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COMPARISON OF PALPATORY AND RADIOGRAPHIC METHODS OF DETERMINING VERTEBRAL SEGMENTAL MOTION

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and

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In a previous paper dealing with radiographic study of the immediate effect of manual mobilization on motion range in the cervical vertebral column a question was raised concerning the reliability of palpatory examination in determining changes in vertebral segmental motion. Certain findings relative to a comparison of palpatory and radiographic techniques in examining for vertebral motion were contained in a still earlier paper by two of us outlining a new radiographic procedure. These latter findings failed to show good correlation between palpation and x-ray methods of determining motion range. While the findings were presented as merely suggestive at that time, we have been forced to question the value of our own earlier results. One fault with the earlier study on this point brought to light by more recent studies was the time interval variable between palpatory examination and roentgenographic study. There was in some instances as much as a 24-hour difference between the two examinations. Recent studies have indicated that changes in segmental motion range occur in the unmanipulated subject between an a.m. and p.m. study made on the same day. This would make conclusions based on any study with a long time interval between the two examinations inadmissible.

In the study recently reported (1) opportunity was presented to make comparisons with a greatly shortened time interval between the two examinations. In this series radiographic examination was made immediately after palpatory examination, the only time interval being that consumed in walking from the treatment table to the x-ray apparatus, a distance of some fifteen feet.

A review of the radiographic technique used and other procedures previously published in this journal should be referred to.

Material and Procedure

The subjects used for this study were fifty patients from the clinic of the College ranging in age from 15 to 53 years, including 31 females and 19 males. The spinal palpatory examinations were all made by one of us (Soden) and recorded on the osteogram before roentgen study was
made. Immediately after palpatory examination films were made according to the technique referred to above. These films were ruled and the results compared with those determined by palpation. The basis used for determining flexion-extension motion from the films was the millimeter differences in the lengths of extended intersegmental vertical (E.I.V.) lines.

**Results**

Each of the fifty subjects had two examinations that could be used for this study making a total of 500 segments included in the results. Of this number 159 segments were recorded as restricted in flexion-extension motion and 341 as normal. The mean ranges were determined for both the restricted and unrestricted groups. The results are shown in table 1. It may be seen from the composite radiographic findings for all the segments that the mean range for the segments determined restricted in motion by palpation is slightly greater than those palpated as normal. Comparisons of each of the five segments involved indicate that there were no significant differences among them. It is of interest to note that in three of the five segments the lowest radiographically determined motion range values occurred in segments determined by palpation to be normal in motion.

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**TABLE 1**

Radiographically determined mean and extreme ranges of motion in segments palpated restricted, and unrestricted (normal) expressed in millimeters.

<table>
<thead>
<tr>
<th>Segments</th>
<th>Restricted</th>
<th>Normal</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>means</td>
<td>extremes</td>
</tr>
<tr>
<td>2</td>
<td>20.2</td>
<td>12.5 - 29.0</td>
</tr>
<tr>
<td>3</td>
<td>28.7</td>
<td>13.0 - 43.0</td>
</tr>
<tr>
<td>4</td>
<td>31.2</td>
<td>18.5 - 47.5</td>
</tr>
<tr>
<td>5</td>
<td>32.2</td>
<td>15.0 - 42.0</td>
</tr>
<tr>
<td>6</td>
<td>23.2</td>
<td>17.5 - 29.5</td>
</tr>
<tr>
<td>Composite</td>
<td>28.1</td>
<td>12.5 - 47.5</td>
</tr>
</tbody>
</table>
The 159 segments recorded restricted according to palpation were arranged in quartiles based on the range of motion in each determined by x-ray study. The ranges of motion for each segment used for establishing the quartile limits were those for both the restricted and normal segments and, therefore, represent the extreme ranges noted in this series for each segment. The low ranges were placed in quartile I and the high ranges in quartile IV. The palpation findings in each of the four groups of radiographically determined ranges were recorded and the results are shown in table 2. It will be seen that 71.7 per cent of the segments determined restricted by palpation were in the second and third quartiles.

