# PERCUSSION OF THE ABDOMEN.

Percussion of the abdomen is most conveniently practised when the patient is made to lie on his back, in which position the abdominal coverings, especially the recti muscles, are relaxed to the greatest extent.

The object to which percussion is here directed is the delimitation of certain of the subjacent organs,—the liver, spleen, and gastro-intestinal canal, very rarely the kidneys. The pancreas, ovaries, and uterus, when of their *normal* size, are not definable by percussion.

The diagnostic importance of percussion in many abdominal diseases is merely secondary, particularly in cases of enlargement of the various organs, the information obtained by palpation being more reliable, inasmuch as by the latter means we are enabled to detect not only increase in volume but also many other alterations to which the parts are subject and thus to form a clearer conception of the precise nature of the morbid process going on; this is exemplified in cases of palpable tumour of the liver, spleen, ovaries, uterus, and in various other abdominal tumours. In other cases, however, in which palpation gives negative or uncertain indications, percussion comes to be of the greatest value as a method of physical examination, as, for instance, in free ascites, encysted peritoneal exudation, intestinal meteorism, accumulation of gas in the peritoneal sac, atrophies and dislocations of the liver, and in the slighter (and therefore non-palpable) forms of enlargement of the liver and of the spleen. Further details having a bearing on this subject will be given in discussing the percussion of the different organs.

It is immaterial in what order the abdominal organs are percussed, though it is customary to begin with the liver and spleen and afterwards to turn the attention to the gastro-intestinal canal.



## Percussion of the Liver.

This is undertaken with the view of ascertaining the position and size of the liver.

In normal circumstances, in which the liver is not definable by palpation, percussion is the only method by means of which the dimensions and situation of the organ can be determined, while in those cases in which, on account of enlargement, the liver projects from under the costal arch and may therefore be distinctly felt, percussion supplements the results obtained by palpation by fixing the *upper hepatic boundary;* diminution in the size of the organ can be recognised only by percussion.

The liver lies in the greater part of its extent close against the thoracic and abdominal parietes, only its upper convex surface, occupying the concavity of the diaphragm, being by the latter structure, and by the lung towards the right, separated from the chest-wall. That portion of it which is in contact with the thoracic and abdominal wall, extending on the front of the chest from the sixth rib superiorly to the margin of the arch of the ribs inferiorly, and reaching in the median line to midway between the base of the xiphoid cartilage and the umbilicus, gives at all points a dull sound to percussion. This area of dulness is known as the *absolute hepatic dulness*. That part of the liver which is separated from the chest-wall by lung-tissue extends upwards, when the diaphragm is in a medium state of contraction (as in quiet expiration), to the level of the fifth rib between the right mammillary and parasternal lines; from this point downwards to the inferior border of the lung, beyond which the liver is in immediate contact with the thorax, the sound is not dull, but is only less loud than that elicited higher up (at parts behind which lung *alone* is situated), and is therefore spoken of as merely *relatively dull*. The height of this relative hepatic dulness, however, is less than the actual height of the upper convex segment of the liver which is sheltered behind pulmonary tissue, as the dulness always begins in the middle of the fifth intercostal space, where the stratum of lung which comes in front of the liver becomes sufficiently thin, while above this level the layer of lung is too deep to permit of any diminution in the intensity of the percussion-sound taking place.

As, accordingly, the relative hepatic dulness can never be defined with rigorous exactness no attempt is as a rule made to do so, attention being directed to the determination of the area of absolute dulness only. The full vertical diameter of the organ may nevertheless be approximately shown by placing the upper boundary of the absolute dulness 4 ctm. higher,—the extent to which the liver, in the mammillary line, is covered by lung, the diaphragm occupying a middle position between relaxation and extreme contraction.

The liver should be percussed during the respiratory pause, and generally along four lines, the axillary, mammillary, parasternal and median lines.

The *upper boundary* of the hepatic dulness is found at the eighth rib in the *axillary line*, at the upper (sometimes the lower) border of the sixth rib in the *mammillary line*, at the upper border of the sixth rib (sometimes in the fifth intercostal space) in the *parasternal line*, and at the base of the xiphoid process in the *median* line. Posteriorly the liver rises as high as the level of the tenth rib. The superior boundary of the hepatic dulness is thus conterminous with the inferior margin of the right lung.

