

**A TREATISE**  
ON  
**OBSTETRIC AUSCULTATION.**

BY

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**TRANSLATED FROM THE GERMAN**

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# ADVERTISEMENT

BY THE

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THE treatise by Dr. Kennedy on the Signs of Pregnancy, is the only work in our language devoted to a consideration of Obstetric Auscultation: most English writers on Midwifery dismiss the subject with very few words, or pass it over altogether without notice.

It is hoped that the following pages may lead to a higher estimate of the value of the stethoscope, and to a better acquaintance with its employment, both during pregnancy and at the period of labour. They present the results of six hundred observations, which add some new facts to our stores of knowledge, and afford a most valuable confirmation of many others with which we were previously acquainted.

This Translation was undertaken at the suggestion of Dr. Rigby, to whose many friendly offices I am much indebted, and for which I gladly seize this opportunity to tender my most sincere thanks.

It was in the Lying-in Hospital at Dublin that I became practically acquainted with the value of obstetric auscultation; and I cannot omit to acknowledge, in connexion with this circumstance, how much I owe, in every department of midwifery, to the instruction of Dr. Kennedy, and with what pleasure I recal the time when every day gave me the benefit of his teaching, and the enjoyment of his company.

CHARLES WEST.

40, *Craven Street, Strand,*  
*July, 1839.*

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# INTRODUCTION.

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## GENERAL OBSERVATIONS ON THE EMPLOYMENT OF AUSCULTATION.

### § 1.

THE auscultation of pregnant and parturient women is attended with difficulties precisely similar to those which retard the student's acquisition of skill in manual exploration. In both, the necessary dexterity can be obtained only by long-continued practice, with adequate opportunities for observation; and as the practitioner of midwifery will be unable to satisfy himself about many very important occurrences until his sense of touch has been much exercised, so, before he can venture to rely upon the information which his ear affords, his sense of hearing must have undergone long schooling. Perhaps,

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indeed, even more diligence and patience are requisite in the latter, than in the former mode of examination; and he who is not possessed of at least a moderate amount of persevering attention, can never succeed in gaining such a knowledge of auscultation as will enable him to apply it successfully in detecting pregnancy, or in ascertaining the different phenomena which take place during labour. This knowledge may be acquired in lying-in hospitals incomparably better than elsewhere, though persons may both learn auscultation thoroughly, and employ it skilfully, without having had greater opportunities than those presented to them in private practice.

Some persons have asserted, that it is necessary to possess a more than usually acute sense of hearing, in order to practise obstetric auscultation with success; this, however, is by no means indispensable, for the ear will become so expert by frequent exercise, as at length to detect the most delicate variations of sound. One circumstance which greatly facilitates the acquisition of skill in this method of examination, is, a previous acquaintance with the use of the stethoscope in detecting diseases of the chest; yet, it should

always be borne in mind, that the former is attended with far greater difficulties than the latter. Persons are very apt to forget this fact, and to feel disappointed with the slowness of their progress : let them console themselves with Laennec's assurance, that "*L'étude de ces phénomènes demande incomparablement plus d'attention que celle de tous ceux que présentent les maladies de la poitrine.*"

### § II.

Auscultation of the abdomen, as of the chest, may be practised either with the unaided ear, or by means of the stethoscope : both methods have had their warm advocates, and much controversy has arisen respecting their comparative advantages. An undue importance seems to have been attached to this question, for a person may succeed in either way in ascertaining the existence of pregnancy, or in distinguishing the occurrences which take place during labour. The employment of mediate auscultation, however, has many circumstances in its favour ; its superior delicacy must be obvious to all ; and it often happens that no sound is audible except in some part of the abdomen, such as the hypogastric, or

inguinal region, which it would be impossible to auscult without the stethoscope. But, independently of the needless indelicacy of applying the ear to the abdomen of the patient, the practitioner who does so must place himself in a position often exceedingly incommodious, and likely to occasion congestion about the head. Nothing interferes so much with the successful employment of this mode of examination as an inconvenient posture; and it is useless to continue listening to the abdomen after our ear has become red, and the beating of the arteries of the tympanum perceptible. Moreover, if the ear is applied directly to the abdomen, the number and variety of the sounds heard is very confusing, while the stethoscope has the great advantage of limiting and isolating the field of observation. Another benefit which attends the use of this instrument is, that by means of it a moderate degree of pressure may be exerted upon the abdomen of the patient; and this is often very necessary, if, in addition to her not being far advanced in pregnancy, her abdominal integuments be loaded with fat, or if her uterus contain an unusually large quantity of liquor amnii.

## § III.

Various instruments have been recommended as possessing peculiar advantages for obstetric auscultation; and the most dissimilar materials have been employed in the construction of cylinders or cones, which were either hollow, or solid, or otherwise modified in shape, according to the fancy of the different inventors. This, however, is not the place for a critical examination of these instruments; which, indeed, is the less important, since the auscultation of the abdomen may be practised almost equally well with any stethoscope.\*

## § IV.

A person but little versed in auscultation will find it necessary to have the room perfectly quiet;

\* We are in the practice of employing Piorry's stethoscope, slightly modified. It is a cylinder made of any firm wood, from seven and a half to eight inches (Parisian measure) long, from six to seven lines thick, and with a bore of four lines in diameter: one extremity expands into a conical cavity one inch four lines deep, and one inch four lines in diameter at its base; while an ivory ring two lines high is attached to the other end, and to this ring an ivory ear-piece is screwed which is two inches in diameter, and plane on both sides.

but, by degrees, as he becomes more familiar with the sounds heard in the abdomen of pregnant women, external impressions will cease to distract him, and he will at length be able to carry on the examination without difficulty, even though persons may be conversing together in the same apartment. The period of digestion should also be avoided by the beginner, since the noises then heard in the intestinal canal are very likely to disturb and perplex the unpractised ear.

#### § v.

In order to examine the abdomen with the stethoscope, the patient should lie on her back, upon a moderately high bed, her head supported by a pillow, and her arms stretched out by her side: the whole uterine region is thus rendered accessible to the stethoscope, while the intestines lying on either side of the abdomen, or pressed towards the spine, seldom if ever interfere with the examination. Although these are generally the most favourable circumstances for practising auscultation, yet there are cases (to be hereafter more exactly described) in which it is advantageous to turn the patient more or less on her side.

It is likewise exceedingly important for making an accurate examination, that the posture of the practitioner should be such as he can maintain for several minutes with ease to himself, since it is often necessary to prolong the auscultation for a considerable time, or, at least, to interrupt it only by very short pauses. Perhaps the least weariness will be felt by kneeling on a cushion at the bed-side of the patient. It is furthermore desirable to acquire the practice of hearing with equal facility with either ear; for prolonged exercise of one ear renders it red and painful, and compels us to desist from our examination.

Any one who attempts to auscult a patient while standing or sitting, labours under very great disadvantages; for not merely is the perception of sounds thereby rendered more difficult, but the position in which he is forced to place himself is exceedingly incommodious, and many parts of the abdomen of the patient are rendered quite inaccessible to the stethoscope.

#### § VI.

Although a practised ear will detect the different sounds through the ordinary dress of the patient, yet it is always desirable that she should

be thinly clad; it will therefore be found a useful plan, to direct her to roll up her under garments so that nothing but the gown and shift may be interposed between the stethoscope and the abdomen; for woollen stuffs interrupt the examination by the rustling noise which they occasion. Patients in labour may be examined in their night-dress, the bed-clothes having been turned aside from the abdomen; but no case can occur, in which exposure of the person is either necessary or justifiable.

#### § VII.

After the practitioner has placed himself in a convenient posture at the bed-side of the patient, he should next smooth the clothes over her body, so as to obtain an even surface on which to place the stethoscope. The pressure of the ear upon the instrument will generally suffice to maintain it in its position, or it may be held between the thumb and fore-finger of one hand. The other hand will serve the examiner to lean upon; or he may use it to feel the patient's pulse; or, placing it on the abdomen, he may endeavour to steady it by gentle pressure; but he should especially guard against using force either with the hand



or with the stethoscope, since not only does it give the patient pain, but it may cause some violent movement of the foetus, which would excite its circulation, and render it impossible to count the frequency of the pulsations of its heart.

## PART I.

*Results of the auscultation of women during pregnancy and in labour.*

## § VIII.

**VARIOUS** sounds may be heard in the abdomen of a person during the latter months of pregnancy, some of which proceed from the mother, others from the foetus.

It must not, however, be supposed, that all sounds distinguishable in the abdomen of a pregnant woman are indicative of her condition, for many of them are also present in persons who have never been impregnated. Thus, the pulsations of the patient's heart, the respiratory murmur, especially when altered by disease, the beating of the aorta and of the iliac arteries, and noises caused by flatus in the intestinal canal, are as often heard in the abdomen at other periods,

as during that of utero-gestation. But, beside these, there is one sound characteristic of pregnancy, and which, proceeding from the uterus, and being caused by the circulation of blood through its substance, may be very appropriately called *the Uterine sound*.

Furthermore, our ear assures us of the existence of pregnancy, by detecting the following signs, which result from the presence of a child in the uterus; namely, the beating of the heart of the foetus, the movements of its limbs, and the pulsations of the umbilical cord.