TABLE 2

Segments arranged into quartiles according to radiographically determined ranges for each segment showing the number of segments palpated as normal and as restricted falling in each quartile.

<table>
<thead>
<tr>
<th>Quartile</th>
<th>Restricted</th>
<th></th>
<th>Normal</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>no.</td>
<td>per cent</td>
<td>no.</td>
</tr>
<tr>
<td>I</td>
<td>21</td>
<td>13.2</td>
<td>34</td>
</tr>
<tr>
<td>II</td>
<td>50</td>
<td>31.4</td>
<td>113</td>
</tr>
<tr>
<td>III</td>
<td>64</td>
<td>40.3</td>
<td>147</td>
</tr>
<tr>
<td>IV</td>
<td>24</td>
<td>15.1</td>
<td>47</td>
</tr>
</tbody>
</table>

with 40.3 per cent in the third quartile containing the next to greatest ranges of motion. Only 13 per cent of the segments recorded restricted by palpation are in the first quartile, made up of the low ranges of motion and in which we might expect to find the highest percentage of segments determined restricted by palpation. In the fourth quartile comprising the greatest ranges found radiographically 1.9 per cent more segments were charted restricted by palpation than in the first quartile. Comparison with the segments found normal in motion by palpation indicates that there was no significant difference in percentage distribution among the quartiles between the two groups. These findings would seem to indicate that palpation examination of flexion-extension motion in the cervical vertebral segments was not effective in determining extent of range of such motion.
TABLE 3
Comparison of palpatory and radiographic findings following manipulation.

<table>
<thead>
<tr>
<th>Palpatory</th>
<th>Increased</th>
<th></th>
<th></th>
<th>Decreased</th>
<th></th>
<th></th>
<th>Unchanged</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>no.</td>
<td>per cent</td>
<td>av. change</td>
<td>no.</td>
<td>per cent</td>
<td>av. change</td>
<td>no.</td>
<td>per cent</td>
<td></td>
</tr>
<tr>
<td>R before manipulation</td>
<td>42</td>
<td>53</td>
<td>3.2</td>
<td>33</td>
<td>41</td>
<td>2.8</td>
<td>5</td>
<td>6</td>
<td></td>
</tr>
<tr>
<td>N after manipulation</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>R before manipulation</td>
<td>20</td>
<td>53</td>
<td>2.9</td>
<td>12</td>
<td>31</td>
<td>4.8</td>
<td>6</td>
<td>16</td>
<td></td>
</tr>
<tr>
<td>R after manipulation</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>N before manipulation</td>
<td>68</td>
<td>53</td>
<td>3.3</td>
<td>54</td>
<td>42</td>
<td>3.6</td>
<td>7</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>N after manipulation</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

R—restricted.  N—normal (unrestricted).
Comparison was made of palpatory findings before and after manipulation with those determined radiographically. Certain segments were recorded restricted by palpation before manipulation and normal after manipulation indicating that an increased range of motion was believed to have been palpated. Other segments were recorded restricted both before and after manipulation indicating that in these segments palpation failed to reveal any increase in flexion-extension motion range. Still others were recorded normal in motion both before and after manipulation had been carried out to mobilize adjacent segments determined to be restricted. The radiographic findings in these three groups are indicated in table 3. In all three groups of segments certain ones increased in motion, others decreased, and some remained unchanged. In all groups the percentage of segments evidencing each change is seen to be essentially the same. There was correlation between palpation and radiographic findings in 53 per cent of the first group, in 47 per cent of the second group, and in 58 per cent of the third group. These data would seem to indicate that there was good correlation between palpation and radiographic findings following manipulation in approximately one-half (50.8 per cent) the number of segments palpated restricted before manipulation.

**Summary and Conclusion**

Comparison of palpatory and radiographic methods for determining flexion-extension motion range in five cervical vertebral segments was made utilizing fifty subjects.

The radiographically determined mean of ranges was slightly greater in the segments palpated restricted in motion than in those palpated unrestricted.

There was good correlation between palpatory and radiographic study following manipulation in approximately one-half of segments palpated restricted before manipulation.

