should be noted in this case that the patient was excessively obese.

5. It is probable that some of the tumors arising from the pars intermedia may have been regarded as peculiar types of adenoma or sarcoma.

6. Stains which differentiate granules should be used in examining all growths of the hypophysis in order that incorrect anatomic diagnosis may be avoided, for hypophyseal cells tend to reproduce the morphology of a sarcoma when proliferating. The specific granules will differentiate the hypophyseal cells from those of a sarcoma.

7. Failure to recognize the morphology of the different elements in the hypophysis and their relation to tumor formation accounts for much of the confusion concerning the relation of the gland to acromegaly.

150 Michigan Avenue.

THE ESSENTIAL DIFFERENCES BETWEEN THE PHYSICAL FINDINGS IN CHILD- HOOD AND ADULT LIFE

A CLINICAL AND ROENTGENOGRAPHIC STUDY*

LOUIS A. LEVISON, M.D.

AND

HARRY DACHTLER

Roentgenologist to Toledo and St. Vincent's Hospitals
TOLEDO, O.

It has not been our purpose to compare serially all the physical findings of infancy and childhood with those in later life, as this would be both long and without advantage. This paper originated rather in the difficulty which we experienced and which has doubtless been duplicated by every diagnostician, in interpreting properly many of the physical findings of childhood, even in normal children. This interpretation of signs in childhood might be compared to those in adult life as the examination of a moving train is to the examination of one stationary. There can be no permanency at any stage of the child's development; there can be no entirely definite and satisfactory standard at any age; there can, indeed, be no certainty of what constitutes the norm in a child, as the abnormal is so frequent and the differentiation so delicate.

It would seem that, with such unlimited material in the hands of nearly every practitioner of medicine, with such abundant opportunities for observation, there would be at this time little difference of opinion in regard to many signs in childhood. Yet this is not true. The ideal method of acquiring skill and accuracy in physical diagnosis is by the checking up process of the autopsy table, but this is unfortunate in that it has to do with pathologic conditions. The acquisition of accuracy in physical diagnosis cannot possibly come from observation of others, reading, or lectures, but must be obtained by the individual on the living body. The autopsy control is clearly impossible to the vast majority and, for the reason above mentioned, not entirely satisfactory to the remaining small minority.

The replacement of this control in diagnosis on the unhealthy dead by another control on the healthy living is made possible with the Roentgen examination, a

means that we have used with much satisfaction. The Roentgen ray can never be a substitute for the eye and the hand and the ear, because it is too often unavailable at the time needed, because it is impossible for poor patients in their homes, and for other very obvious reasons. All of the Roentgen work in this connection has been done by one of us. It has been our aim to check up the physical findings, especially percussion findings, with the Roentgen ray and to pay especial attention to a number of points concerning which there is still much discussion and uncertainty.

EXAMINATION OF THE CHEST

The roentgenographic examination of the thorax in infants is difficult. This is particularly true with the orthodiagraphic method. Fortunately, improvements in apparatus and technic allow young children to be examined by means of the teleroentgenographic method with accuracy and dispatch. This has been the method utilized by us. In order to make the exposures within the time limit necessary to secure good results, a tube distance of 1 meter was adopted. Observations made by us showed that, with children at the ages studied (under 12 years), this distance allowed more accuracy than a distance of 2 meters in adults, a distance which has been generally accepted and proved of such accuracy as to replace the orthodiagraph in routine work. All children old enough to stand upright were examined in this position with face to the plate. This method reduces the apparent enlargement of the heart and great vessels to a minimum, so that it can be virtually disregarded. Seventy children under the age of 12 have been studied by us with this method. Our material has been derived from the St. Vincent Orphanage, the Toledo Juvenile Home, and the private practice of each of us.