Each of these signs of pregnancy deserves a distinct consideration. It will be best to begin by examining the uterine sound, and afterwards to investigate such as proceed from the foetus, while the different noises which have been alluded to as not dependent on pregnancy, may receive a cursory notice, as far as they are of importance to the practitioner of midwifery.

## CHAPTER I.

## OF SOUNDS PROCEEDING FROM THE MOTHER.

*A. Of the Uterine Sound.*

## § IX.

The circulation of the blood through the uterus produces a single, whizzing, or humming sound, which differs in its apparent distance from the ear of the observer, is always synchronous with the pulse at the wrist, and changes with every alteration that the pulse undergoes, becoming slower, quicker, or intermittent, in accordance with the changes in the maternal circulation.\*

This sound bears a considerable resemblance to that bellows-sound sometimes heard in the

\* Hohl, in his valuable work, (*Die geburtshülfliche Exploration*, 1 Theil, das Hören, Halle 1833,) has stated, that the uterine sound coincides with the maternal pulse not merely in rhythm, but also in strength and fulness, weakness or smallness ; this, however, is far from being the case, for the former often seems to the ear very distant and feeble, at a time when the mother's pulse is very strong and full.

heart or arteries when any mechanical obstruction is presented to the circulation. The similarity, however, is far from complete, for the ordinary *bruit de soufflet* is much less shrill and loud than the uterine sound; which indeed varies so much in tone and intensity in different persons, and even in the same individuals at different periods, that it is difficult to say with what it may be most aptly compared. Sometimes it resembles the blowing of the wind; at other times the deep sound caused by the vibration of the string of a violoncello; while occasionally it is like the highest tones of a violin.

The resemblance of the uterine *souffle* to the ordinary *bruit de soufflet*, and its isochronism with the maternal pulse, have induced some persons, overlooking the fact that it communicates no shock to the listener's ear, to apply to it the inappropriate name of a pulsating sound.

It is worthy of observation, that the uterine sound varies in its intensity at the same part of the abdomen within a very short time: occasionally, indeed, it disappears completely in perfectly healthy women, without any evident cause. In some of these cases, the sound has merely changed its position, and become distinctly audible

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in a part where it had never before been heard, while, in other instances, it leaves its old situation for a time, and cannot be detected in a new one. Some exceedingly rare cases have occurred, in which a living child was born, although this sound was not audible at any period during pregnancy or in labour.

### § x.

This sound is far from being limited to one particular spot: in one patient, it will be found confined to the lower part of the uterus; in a second, diffused over the whole organ; while it would not be possible to point out any part of the uterine region accessible to the stethoscope, where it has not in some case or other been heard. It is usually, however, audible in one or both inguinal regions, whence it generally extends either towards the hypochondrium, or more forward towards the umbilicus, though it seldom passes the mesial line. But, whatever may be the situation it occupies, it will almost always be heard over a surface fully equal to, and often greatly exceeding in size, the circumference of the placenta.

## § XI.

The uterine *souffle* is seldom sufficiently distinct to be clearly recognised before the fourth month of pregnancy; as is shown by the fact, that while it was audible in twenty out of thirty-five patients at the fifteenth week of utero-gestation, it was heard in three only at the fourteenth week. Sometimes, indeed, it cannot be detected till the beginning of the fifth month, or the middle of pregnancy; but it can always be distinguished several weeks sooner than the pulsations of the foetal heart.

When it first becomes audible, the uterine sound is feeble,\* diffused over the whole of the small uterus, and most distinct just above the pubes; but, as the uterus rises with the advance of pregnancy, the sound is heard higher up, and

\* It is a common practice with the student, when examining women in the early months of pregnancy, to press the stethoscope deeply into the abdominal integuments, under the erroneous impression that he will thus hear with greater facility. This should be avoided; for not only is it needless, and likely to put the patient to pain, but, in some instances, premature labour has followed soon after examining a patient with the stethoscope, and has appeared to be altogether the result of roughly-conducted auscultation.

generally becomes most intense at the sides, even if it should not be confined to that situation. Changes in its intensity during the second half of pregnancy are far from common; sometimes it does become louder as the end of utero-gestation approaches, but there are equally numerous instances of a decline in its strength with each succeeding month.

#### § XII.

The uterine sound rises in frequency during labour synchronously with the pulse of the parturient woman: in some cases its loudness is increased, while in others there does not occur any change in its intensity. During the acme of each pain, it generally becomes inaudible in the fundus and body of the uterus, though it may still be heard in the inguinal region. Hohl\* has asserted, that the access of each pain is announced by an increased intensity or greater loudness of the uterine sound, or by certain modifications in its tone, which he represents as following a regular order; but the most careful examination of a great number of women has not verified any of these statements.

\* Loc. cit. p. 104, et seq.



It has been already mentioned, that in some rare instances the uterine sound is inaudible during the whole labour.

The same pain which expels the child, usually detaches the placenta, and is then immediately followed by a cessation of the uterine murmur; but if any interval should elapse between the two processes, the sound will continue to be heard until the separation of the placenta has been effected. From this, however, it must not be inferred that the sound ceases because the placenta is detached, but rather because the contraction of the uterus, and the consequent diminution in the calibre of its vessels, limit the quantity of blood which that organ receives, to a supply adequate for it only in the unimpregnated state.

### § XIII.

The term *uterine sound* not being that commonly employed, it will be necessary to state why it has been thought proper, in this treatise, so to designate the sound treated of in the foregoing paragraphs.

This name was chosen in preference to those

hitherto in vogue,\* from a supposition that the sound not only proceeds from the mother—not from the foetus—but that it has its seat in the uterus, and is produced by the alterations the uterine vessels undergo during pregnancy; all which opinions are supported by the following circumstances.

FIRST.—The perfect isochronism which exists between this sound and the pulse of the mother, and the fact that all changes in the movements of the maternal heart, as the acceleration, retardation, or intermission of its pulsation, communicate themselves to the uterine sound, both point to its origin in the vascular system of the mother: while its independence of the foetal circulation is shown by the fact, that, although in some rare cases it has been found more frequent than the pulsations of the foetal heart, no instance

\* Kergaradec, who inclined to the opinion that the placenta had some share in the production of this sound, called it *Battemens simples avec souffle*, (see his *Mémoire sur l'auscultation appliquée à l'étude de la grossesse*, &c. Paris, 1822, p. 30.) Soon afterwards De Lens named it *Pulsations placentaires*, (see his *Observations Additionnelles*, in Kergaradec, p. 39); and, since 1822, it has been commonly called *Bruit placentaire*, *Souffle placentaire*, *Placental sound*.

was ever yet observed in which the two sounds were synchronous.

**SECOND.**—The situation in which this sound is heard, the period at which it becomes evident, and the time of its disappearance, are all in favour of its origin being in the uterus, and not in any other abdominal organ. It is probable that the uterine sound might be heard soon after conception, at which time the vital action in the uterus seems to be so much increased, if it were possible to bring the stethoscope near that organ; but its position in the pelvic cavity at the commencement of pregnancy, as well as the thick layer of fat just above the symphysis pubis, afford no opportunity for so doing. As the uterus, however, rises out of the pelvis in the fourth month of pregnancy, the stethoscope placed just above the pubes is brought into close proximity to its fundus, and this sound may then be detected; it being usually first audible in the linea alba, where the abdominal parietes are thinnest. As the uterus gradually rises, the sound accompanies it; and sometimes it may be heard in the eighth month of pregnancy, extending from the symphysis pubis to the epigastrium; but this has been the case

only where the placenta was attached to the fundus uteri, and other circumstances concurred to favour the diffusion of the sound. After the birth of the child, and the expulsion of the placenta, the sound in the uterus generally ceases ; though exceptions to this are sometimes met with in the case of women who have already borne children and are subject to severe after-pains : in them a slight murmur may, from time to time, be detected in the uterus for a short period after delivery, but disappears as soon as the after-pains have subsided.

THIRD.—The assertion, that the vascular system of the uterus is the seat of this sound, and that the changes which the uterine vessels undergo are its cause, is supported by the resemblance which exists between it and the bellows-sound, frequently heard in other parts of the vascular system, especially in cases of aneurysmatic dilatation of the vessels.

Although, as has been already observed, the similarity between the uterine sound and the *bruit de souffle* sometimes audible in the heart and arteries, is far from complete, yet, according to the statement of some recent observers, there is a sound which bears the most exact re-

semblance to it, namely, that heard in varix aneurysmaticus—a disease in which a direct communication exists between the blood in the vein and that in the artery. The chief point to be borne in mind, in order to explain how the sound is produced in these cases, is, that one column of blood, moving quickly, passes out of the dilated artery into the dilated vein, where it comes in contact and eventually mixes with another column of blood travelling more slowly through the vein. Paul Dubois\* was the first to call attention to this analogy between the uterine sound and that produced by varix aneurysmaticus; and Hohl† subsequently asserted their perfect resemblance. The next question will naturally be, whether, since the sounds are similar, a resemblance in structure does not also exist between the organs that produce them? Dubois, whose experiments prove, to say the least, an exceedingly easy transition of injected fluids, or of air, from the arteries into the veins, has answered this question in the affirmative, and compares the structure of

\* *De l'application de l'auscultation à la pratique des accouchemens ; rapport fait à l'Académie de Médecine (29 Nov. 1831.) Extrait des Archives Générales de Méd., p. 26.*

† *Loc. cit.* p. 76, 157, 158.

the uterine walls to a tissue, naturally formed, of varicose aneurisms. Hohl agrees with him in this opinion ; but, going even further, he assumes the existence of the so-called placenta uterina to be fully proved, and imagines that the communication between arteries and veins takes place there, not by anastomosis, but through the medium of large cells ; in which he follows the opinion of Meckel. Were this really the case, no more apt comparison of the structure of the uterine vessels could be found, than that with the varix aneurismaticus ; or, to speak more strictly in the language of modern surgery, the aneurysma varicosum. Such an analogy between these two structures would serve excellently well to explain the occurrence of the uterine sound, while the conclusion would naturally follow, that "the pulsation is heard only at that part of the uterus to which the placenta is attached ;"\* and not merely would the term placental sound be justifiable, but there would be no reason for substituting for it another name.