Within the limits of this study the reliability of palpation as a method for determining cervical vertebral flexion-extension motion range must be questioned.

**References**


Clinical Data

The patient, F. H., an emaciated white male, age 57 years, a roofer by occupation, entered the hospital May 6, 1944. He complained of a continuous headache of thirteen weeks' duration. This headache was located across the eyes and occasionally was accompanied by occipital pain. He had been constipated since the onset of the pain.

A cough of increasing severity had been present for the same period as the headache noted above. A thick, purulent, occasionally blood-streaked material was expectorated. Dyspnea was experienced on moderate exertion. He had lost 60 pounds in weight in the previous ten months. His appetite was poor and he was easily nauseated.

He had been in another hospital for twelve days in March, 1944, where, by means of x-ray examination and aspiration biopsy, a diagnosis of bronchogenic carcinoma was made. Dextrocardia was also discovered.

His urine on admission was normal. The blood count showed 8550 neutrophiles per cu. mm. and a multiple index of 5.8. His sedimentation rate was 26 mm. per 1 hour, with a vertical curve to 22 mm. in 20 minutes (Cutler method).

Roentgenological Data

Roentgenological examination of the chest on April 7, 1944 showed a roughly triangular shaped opacity in the upper lobe of the right lung, located to the first rib and first interspace levels anteriorly. The hilar and intermediate lung zones were involved. The upper lobe trunks were accentuated from hilum to the opaque area. The bronchovascular and linear markings were rather prominent in both lungs.

The mediastinum showed no widening or gross abnormality.

The heart and aorta showed evidence of transposition with the left ventricle and the aortic arch to the right side. The right diaphragmatic leaflet was higher than the left.

Oral administration of barium showed the stomach located to the right side. The duodenum and liver were demonstrated on the left side.

*For the Resident Staff of the Hospital.
Complete visceral transposition was evident.
Films of the skull showed no intracranial calcifications. In the frontal bone, variations in density and alterations in vascular relief favored a diagnosis of metastatic malignant disease.

*Radiological Impression:* Primary bronchogenic carcinoma of the right lung with osteal metastasis to the skull. Complete transposition of viscera.

High voltage roentgen therapy was utilized for purposes of a palliation, treatment being directed to both the primary tumor and to the involved cranium.

Roentgen therapy to the head and chest relieved the headache, but he became progressively weaker. He was observed at 5:30 A.M. on May 15 and appeared as usual. At about 6:50, the same morning, he was discovered with the bed clothing covered with fresh blood. He was pronounced dead.

*Postmortem Data*

*External Examination:* The body was that of an emaciated white male, said to have been 57 years old. He was 67.5 inches long and the estimated weight was about 100 pounds. There was a marked bronzing of the skin. A tendency towards pigeon breast with a deformed xyphoid process was noted. Complete upper and lower dentures were in place. The left pupil was larger than the right. The whorl of the hair on the crown was counter-clockwise.

*Internal Examination:* Two to three millimeters of deep orange colored subcutaneous fat was seen on incision of the skin.

The pericardial sac contained 100 cc. of clear, straw-colored fluid. White patches were noted on the pericardium. The heart measured 9 x 9 x 4 cm. and the cardiothoracic ratio was 9/22. The coronary arteries were tortuous and the heart was a deeper brown color than normal. The whole presented the appearance of brown atrophy. Examination of the interior of the heart disclosed a patency of the foramen ovale large enough to admit a grooved director. The valves presented no lesions. This organ presented dextrocardia. The apex was to the right. The aorta arched to the right and lay to the right of the inferior vena cava. The aorta demonstrated some atherosclerosis in its abdominal portion with ulceration but no calcification.

The heart, thoracic aorta, bifurcation of the trachea and the mediastinal nodes, which were enlarged, were bound together in a firm mass which presented difficulty to dissection.