The general points of difference in the thorax of childhood and adult life are at once distinctive. The younger the child, the greater is the distinction. The shape of the thorax in the new-born is obtusely conical, with the greatest circumference at the base. The circumference decreases gradually toward the upper aperture, but not with a cone-like regularity. The antero-posterior diameter at birth is practically that of the transverse dimension. This cylinder-like chest has a direct bearing on certain physical findings, especially cardiac, to be touched on at another point. The figures of Rauchfuss show that these dimensions change with some constancy as development progresses. The ratio of the antero-posterior diameter to the transverse is as 14 to 18 at the sixth year and as 14.5 to 20 at the twelfth. The sternum in childhood shows a marked difference in position relative to the vertebral column. It may be fully two vertebrae higher in early life, with a corresponding rise of the anterior border of the upper thoracic aperture, with the result that this aperture lies in a more nearly horizontal plane.

The ribs in childhood vary distinctively from their position in after-life. It is this fact which is responsible for the error incurred in considering ribs and interspaces as landmarks comparable to those of adult life. In childhood the projection of the ribs from the spinal column is transverse rather than the oblique direction of later life. A given point on the thoracic wall in childhood would not correspond to a similar point in adult life measured in terms of spinal vertebrae, which is our most fixed and stable means of comparison. The ribs not only project more transversely at

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their beginning, but continue around the chest without the downward inclination of adult life, resulting in a chest contour resembling the adult chest at the height of inspiration. The transverse direction of the ribs allows more room for the lungs posteriorly and this fact is not without significance in the interpretation of signs under the sternum, where the anterior lung borders constitute a factor. The epigastric angle in consequence of the horizontally placed ribs is, of course, more obtuse than in adult life.

The examination of the chest in childhood is all too frequently by auscultation alone. This is due to the difficulty of obtaining satisfactory results from percussion. The great number of methods recommended for accurately outlining the thoracic organ borders attest the more or less unsatisfactory nature of most of them. There is a practical unanimity of belief in the greater advantage of light over strong percussion, but a considerable difference of opinion as to the degree of lightness. Strong percussion will not uncommonly produce a tense, involuntary, muscular contraction, which tends to cloud the actual note of the underlying structures. Hein showed by his experiments that with light percussion he could demonstrate the presence of airless organs through layers of lung tissue up to 7 cm. thick. In reality, the edges of the lung which cover the heart in children never reach this thickness.

It is not at all probable that one will percuss too lightly in children, so the care should be taken in the other direction. That form of percussion known as Goldscheider's or "threshold percussion" is peculiarly adapted to children. Here the lightest stroke possible is employed and the note produced is at the extreme limit of audibility. The percussion stroke by this method does not disturb tissue structures except under the percussing finger. No one can be sure that the tone produced by ordinary percussion is not a transmitted one or is influenced by adjacent organs or structures. Ideal conditions of quietness are absolutely essential in order to hear and to interpret properly a note at the extreme limit of audibility. Practically such a degree of quietness is not always attainable and to use Goldscheider's method under other conditions means failure. It is difficult to understand from purely theoretical reasons Goldscheider's statement that by this method only the axial waves produced in the direction of the finger stroke are perceived, and that all divergent, radiating waves are imperceptible.

The vibrations produced by a percussion stroke of the body wall, the underlying tissues, and contained air does not extend only along one line and that a prolongation of the axis of the percussing finger, but radiates in all directions. Any area of resonance or tympany that is reached by these centrifugal lines of vibration may mask, cloud or disturb a non-resonant note produced immediately under the percussing finger. It is on account of this fact that we should tend to percuss a point rather than an area. In order to do this, the smaller the pleximeter area in contact with the body wall, the greater is the likelihood that the note produced will be from the point or area in question and will not include a transmitted sound. The Plesch method of percussing on the terminal phalanx of the finger is good theoretically, if it does not involve an unnatural over-extension of the terminal interphalangeal joint, resulting in an uncomfortable and difficult position. It happens, not uncommonly, that such a method of percussing cannot be carried out without lavishing such a degree of atten-

tion on the art of percussion *per se*, that the interpretation will seriously suffer thereby. The technic of percussion becomes to all good diagnosticians, a second nature, and one should be entirely unconscious of the stroke, giving his entire attention to the note produced and the degree of resistance encountered. It is questionable if one who has to weigh the individual percussion stroke can interpret the note accurately. The average clinician learns his percussion technic on adults and neglects, or is unable, to change to another method; it is necessary that one should change with children, and still be unconscious of the change.

