Auscultatory Percussion of Heart

THESIS for DEGREE of M.E.

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AUSCULTATORY PERCUSSION of the HEART.

Percussion of the heart is a matter of vital importance in a case of cardiac disease. It is our chief means of estimating the size of the organ, as inspection and auscultation often fail to give us any clue to the size of the organ. But percussion is notoriously uncertain in its results, and requires years of practice for accurate accomplishment, and an accuracy of ear which, unfortunately, many do not possess. The object of this paper is to emphasize the use of auscultatory percussion, and to point out its advantages. By the use of tracing paper diagrams, it is hoped that the points in the investigation may be made clear. The results were, in most cases, confirmed by post mortem examinations, or by the use of the orthodiagraph.

The method adopted is as follows:— The bell of a binaural stethoscope is placed over the prae- cordial area,—preferably over a place where the heart is uncovered by lung. It is held in position by one hand of the physician, and with the other hand he then percusses directly on the skin, from without in, along lines at right angles,—so far as he can judge,—to the borders of the heart. A marked increase in the loudness of the note will be found whenever the border of the heart is reached. Very light percussion alone need be used. This method is superior to that described in some text-books of physical diagnosis (Butler),
in that it does not require the assistance of a nurse or
the patient, and the percussing hand can quite well hold
the marking pencil. Errors to be avoided are too heavy
pressure with the stethoscope, rendering the skin round
it tense, or a too low position of the bell, when
stomach resonance will often be heard. In emphysema-
tous chests also, an increase in the resonance is found
towards the lung borders, but the cardiac sound can be
appreciated quite clearly in addition, its border following
the shape of the heart.

The following are the advantages claimed for
the method:- The change of note at the cardiac border
is so great that it can be appreciated by the duldest
ear, and in a comparatively noisy room or ward,—a fact
of the greatest importance to the general practitioner.
The method can be used in cases of emphysema where
ordinary percussion is useless, where inspection and
auscultation fail, and where an accurate estimation of
the size of the heart is of the utmost value,—both for
diagnosis and prognosis. It can map out the whole of
the lower border where it is adjacent to the liver, and
also the right or left borders where there is fluid in
the pleural cavity, or where there is consolidation of
the lung with continuous dulness to ordinary percussion.
There is the further benefit that it avoids all heavy
percussion with its discomfort to the patient, and, as
accuracy in percussion varies directly with the weight
of the stroke, the method gains accordingly in exactness.

The following statistics are given as showing the inexact nature of the results of ordinary percussion. They are taken from Walsham & Orton's "Röntgen Rays and the Chest", p.p. 50-51. The weight of the excised heart is in them compared with the normal weight, and the proportion of cases unrecognised during life is given. 290 grammes is taken as the average weight of the heart in an adult man.

<table>
<thead>
<tr>
<th>Weight in grammes</th>
<th>No. of Cases Unrecognised</th>
</tr>
</thead>
<tbody>
<tr>
<td>350 - 390</td>
<td>74</td>
</tr>
<tr>
<td>400 - 450</td>
<td>36</td>
</tr>
<tr>
<td>450 - 500</td>
<td>24</td>
</tr>
<tr>
<td>500 upwards</td>
<td>69</td>
</tr>
</tbody>
</table>

When we consider that dilatation would be present in the majority of these cases, and that it would enlarge the percussion area without necessarily increasing the weight, these figures are even more significant. A second set of statistics where the diagraph was used (Practitioner, April, 1907) shows similar discrepancies, and, as in both cases it was claimed that the emphysematous and the very obese were excluded, the figures are rather below than above what they should be.

Thirteen diagrams are presented as illustrative of the above points in favour of auscultatory percussion. These are all tracings of drawings made on the skin of the patients. Where examination post mortem was used in/
in corroboration, the percussion was done on the dead body. This excludes any alteration in the cardiac area from dilatation immediately before death. It also avoids the heart sounds, the excursions of the lung borders, and the changes in shape with the heart beat. After mapping on the chest the area percussed, and its relation to ribs and sternum, these were traced on the paper. Pins were then passed into the body at right angles to the skin, along the lines thus mapped out, and the dissection was then proceeded with. The results are shewn in Diagrams IX., X., XI.

Where X, Ray tracings were made, the percussion outline was drawn the day before. The diagraph was then used to get an accurate outline of the heart, and the outline thus independently made was traced on the paper containing the percussion outline. Some of these only show the general correspondence of shape, as no location of ribs and interspaces was made, but in Diagrams VI., VII., & VIII., lead wire was used to locate the ribs, which, on the diagraph screen, are not seen clearly in their anterior portions.

The following are brief notes of the cases of which Diagrams are presented:-

Diagrams I., and II., are representatives of a series of normal hearts which were first percussed. The one patient suffered from diabetes, and the other from epileptic/
epileptic fits. In both there is a tendency for the percussion area to overlap the Diagraph tracing.

III. and IV. are also from a normal patient. It was found to be much easier to take the diagraph tracing in the erect position. The straight right border in the erect diagraph shadow may be noted. In a number of cases the percussion area extended beyond the diagraph outline in the region of the apex. In others this was not so. The reason lies in the shape of the chest. In narrow chests, the apex of the heart approaches the side, and the percussion outline lies outside the diagraph shadow, which is thrown directly forward. In broader chests, with a flat anterior aspect, both percussion line and shadow are directly in front of the cardiac border.

Diagram V. shows enlarged area in a case of mitral disease.

Diagram VI. is interesting as showing the result of too light percussion of the right border. The great dilatation of the right heart escaped notice in the first instance. The border is shown as percussed lightly, and also somewhat heavier. A similar experience is illustrated in Diagram XI. from a post mortem case.