Since, however, the doubt, whether the structure of the uterus does really resemble a tissue of varicose aneurisms, is by no means solved,

\* Hohl, l. c. p. 154.

and since the investigations with regard to the arrangement of vessels in the uterus, and the connexion between it and the placenta, are far from concluded, it will be better, leaving untouched the questions of the existence of an uterine placenta, of the sinuses of Meckel, &c., to show why such a structure, even though it were actually demonstrated, would not suffice to explain the occurrence of this sound.

Hohl's assertion, that the uterine *souffle* is audible only over that part of the uterus which corresponds to the insertion of the placenta, has already been noticed. It is a statement entirely at variance with daily observation; for when the uterine sound is to be heard at all, it may usually be detected in both inguinal regions, from one of which it will be heard extending forwards, or upwards, with increased intensity. Often, indeed, it is audible, not merely in the lower and lateral parts of the uterus, or reaching over a larger surface on the one than on the other side, but diffused with equal loudness over the whole organ; and it is almost always heard through a space considerably larger than that portion of the uterus to which the placenta is attached. The average diameter of the placenta may be estimated at

about six or seven inches ; and in very many cases, the uterine sound is heard distinctly over a surface three or four times that extent.

Any person who will apply his stethoscope along the course of Poupart's ligament, may convince himself that a *souffle* is constantly audible in the lower part of the gravid uterus. But if this be the case, there at once arises the question how the phenomenon is to be explained, since it is impossible to assume the existence of sinuses in this situation. May it not be produced by the uterine arteries before their entrance into the womb ? for it is known that these vessels change their character immediately on reaching the broad ligaments ; that they become wider than when given off from the main trunks, and run in a tortuous course before entering the substance of the uterus. In further support of this view, it may be observed, that, as a louder and more extended *souffle* is heard on one side of the uterus than on the other, so examination after death often shows that the uterine vessels are larger and more developed on the side to which the placenta had been attached. The loudness of the murmur at one part of the abdomen will often enable a person to form an accurate conjecture as



to the seat of the placenta; and surely no one can feel surprised that the sound should be loudest at that part of the uterus where the placenta is attached, since thither, as to the centre of the vascular activity of the organ, all the largest vessels direct their course. Lastly, if the causes above assigned for the uterine murmur be correct, the occurrence of some cases in which auscultation gives no satisfactory information with regard to the seat of the placenta, not merely ceases to excite surprise, but the reasons for this deviation from the ordinary rule at once become apparent.

Such are the facts which have been adduced to prove that Hohl's theory, even admitting it to be correct, is yet insufficient to explain this phenomenon; and which also favour the opinion, that it is produced by causes existing in the structure of the uterine vessels, such as the tortuousness of the arteries, and perhaps also the dilatation of their cavities, and attenuation of their coats. If they should be considered to afford sufficient proof that this sound is often heard in places which are distant from the insertion of the placenta, and that, though it is frequently louder near that part to which the placenta is attached,

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still it is not produced by it, but has its seat in the arteries of the uterus,—it will follow, of necessity, that no name could be applied to it so appropriate as that of the *uterine sound*.

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*B. Of some other sounds occasionally heard in the abdomen of pregnant women, but not resulting from pregnancy.*

#### § XIV.

First of all may be noticed the pulsations of the maternal heart, which are often audible over a large part of the pregnant abdomen, probably in a great measure owing to the sound being conveyed by the intestinal canal distended with gas. If the stethoscope be placed on the front of the abdomen, where the uterus is in contact with the abdominal parietes, these pulsations of the heart cannot be heard, but are distinctly audible at either side, (where the intestines lie close to the uterus,) even as low down as the *ossa ilia*. The importance of this phenomenon in diagnosis will be hereafter spoken of more at large.

The beating of the aorta, or of one or other

iliac artery, synchronously with the first sound of the heart and the pulse at the wrist, is sometimes, though very rarely, heard. It occurs only in hysterical or hypochondriacal patients, in whose circulation irregularities of all sorts are met with, as well as in persons labouring under diseases of the heart.

Occasionally, especially when persons are suffering from catarrhal affections, the sounds produced by respiration, as rhonchus sibilans, rhonchus mucosus, puerile respiration, &c., are conveyed to either side of the uterus by the same circumstances which rendered the beating of the heart audible in this situation.

The rumbling of flatus in the intestinal canal may be heard in the abdomen of many women during pregnancy, as at other times, almost incessantly; and it may often be discovered, from the situation in which it is heard, where the uterus and where the intestines are in contact with the abdominal parietes.

## CHAPTER II.

## OF SOUNDS PROCEEDING FROM THE FŒTUS.

*A. Of the pulsations of the fœtal heart.*

## § xv.

The sound which proceeds from the fœtal heart consists of a rapid succession of regular, short, double pulsations, which resemble those of the adult heart, but are, in most instances, twice as frequent. Ever since the time of Kergaradec, persons have been in the habit of comparing this sound to the ticking of a watch ; but it so nearly resembles the pulsation of the heart of a new-born infant, that no considerable difference can be detected between them, either in character or in frequency.\* The only difference between the

\* It is a very good plan to let those who are commencing auscultation listen, for a few times, to the chest of new-born children, in order that they may form some idea of the sounds of the fœtal heart. Children one year old answer almost equally well for this purpose ; and those persons

two appears to consist in the fact, that no relation necessarily exists between the strength of the sound and the development of the foetus; for, though generally the strength of the heart's sounds corresponds to the degree of foetal development, yet sometimes the reverse of this is found to be the case, the heart's pulsations being indistinct in a very strong, well-developed foetus, while they are remarkably loud and clear in another which is young and feeble. This discrepancy is no doubt in great measure owing to the circumstance that the heart's action is heard through various media, which differ in thickness, density, and conducting power, and that the position of the foetus is not always equally favourable to the transmission of sound. In the great majority of these cases, the heart would probably be found acting with a force exactly proportionate to the age, and degree of strength, and development of the foetus, if it were possible to apply the stethoscope immediately to its chest. It must, however, not be forgotten, that the heart's action is sometimes less distinct in a

who have previously practised listening to the heart of infants, will learn to distinguish the pulsations of the foetal heart in a very short time.

strong child than in a weaker one, although circumstances may in both be equally favourable to the transmission of sound. This, indeed, is not an occurrence peculiar to the foetal state, but is, also, occasionally noticed in adults.

But, independently of this, the action of the foetal heart is subject to other apparent changes, from a different cause. On listening attentively for a considerable time to the same part of the abdomen, the beating of the foetal heart is sometimes found to undergo a great and sudden increase in intensity; or, on the contrary, to diminish in force just as rapidly, becoming so feeble as to be almost inaudible. These changes in the heart's action, however, though so striking as to have attracted the notice of Kergaradec, last but for a moment, and are merely apparent; the movements of the foetus, and its consequently varying distance from the uterine parietes, occasioning the sounds to be heard sometimes with greater, at others with less distinctness.

The pulsation of the foetal heart has just been described as a short, quick, double beat, exactly similar to that of an infant's heart; and this character has been insisted on, as serving to distinguish it from any similar sound heard in the

abdomen of a pregnant woman. Now, it occasionally happens that only one sound is to be heard, and consequently this diagnostic mark of the action of the foetal heart is absent, some circumstance having rendered the second sound exceedingly weak, or quite inaudible. Hitherto, no one has called attention to this peculiarity in the heart's action; but it is very important that it should be borne in mind, since forgetfulness of it may easily lead a person into error.

#### § XVI.

The frequency of the foetal heart's pulsations, as deduced from a comparison of six hundred cases, averages one hundred and thirty-six strokes in the minute. Most writers appear to have estimated the rapidity of the action of the foetal heart at too high a rate, for when the foetus was healthy, it was never found to exceed one hundred and eighty, though it sometimes sank to ninety strokes in a minute, and varied from one hundred and thirty to one hundred and forty pulsations in most cases.

Although it may appear very rational to suppose that an alteration would take place in the rapidity of the action of the foetal heart with the advance of pregnancy, and that its pulsations

would become slower, as they do in infantile life, yet careful observation proves such a notion to be erroneous; while Dubois'\* investigations verify the opinion, that the rhythm of the heart's pulsations continues the same at the end as it was at the beginning of pregnancy.† Indeed, so far are the pulsations of the foetal heart from becoming diminished in frequency as the end of uterogestation approaches, that instances sometimes occur of their rapidity increasing in the latter months of pregnancy, and even continuing greater for some months after birth than it was when the heart's action first became audible.