The lungs demonstrated, as did the heart and all other viscera examined, situs inversus viscerum. The right lung had only two lobes and the left had three lobes. The left pleural cavity was dry. The left lung
weighed 840 grams. Edema was noted. A firm greyish nodule about 3 cm. in diameter was seen, in the hilar region. The bronchi were filled with blood. Healed tubercular lesions were noted at the apex. The right pleural cavity contained no fluid. The right lung weighed 700 grams. The upper lobe was firmly adherent to the parietal pleura and it tore on removal. This lobe was riddled with many nodules and masses of greyish tissue. The lung substance about the nodules was soft and had a gangrenous odor. Examination of the bronchi disclosed a neoplastic thickening and roughening of the epiarterial bronchus. All the bronchi were filled with blood.

The esophagus demonstrated no noteworthy lesions but its normal curves from the midline tended towards the right, rather than to the left.

The stomach was completely reversed in position. It showed no other abnormalities but contained a small quantity of undigested blood. The intestines were normal except that all positions were the reverse of normal.

The cecum and appendix were located in the lower left quadrant. The appendix was retrocecal.

The liver weighed 1310 grams. It was on the left instead of the right side. Its substance contained four cysts, one to two centimeters in diameter. Fatty metamorphosis and "nutmegging" were evident. No tumor masses were seen.

The gallbladder contained a large amount of dark, thin bile and some fine gravel. The bile emptied through the ampulla readily with the application of pressure.

The pancreas was normal except for its reversed position.

The spleen was located on the right side. It weighed 100 grams and measured 9 x 6.5 x 3 cm. No lesions were evident. The retroperitoneal glands were enlarged.

The right kidney weighed 240 grams and measured 13 x 5 x 5 cm. The left kidney weighed 160 grams and measured 12.5 x 4.5 x 3 cm. Both showed remnants of fetal lobulation. Both appeared somewhat congested. No metastatic lesions were found. Their capsules stripped easily.

The bladder contained 75 cc. of amber, cloudy urine. Numerous small diverticuli were present in the walls.

The prostate was normal.

The right suprarenal gland weighed 15 grams and measured 5 x 3 x 1.5 cm. The left suprarenal gland weighed 80 grams and measured 8 x 5.5 x 2 cm. Both were very firm. Their cut surfaces were mottled yellow and white with small areas of hemorrhage.

A mass of tissue, similar to that found in the lungs, measuring about 2 cm. in diameter was located in the right cerebellar lobe and a similar mass was found in the right frontal lobe of the brain.
Anatomical Diagnosis

Situs inversus viscerum
Atherosclerosis
Hemorrhage (bronchial origin)
Bronchogenic carcinoma
Metastatic carcinoma in the suprarenal glands, mediastinal and retroperitoneal lymph nodes, right cerebellar lobe, and right frontal lobe.

Cause of Death: Hemorrhage due to bronchogenic carcinoma.

Case II

Clinical Data

This patient, Mrs. E. D., 60 years of age, was admitted to the hospital on May 13, 1941 complaining of a "dragged out feeling and heart thumping." She had been under a physician's care and had been told a month previous to admission that she had a blood disorder. She had noted a slight yellow discoloration of the skin for the previous ten days.

Her appetite was poor, she had been constipated for years and took mineral oil every night. Fourteen years previous to admission she had had an attack of "gastritis."

Physical examination revealed an emaciated female, slightly jaundiced, with a blood pressure of 130/60. Her cervical lymph nodes were slightly enlarged and tender. Tenderness was evident over the gallbladder area and over the right flank. The liver margin was palpable. No masses were noted.

Urinalysis revealed nothing suggestive. A blood count done on the date of admission showed 1,680,000 erythrocytes per cu. mm.; hemoglobin, 4.5 grams per cent (33 per cent); a color index of 1.0, and a white count of 68,700 per cu. mm. A differential study divided the latter into lymphocytes 96 per cent (65,957 per cu. mm.), and neutrophiles 4 per cent (2,748 per cu. mm.).

Roentgenological Data

Roentgenological examination of the chest and abdomen on May 5, 1941 showed the lungs to be negative for active pulmonary tuberculosis and other indications of parenchymal pathology. The heart appeared to be generally enlarged, the left heart being preponderant.