It is very doubtful if a single method of percussion is applicable to every one. Certainly, different clinicians get equally good results with different methods. Other things being equal, the smaller the pleximeter finger area is in contact with the body wall in children, the better. This is true, especially in children, because of the greater vibration than in the adult from a blow of equal force. There are a number of factors concerned in this—the thinness of the chest wall, the absence of complete ossification in the costal cartilages, and the greater delicateness of the bony framework. We have found that in extending the last two phalanges of the pleximeter finger on the body wall, it is possible to exert the greatest pressure, comparatively speaking, directly under the terminal interphalangeal joint and still to allow the finger to rest lightly in contact with the body wall. This preserves the natural finger position and has been found satisfactory.

There are many points of difference in gross anatomy between childhood and adult life, which have a direct bearing on the differences in the physical signs. The incomplete development of the heart and lungs, the greater relative size of the thymus, the different position of the diaphragm, the differences in the thoracic wall, all have their influence on the diagnostic findings.

EXAMINATION OF THE THYMUS

The thymus gland is a structure producing in infancy and childhood physical signs which are essentially different from those in adult life. This is an instance in which these differences are due to a complete or almost complete obliteration of an anatomic structure in the change from childhood to adolescence. There has been an interesting difference of opinion among anatomists concerning the thymus, which is well illustrated by the extremes of size given, varying from 2.0 gm. to 31 gm., a variation that is difficult to harmonize with normal body differences. A partial explanation at least may be found in the inability of anatomists to secure normal infants for anatomic measurements. The thymus mirrors or reflects in considerable degree the general nutrition of the child. Poorly nourished children, or those dying after prolonged infections or wasting diseases usually show a small thymus. Friedleben gives the following figures of average thymus weights:

Weight at birth.....	14.3 gm.
1 to 9 months.....	20.7 gm.
9 to 24 months.....	27.3 gm.
2 to 14 years.....	27.0 gm.
15 to 25 years.....	22.1 gm.
25 to 35 years.....	3.1 gm.

The examination of the thymus for physical signs is difficult and very often unsatisfactory. Inspection does not show anything and palpation shows but little. Auscultatory help is questionable and our methods fall back on percussion alone. The dulness produced by the

thymus has never been in our experience more than a slight diminution of resonance. The demarcation of borders is very unsatisfactory when the percussion note is not distinctly dull. The differentiation of this diminished resonance is peculiarly difficult on account of the close association and relation with the sternum, great vessels of the thorax and occasional enlarged bronchial glands. Typical cases show, according to Blumenreich, an area of diminished resonance that is roughly triangular, with blunted angles. The base of this triangle is a line drawn between the lower edges of the clavicular extremities. The tip of the triangle lies on the sternum on or more often below the angle of Louis. Lines drawn slightly convex outward, which connect the extremities of the base line with the apex, will map out the lateral edges of diminished resonance. These lateral lines, however, are not symmetrical. The left edge of diminished resonance usually projects considerably over the left sternum border, but not so on the right. A large thymus manifests itself by an extension of the area of diminished resonance downward and to the left rather than to the right. This enlarged area tends to merge with dullness produced by the heart and great vessels.

We have given especial attention to the thymus in our roentgenographic work. Basing conclusions on our seventy examined cases, we believe that reports of other investigators that it is possible to determine the normal thymus shadow by the use of the Roentgen rays, are erroneous. Hochsinger states that "the middle shadow thrown by the thymus under normal conditions rests on the shadow thrown by the heart, just as the slender neck of a bottle is fixed on the body of the bottle." This bottle-neck shadow, due to the thymus and heart, has come to be a sort of fixture in medical literature, mainly by reiteration and quotation. The roentgenographs published by Hochsinger are far from conclusive. It is to be remembered that the thymus shadow from its anatomic location merges with the shadow produced by the sternum, spinal column, and particularly with the great thoracic vessels. A definite enlargement of the thymus could not be differentiated accurately unless the thymus enlargement extended laterally beyond the great vessels, which is improbable in consideration of the great relative width of these structures in childhood. Anatomic studies have, but uncommonly, shown such a degree of hyperplasia. Furthermore, it is entirely probable that a thymus enlargement may extend antero-posteriorly, rather than laterally, rendering the delineation still more difficult.