Irregularities in the rhythm of the heart's contractions are still more frequent than variations in their strength. Whenever the foetus moves, the action of its heart is quickened, and

\* Loc. cit. p. 47, 48.

† Hohl (l. c. p. 104—170) states, that the action of the foetal heart becomes slower and more regular with the advance of pregnancy; but that diminution in the rapidity of the circulation, which takes place in the new-born child, cannot be urged in support of this statement; for not only does it really occur much later than is commonly supposed, not becoming distinctly evident until several months after birth, but the circumstances which concur to produce this retardation are essentially different from those which exist during intra-uterine life.



sometimes its pulsations become too rapid to be counted by the unpractised ear; but, on continuing to listen for some time to the same part of the abdomen, they will be found to become slower by degrees, and at length to return to, or sink beneath, their former number. These changes are of such common occurrence, that frequently-repeated auscultation would probably not fail to detect them in every case. They are often manifestly connected with, and probably dependent on the motions of the fœtus; and though they are often observed without its being possible to assign any reason for their occurrence, yet this should not be regarded as a phenomenon peculiar to foetal existence, for the heart of the infant is even more subject to sudden, transitory, and apparently causeless changes in the rhythm of its pulsations. How strangely does the pulse of children vary during the first few years of their life! To-day it beats eighty in the minute; to-morrow, although there may be no perceptible difference in the state of the child, the pulse has risen to one hundred and sixty, or one hundred and eighty: it varies with extreme rapidity during tranquil sleep, as well as when the infant is awake. If the child move, or take food, or if

it be under the influence of any mental impression, the pulse rises thirty, forty, or sixty strokes in the minute; and this variableness, while it would confound the inexperienced, has taught those who are well acquainted with children's diseases, not to draw their conclusions from the state of the pulse.

Sometimes, even in perfectly healthy foetuses, the heart's action is intermittent.

#### § XVII.

Since it has been shown that the frequency of the uterine sound is increased by whatever accelerates the maternal pulse, and that the causes which retard the latter, render the former more slow; in short, that a perfect correspondence exists between the pulse at the wrist, and the *souffle* in the uterus; it becomes an interesting subject of inquiry, whether the action of the foetal heart is liable to similar modifications. Numerous observations have been made in order to ascertain the exact nature of the relation which subsists between the circulation of the mother and that of the foetus; and it will be seen from their results, as detailed below, that very considerable alterations may take place in the

maternal circulation, without at all influencing either the strength or the rhythm of the pulsations of the foetal heart.

Hohl \* has noticed, that those changes in the pulse which are produced by different positions of the body, as when a person lies, sits, stands, &c., do not communicate themselves to the action of the foetal heart. These observations have been verified by frequently-repeated examination of pregnant women soon after a meal, or after they had been made to take some violent exercise, as walking, running, or ascending the stairs as quickly as possible ; when it has been found that, although the pulse of the mother was much accelerated, beating from ninety to one hundred, or one hundred and twenty times in a minute, yet the action of the foetal heart had not experienced the slightest alteration in force or frequency.

A strong woman, pregnant for the first time, took an ounce and a half of tincture of cinnamon, which produced great excitement of the vascular system ; labour set in, and the pains soon became extremely violent : yet the foetal heart continued to beat quietly, without the slightest deviation

\* Loc. cit. p. 80, et seq.

from its natural condition. The action of the foetal heart was also found unchanged in cases where the patients had taken spirituous drinks when the first pains began, under the impression that their labour would thus be rendered quicker, and whose pulse had thus been raised in frequency to eighty-five or a hundred pulsations in the minute.

Slight febrile attacks with catarrhal, gastric, or rheumatic complications, do not alter the action of the foetal heart: women were examined during the exacerbations of fever, as well as in its intervals, and the foetal heart was found beating only one hundred and thirty, or one hundred and forty times in a minute, while that of the mother acted with scarcely less frequency.

Even violent and purely inflammatory diseases produce no change in the action of the foetal heart; as is shown by the fact, that its pulsations were quite natural in a pregnant woman who was suffering greatly from pleuritis, and in another who was attacked by pneumonia in the seventh month of utero-gestation. These two cases, and another of a woman who suffered frequent attacks of dyspnœa during her first pregnancy, in consequence of tubercles in her

lungs, together with a fourth, the particulars of which will be immediately related, are at variance with Hohl's \* opinion, that whenever the respiration of the mother is rendered imperfect or laboured, the pulsations of the foetal heart diminish in strength and frequency, and become irregular.

The following is the case above referred to, which presents many points of interest. *Genofeva Merz*, from E—, twenty-two years old, of middle size, tolerably strong, and apparently healthy, was admitted during her second pregnancy into the lying-in hospital in the month of January, 1837. She had suffered since the commencement of pregnancy from convulsive fits of coughing, which returned periodically, sometimes with so much violence as to produce syncope, after which they ceased; as was also the case after venesection, which indeed sufficed to cut short the attack, if resorted to with sufficient promptitude. She was often examined during these fits, but no change in the action of the foetal heart could ever be detected. About the middle of pregnancy, the cough left her; but she became subject to fainting fits, which came

\* Loc. cit. p. 91 et seq.

on suddenly, without any previous warning, and independently of any great exertion. These fits often lasted for a considerable time, and could not be cut short by any remedy, though they produced no ill effect. On the 4th of May, eighteen days before she was delivered, she was overcome by one of these fainting fits while ascending the stairs, and falling suddenly down motionless, was at once removed to bed, and examined with care. Her face was pale, the whole body cold; all her limbs were relaxed as those of a dead person; a feather held to the nose did not stir, and neither the pulse nor the impulse of the heart could be felt; but with the stethoscope the heart could be heard acting regularly and distinctly, though contracting only fifty-two times in the minute, instead of eight-four, as it usually did. The uterine *souffle*, which was generally loud, was now very low, but could still be heard in both inguinal regions, and extending over the left side of the abdomen. Nevertheless, the pulsations of the foetal heart continued unaffected; they were audible over the whole of the right side of the abdomen, and more distinctly than usual, since they were no longer overpowered by the loudness of the

uterine sound. They preserved their ordinary frequency, (one hundred and thirty-six in the minute,) and the child moved vigorously from time to time. In the course of twenty minutes, convulsive twitchings began about the lower jaw, followed by hasty inspirations, and the patient soon recovered. Eighteen days afterwards, she gave birth to a strong lively girl, weighing eight pounds four ounces, and passed through the puerperal state without any unfavourable symptom.

This case is in direct opposition to Hohl's assertion : it has been detailed the more minutely, because no account has hitherto been given of the result of auscultation during syncope.

How great soever the alterations may be which venesection during pregnancy produces in the maternal pulse, it does not occasion any evident change in the action of the foetal heart. In many cases in which menstruation continued during pregnancy, and very recently in an instance where up to the eighth month hæmorrhage set in regularly every fourteen days, the foetal heart's action was found at all times equally strong and frequent. Even when serious hæmor-

rhages have taken place, the same has been observed.

The following is a remarkable instance of sudden fright and terror not producing any discernible change in the pulsation of the foetal heart. *Maria Seyboth*, from H—, in the eighth month of pregnancy, was suddenly attacked while in the street by a large dog, which sprang on her, and placed its feet on her shoulders. The sudden fright caused immediate rupture of the membranes, on the occurrence of which the woman hastened to the hospital, where she was carefully examined;—the foetal heart was then beating one hundred and fifty times in a minute; a few days before, it beat one hundred and fifty-six. The liquor amnii drained away sparingly, and at the end of twenty-four hours labour pains set in; the foetal heart's pulsation varied from one hundred and fifty to one hundred and sixty; and at nine P.M. the patient was delivered of a boy, who had evidently not arrived at the full term, (the child weighed four pounds four ounces,) but cried vigorously, and survived. On the other hand, cases have sometimes occurred, in which the death of the foetus followed almost



immediately after a violent impression on the mind of the pregnant woman. These cases will be spoken of hereafter; and it is much to be desired that other observers would communicate the results of their experience, with regard to the very interesting point of the relation between the action of the maternal and that of the foetal heart.

### § XVIII.

The pulsations of the foetal heart are usually heard most distinctly in the middle or inferior abdominal region, more often on the left than on the right side, and usually extending from that part where they are loudest, upwards and to either side. The extent of surface over which the beating of the heart is heard, cannot be accurately defined in inches and lines, but it certainly is audible through a larger space than most observers have represented. Its sounds reached beyond the linea alba toward the other side in one hundred and eighty-five of three hundred and seventy cases in which the position of the foetus with its back to the left side of the mother was distinctly ascertained by the ear, and afterwards verified by the result of the labour; in forty-six they were audible over nearly the whole abdo-

men; while, in one hundred and thirty-seven, they were confined to the left side, and did not reach the mesial line. The heart's sounds were audible beyond the mesial line, only in forty-five of one hundred and eighty-five instances in which the back of the fœtus was directed to the right side; one hundred and fourteen times they were distinguishable on the right side only; but in twenty-six they extended over the whole abdomen. In all those instances in which the heart's sounds were not limited to one lateral half of the abdomen, their greater intensity at one part indicated the situation of the back, and consequently the position of the fœtus.\*

\* In presentations of the head, or pelvis, the back always corresponds to that part of the abdomen where the heart's sounds are most distinctly perceptible: it will hereafter be explained why presentations of the face form an exception to this rule.