The right mediastinal relief showed some prominence which was judged to be due to the aorta and great vessels. No aneurysm was present.

Exploratory films of the abdomen showed the spleen to be enlarged, producing pressure upon and displacement of the left kidney. The liver also showed enlargement.

The patient was referred for radiation therapy for lymphatic leukemia. Treatment was instituted on May 25, 1941 and continued to June 7, 1941.
Paravertebral irradiation was utilized, with treatment directed to the dorsal and lumbar regions. Six surface portals were employed, each port receiving 280 r (air).

A diagnosis of an atypical form of acute lymphogenous leukemia was made and irradiation was instituted. Eight blood transfusions were given. A progressive decrease of leucocytes was noted in seven determinations and the patient was discharged June 7, 1941 with a red blood count of 1,290,000 per cu. mm., hemoglobin less than 3 grams per cent, and a white count of 3,800 per cu. mm. The neutrophiles were 80 per cent, 3,040 cells per cu. mm. The lymphocytes were 20 per cent, 760 cells per cu. mm.

The patient was next seen on September 24, 1942 for examination of the stomach and duodenum. The exploratory film again demonstrated enlargement of the liver and spleen. The esophagus showed no pathologic changes to the administration of liquid barium.

The stomach presented an altered mucosal pattern in the prepyloric (antral) segment, and there was a constant filling defect demonstrated in the antrum involving both the greater and lesser curvatures. Complete absence of peristaltic activity was noted at the site of defect. Palpatory examination revealed a well defined tumor mass located to the region of defect.

The post-pyloric cap, duodenum and jejunum appeared to be negative for intrinsic pathology.

Examination at the five hour period showed a small gastric residuum at the site of filling defect. The bulk of the contrast meal was located to the ileum and cecum. Marked pressure tenderness was elicited on palpation over the ileocecal regions, though no tumor mass was felt.

The colon was examined by clysm. Modified filling of the cecum was established with no barium entering the ileum. The possibility of ileocecal intussusception was suggested.

*Radiological Impression:* The gastric examination revealed findings typical for neoplastic disease with a constant defect present in the antral segment. Consideration was given to (1) neoplasm of leukemic origin and (2) gastric carcinoma.

The possibility of neoplastic disease located to the ileocecal region was given consideration and ileocecal intussusception was felt to prevail.

She was readmitted to the hospital in a cachectic state on March 1, 1943, with the complaints of intermittent pain in the abdomen for the past three years, which were becoming more frequent and more severe. There was a concomitant loss of weight.

Physical examination revealed crepitant rales in the hilar areas, bronzing of the skin and a paracentesis wound in the midline between the umbilicus and the pubes, which was draining very little. The abdomen was distended and contained much fluid. A mass was palpated low in
the abdomen. It was stated that a mass which had previously been palpable in the upper abdomen was not evident. No enlargement of the axillary or inguinal nodes was found.

A blood count done March 1, 1943 showed the following: Erythrocytes, 2,900,000 per cu. mm.; hemoglobin, 8.5 grams per cent; (61.9 per cent,) color index, 1.06; coagulation time of 3 minutes. The differential was as follows: Neutrophiles, 13 per cent, 8630 cells per cu. mm.; monocytes, 1 per cent, 510 cells per cu. mm.; lymphocytes, 86 per cent, 43,860 cells per cu. mm., a total of 51,000 cells per cu. mm. The lymphocytes were 4 per cent large and 82 per cent small. The Schilling index was 3/10, and the multiple index was 4.8.

On the second hospital day the patient was incontinent and complained of pain in the chest and abdomen. The next day small quantities of rusty sputum were expectorated. Her temperature started rising on the third day and she died March 5, 1943 at 5:50 a.m.

Autopsy Protocol

The body was that of an elderly, emaciated, white female, said to have been 62 years old. The abdomen was distended with fluid, and a large mass was palpable in the midline, just above the pubes. There was a scar of what appeared to be a midline incision extending from the pubes to the umbilicus. A small paracentesis wound was located midway between the umbilicus and pubes in the midline. The left leg and thigh were markedly edematous.