A broadening of the shadow above the heart is much more probably due to the thoracic vessels than to an hyperplastic thymus. We have not been able to demonstrate this broadened shadow above the heart, even in cases which gave strong clinical evidence of hyperplasia of the thymus. This has also been the experience of Lange in four cases, in which thymus enlargement was definitely diagnosed clinically.

EXAMINATION OF HEART

The heart in childhood is situated nearer the sternum than in adults, and in the developmental change from childhood to adolescence, there is a gradual displacement to the adult position. This situation near the sternum contracts the retrosternal space between the sternum and the anterior layer of the pericardium. The heart is held in this position by the shorter and tighter inferior and superior sternopericardiac ligaments. This

space can be demonstrated distinctly with the Roentgen ray in lateral views. The more transverse or horizontal position of the heart in childhood results in distinct differences in percussion boundaries. In relation to the bony structures, the heart occupies a higher position due to the higher situation of the liver, the position of the diaphragm, the shorter and broader great thoracic vessels. The attachment of the child's heart to adjacent structures is less firm, resulting in greater mobility and easier displacement. The size of the child's heart is relatively large. This is likewise true of the great arteries of the thorax. The heart and the arterial tree gradually decrease in relation to the body weight as the child passes on to adolescence. Baginsky states that the ratio between the heart volume and lumen of the aorta ascendens is as 25 to 20 in the child, 140 to 50 preceding puberty, and 290 to 61 immediately following puberty, during which latter time the heart increases in weight markedly. Anatomists are agreed that the growth and development of the heart occur in an irregular manner. Two points are generally conceded, namely, that the size of the heart is large in relation to the body weight during the first year of life and again at puberty. Von Busch asserts, however, that in addition to these periods, there is another period of growth from the third to the seventh year, during which the heart becomes again relatively large. Vierordt states (quoted from Hochsinger) that the heart weight is 0.89 per cent. of the body weight during infancy, but only 0.52 per cent. during adult life. The marked difference between the thickness of the ventricular chambers and the heart weight is important anatomically, but does not influence the physical findings as much as the ratio between the size of the great vessels at the base and the heart. This relatively large volume of the great vessels has its bearings on the percussion borders of the heart, and likewise on the differentiation of the heart, great vessels and thymus from one another with the Roentgen ray.

There are a number of factors which make the percussion of the child's heart a difficult procedure. One cannot fairly compare the cardiac percussion dullness in the child with that in the adult. The changed position of the heart in early life, its more horizontal and higher situation results in a different standard of comparison, even after the relative differences in the size of the body has been taken into consideration. This altered situation of the heart brings the right edge of dullness further to the right, a fact which is often ascribed to a disproportion in size between body and heart in childhood. There are particular reasons which make the determination of each heart border peculiarly difficult in the child. The upper heart border has to be demarcated from the great vessels of the thorax, which in the child are relatively large in size and volume, from enlarged bronchial glands, an enlarged thymus, and the dull area described by Hamill. The left cardiac border is difficult of determination for two reasons chiefly. There is a tendency, fixed naturally and by habit, to percuss out the left heart border in children, as well as in adults, with a percussion stroke having its axis perpendicular to the body wall. The more or less circular or cylindrical shape of the child's chest results in a considerable degree of distortion of the cardiac outline, which can be obviated by making the percussion stroke for the left border parallel to that for the right border, regardless of our tendency to percuss at the right angle to the body surface. An impairment of

the note along the left edge of the heart, especially along the lower part, may result from gastric or intestinal dilatation, even when it is not apparent. The right border of the heart is peculiarly difficult to map out, because the higher position of the liver on the right side may influence the normal resonance of the lower right front. Two other factors influence the position of the right border, the diminished resonance normally obtained over the sternum and, secondly, what we believe to be an actual slight degree of normal variation, due to the greater and freer mobility of the child's heart.