Some readers may perhaps be surprised to find it stated, that the action of the fetal heart is most distinctly perceptible along the back, while in the adult, as also in the child, its beatings can be heard only at the anterior wall of the chest. The reasons of this, however, will at once appear on a moment's consideration of the different relations of the thoracic viscera in the fœtus, and in the child after respiration. In the fœtus, the heart is proportionably larger than in the child, and consequently fills up

Many have asserted, that the sounds of the foetal heart are audible only throughout that part more of the narrow thorax ; the auricles especially are more capacious and project further backwards than after birth. The foetal lungs are very small and compact bodies, situated on either side of the vertebral column, and constantly subject to pressure backwards, which renders them the fitter to convey the heart's sounds. Of this any one may convince himself by applying a stethoscope to the back of a new-born infant before respiration is thoroughly established: at first, both sounds of the heart will be heard loud and diffused over the whole of the back, but growing fainter as respiration becomes more complete ; and at last, when the child breathes freely, and the lungs are perfectly inflated, (which in strong children usually takes place within a few hours, but in weakly ones sometimes not till after several days,) no trace of the heart's sounds will be found posteriorly, for the lungs distended with air, having three times their former volume, now surround the heart on either side, separate it completely from the vertebral column, and leave it nowhere in contact with the walls of the chest except in front, where the attachments of the pericardium prevent its being moved from its position. Persons may perchance object, that since air is a good conductor of sound, the inflation of the lungs ought to facilitate rather than impede the hearing the heart's pulsations ; but it should be remembered, that air conducts sounds well, only when its vibrations are not impeded by the interposition of a solid body, such as the parenchyma of the lung.

of the mother's abdomen in which its thorax is situated; but this statement is erroneous. Dubois' \* observations have verified the opinion, that they may be heard, though not with the same intensity, along the whole vertebral column of the fœtus.

Exceptions, however, do sometimes occur to what has been stated, as to the part of the abdomen where the fœtal heart's action is usually heard; for now and then it can be detected only through a small space in the superior or inferior abdominal region. In these cases, the heart's sounds are generally obscured by the interposition of the intestines between the uterus and the abdominal parietes; or the same effect may be produced by the insertion of the placenta at some particular part of the uterus: the stethoscope will always show to which of these causes it is in any case to be attributed.

A subsequent paragraph will be devoted to the consideration of the use of auscultation in detecting the different positions of the fœtus.

\* Loc. cit. p. 17.

## § XIX.

The regulations of the hospital in which the following observations (as to the earliest period at which the action of the foetal heart is perceptible) were made, allowed patients to be received in the third month of pregnancy, and consequently afforded ample opportunities for thoroughly investigating the subject.

So soon as a patient in an early stage of pregnancy was admitted into the hospital, she was carefully examined, the results of the auscultation were registered, and the examination was repeated at intervals of from two to five, or ten days. It is almost needless to observe, that no inferences have been drawn from any cases but those in which it was possible to determine exactly the period of pregnancy, and in which the correctness of previous calculations was verified by the birth of the child.

The eighteenth week of pregnancy is the earliest period at which the action of the foetal heart was distinctly heard : in all these instances, the patients were pregnant for the first time. The pulsations of the heart of the foetus were heard in thirty out of fifty patients who were

examined before the middle of pregnancy; and although most examinations were fruitless before the twentieth week, yet they almost always succeeded at the beginning of the second half of pregnancy. In some rare cases, the pulsations of the foetal heart did not become audible before the fifth month. There are many circumstances which exercise a considerable influence upon the period at which the beating of the foetal heart is first detected. Thus, the persons in whom it could not be heard before the sixth month of pregnancy, were all strong, young women, pregnant for the first time, and whose abdominal integuments were very thick. In the same way, the presence of a more than usually large quantity of liquor amnii may tend to obscure the sound; as may the intervention of the intestines between the uterus and the abdominal parietes, to which latter case reference has already been made. Another circumstance which, without doubt, renders the action of the foetal heart imperceptible before the end of the first half of pregnancy, is the relative smallness of the foetus in proportion to the size of the cavity in which it is contained, as also the large quantity of the liquor amnii, and the consequently greater mobi-

lity of the foetus ; owing to which, the stethoscope, though pressed firmly against the abdomen, cannot be brought sufficiently near to the foetus to detect the action of its heart.

The neighbourhood of the linea alba is the part of the abdomen where the heart's action has been most frequently detected in the early months of pregnancy ; but a frequent repetition of auscultation is necessary in every case, at the commencement of utero-gestation, before confidence can be placed in the results which it may yield.

#### § xx.

In natural labours, the action of the foetal heart undergoes no evident alterations, either in the force or in the rhythm of the pulsations. It is found, after labour has begun, just as it was before its commencement. In some cases, the foetus moves frequently and vigorously, and then the heart's action is quickened ; but it happens just as often that the foetus remains perfectly quiet. A recent observer has stated, that the foetus always moves from the very commencement of labour, " appearing to anticipate the onset of the uterine contraction," and that in conse-

quence the double pulsations change their place; \* but observation has not proved the truth of this, any more than of another statement of the same author, namely, that the fluctuation of the liquor amnii is heard, when labour pains begin, as “ a sudden and transient sound;” † which is physically impossible. It is but seldom that any considerable alteration in the situation of the foetal heart’s pulsation takes place even in the early stages of labour; and later, after the escape of the liquor amnii, it never occurs. But this subject will again come under consideration.

If the pains are regular in character, that is to say, sufficiently long and vigorous, then it is always observed that the beat of the heart becomes weaker, or even inaudible, during each pain. The reason of this phenomenon is doubtless, that the pulsations of the heart are overpowered by the sounds produced by the contraction of the uterus and abdominal muscles, the intensity of which is always in proportion to the vigour of the uterine contraction; ‡ so that, if the

\* Hohl, loc. cit. p. 106, 138.

† Hohl, loc. cit. p. 77, 106.

‡ It is not possible to describe this sound, but a person may easily convince himself that it resembles that pro-



pains be not energetic, the pulsations of the foetal heart may still be more or less distinctly heard. It is scarcely necessary to caution against confounding this indistinctness or inaudibleness of the heart's sounds with their disappearance from a certain spot, owing to changes in the position of the child.

After the rupture of the membranes, the pulsations of the heart become more distinct, because the uterus now envelopes the foetus closer, and the sound passes through more uniform media, and consequently is conveyed to the ear with greater clearness than when, as often occurred before, a layer of liquor amnii was interposed between it and the uterus. The motions of the foetus become less frequent as the waters drain away, and the uterus embraces its contents more closely, while the same cause now renders changes in the presentation exceedingly rare, if not impossible.\*

duced by muscular contraction, if he will apply the stethoscope to the masseter muscle of a strong man, at the same time directing him to move his jaw as in mastication.

\* This increase in the distinctness of the foetal heart's pulsations is heard most distinctly after the escape of the liquor amnii, in cases of preternatural presentation, provided the increased uterine contraction has not affected the foetal circulation.

Supposing that, in a case of head presentation, the pulsation of the foetal heart had been audible only in the superior abdominal region, it will be found to descend lower and lower in the third and fourth stages of labour, and at the same time cease to be heard at the upper part of the abdomen. Until the head has descended so low as to appear between the labia, the action of the foetal heart continues perceptible in the inferior abdominal region ; but, so soon as the head is born, the sound becomes inaudible above the pubes.

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*B. Of the Sounds produced by the movements of the Fœtus.*

§ XXI.

During the early stage of pregnancy, while the foetus is very small in proportion to the size of the cavity which contains it, and while the free movements of its limbs are consequently unrestrained, these sounds may occasionally be distinguished as gentle taps, repeated at intervals, and continuing uninterruptedly for a considerable time. They are often taken by the unpractised for the beatings of the foetal heart ; but that

they are produced by the motion of the limbs of the fetus, is evident from the fact, that whenever they are more than usually frequent and loud, the mother becomes sensible of the motions of the child, and the action of the foetal heart is accelerated. They become less distinct, in proportion as the quantity of the liquor amnii diminishes with the advance of pregnancy; and at the end of utero-gestation, the movements of the foetal limbs cannot be heard, and are even scarcely to be felt, the chief proof that they still take place being afforded by that occasional acceleration of the heart's action, which they have been found to cause.

These sounds may sometimes be distinguished several weeks before the mother becomes conscious of the motion of the child, and also earlier than the pulsation of the heart, or the uterine *souffle*.

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### *C. Of the Sounds produced by the Umbilical Cord.*

#### § XXII.

In addition to the sounds which have been already treated of, there is another, often heard

in the uterus during pregnancy, as well as in labour. It is a bellows sound, synchronous with the pulsations of the foetal heart, with the first sound of which it begins, and disappears at the moment of the expansion of the ventricles. A resemblance exists between it and the uterine sound; but it may be much more fitly compared to the *bruit de soufflet* occasionally heard in the subclavian or carotid artery of chlorotic and anæmic females. Its want of isochronism with the maternal pulse proves, in spite of its similarity to the uterine sound, that it is caused by the child, not by the mother. We thought for a long time that its cause existed somewhere in the foetal heart; but, having noticed that, in almost all cases in which this sound had been heard, the funis was found at birth wound round the neck of the child, this induced us to suspect that it might be occasioned by the umbilical cord.