The left hemithorax contained 1,100 cc. of an amber red-tinged fluid. No fluid was found in the right hemithorax. The right lung had a few fine adhesions to the pericardium and the diaphragm. The left lung had a few fine adhesions, also, to the diaphragm. Both lungs demonstrated hypostasis. The lower lobe of the left lung was atelectatic. The bronchi contained a rusty, frothy exudate.

The pericardial sac contained about 70 cc. of straw-colored slightly turbid fluid. The heart had the classical appearance of brown atrophy. It measured 10 x 8 x 5 cm. in situ and weighed 200 grams. The right ventricle exhibited some myomalacia. There was some calcification distal to the aortic cusps. Atherosclerosis was evident about the coronary openings and along the coronary arteries. The mitral curtain was thickened along its free border. The abdominal aorta had some calcification in its wall, and several atheromatous ulcers.

The abdomen contained 3000 cc. of fluid contaminated with fecal matter. The greater omentum had one firm adhesion to the anterior abdominal wall, low in the abdomen.

The intestinal tract appeared to be gangrenous from the esophagus to the ascending colon. No cause, such as embolism or thrombi, was
demonstrated. The stomach presented a ragged perforation in the anterior wall of the fundus, which measured about 2 cm. in diameter. The wall in the prepyloric region presented a thickening which involved the pylorus. The inferior surface of this thickened area was ulcerated. The area was 8 x 5 cm. and 1 cm. thick.

The duodenum, jejunum, and ileum were gangrenous as mentioned before, as was the cecum, ascending colon and appendix. A perforation existed in the cecum similar to the one in the stomach. Both were probably due to gangrene. The ileocecal region was adherent to a large pelvic mass and to the anterior abdominal wall. The sigmoid colon was bound by adhesions to the parietal peritoneum on the left and anteriorly.

The gallbladder was distended and thin-walled but emptied with moderate pressure. It contained amber-colored bile. The liver was stained by the abdominal contents. The left lobe showed many fibrous bands. The cut surface demonstrated some cirrhosis. This organ weighed 1550 grams.

The spleen weighed 350 grams and measured 16 x 8 x 3 cm. It was fairly firm. The cut surface was characteristic for this organ.

The pancreas presented no abnormalities.

The left kidney weighed 160 grams and measured 11 x 5 x 3 cm. The capsule stripped with difficulty. The surface was granular. The right kidney showed remnants of lobulation. A small cortical cyst measuring 0.8 cm. was present. A mild degree of pyelectasis was evident. The right kidney weighed 150 grams and measured 10 x 5 x 3 cm. Its surface was granular and the capsule was difficult to strip.

The bladder contained 50 cc. of cloudy, amber fluid. Its interior was ribbed.

The mass in the pelvis proved itself to be taking the place of the right ovary. This mass was bound by adhesions to the posterior abdominal wall and to the terminal ileum and cecum. The right ovarian tube extended over the right anterior surface of the mass. The presence of this tumor had flattened the uterus antero-posteriorly. The neoplasm weighed 1500 grams and measured 19 x 15 x 10 cm. It was markedly cystic in some areas. Other areas were white and caseous, and in other places the growth was quite solid. The left ovary was hard and wrinkled. It measured 3.5 x 2 x 1 cm. A small subserous fibroid was seen on the fundus of the uterus. It measured about 1.5 x 0.6 cm.

Examination of the lymph nodes of the body revealed no enlargement of the cervical or axillary nodes. The deep inguinal nodes and retroperitoneal nodes were slightly enlarged.

Sections were taken of the various tissues, including the stomach mass, the pelvic neoplasm, enlarged nodes, and the lumbar vertebrae for microscopic study.
Anatomic Diagnosis

Lymphogenous leukemia
Ulcerocarcinoma of the stomach
Secondary carcinoma of the right ovary
Pulmonary atelectasis

Microscopy

Sections of the heart muscles show atrophy of the myocardial cells but with no evidences of leukemic infiltration.

