an emergency measure.

The pericardial sac contained a small quantity (less than 25 cc.) of amber fluid. The heart measured 8 x 5.5 x 4 cm. The greatest diameter of the thorax at the upper level of the diaphragm was 13 cm., giving a cardiothoracic ratio of 8/13. There were no valvular lesions and no congenital defects, but there were strong suggestions of right heart failure with dilatation.

The lungs presented some post-mortem lividity in the dependent portions. There were no effusions in the pleural cavities. There were no evidences of infective disease of the lungs. A few petechial hemorrhages were demonstrated here and there. There was a small amount of mucoid exudate in the bronchial tree, but the respiratory tree was explored into the mouth and no obstruction could be demonstrated.

The abdominal cavity contained less than 25 cc. of amber fluid. There were no noteworthy lesions of the esophagus.

The stomach presented no noteworthy lesions, and there were no suggestions of poisoning, either by odor nor by gross inspection.

The small bowel, particularly the ileum, presented a most unusual and excessive hyperplasia of the lymphoid elements giving the gross appearance of the hyperplastic stage of typhoid fever. This hyperplasia of lymphoid tissue extended into the large bowel with here and there a
suggestion of the "shaven-beard" appearance with little black spots embedded in lymphoid follicles.

There were no noteworthy lesions of the liver, nor of the gall-bladder.

The spleen measured 9 x 6 x 2 cm. and showed an excessive follicular hyperplasia.

The kidneys measured respectively, right and left, 8 x 4.5 x 3 cm. and 8 x 4 x 2.5 cm. These kidneys were intensely congested. There was no noteworthy lesions of the urinary bladder, of the ureters, nor of the external genitals.

There were no noteworthy lesions of the suprarenal glands.

Postmortem blood chemical examination showed, in the left atrial blood, 480 mgm. of sugar per 100 cc.; in the portal blood, 910 mgm. of sugar per 100 cc.

Bacteriological study of blood taken from the inferior vena-cava presented the cultural characters of B. coli communis. Bacteriological examinations of exudates from Peyer's patches presented, likewise, B. coli communis and these cultures failed to reveal any organisms of the typhoid or of the dysentery group.

Microscopic studies of tissues removed at the time of autopsy demonstrated generalized lymphoid hyperplasia compatible with the gross findings. The changes in the thymus gland were particularly striking. Corpuscles of Hassel were numerous, many of them being calcified. This latter change may have had considerable influence on the untimely death of this youngster.

Remarks

Because of the hyperplasia of the lymphoid elements of the ileum and the large bowel, and with great concern for the health of the community, the possibility of typhoid fever was strongly entertained, in spite of the clinical history characteristic of a syndrome referred to as thymic death. Efforts were made to provide protection for other members of the family against the possibility of typhoid. Bacteriological examinations seem to have eliminated the possibility of a bacterial cause of death. In the face of this evidence we were forced to conclude that this case should be placed in the category of thymic death, the mechanism of which is not known. The significance of the elevated blood sugar is not known. We would judge it to represent a reaction of suprarenal origin.

Cause of Death: Status thymicolymphaticus (thymic death).