Many observers have taken a good deal of trouble to prove the impossibility of the funis producing any perceptible sound. Hohl has endeavoured to substantiate the arguments against it, previously adduced by Haus,\* and among

\* *Die Auscultation in Bezug auf Schwangerschaft.* Würzburg, 1823, p. 48.

other new reasons makes the assertion, "that the funis cannot be heard to pulsate within the uterus, since no body is present there which might serve to conduct the sound.\*"

It is singular that Hohl did not think of the coiling of the umbilical cord. So long as the funis continues to occupy that space just in front of the abdomen of the foetus, which the position of the child in the uterus usually secures for it, it is too far from the inner surface of the uterus for that organ to serve as a conductor of the sound, and consequently the funic *souffle* cannot then be heard: but the supposition that the funis may be coiled around the neck or body of the child, and that part of the child be brought into contact with the uterus, would at once remove all difficulties as to the way in which the sound is transmitted, provided that the funis were proved to be capable of producing it; for which opinion the following reasons may be adduced:

1. It is a single sound, although synchronous with the pulsations of the foetal heart.

2. The space which it occupies, and the direction in which it is heard. The surface over which it is heard is narrow, and extends for a

\* Loc. cit. p. 179.

few inches transversely across the abdomen, while, both above and below it, the clear, double beat of the foetal heart may be distinguished free from any other sound, as well as from the much slower *bruit de soufflet* which proceeds from the uterus.

3. The fact that it is almost always perceptible when the funis is wound around the body of the child. It is likewise heard when the umbilical cord is compressed between the uterus and the back of the foetus; and then it is audible on that side of the abdomen to which the back of the foetus is turned.

4. The region of the body in which this sound is heard, when the cord is twisted round the child. In head presentations, it may be perceived in the middle, still more frequently in the lower abdominal region, and in the latter only, after the liquor amnii has escaped, and the head has entered the pelvis, when it is usually detected near the groin. In breech presentations, it is heard in the upper abdominal region; and since it appears that when the funis is coiled round the child, it runs almost invariably around the neck, or from the umbilicus over the back, towards the shoulder, the circumstance of the *souffle* being audible high up in the abdomen would always warrant

the suspicion of the existence of a breech presentation.

5. The change in position which this sound undergoes during labour. Not merely is it more plainly heard after the rupture of the membranes, when the uterus surrounds the child more closely, but it descends during the progress of labour, just as is the case with the pulsations of the foetal heart. This is especially striking in breech presentations, for then the *souffle* which had been heard during pregnancy in the superior abdominal region, is found to descend gradually during labour.

Such are the facts which favour the opinion, that this sound is produced by the circulation of the blood in the umbilical cord.\*

### § XXIII.

With regard to the manner in which the funic *souffle* is produced, observation has shown that its

\* It would appear from Dubois' remarks, in his Treatise which has been already so often quoted, p. 53, that he was acquainted with this sound, though he confounded it with the pulsation of the foetal heart, and fell into the error of supposing that it was produced by the mingling of the blood from the pulmonary artery with that of the aorta.

loudness is in proportion to the tortuosity of the umbilical arteries, and to their size and greater degree of development. The diameter of these arteries is, however, larger when their course is more tortuous; and the cases in which this sound was most intense, were those in which the arteries presented at intervals small dilations of their cavities. In some very rare instances in which the arteries did not encircle the vein, no *souffle* was detected, though the cord was coiled around the child. It may be asked, whether the coiling of the cord has any share in the production of the sound? If the cord be examined immediately after the birth of the child, and while it still pulsates strongly, the ear detects only a simple beat, but no *souffle*: it is then possible that such a pressure may be necessary to the production of this sound, as that to which the umbilical arteries are subjected when the funis is coiled around the body of the child, and the back of the fœtus is in contact with the uterus.

This sound has been occasionally heard in cases where the cord was not completely wound round the body of the fœtus, but merely encircled it in part, and was then doubled upon itself so as



to form a loop ; in one such instance, the funis, which had been compressed for a considerable time between the back of the foetus and the uterus, appeared quite bruised at that part where the loop had been formed.

## PART II.

### *Deductions from the Results of Auscultation.*

#### CHAPTER I.

##### VALUE OF AUSCULTATION IN DETECTING PREGNANCY.

###### § XXIV.

THE difficulties in the way of detecting pregnancy, and distinguishing it from a variety of morbid conditions in which similar symptoms occur, were formerly much greater than they are, now that the utility of auscultation for this purpose is universally recognised. The only signs then relied on, such as the motions of the child sensible to the hand of the practitioner, or its limbs evident through the abdominal parietes, were not perceptible until the latter half of pregnancy, and frequently could not be distinguished before its last months, or weeks; while they

were even then often obscure, or too indistinct to be conclusive.

The information which auscultation affords to the practitioner is then most important, since it places him in possession of new and certain evidences of pregnancy, which, although they do not exist from its very commencement, yet are for the most part to be found at an earlier period than those other signs detected by the sense of touch.

First among the signs learnt from auscultation, may be classed the audible movements of the fœtus, which are often heard much earlier than the hand of the practitioner placed upon the woman's abdomen can feel them, or than the mother herself becomes sensible of their occurrence. Unfortunately, however, although the earliest positive proof of pregnancy, they are not heard in every case, nor at all times.

Another certain token of pregnancy, likewise observed in the early months, and much more frequently met with than the preceding, is the bellows sound which proceeds from the enlarged uterine arteries. It is distinctly audible so early as the fourth month of utero-gestation; and the instances in which it cannot be detected in a

pregnant woman are exceedingly rare: it can neither be feigned nor concealed, neither is it heard except in the gravid uterus; for no sounds resembling it were detected in cases in which the womb, or any other pelvic viscus, was diseased. It is usually discernible some weeks earlier than the pulsation of the foetal heart, though this may almost always be detected during the whole of the second half of pregnancy.

Although the pulsation of the foetal heart cannot be distinguished till a later period than the other signs of pregnancy which are detected by auscultation, yet it is one of peculiar importance, and may indeed be regarded as the most valuable of all; for, while it makes its appearance at a time when the evidences which manual exploration affords are either absent or inconclusive, it is so readily perceived, that even the unpractised ear usually detects it with ease. Auscultation, however, can never supersede manual exploration, nor render it in all cases unnecessary: the former is a valuable auxiliary to the latter, and the results obtained by combining both, assist us in arriving at definite conclusions. The following cases may serve to illustrate this point. There is reason to suspect

that a certain woman is pregnant; but, on examining her with the stethoscope, the pulsations of the foetal heart cannot be heard, although the uterine sound is audible, and the other symptoms of pregnancy are manifest. Doubt must exist as to the real nature of the case, unless some part of the child can be felt presenting, when it may be fairly inferred that the patient is pregnant, but that her child is dead. If, in another case of doubtful pregnancy, the characteristic sounds cannot be detected, and if the other signs palpable to the sense of touch should also be wanting, it is equally certain that pregnancy does not exist. In short, while each method of exploration has its peculiar advantages, the greatest are derived from the employment of both, when their results mutually control each other.

#### § xxv.

In all cases when the action of the foetal heart is heard with greatest intensity at one part of the abdomen, gradually diminishing in loudness in proportion as the ear of the observer removes from that spot, it may be concluded that the uterus contains but one child.

The diagnosis of compound pregnancy is by

no means easy, for no reliance can be placed on the signs commonly adduced as proving the existence of twins; and even after the birth of one child, the presence of a second in the uterus is often doubtful. Many persons have sought to obtain additional information on this point from auscultation; but the opinions which they have expressed are very discordant, owing to the infrequency of opportunities for observing compound pregnancy.

In the ten cases to which the following observations refer, no changes in the character of the uterine sound were noticed, such as would have led to the supposition that the uterus contained twins. Hohl, indeed, states, that "this sound is heard over a larger surface, with greater intensity, and with a more varied tone; that, for the most part, it is loudest on the right side, and extends thence towards the left, and that its loudness seems augmented at two different points;"\* but in none of these instances was anything of the kind observed.

It might indeed be very rationally conjectured that the placental *souffle* would be louder and extended over a larger surface, when the placenta

\* Loc. cit. p. 222 et seq.

is larger than usual, or when two placentæ are present ; but experience most plainly contradicts this, and shows, on the contrary, that the uterine sound is very often, in simple pregnancy, heard on both sides, and consequently in two different situations. It frequently happens too, in cases of simple pregnancy, that the uterine sound is very loud and widely diffused, although the placenta is small, or, on the contrary, that the placenta is very large, and the *souffle* weak and circumscribed.

The only sign which proves with certainty the presence of twins, is the hearing the pulsations of two hearts. Usually, the beating of one heart is heard in the left or right inferior abdominal region, while that of the other is audible in the superior abdominal region of the opposite side ; but it never happens, be the position of the children what it may, that the beating of the two hearts is heard on the same horizontal plane.