The *lower limit* of the hepatic dulness is situated between the tenth and eleventh ribs in the axillary line; in the mammillary and parasternal lines it comes close to the edge of the arch of the ribs, comparatively seldom passing beyond it, and then only to the extent of 1—1½ ctm. In women this inferior boundary may be considerably lower,—as much as 2½—5 ctm., a condition which is commonly due to tight lacing, sometimes to relaxation of the suspensory ligament of the liver; in the latter case the upper limit also is lowered. In the median line the hepatic dulness reaches downwards to nearly midway between the base of the xiphoid process and the umbilicus; from the median line it extends about 5 ctm., at most 6—7 ctm., to the left, where its lower edge, turning upwards, passes into the lower margin of the cardiac dulness and there ends, as might be expected from the anatomical site and outline of the liver, in the upper border of the hepatic dulness.—Posteriorly the lower boundary of the liver-dulness is no longer demonstrable beyond the scapular line, in which it is situated at the level of the eleventh rib; the dulness is here undefinable, being lost in that arising from the thick mass of the dorsal muscles.



The percussion-sound is not equally dull at all parts of the hepatic area; over the thick right lobe of the liver the non-resonance is much more decided than over the thin left lobe, while towards the lower margin of the organ, where it diminishes rapidly in thickness, the sound becomes more and more clear. The proximity of the intestine to the lower part of the right lobe, and of the stomach and bowel to the whole left lobe, adds to the dull sound heard on percussing in these regions one of tympanitic quality; by striking gently with the hammer or finger the confusion arising from the mingling of these sounds may be reduced to a minimum. It is only in children that, notwithstanding the employment of a light stroke in percussing, the dull sound over the whole hepatic area is accompanied by a tympanitic sound.

### Dislocation of the Liver.

In this affection the boundaries of the area of liver-dulness are altered, but the organ itself remains of normal size.

Dislocation of the liver from *physiological* causes occurs during the respiratory act; in quiet respiration the amount of displacement is merely trifling; deep inspiration, on the other hand, occasions a very considerable sinking of the liver, and consequently also of the upper limit of the hepatic dulness. At the same time the vertical diameter of the dull area diminishes, as in inspiration the lower margin of the liver descends only to a point about 1—1½ ctm. below the edge of the costal arch, whilst the upper convex surface of the organ is overspread by the expanding lung to the extent of 2—3 ctm. The attitude of the body has also a certain influence on the position of the lower border of the liver; in lying on the right side the right lobe sinks and the left rises somewhat, and if decubitus be on the other side these relations are usually reversed.

*Pathological* displacement of the liver takes place generally *downwards*, seldom (and then only to a very inconsiderable degree) upwards or laterally.

Dislocation *downwards* is produced by all those conditions in which depression of the diaphragm is a marked symptom,—the severer forms of *pulmonary emphysema*, right *pleuritic exudation*

and *pneumothorax;* in a rarer class of cases the depression is due to relaxation of the ligamentum suspensorium hepatis.

If both lungs be emphysematous the displacement of the liver is uniform,—and this is the more common variety of the affection; but if the disease be more marked in the right lung, as it occasionally is, the right lobe is pushed further downwards than the left.

The extent to which the upper boundary of the liver sinks,—one, or even two intercostal spaces,—is proportionate to the degree of distension of the emphysematous lung; in aggravated cases it may even come to occupy a position opposite the eighth rib in the mammillary line, when the margin of the organ will be found to project beyond the arch of the ribs. This descent of the lower hepatic boundary, however, is not so great as that of the upper boundary; the hepatic dulness is therefore not simply displaced but is also diminished in size, a condition which is favoured by the fact that the adjacent intestine gives a tympanitic note which accompanies the percussion-sound of the lower segment of the liver.

A second very common cause of downward dislocation of the liver is right pleuritic exudation; much more rarely, and then not to such a marked extent, a similar displacement is produced by right pneumothorax, if it have not at the same time given rise to an abundant pleuritic effusion. In such cases the right lobe of the liver is driven further downwards than the left, so that the organ is made to take up an oblique position in the abdominal cavity, the descent of the heavy right lobe rendering tense the suspensory ligament and causing the left lobe to turn more to the left and upwards.—*Left* pleuritic effusion, left pyo-pneumothorax, or very *copious pericardial effusion*, may, but never to any great degree, depress the *left* lobe of the liver.

The liver, when dislocated downwards, may generally be felt with the hand if the abdominal coverings be not too tense; but when it is not distinguishable by palpation the characteristic feeling of resistance which it gives to percussion, the dull sound brought out by a gentle percussion-stroke, and the dull tympanitic sound it renders in answer to a more forcible stroke, make its recognition comparatively easy.

That the liver is simply dislocated,—not enlarged, as might be supposed by its projecting and coming within reach of the hand beyond the edge of the costal arch,—is at once shown, when the cause of the displacement is pulmonary emphysema, by the percussion-signs above enumerated, particularly by those which indicate a descent of the upper limit of the hepatic dulness. In right pleuritic effusion, on the contrary, the determination of the superior boundary of the liver becomes impossible, as the dull sound of the fluid passes directly into that obtained over the hepatic area.



