

A METHOD OF INDICATING THE POSITION OF THE DIAPHRAGM  
AND ESTIMATING THE DEGREE OF VISCEROPTOSIS. By  
ARTHUR KEITH, M.D.

THE manner in which the abdominal viscera are supported and maintained in position during life is a subject which has not received from anatomists the attention which its practical importance deserves. Amongst clinical men crude ideas prevail as to how the stomach, the liver, the kidneys, and the uterus are supported during life, and wholly unscientific methods employed to rectify their displacements. This undesirable state of affairs is due, in the first place, to the attention of the anatomists being too largely confined to the dead body, and in the second place, to the lack of an accurate method which can be applied to the living body for estimating the normal position of the abdominal viscera and the degree to which they may have fallen down from the normal. For clinical purposes it is useless to employ vertebræ as landmarks. The investigations of Dr Addison have done much to standardise<sup>1</sup> our knowledge of the position of the abdominal viscera. It was undoubtedly his methods that suggested to me the use of the xiphi-sternal line as a standard from which to measure the extent to which the viscera had fallen in cases of Glénard's disease.<sup>2</sup> A prolonged experience has convinced me that the xiphi-sternal line (fig. 1, *cc*) is of great clinical utility.

Even in fat people the depression at the junction of the meso-sternum with the xiphi-sternum, or the depression below the insertion of the seventh pair of cartilages—which for practical purposes may be regarded as the same—can be readily recognised. If a line be drawn horizontally across the body, through this point, it gives a standard in terms of which the upper limits of the abdominal viscera may be stated, not in vague intercostal spaces, but in centimetres. In X-ray work I have found a narrow strip of tin-foil applied along this line to serve as an excellent standard from which to take measurements.

*The xiphi-sternal line as an index of the type of thorax.*—In the normal

<sup>1</sup> C. Addison, "The Topographical Anatomy of the Abdominal Viscera in Man," *Journ. of Anat. and Physiol.*, vols. xxxiii., xxxiv., and xxxv.

<sup>2</sup> A. Keith, "Hunterian Lectures on the Anatomy and Nature of Glénard's Disease," *Lancet*, March 7 and 14, 1905.

thorax, in a position of rest, the xiphi-sternal line crosses the fifth pair of cartilages (fig. 1, *a*); if the thorax is emphysematous, it crosses below the cartilage (fig. 1 *a'*); if the ribs are depressed, as in the condition known as the *habitus phthisicus*, and in women who have worn tightly fitting corsets, it crosses above the fifth cartilage (fig. 1, *a''*). By stating the relationship of the xiphi-sternal line to the fifth pair of cartilages, definite information is given of the type of thorax. In three cases where eight cartilages reached the sternum on the right side, the xiphi-sternal line crossed, not the fifth pair of cartilages, but the sixth pair.

The following was the relationship of the xiphi-sternal line to the ribs

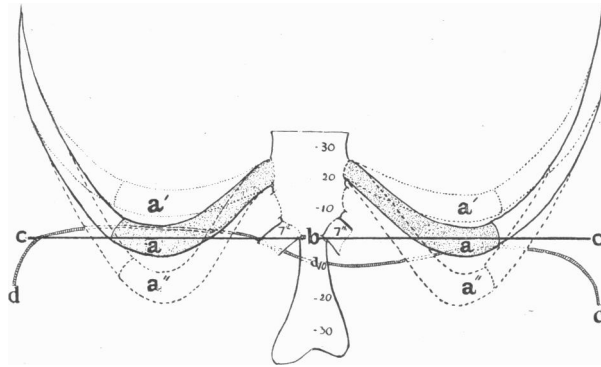


FIG. 1.—The xiphi-sternal line and its relationship to the fifth pair of costal cartilages.