This difference in the place where the beating of the two hearts is most distinctly heard, deserves especial notice, because an isochronism often exists between their action. A very striking instance of this occurred a short time ago, in which the existence of twin-pregnancy

was discovered, merely from the heart's pulsations being heard with equal distinctness in two different situations. They were clearly audible in the left inferior abdominal region, which proved that the back of the child lay in this direction, while, quite high up in the right abdominal region, towards the hypochondrium, the beating of another heart was heard. The pulsations of both hearts were perfectly synchronous.\*

The existence of a complete isochronism between the action of the two foetal hearts may seem to some persons so unlikely, as to lead them to doubt the correctness of this observation ; yet, the same condition often continues, as it did in the case above alluded to, even for a consider-

\* Dubois seems to have arrived at precisely the same conclusions with regard to this point. He says (l. c. p. 19) : "*Tous nos soins furent employés à rechercher quel était le rythme des deux circulations ; il nous a semblé qu'il existait un isochronisme parfait entre les pulsations des deux cœurs.*" Kergaradec, indeed, thought (l. c. p. 26) that the necessary want of isochronism between the pulsations of the two hearts would prove the presence of twins, but he confessed that he had had no opportunity of ausculting in cases of compound pregnancy. Subsequent observers seem to have adopted this opinion without any further inquiry, as though it were perfectly well established.



able time after birth. In that instance, both hearts beat during labour at the rate of one hundred and thirty strokes in the minute: the children, a boy and girl, were born on the evening of the 24th of January, and auscultation subsequently gave the following results:—

	Boy.	Girl.
Jan. 25, 10 A. M. (fourteen hours after birth)	108	104
Jan. 25, 4 P. M. . . . .	100	102
Jan. 26, 10 A. M. (directly after sucking)	118	120
Jan. 26, 11 A. M. (during sleep)	102	100
Jan. 26, 3 P. M. (during sleep)	100	104
Jan. 26, 6 P. M. (during sleep)	104	104
Jan. 27, 10 A. M. . . . .	120	112
Jan. 27, 4 P. M. (during sleep)	120	118
Jan. 28, 10 A. M. (during sleep)	120	116

The girl now fell sick, and consequently the observations could not be continued any longer.

In order to avoid being deceived with regard to the pulsations of the foetal hearts in these cases, it is advisable that two persons, equally well practised in auscultation, should kneel by the side of the bed, each having placed his stethoscope on the abdomen, where the pulsations of the hearts are very distinct, and should then begin to count at the same time, and cease together. One person alone is very apt to fall into error.

We have never had an opportunity of examining a case of triplets. Hohl,\* who met with such a case, says that he was unable, from the pulsations of the hearts, to ascertain the number of children which the uterus contained.

With regard to the information afforded by the stethoscope in extra-uterine pregnancy, in the absence of personal experience, we can merely conjecture that it must, as Kergaradec says, be a valuable auxiliary in forming a diagnosis.

#### § XXVI.

All the previous paragraphs treat of the value of auscultation, and of its use in detecting pregnancy, especially at an early period; but it will be necessary to show how, in one particular instance, the employment of the stethoscope may lead to an erroneous conclusion.

It has been already remarked, that the pulsation of the maternal heart may often be heard diffused over a large part of the pregnant abdomen, and that it is distinguishable, in some cases, even as low down as the ossa ilia, the intestines distended with gas serving, in all probability, to conduct the sound. Now, the same

\* Loc. cit. p. 163, 224.

thing may occur in a case where the abdomen is distended in consequence of some morbid cause, and where also other symptoms, as suppression of the menses, swelling of the breasts, &c., may simulate pregnancy. The stethoscope is had recourse to with the hope of thereby solving the difficulty; and the pulsations of a heart are heard, which the observer, who does not notice the acceleration of the maternal circulation, but merely judges from their frequency, would attribute to a foetus, and would declare the patient to be pregnant. No German writer has hitherto alluded to the possibility of making this mistake; but it will be seen by the following case, which occurred to Dubois, that he fell into it for a short time.

A young person, who had not menstruated for five months and a half, applied for admission into the *Maternité*. The enlargement of her abdomen corresponded to the statement she made with regard to the duration of her pregnancy; the cervix of the uterus was softened, thickened, and flattened; and she said that she felt the motions of the child. Although no part of the child could be felt on a vaginal examination, and consequently the existence of pregnancy could not

be looked upon as positively ascertained, yet, in consideration of her ill health, she was received into the hospital. About a month after her admission, Dubois ausculted her, and detected in the lower part and left side of the abdomen quick double pulsations, beating one hundred and twenty or one hundred and thirty times in the minute. Soon afterwards, on examining the mother's pulse, in order to compare its frequency with that of the beating of the foetal heart, he was surprised to find that the two were in exact correspondence. On again applying the stethoscope to the abdomen, he discovered that these double beats increased in loudness as he approached the epigastrium, so that their source could now no longer be mistaken. The pulsations of the maternal heart extended from above downwards over the whole abdomen, at the lower part of which they became so feeble that they might easily be supposed to proceed from the foetal heart. It was subsequently ascertained, on repeating the vaginal examination with great care, that the patient was not pregnant.\*

A person may fall into just the same error in cases of real pregnancy, and, mistaking the

\* Loc. cit. p. 45.

beatings of the maternal for those of the foetal heart, may imagine pregnancy to be much further advanced than is really the case. This error may be avoided by counting the pulse at the wrist at the same time that we listen attentively to the abdomen; but it may otherwise be very easily fallen into, since the pulsations of the heart of pregnant women are often very much more frequent than is commonly supposed.\* Although Kergaradec says, "*Il est essentiel d'observer que la fréquence beaucoup moindre de ces pulsations doubles ne permet en aucune manière de les confondre avec celles du fœtus,*"† and Du-bois‡ likewise insists upon the same circumstance, yet, he who relies upon it is very liable to be deceived; for the heart of a healthy foetus is often found beating only seventy or eighty in the minute during labour, and sometimes it has not exceeded ninety during the whole of pregnancy.

\* We have often found the heart of perfectly healthy pregnant women continue to pulsate for several weeks at the rate of from 110 to 120 beats in a minute.

† Loc. cit. p. 22.

‡ Loc. cit. p. 47.

## CHAPTER II.

OF AUSCULTATION AS A MEANS OF DISTINGUISHING THE POSITION OF THE FŒTUS AND THE SITUATION OF THE PLACENTA.

## §. XXVII.

If the foetal heart is heard towards the end of pregnancy, or at the beginning of labour, with much greater distinctness at one side of the abdomen than at the other, while the sound passes but little beyond the linea alba, it is fair to infer that the child is situated in the long axis of the uterus. In most instances, however, auscultation gives no information as to which part of the body of the foetus is nearest to the entrance of the pelvis; nor is it possible, by means of the stethoscope alone, to tell whether the child presents with the head or with the breech. But, on the other hand, if the finger has once ascertained the presenting part, auscultation will determine the exact nature of its position at a time when this cannot be done by internal ex-

amination. Thus, if, in a case of vertex presentation, the pulsations of the foetal heart are distinctly heard in the left inferior abdominal region, diminishing in intensity as the ear leaves this part, but extending upwards and forwards, and continuing audible as far as the linea alba, or even beyond it, it may be presumed that the head occupies the first position.

We are warranted in supposing that the head is situated in the second position, if the heart's pulsations are most distinctly heard in the right side of the abdomen. It is remarkable that, when the head occupies this position, the beatings of the foetal heart are heard during the first stages of labour with the greatest distinctness posteriorly; which fact affords a fresh confirmation of the opinion, that in second vertex presentations the occiput is at first directed backwards and to the right.

Dubois attaches but little value to auscultation as a means of distinguishing the position of the child; and he mentions, in support of this opinion, that the pulsations of the heart may often be heard with equal distinctness in situations very remote from each other. Now, although the foetal heart's action may often be heard over a

very extensive surface, yet, the spot whence the sound proceeds may almost always be distinguished, and consequently a tolerably accurate conclusion may be drawn as to the position of the head.

It sometimes happens, though very rarely, that the action of the foetal heart is found to be loudest at the linea alba, whence it is equally diffused in all directions. In such a case, the position of the head cannot be determined with certainty, but internal exploration usually ascertains it to be in the first position. In some few cases, too, of second vertex presentation, where the little fontanelle was directed backwards and to the right, the pulsation of the foetal heart was heard with greatest intensity along the linea alba. The birth of the head took place in the usual manner, but the passage of the back proved that no error had been made in the auscultation, for the shoulders passed through the outlet of the pelvis in the transverse diameter. Here the neck is necessarily more twisted than in cases of first vertex presentation.

It may be worth while here to detail a case in which, though the head was felt to be in the second position, yet the results of auscultation



would have led to the opinion that it occupied the first.