Dislocation of the liver *upwards* is invariably the result of pressure from below by enlargement of the abdominal organs, intestinal meteorism, ascites, large tumours of the abdominal cavity, especially of the ovary. The displacement is thus most frequently uniform; occasionally, however, the liver is pushed up unequally, according as the pressure takes effect chiefly on its right or left lobe. The actual extent of the upward dislocation from these causes connected with the abdominal organs is never so great as that of the displacement downwards from thoracic disorder, as from the more yielding character of its walls the abdomen undergoes a much greater degree of enlargement than the thorax before the signs of pressure on the liver become evident; generally, indeed, the effect of even very considerable abdominal pressure is merely to raise the liver but one interspace higher, so that the upper boundary of the organ comes to coincide with the fifth rib. Still further elevation of the liver, till it reaches even as high as the fourth rib, is rare.—The determination of the *lower* border of the liver by percussion is often difficult, occasionally quite impossible, when the dislocation is due to pressure from below,—in cases of very abundant ascites, for instance, as this affection itself is associated with a dull percussion-sound. And even in those suffering from intestinal meteorism, or abdominal enlargement from other causes, we frequently fail to delimit the liver inferiorly, as its dulness is swallowed up in the tympanitic sound of the bowel; in these circumstances therefore the vertical measurement of the hepatic dulness is less than it is normally.

### Enlargement of the Liver.

When the liver increases in size its surface and margin, as already observed (p. 324), come within easy reach of the hand, when it is no longer necessary to have recourse to percussion to recognise the presence of the enlargement. Less marked augmentation of volume, however, gives no sign which is appreciable

by palpation, especially if there be much tension of the abdominal wall; in cases of this kind the increase is clearly enough shown by the dull sound elicited by percussion of the hepatic area. This sound is never absolutely non-resonant, but is of a dull tympanitic quality. The distance downwards to which the liver reaches is indicated by the line of demarcation between the dull tympanitic sound of the organ itself and the clear tympanitic note of the adjoining intestine.

But the liver, even when distinctly enlarged and projecting below the ribs, is not demonstrable by percussion in the presence of copious effusion into the peritoneum (ascites) or meteorism of the intestine. In the first case, provided that the fluid be abundant enough to reach to the upper part of the abdomen and that the abdominal walls be in a condition of considerable tension, the dull sound of the liver is indistinguishable from that of the effusion; the fluid often rises as high as the liver, or even covers it, when the patient lies on his back. In the second case (meteorism) the colon, distended by gas, sometimes comes between the liver and the abdominal wall, when percussion educes only the loud intestinal sound. In the same way an enlarged left lobe of the liver may be so masked by the dilated, air-distended stomach as to be undiscoverable by percussion.

Of the complications just enumerated, which hinder or render impossible the delimitation of the liver by percussion, ascites is the most common (as in cases of hepatic enlargement, and peritoneal effusion in the stage of failure of compensation in mitral lesions). If the superficial tissues be sufficiently lax the swollen organ is *accessible to palpation*, when the enlargement is easily detected without the aid of percussion. Even when the abdominal parietes are moderately tense the hypertrophied liver may be explored by palpation, by pressing suddenly and firmly with the hand over that part of the abdominal surface corresponding to the site of the liver, and in this manner pushing the fluid aside.

A liver of normal size may appear enlarged when close to its lower border is situated some solid medium giving a dull sound to percussion. The hepatic dulness is thus apparently increased by the presence of firm, hard fæcal masses filling up the transverse colon, by tumours of the pylorus and of the stomach in general, and by peritoneal exudation encysted in the neighbourhood of the liver.



In these cases also, in which percussion is plainly not to be relied on as a means of investigation, palpation very generally, though not invariably, furnishes such indications as warrant a positive diagnosis. But even with the aid of the latter method of examination it is not unfrequently impossible to distinguish between cancer of the pylorus and cancer of the left lobe of the liver; it is then necessary to fall back on the other symptoms which point to the presence or absence of functional disorder of the stomach.

Several of the above-named conditions, which complicate or render uncertain the results of percussion, such as distension of the stomach by food, the overlapping of the enlarged liver by coils of intestine, the accumulation of a quantity of hard fæcal matter in the colon, &c., are of short duration, so that repeated examination usually removes any doubt that may have at first arisen as to the real dimensions of the liver; in all such cases, however, the symptoms relating to the development and course of the disease possess a much higher diagnostic value than the doubtful objective results of physical examination.