There is a considerable difference of opinion as to the advisability of attempting to percuss out the superficial heart dulness or the actual size of the heart. In adults, the percussion of the actual borders of the heart is so difficult that it is not ordinarily attempted. In children, better results can be obtained with the actual heart borders. This does not imply that the determination of the size of the heart in children is easy, either relatively or absolutely. On the contrary, the reverse is true, and to map out the heart percussion borders accurately is truly a difficult procedure. We know from the numerous experiments of Oestreich on the cadaver that the superficial heart dulness in adults can be determined with great accuracy. Superficial dulness maps out simply the lung borders and not at all the shape or size of the heart. It is stated by Mayer and Milchner that there is often a moderate degree of emphysema of the lung edges in young children, which may lead to erroneous conclusions. There are many more objections against the superficial dulness in children than in adults. There are greater numbers of functional disturbances and constitutional anomalies affecting the child's heart than the adult and the superficial dulness helps in no way, or at least but slightly, to determine these. Such disturbances of childhood, which have been described, are the so-called adenoid heart, the *cœur de croissance* of Germain, the relatively small heart of Bouehard, the heart of the narrow-chested of Kraus (*Herz der Engbrustigen*), the constitutionally weak heart of Martius, the dilatative heart weakness of Neumann, and functional disturbances after acute infections.

There are still more important reasons for determining the actual heart size in children. In adult life that part of the heart covered by the chest wall area from the fourth to the sixth costal cartilage and rib is fixed, determined and stable. In childhood this area is changing with the body development, but not with a definite rate of progression. It is impossible at any given age to tell how far the superficial heart dulness is due to the heart itself, or to natural changes of development, which are continually occurring. Likewise, in adults, the relationship between heart and the great vessels, thorax, and mediastinum, are fixed and definite. Not so, however, in childhood, as the bony thorax is constantly developing by a chondro-epiphyseal growth which widens the thorax and, as a result, any bony landmark used to express heart size in children is indefinite and variable.

It is because of this lack of definitely fixed bony landmarks that we should use actual figures of measurement for describing heart borders rather than the relation to a certain variable rib or arbitrarily drawn line. This is true particularly of the lateral borders, if not of the upper. This is one of the points which we desire to emphasize most strongly, and the lack of such

custom has, in our opinion, been one of the causes for the present great difference of opinion concerning heart borders in children. A mapped-out area of cardiac dulness expressed in centimeters from the fixed mid-sternum, a line not subject to variations due to irregular and varying degrees of growth, expresses the heart size without equivocation or possibility of misinterpretation. Sahli's measurements in terms of relation to ribs and nipples may be taken as average boundaries. He gives the superficial area of dulness as follows: above, the upper border of the third interspace; left border, a line drawn between the parasternal and mammary line; right border, the left border of the sternum. The deep heart borders are as follows: above, the second interspace or the lower border of the second costal cartilage; left border, at or beyond the mammary line; right border, at the right of the parasternal line or beyond. These borders are for children, not infants or very young children. Expressed in centimeters, Sahli's figures are as follows:

Age.	Widest diameter.	Right.	Left.
2 to 6 years....	10.5 cm.	3 cm.	7.5 cm.
7 to 12 years....	11.5 cm.	3 cm.	7.5 cm.

Troitzky, summing up various measurements, arrives at the following averages. He has, however, taken the width of dulness at the upper part of the sternum and not at the level of the nipples.

Age.	Width.	Right.	Left.
2 to 6 years....	7.5 cm.	2.5 cm.	5.0 cm.
7 to 12 years....	9.0 cm.	3.0 cm.	6.0 cm.

This shows the lack of uniformity, a desideratum which is much to be desired, if the average clinician or general practitioner is to have recourse to an accepted standard.

Reyher's figures with the orthodiagraph are as follows:

Age.	Width.	Right.	Left.
2 to 6 years....	8.2 cm.	3.0 cm.	5.5 cm.
7 to 12 years....	11.1 cm.	3.5 cm.	7.6 cm.