Sections of the mammary glands show a great increase in quantity and density of the supporting framework. There is some hyperplasia of the ductal elements with here and there the suggestion of the possibility of early cystic disease.

Sections of the lungs show some compression of the alveoli suggestive of pressure atelectasis. Congestion is evident in most portions examined. There are no areas of consolidation demonstrated.

Sections of various lymph nodes show some hematogenous pigmentation, particularly about the outer margins of the lobules of these structures. In general there is a striking lack of germinal centers in these lymph nodes and lymph follicles and for the most part the architecture of the nodes present a monotonous uniformity of cells, such as might be seen in lymphosarcoma. If the blood picture were not known we would probably judge this to represent lymphosarcoma. However, in the light of the blood picture we are inclined to believe that this represents lymphogenous leukemia.

Sections of the spleen show a very conspicuous accumulation of iron-containing blood pigment. There are no evidences of tumor and little changes corresponding to those of the lymph nodes, described above.

Sections of the kidneys show some distention of the tubular apparatus with retained fluid and albuminous debris. The blood in the blood vessels evidences an excess of cellular elements of the lymphatic series. True leukemic infiltrations, however, are not noted in these kidneys. There is little thickening of the blood vessels, considering the age of this patient.

Sections of the liver show distinct lobulation due to the development of interstitial hepatitis corresponding to the description of portal cirrhosis. The distribution of blood pigment along these lines of cirrhosis, however, would suggest the possibility of a pigmentary cirrhosis. Fatty metamorphosis is noted. Leukemic infiltrations are not demonstrated.

Sections of one ovary show dense cortical structures compatible with senility. Here and there are invasions by somewhat anaplastic glandular elements, suggestive of secondary carcinoma.

Sections of the tumor mass from the stomach show it to be composed of somewhat anaplastic epithelial elements derived from the mucous membrane. These elements have made a very grotesque architecture with invasion of all the layers of the stomach including the muscularis proprium and the serosa with some of the cells lined about the serosal covering.
Sections of the large tumor mass from the ovary show it to be composed essentially of necrotic, anaplastic epithelial cells and viable anaplastic epithelial cells and the architecture of metastatic adenocarcinoma. This would constitute a Kukenberg tumor.

Sections of the bone marrow selected from the bodies of the vertebra show a moderate amount of fat and a moderate amount of supporting reticulum. There is little evidence of development of the granulocytic series of cells except for a few scattered eosinophilic elements. The development of erythrocytes is, likewise, little short of suspended. The predominating elements in these portions of bone marrow are comparatively small, uniformly rounded cells, very much the same as those previously described above in the lymph nodes. It would be our impression that these elements represent a leukemic replacement of bone marrow. These sections do not show this replacement uniformly throughout all portions but predominantly these are the changes noted.

SPONTANEOUS RUPTURE OF THE AORTA DUE TO NON-LUETIC DISSECTING ANEURYSM: AUTOPSY REPORT OF A CASE*

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In a previous communication a case of rupture of the aorta due to syphilis was reported with the autopsy protocol. Syphilis is so frequently the basis for rupture of the aorta that there is danger of assuming all such cases to be luetic. The case to be presented here is to contrast with the previous one to demonstrate one of the non-luetic mechanisms.

A-44-1562
Died: May 26, 1944, 1:50 p.m.
Autopsy: May 26, 1944, 3:15 p.m.
At the City Morgue

Clinical Data

"Deceased was doing some scrubbing and he collapsed."

External Examination

The body was that of a well-developed negro, said to have been 45 years old. His length was 67½ inches and his weight was estimated at 160 pounds. There was a fair crop of kinky black hair on the scalp, with frontal baldness. The pupils were equal in size and the conjunctiva was moist, suggesting that death was very recent. There was no rigor mortis.

*Case reported through the courtesy of Dr. Benjamin Gouley, Chief Coroner's Physician, City of Philadelphia.
The mouth was in foul condition with snags of teeth here and there. The face was unshaved for 24 to 48 hours. The penis was carefully inspected for the possibility of a healed chancre but none was found. A right-sided hydrocele was quite evident. The legs were thin and the feet were flat and excessively dirty.