In a rarer class of cases the liver increases in size not merely downwards but also upwards, pushing the diaphragm before it, rising sometimes as far as the third intercostal space, compressing the lung and dilating considerably the right half of the chest, particularly laterally; this is observed specially in *hydatid disease of the liver*.

At the first glance such a case may readily be mistaken for one of pleuritic exudation, but a closer examination will reveal the true nature of the affection. Thus, in a woman whom I lately had under observation, suffering from hydatids of the liver, the tumour, which was large and distinctly fluctuant, was not simply abdominal but grew upwards also into the thoracic cavity, and that so quickly that in a short time the right side of the chest, from about the fourth rib downwards, was dilated to an extent such as is generally noticed only in cases of enormous pleuritic exudation. To fall into the error of confounding such an affection with pleuritic exudation is scarcely possible; apart from the objectively-demonstrable fact that the liver forms a prominent tumour in the abdomen, it will be found that the intercostal spaces, when the chest is dilated by an hepatic tumour, are not obliterated; that, further, the dilatation of the thorax is very irregular, and that above all the outline of the area of dulness does not in the least resemble that which is so distinctive of pleuritic exudation.

### Contraction of the Liver.

The principal sign which this condition gives to percussion is *diminution in the extent*, or even *entire disappearance*, of the

*hepatic dulness*. In the latter case the existence of atrophy of the liver is unquestionable, in the former case its presence is to be regarded as satisfactorily demonstrated only after all possible complications such as might invalidate the results of percussion have been excluded.—The circumstances under which the liver, even when of its natural size, may be associated with an area of dulness abnormally small, have already been in part enumerated on p. 343; the following may also be mentioned here. 1. When some coils of intestine, distended by gas, come between the convex surface of the liver and the thoracic or abdominal wall, the vertical measurement of the hepatic dulness is diminished, as over the lower part of the liver the non-resonant percussion-sound gives place to a loud tympanitic note, while the dull sound proper to the left lobe may almost totally disappear. It is usually the transverse colon which, when inflated with intestinal gases, rises in front of the liver and masks the percussion-dulness of its right and left lobes; the area of non-resonance corresponding to the left lobe may also be invaded and reduced in size by distension of the stomach. 2. The hepatic dulness is encroached upon when the upper surface of the liver is in great part covered over by emphysematous lung; its upper limit sinks very considerably, while its lower limit is pushed downwards into the abdomen to but a very slight degree. 3. Similarly, a very decided reduction in the area of the hepatic dulness takes place when the liver is driven upwards by ascites, intestinal meteorism, or large ovarian tumours, as a much larger portion of the convex surface of the liver is thus caused to pass behind the anterior lower margin of the lung. 4. Finally, a decrease in the extent of the hepatic dulness is also observed in certain rather rare cases in which, in consequence of perforation of the intestine (as in typhoid fever) gas finds its way upwards between the liver and the thoracic or abdominal wall.

Actual diminution of the area of hepatic dulness is due to contraction of the liver, arising specially from cirrhosis and acute yellow atrophy

In *cirrhosis* of the liver the contraction of the organ is often very marked. It may become difficult or even impossible to demonstrate any diminution in the extent of the hepatic dulness, on account of the ascites which invariably accompanies cirrhosis, the non-resonant hepatic area being continuous inferiorly with



the dulness associated with the ascites, while its superior boundary is found at its normal level or even somewhat lower, if the liver be pushed upwards and so brought more fully under cover of the lung. If, on the other hand, the ascites be but trifling one can generally convince himself—always, if the fluid be drawn off by puncture—that the dulness which represents the right lobe of the liver is diminished in height, and often that of the dulness corresponding to the left lobe no trace is discoverable.*

The most extreme degree of contraction of the liver occurs in the course of *acute yellow atrophy*. The liver, in this affection, may very rapidly become so small as to sink quite to the back of the abdominal cavity and lie against the vertebral column. Coils of intestine then come in between the liver and the chest-wall, and the pulmonary percussion-sound may, as I observed in one case, in the front and side of the chest pass directly into the tympanitic intestinal sound.

### Percussion of the Spleen.

The spleen lies deep in the left hypochondrium, its long diameter being directed obliquely from above and behind, downwards and forwards. Its upper or posterior end is situated close to the body of the tenth dorsal vertebra, in the concavity of the diaphragm, and under the edge of the left lung, while its lower or anterior end is found behind the eleventh rib near its free termination, that is, somewhat posterior to the middle axillary line. The *anterior* border of the spleen runs parallel with the ninth rib, the *posterior* parallel with the eleventh. The organ is more or less rounded at its upper and lower ends.