*a*, the relationship of the line to the fifth pair of costal cartilages in a normal thorax; *a'*, its relationship in the emphysematous thorax; *a''*, its relationship in the so-called "phthisical thorax"; *b*, xiphi-sternal point; *c*, xiphi-sternal line; *d*, position of diaphragm (average of fifty dead subjects).

and intercostal spaces in twenty-nine adult male subjects, forty adult female subjects, and sixteen newly-born children:—

The line crossed—	Males.	Females.	Newly-born.
Fourth rib . . . . .	0	1	0
„ space . . . . .	2	22	2
Fifth rib . . . . .	26	14	9
„ space . . . . .	0	1	4
Sixth rib . . . . .	1	2	1

*The xiphi-sternal line as an index to the position of the diaphragm.*— Taking the xiphi-sternal line as a standard, the position of the domes of the diaphragm are found to be extremely variable in position. To indicate the average level of the diaphragm, three points are taken on the line: (1) a *right*, vertically below the mid-point of the right clavicle; (2) a *median*,

at the xiphi-sternal point; (3) a *left*, in the left mid-clavicular line. The right dome should reach the level of the right point, the left dome lies from 5 to 10 mm. below the left point, the central tendon is 10 mm. below the median point. These three points can be used with great facility for clinical purposes. My observations on the living—chiefly on students—show that in the supine position the domes rise 8 to 10 mm. above the level they occupy in the upright posture. The respiratory excursions of the diaphragm above and below the line varies not only with the amplitude of the breadth taken, but also with the type of respiration and with training. In those whose movements are purely thoracic in type, the respiratory excursions of the diaphragmatic domes may be only 10 mm. above and 15 mm. below this line (a total excursion of 25 mm.), while in those with movements of the abdominal type, they may extend from 25 mm. above to 65 mm. below the line, a total excursion of 85 mm.

*The xiphi-sternal line as an index for estimating the degree of visceroptosis.*—Dr Franz Glénard,<sup>1</sup> to whose clinical labours we owe the recognition of the condition of visceroptosis, proposes to distinguish the low condition of the diaphragm described by me<sup>2</sup> under the name of *phrenoptose*, evidently regarding the condition as forming a variety of the forms of visceroptosis. On the other hand, I consider the level of the diaphragm as the true index of whether visceroptosis is present or not, and of the extent to which it is present, for there can be no ptosis of the viscera unless a corresponding sinking of the diaphragm be present. The diaphragm marks the upper level of the abdominal viscera; the extent to which they have sunk must be measured by the extent to which their upper level is depressed. In estimating the degree of ptosis, I take the three points in the xiphi-sternal line already mentioned—the right, middle, and left—and measure the distance to which the right dome, the central tendon, and left dome have sunk below these three points. If the right and left domes are 25 mm. or more below the right and left points, I regard the condition as one of visceroptosis. How far clinical experience will justify this artificial standard, time will show, but to make progress it is necessary, at least to commence with, to make an artificial standard.

In the following table I give the distance of the right dome, central tendon, and left dome above or below the right, middle, and left points of the xiphi-sternal line, as measured in 107 dissecting-room subjects, of both sexes, the majority of whom were over sixty years of age.

<sup>1</sup> *Bull. et Mem. de la Société Médicale des Hospitaux de Paris*, Feb. 22, 1906, p. 158.

<sup>2</sup> *Lancet*, March 7, 1903.

	Right Dome.	Central Tendon.	Left Dome.
+ 51-60 mm. . . .	1	0	1
+ 41-50 „ . . . .	1	0	1
+ 31-40 „ . . . .	4	0	5
+ 21-30 „ . . . .	15	1	9
+ 11-20 „ . . . .	15	16	10
+ 1-10 „ . . . .	} 38	37	37
xiphi-sternal line . . . .			
- 1-10 mm. . . .			
- 11-20 „ . . . .	9	22	11
- 21-30 „ . . . .	6	14	13
- 31-40 „ . . . .	8	11	9
- 41-50 „ . . . .	8	4	10
- 51-60 „ . . . .	2	2	1
- 61-70 „ . . . .	0	0	0