Diagrams VII. and VIII. are from cases of emphysema. The smaller areas marked in green being not as in the former diagrams, areas of superficial dulness, but areas marked by fairly firm percussion (ordinary) while no proper/
proper deep dulness could be elicited at all by this method.

Diagram VIII, is not very accurate when the diagrams are arranged by the lead wire shadows, but, as the purple outline shows, the shape closely corresponds and the size,—this outline being drawn by adjusting the levels of the liver dulness and diaphragm shadow.

Diagrams IX, X, and XI, are from post mortem examinations,—the percussion being done on the dead subject. For demonstration purposes, a free hand outline of the excised heart was drawn to measurement, and its outline transferred to the chart of the chest containing the percussion outline. It is not, of course, claimed that this is accurate, but the dissection of the pins gives accurate proof.

In IX, the subject was a woman with very fatty breasts, and percussion was very difficult. The outline given was larger than might be expected, and Pin 1 was too low, being 1 inch below the upper border of the liver and ½ inch from the right of the heart.

In X, the aorta was greatly dilated with atheroma. The pins were all correctly placed, and the dilatation of the aorta was expected from the uncertain percussion of the upper part of the right border.

Diagram XI, was from a case of fatty heart. The right border in this case was doubtful, a slight increase in percussion giving a considerable increase of area.

Pin/
P in 1 was inserted at the inner of these borders, and, on excision, was found to be \( \frac{3}{4} \) inch inside the right border.

Diagram XII. was made from a case of pleurisy with effusion. The double green lines could alone be mapped out here by ordinary percussion, but, by auscultatory percussion, the whole area was traced.

Diagram XIII. was a case of complete dulness over the left side of the chest, supposed to be due to tumour growth with fluid in the pleural cavity. A.B. was the only part which ordinary percussion could have elicited of the cardiac border. By the combined method the whole area was mapped out. The line C.D. could also be marked by auscultatory percussion, with the stethoscope placed well below this level. Below C.D., vocal resonance and fremitus were lost, and above it distant tubular breathing was audible, so that this probably was the level of the fluid.

The conclusions drawn from the above cases are that the method is worthy of much more extensive practice, that it is useful in many cases where other means of estimating the size of the heart fail; it is easily learnt; is at least as accurate as ordinary percussion, and by it a greater extent of the cardiac boundary can be outlined. The method is of little use in very stout subjects.

Literature/
Literature:— Practitioner, April, 1907,
Walsham & Orton's "Röntgen Rays & the Chest",
Butler's "Diagnostics of Internal Medicine",
Da Costas' "Principles & Practice of Physical Diagnosis",
Le Fevre's "Physical Diagnosis".

APPENDIX.

The above thirteen diagrams were selected from over sixty cases examined in the Wards of Glasgow Royal Infirmary and of Merryflats Parochial Hospital, and a few seen in private practice. A large number of these could not be confirmed, but over a dozen were examined by the X Rays, with results similar to those illustrated. A large number of normal hearts were examined, and a large number of various valvular lesions. Selections of these only are shown. Only three post-mortem examinations were carried out, diagrams of which are presented. The other diagrams are illustrative of points which were found of importance in the method, or in the interpretation of its results.
Diagrams Illustrating Thesis.

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April 30th 1909.
Diagram 1

John M. Intyre
Epileptic. 74.743
Diagram II
Alexander M. McMillan
Diabetes

Interphase

Superficial Cardiac Dullness

X-ray Tracing

Assentating Radiation Area.
Diagram IV

W. W. Rementes
Erect

X-ray tracing
An cutaneous Percussion
Diagram VII

Henry M. McBride

Empyema

X-ray Tracing
Resonant Percussion Line
Yield Wire
Ordinary Percussion Line
Diagram VIII
Pat. McGouran.
Emphysema

- X-ray examination
- Auscultatory examination
- Tend wires
- Ordinary firm percussion area
- X-ray facing adjusted to lower thorax region
Mary Currie.  
Post Mortem.  
Died of traumatic condition shortly after admission.  

IX. 
Penetrated liver about 1 inch below upper border. Was about 3 inches outside heart also.  

2. Was touching border of heart.  

3. Perforated apex close to tip.  

Percussion (anastomotic)  
Rough free-hand sketch of heart after removal, as it lay on table.
Case of sudden death.

1. Gross air dilatation
2. No other post mortem

X 1
X 2
X 3

were all tending towards a 4.

X 4

was 4, inch to 4 wide of artery — easily palpable from pericardial sac which contained

andgs. of fluid.

Assault by percussion area

Rough free-hand marking of heart on post mortem.
John Stanley 52
Pst. Mortem
Date 28/12/10.

Right side of heart much dilated & fatty
7 oz. fluid in pericardium
Fluid in left pleural cavity
Left lung emphysema
Right very adherent.

Pins all in correct position
but the one at right border
where it was inserted at
six inches by very slight
percussion. This was
about ¼ inch inside the
right border.

Lower border was ½ inch
above pin in costal angle.

Ventricles scraped heart.

Inspection percussion
ventricles, including lower
border.

Ventricles presences &
somewhat heavier movement.
Stevenson.
Left side Pneumonic Effusion

- Full area.
- Cardiac & pleural Effusion area.
- Upper level of fluid.
- Lung Borders.

Living Death & Dullness
Consolidation & fluid on left side of chest.

- dull area.
- cardiac insufficiency, percussion area & upper level of fluid (?) - border of right lung.
- area of resonance probably due to stomach.

[Diagram with labeled parts: A, B, D, margin of right lung, and "Thigh & femur".]