There were no evidences of trauma, no evidences of caustic poisoning, no areas of edema, and no scars on the body.

**Internal Examination**

The subcutaneous fat was 1 cm. in thickness.

The pericardial sac contained several hundred centimeters of free blood and large quantities of blood clots, equivalent to several hundred cubic centimeters of blood. A rupture of the first portion of the aorta was evident, bringing about this hemorrhage.

The heart was crowded upon by the blood clots in the pericardial sac, yet it measured 19 x 8 x 9 cm. The greatest diameter of the thorax at the upper level of the diaphragm was 23 cm. with a cardiothoracic ratio of 19/23. All the chambers of the heart were dilated. The aortic valves were broadened but there were no evidences of syphilis. A dissecting aneurysm of the first portion of the aorta was noted with a transverse tear of the aorta and perforation into the pericardial sac. The pericardium was adherent to the apex of the heart but we were unable to demonstrate sufficient evidence to account for this on the basis of coronary occlusive disease. The aorta was scanned throughout its extent for evidences of syphilis and none could be demonstrated.

The pleural cavities had been obliterated by adhesions, but some fluid had accumulated in the right. The lungs had been somewhat collapsed by the pressure of the accumulated hemorrhage in the pericardial sac. There were no noteworthy lesions of the lungs.

The esophagus presented no noteworthy lesions.

The stomach was empty and presented hyperplasia of the gastric mucosa. There were no evidences of tumor and no suggestions of ulceration.

The intestines contained a small quantity of digested food and a large quantity of bile. The serosa of the intestines, particularly along the mesenteric attachment was studded with small cystic bodies suggestive of chronic peritonitis. Adhesions were noted here and there.

The colon presented no noteworthy lesions.

The appendix was embedded in adhesions.

The peritoneum was roughened, as noted above, along the intestines. Free fluid was found in the abdominal cavity, probably less than 50 cc.

The gallbladder presented a cystic serosa but no lesions within.

The liver was 18 cm. tall. Numerous cavernous hemangiomata were demonstrated on the superior surface of the liver, within the substance of the liver and in the inferior surface of the liver. The largest of these was a mass 8 cm. in diameter on the under surface of the liver.
The pancreas presented no noteworthy lesions. The spleen measured 14 x 8 x 6 cm. and was quite large for a colored individual. This organ was firm and gave the characteristic impression of cyanotic induration.

The urinary bladder was empty. The prostate gland was small. The ureters were not dilated.

The kidneys measured respectively, left and right, 12.5 x 7 x 4 cm. and 12 x 7 x 4 cm. The capsules stripped with some difficulty, presenting a granular cortex suggestive of previous attacks of nephritis.

The suprarenal glands had an aggregate weight of 20.5 grams. Cortical adenomata were demonstrated in both glands with one of these adenomas slightly more than 1 cm. in diameter.

The right tunica vaginalis testis was explored and found to be distended with a quantity of amber fluid.


Anatomical Diagnosis
Dissecting aneurysm ascending aorta
Rupture of aorta (transverse tear first portion)
Hemopericardium
Adhesive pericarditis
Adhesive pleurisy
Peritoneal adhesions
Chronic peritonitis
Hemangiomata of liver
Right hydrocele
Polyserositis (?)
Suprarenal adenomata

Cause of Death—Rupture of the aorta due to dissecting aneurysm.

While the foregoing case has been presented particularly to show non-luetic spontaneous rupture of the aorta one cannot help but note the many disease entities present in this body. It, indeed, represented what Krumbahr once referred to as “the constellation of diseases.”

Summary
An autopsy protocol of a case of spontaneous rupture of the aorta is presented.
Syphilis was not a factor; postmortem serology presented negative reactions for syphilis by complement fixation and precipitation.
Dissecting aneurysm was the underlying cause of the rupture.
Suprarenal adenomata were associated as a possible cause of hypertensive cardiovascular disease.

Reference

Backache and Sciatic Neuritis
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