Percussion of the spleen can be carried out equally well while the patient is in the sitting, standing, or recumbent posture; but in those cases in which the organ is enlarged, forming a tumour which projects beyond the margin of the arch of the ribs, percussion must be practised not only with the patient in the upright position, but also while he is recumbent and, as the spleen is placed at some distance from the front of the trunk, turned somewhat to the right. The result obtained by percus-

* In one case of cirrhosis which I saw the ascites was exceedingly slight in amount, a condition which was obviously owing to the fact that the patient had almost daily, during a period of several weeks, a very profuse watery discharge from the bowel; the smallness of the liver was for this reason very easily demonstrable.

sion varies a little, however, according as the person under examination assumes the one or the other position. When he reclines on the right side the splenic dulness is displaced and slightly diminished in area; it *shifts*, as the spleen sinks and is turned still further forward (inward) at its lower end, in such a way that the direction taken by its long diameter is no longer diagonal, as in the standing posture, but more nearly horizontal; it is then also *diminished in area*, by the descent (2—3 ctm. in extent) of the lower margin of the left lung, whereby a larger part of the upper (posterior) end of the spleen is hidden by pulmonary tissue, the lower (anterior) end of the organ falling downwards. This displacement and diminution in size of the splenic dulness is recognised by comparing the areas of dulness obtained in the upright and right lateral positions; the difference is often quite perceptible even while the spleen is normal in volume, but is much more obvious when it is enlarged. It is in almost every instance advisable to percuss in *both* positions alternately, as a comparison of the outline of the non-resonant areas provides a convenient test of the accuracy of the results of this method of investigation.

The spleen, being of comparatively small size, only $2\frac{1}{2}$—4 ctm. in thickness, and surrounded on almost all sides by air-containing organs, gives a sound to percussion which is much less dull than that of the liver. In adults frequently, in children generally, the splenic sound is not absolutely dull, but merely slightly muffled and at the same time of tympanitic quality; the percussion-stroke employed must therefore be gentle, otherwise vibration will be set up in the adjacent structures (the lungs, stomach, and colon), and the muffled splenic sound will be almost lost in the clear sound so awakened. The stroke must also be delivered in the respiratory pause, as during inspiration the greater part of the upper end of the spleen is sheltered behind pulmonary tissue; a very deep and full inspiration may even cause the splenic dulness to disappear entirely. Even after complete expiration, however, nearly the whole upper third of the organ, about 4 ctm. in length, remains covered by lung; this portion of the spleen is accordingly not definable by percussion,—though exactly the contrary has been maintained by some authors. At that part of the posterior thoracic surface which coincides with this upper segment of the spleen, that is, in the



space lying between the ninth and tenth dorsal vertebræ and the scapular line, no diminution in the intensity of the percussion-sound is heard, the note being uniformly clear quite up to the lower border of the lung. As the upper third of the spleen is thus too deeply seated to be recognisable by percussion, it follows naturally that the long diameter of the organ as indicated by this method of examination is one-third shorter than it really is anatomically.

In percussing from above downwards—preferably without the hammer—between the left middle and posterior axillary lines, the patient being in the standing posture and having his left arm slightly raised, distinct dulness is first obtained usually at the *upper border of the ninth rib*, and at the same time the sense of resistance experienced in the finger is increased; this marks the superior boundary of the splenic dulness. This area of non-resonance extends downwards to the eleventh rib or to its lower border, which is therefore regarded as the inferior boundary of the splenic dulness; the muffling of the percussion-sound ceases at this point, and is replaced by the clear note yielded by the bowel. Posteriorly the splenic dulness is bounded by the scapular line, from the ninth to the eleventh rib; its anterior limit coincides almost exactly with the middle axillary line, also between the ninth and eleventh ribs.—The long diameter of the splenic dulness measures about 7—8 ctm., its greatest breadth 5—6 ctm., while the actual length of the spleen itself is on the average about 12 ctm., and its breadth about 8 ctm.

Whilst the spleen is easily definable between the ninth and eleventh ribs in the axillary line, the delimitation of its anterior and posterior borders in their *whole* extent is an undertaking of much greater difficulty, and one which sometimes cannot be satisfactorily accomplished. This is accounted for by the anatomical relations of the organ. Thus, the upper part of its *posterior* border lies deeply sunk behind lung-tissue, and is therefore not traceable by percussion; the middle and a portion of the lower part of the same border, also, run up to and overlap the convex edge of the kidney, so that in this direction the splenic dulness is continuous with and indistinguishable from the renal dulness. There remain accordingly of the posterior border only two small portions, an upper and a lower, which may be isolated by percussion from the adjoining resonant pul-