In the seventy cases which we have rayed by the teleoroentgenographic method in heart measurements in centimeters were as follows:

Age.	Width.	Right.	Left.	Distance to left of median line of broadest vessel shadow.
3 months.....	5.4	2	3.4	3.0
4 to 6 years....	7.0	2.5	4.5	3.0
7 to 10 years....	9.5	3.5	6.0	4.0
11 to 12 years....	10.5	3.5	7.0	4.0

It has not been possible for us to compare the roentgenographic measurements of each of these cases with the measurements obtained by heart percussion, but the average figures obtained by us show that our greatest percussion error has been in determining the breadth of the great vessels of the thorax. The right and left borders of the heart can be determined quite accurately by percussion as checked up by the Roentgen examination. The greatest source of error in determining the left border can be overcome, if the axis of the percussion stroke is kept parallel with the axis of the right border percussion stroke and is not made at right angles to the body wall. These figures show what is rather unexpected and surprising, namely, that it is the right border in children that is most accurately demarcated by physical diagnosis and not the left.

EXAMINATION OF LUNG

It is very desirable that one should have a clear understanding of the factors underlying lung percussion sounds, if their interpretation is to be accurate. There is still some difference of opinion concerning the

part played by the thoracic wall in the percussion sound. It is not to be denied that the vibration of the thoracic wall constitutes at least a partial factor of the lung sound. The difference in flexibility and elasticity between the child's thoracic wall and that of the adult accounts in large measure for the normal difference in sound in childhood and adult life. The other factor, the vibration of the bronchial air column, is not subjected to so much difference at the two periods in life, except in the amount of air and the size of the column. If the sound were proportional to the amount of vibrating air alone, with modification by other factors, there would be greater resonance in adult life than in childhood, which is not the case. On the other hand, the great influence of the thoracic wall factor is shown by the change of note in the child when the lateral lying-position is assumed and the chest wall is in contact with the bed. The resultant diminution of thoracic wall vibrations produces a distinct dulling of the percussion note. The same great flexibility and elasticity of the thoracic wall in childhood explains the less resonant percussion note at the end of deep inspiration in children old enough to breathe as directed. Full lung expansion increases the tension of the chest wall, lessens its elasticity and vibratory power, and, notwithstanding the greater amount of air in the lung at the height of inspiration, it is not great enough to counterbalance the diminution in chest wall vibration.

The normal lung sounds in childhood vary from those in adult life, even in other respects than the degree. Posteriorly, the percussion sound in childhood is more resonant than in adult life. This is due to several factors, including the more posterior position of the lung in childhood, relatively speaking. There is a greater volume of air-containing lung tissue nearer the surface of the dorsal body wall. It follows from this that the anterior edges of the lungs should be further separated, relatively, than in adults and this is the case. This is likewise one of the anatomic facts explaining the greater exposure of superficial heart dulness in children. Laterally, the thoracic resonance approaches that obtained over the infraclavicular region anteriorly, until one passes below the sixth rib.

The area of dulness under the inner third of the left clavicle, described by Hamill, has been carefully looked for in every case examined by us, and especial attention has been paid to this area on x-ray plates. Hamill states that, contrary to text-book teaching, it is the left and not the right front which shows a relative impairment of resonance. This area of dulness is indefinite in shape and size, but is to be found, according to Hamill, "beneath the inner third of the clavicle, which (area) sometimes extends outward to the mid-clavicular line, and always downward until it fades into the cardiac dulness." This area of dulness is "constantly present up to the age of 9 or 10 years." Hamill does not give an entirely satisfactory reason for this area of relative dulness, but believes it has to do with the more posterior position of the lungs in childhood and the more exposed condition of the large thoracic vessels. It has not been possible for us to determine this area of dulness as described. We have encountered impaired resonance over this region, but not with sufficient regularity and certainty to consider it a normal condition. According to the studies of Blumenreich mentioned above, there is an asymmetrical area of impaired resonance, reaching farther to the left than to the right, but only up to the sixth year. The location of that part of

the thymus dulness to the left of the sternum and under the inner end of the clavicle corresponds to a part of the area described by Hamill, although it does not extend outward or downward so far. Again, the more posterior position of the lungs in childhood applies equally to both sides, and the measurements by Feer show that at the age of 4 to 5 the right chest circumference exceeds the left by as much as 1.5 cm. The possibility of enlarged bronchial glands necessitating a differentiation will be touched on below. It is our belief, after a careful investigation of this point, that there is no normal impaired resonance directly under the left clavicle. It has been our experience, however, that dulness from the heart and great vessels rises to the upper edge of the left second costal cartilage in young children, and that between this point and the clavicle there is an area, which, while normally resonant to the lightest percussion, may appear relatively impaired in resonance, if the percussion stroke is at all strong. The high position of dulness at the second left costal cartilage in young children is in full harmony with the results obtained with the Roentgen examination. Furthermore, in the area between the great vessels and the clavicle, the Roentgen examination has not revealed anything which could reasonably account for impaired resonance over this area. It is much to be desired that this observation of Hamill be further confirmed. It would seem that such an area of impaired resonance at such an accessible point would not have escaped general observation and acceptance. The diagnostic significance of relative dulness at this point is considerable and the differentiation from the various pathologic conditions that can cause such dulness is of sufficient importance to merit close observation by others.

EXAMINATION OF BRONCHIAL GLANDS

The great frequency of enlarged bronchial glands in childhood makes a trustworthy method of diagnosis very desirable. No method of physical diagnosis can compare with the Roentgen rays. The value of the hitherto described methods of diagnosis have been, as a rule, dependent on the size of the glandular mass. The anatomic landmarks of the bronchial glands are the lower end of the manubrium sterni anteriorly and the fifth dorsal vertebra posteriorly. Dulness or impaired resonance in this region would be therefore in the region of the thymus, the impaired resonance produced by the sternum, the great vessels of the thorax, and the area of Hamill. Localized patches of dulness in the second interspace suggests enlarged bronchial glands, and the tendency of this form of dulness is to extend transversely. It has been advised that attempts to demonstrate such patches of bronchial gland dulness should be made at the end of forced expiration. Curschman and Schlayer found dulness due to enlarged bronchial glands in adults, but this is certainly an uncommon finding. There have been a number of signs described to aid in the diagnosis of enlarged bronchial glands, but which have only a secondary value. Camp described relative dulness over the spinal processes of the fifth and sixth thoracic vertebrae. Petruschky's spinalgia is an area of tenderness between the shoulder-blades, but has not been found to be of great value. The better known sign described by Eustace Smith is not trustworthy. This sign consists in a venous hum audible over the manubrium during hyperextension of the neck. Thus, if the child in the erect posture bends the head backward so that the eyes look toward the ceil-

ing, the hum will appear in the positive cases, owing to the compression of the left innominate vein between the manubrium and the glandular mass. The great frequency of venous hums in children without glandular enlargement render the interpretation of this sign particularly difficult.

CONCLUSIONS

The following conclusions are drawn from this work:

1. The Roentgen examination affords an unexcelled method of controlling the results obtained by physical diagnosis.

2. The teleoroentgenographic method reduces the error by distortion to a negligible quantity and is well adapted to routine work.

3. The anatomic location of the normal thymus renders its differentiation by means of the Roentgen rays improbable.

4. The demarcation of heart-borders in terms of bony landmarks does not offer a fair comparison with adults, owing to the continual change in the development of the bony structures.

5. Absolute heart dulness in children can be quite accurately determined by very light percussion, and the results confirmed by the Roentgen rays.

6. The relatively great volume of the great thoracic vessels in young children offers the greatest difficulty in determining the size of the heart by physical methods only.

7. Extremely light percussion has not given us normal impaired resonance between the upper borders of the great vessels and the clavicle. The Roentgen examination has confirmed the absence of a density of tissue which would produce such dulness.

Sparks Building, 237 Michigan Street.

ABSTRACT OF DISCUSSION

DR. FRANK SMITHIES, Ann Arbor, Mich.: From my experience in teaching physical diagnosis to medical students I have long felt the need of such a piece of work as this. The literature abounds in generalities. There is little said in the text-books or in monographs with respect to the findings spoken of. I was particularly interested in the roentgenographic findings in respect to the thymus. Three cases of thymus death have impressed on me the need of thorough physical examination of the child's thorax before such a simple operation as one on the tonsils or adenoids. In two cases the physician had entirely neglected the examination of the child's thorax except putting the stethoscope over the visible heart beat and saying that that organ was all right. Sometimes a radiograph will give admirable information in regard to the thymus, but it has been my experience that the thymus could be mapped out very readily in infants and in the newborn when the attempt is made. I urge on every one to make careful examination of the thorax before operating on children. The heart is infrequently examined and, where it is examined, unless done systematically, the findings are practically worthless. As to the findings in the mediastinal region, I think often anomalous conditions of the heart and blood-vessels can be traced to glandular conditions in the mediastinum.

Etiology of Intussusception.—H. J. Morgenthau states that the essential cause of intussusception is irregular peristalsis, particularly atony of one part with increased activity of adjoining parts of intestine. It may thus follow any limited, sudden, and severe peristalsis.—*Am. Jour. Obstet. and Dis. of Women and Children*.

PATHOLOGY AND BACTERIOLOGY OF ACUTE ANTERIOR POLIOMYELITIS *

H. E. ROBERTSON, M.D., AND A. J. CHESLEY, M.D.
MINNEAPOLIS

I. PATHOLOGY

A review of the literature shows records of about 100 autopsies on cases of poliomyelitis, nearly one-half of which were performed years after the acute attack.

Our studies include material from six autopsies performed on cases occurring in the Minnesota epidemic of 1909. In the article the cases are reported in detail.

The process as a whole follows a definite and specific course. Whatever may be finally shown to be the agent of infection, its "optimum locus" is in the perivascular lymph channels of the anterior portions of the cord, especially those located in the gray matter. From this site the reaction spreads on the one hand to the surrounding tissue spaces of the gray matter and on the other to the lymph channels of the white matter and pia, often involving the posterior portions of the cord.

CONCLUSIONS

1. Acute anterior poliomyelitis is a specific infectious disease characterized pathologically by general toxemia affecting the parenchyma of the heart, liver and kidneys and the lymphoid tissues of the body, but spending itself locally on the structures of the spinal cord.

2. Grossly the cord is congested and on transverse section shows softening and often hemorrhages in the gray matter of the anterior horns.

3. In the cord the infectious agent is located in the perivascular lymph channels of the anterior portions, especially invading the gray matter, but extending to the white matter and pia and occasionally the posterior horns. The brain stem and basal ganglia may be involved. In the cord the medulla and cervical and lumbar swellings are particularly affected.

4. The characteristic lesion consists of collections of cells in the perivascular and pial lymph channels and tissue spaces of the anterior horns. Of these cells the polymorphonuclear leukocytes appear early and are relatively few in number. They are soon displaced by endothelial cells arising from proliferation of the lining endothelium and lymphocytes coming from the blood and lymph streams.

5. Edema of the interstitial tissue and degeneration and destruction of the ganglion cells are always present.

6. The vessels are congested, their walls degenerated, and the capillary branches in the gray matter irregularly distended and often ruptured, giving hemorrhages, which always intensify markedly the amount of destruction. Thrombosis was not observed.

7. Early degeneration of nerve fibers from the anterior roots is a constant feature.

8. Stains for micro-organisms were uniformly negative.

II. BACTERIOLOGY

Specimens from twenty cases of poliomyelitis were examined by the laboratory division of the Minnesota State Board of Health during the 1909 epidemic.

The cultural and morphologic characteristics of Geirsvold's diplococcus were found to coincide with the description given by Drs. Fox and Rucker.

Geirsvold's diplococcus was found in purity in the spinal fluids from seven cases (two died, see Dr. Robertson's Cases 1 and 3), and also in cultures from the blood, mouth, lung, spleen, kidney, middle ear and brain substance of Case 3.

The tests to determine the pathogenicity of these pure cultures confirmed the opinion of other observers that Geirsvold's diplococcus is not a causative factor in poliomyelitis.

* Authors' abstract of a paper read before the Sections on Nervous and Mental Diseases and on Pathology and Physiology of the American Medical Association, St. Louis, 1910. The complete article will appear in the Transactions of the Sections and in the Archives of Internal Medicine.