*Elizabeth Schmidt*, from H——, twenty-five years old, of short stature and slight frame, already the mother of two children, had reached the end of her third pregnancy, when, on the 27th of December, 1836, at ten o'clock A. M., the first labour-pains came on. The os uteri began to dilate while the head was yet high and moveable above the brim of the pelvis; the pains soon became frequent and energetic, and at noon the membranes ruptured, the os uteri being then fully dilated, and the head entered the brim of the pelvis in the second position, that is to say, with the occiput turned to the right sacro-iliac symphysis. The pulsation of the foetal heart was distinctly heard along the linea alba, but extending more towards the left than towards the right side. The head gradually descended into the cavity of the pelvis, and having there made its usual rotation, was born at half-past twelve P. M., the occiput being directed forwards and to the right. But here began the variation from the ordinary mechanism of labour; for the shoulders did not pass out of the pelvis in the right oblique diameter of its outlet, the left

shoulder first making its appearance under the left crus of the pubic arch ; but, owing to the neck being twisted, the right shoulder was expelled first from under the right crus of the arch of the pubes, and was then followed by the left shoulder and the back, which were directed forwards and to the left. Immediately on birth, the child cried loudly. It weighed 6 lb. 4 oz.

This case (which, indeed, is extremely rare, for it occurred only once in three hundred and fifty labours) proves how very important it is, in order to avoid error in diagnosis, that the practitioner should not neglect any means in his power to obtain the most accurate information with regard to the position of the child.

#### § XXVIII.

The pulsations of the foetal heart often continue audible during the whole of pregnancy, at that part of the abdomen where they were first detected, and remain unchanged in their situation even up to the beginning of labour. This proves that in many cases the position of the child does not vary for months together ; but instances are just as common, in which the pulsations of the heart undergo frequent changes in situation.

Sometimes, indeed, alterations in the place where they are audible have been found to occur three or four times a day in the seventh or eighth month of utero-gestation, though they generally become less frequent as the end of pregnancy approaches; and it very seldom happens that they take place after labour has begun, while they are never met with after the escape of the liquor amnii. These changes of the heart's pulsations from one side to the other correspond to the movements of the child, as felt by the mother. Every one must have observed instances in which the incessant movements of the child were actually distressing to the mother, while other patients feel them less distinctly, and always confined to one spot.

#### § XXIX.

The existence of a face presentation cannot be detected, either during pregnancy or in labour, by the stethoscope alone, and it can be distinguished from a presentation of the vertex only by internal examination.

In a case of first face presentation, the pulsations of the foetal heart are heard in the same situation as in the second presentation of the

vertex ; and *vice versá*, in a second face presentation, their position is the same as in a first vertex presentation. The reason of the pulsations of the heart being audible at a spot which corresponds to the chest of the child is, doubtless, that while its back is turned away from the front of the uterus, owing to the occiput being thrown back upon the nape of the neck, the chest is pressed against the opposite side; and consequently the pulsations of the heart are heard as distinctly as in other cases, where the back of the foetus is in contact with the anterior wall of the uterus.

### § xxx.

If the breech presents, auscultation will show whether the back of the child is directed to the right or the left side of the uterus; but the evidence obtained by the ear alone is insufficient to determine the existence of a breech presentation. Hohl\* states, that the pulsations of the heart are heard much higher in the abdomen than when the head presents; but this cannot serve as a means of diagnosis, since, in cases of the latter presentation, it often happens that the

\* Loc. cit. pp. 237, 244.

action of the heart is audible in the middle, and even in the superior abdominal region.

To this general statement, however, those few cases of breech presentation form an exception, in which the umbilical cord is twisted round the neck of the fœtus; for then the detection by the stethoscope of the funic *souffle* in a transverse direction at the upper part of the abdomen, is alone sufficient to prove that the head is directed away from the brim of the pelvis.

#### § XXXI.

In cases of preternatural presentation, whichever shoulder may present, the pulsations of the heart will be heard most distinctly at the lower part of the abdomen, and on one side, whence they will be found to extend obliquely upwards to the opposite side.

#### § XXXII.

The situation of the placenta may usually be ascertained by the increased loudness of the uterine *souffle* on one side, and by its being diffused over a larger surface, and extending further upwards and forwards than on the other side, where it is usually limited to the spot at

which the arteries enter the uterus. In ten cases, where the hand was introduced to remove an adherent placenta, it was found attached to that part of the uterus where it had been supposed, on the evidence of auscultation, to be situated; and in two instances, the correctness of the information which the ear afforded, was verified by a post-mortem examination.

Although the point of insertion of the placenta may be generally ascertained with tolerable accuracy by means of the stethoscope, yet there are two classes of cases in which it affords no information on the subject. To the one belong those rare cases where no uterine sound is distinguishable; to the other, those much more frequent instances in which the sound extends with equal intensity from both inguinal regions over the whole uterus.

### § XXXIII.

The ordinary insertion of the placenta at the lateral part of the uterus may probably be accounted for by the circumstance, that as all supplies of blood reach that organ at its side, so its vessels are largest and most developed in that situation. The fundus uteri, being much more

sparingly furnished with vessels, could afford the foetus but a comparatively scanty support, and consequently does not usually give insertion to the placenta, the attachment of which to the lateral part of the uterus would, therefore, seem an almost necessary result of this arrangement of vessels \*

It were interesting to ascertain to which side of the uterus the placenta is usually attached. The opinion hitherto almost universally prevalent is, that its general situation is a little to the right of the fundus uteri; but the following observations are at variance with that notion.

The stethoscope indicated the placenta to be attached, in two hundred and thirty-eight out of six hundred cases, to the left; in one hundred and forty-one, to the right side of the uterus.†

\* The mere examination of the secundines would serve, independently of the evidence afforded by auscultation, to show how erroneous is the commonly received opinion, that the placenta is usually attached to the fundus of the uterus, and slightly to one side; for it will be found that the rent in the membranes, through which the child has passed, is on one side but little removed, on the other very far distant from the edge of the placenta.

† In the two post-mortem examinations above alluded to, the placenta was attached to the left side of the uterus.

The remaining observations yielded the following results. In twenty cases, no uterine sound was perceptible ; in one hundred and sixty, it was so weak, and limited so completely to the inguinal region, or else so diffused over the whole surface of the abdomen, that the seat of the placenta could not be determined. Seven times only did the stethoscope indicate the placenta to be attached to the fundus of the uterus.

The placenta was found to occupy the anterior wall of the uterus in thirteen instances only ; in which cases the sound was heard extending from the inguinal region forwards, rather than upwards.

The insertion of the placenta in the neighbourhood of the os uteri is indicated by the uterine *souffle* being heard just above the pubes, while it is inaudible, or very indistinct, in any other situation. This peculiarity in the seat of the sound enabled us, in eleven instances, to discover the existence of placenta presentation before hæmorrhage had taken place, or the nature of the case could be detected by vaginal examination. In four of these cases, the placenta

Hobl found it twice situated on the left, twice on the right side of the uterus. Loc. cit. p. 147.



was adherent, and manual interference was necessary for its removal.

When the placenta adheres to the posterior wall of the uterus, the uterine *souffle* is heard on either side of the abdomen, and so far posteriorly that often it can be detected only on placing the patient on her side, by which means the stethoscope may be brought near the posterior wall of the uterus.

A singular peculiarity in the character of the uterine sound has been noticed in some few cases, in which hæmorrhage took place in the latter months of pregnancy, owing to the insertion of the placenta near the os uteri. The sound was of ordinary intensity in the inguinal regions, but extended thence over the whole uterus, and even the smaller arterial ramifications seemed to concur in its production. The most dissimilar sounds were audible at the same time, and often at the same part, varying from the ordinary hollow murmur produced by the large vessels at their entrance into the uterus, to a hissing, or shrill sound, like the highest tones of a violin. In all these instances of preternatural vascular activity, hæmorrhage

was either going on at the time of examination, or it shortly afterwards made its appearance.

The uterine *souffle* was noticed, in ten cases, to be accompanied occasionally by a louder and shriller sound than natural; and on examining the placentæ after they were expelled, numerous small calcareous deposits were found in their tissue. This sound differed from that alluded to as heard in instances of uterine hæmorrhage, not merely in its character, but also in not extending over the whole uterus, being confined to a surface corresponding in size to the placenta.

Nothing resembling this was observed in cases of cartilaginous induration of the placenta, or in obstruction of some of its vessels.

#### § XXXIV.

Another very prevalent opinion is, that the abdominal surface of the fœtus in utero is directed towards the placenta; but such a notion is equally erroneous with that relating to the situation of the placenta, discussed in the preceding paragraph. It is contradicted by the observations there detailed, which cannot but

lead to the conclusion, that there exists no such relation between the position of the foetus and the situation of the placenta.

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### CHAPTER III.

INFORMATION WHICH AUSCULTATION AFFORDS  
WITH REGARD TO THE LIFE OF THE CHILD  
DURING PREGNANCY, OR IN LABOUR.

#### § XXXV.

The signs usually regarded as indicative of the life or death of the child during pregnancy, or in labour, are so deceptive, that, in all probability, there is scarcely a practitioner who has not met with some instance in which, notwithstanding the presence of several indications of the death of the foetus, a strong and healthy child was born. It is especially in these doubtful cases that the great utility of auscultation becomes most apparent.

Auscultation affords the only certain evidence of the life of the foetus. A person may express

his opinion without the slightest hesitation, provided he has succeeded in detecting the pulsations of the foetal heart; and he may be equally certain that the child is dead, if the heart's action cannot be heard. Some writers, indeed, have endeavoured to throw discredit upon this latter statement; but if a practised ear be unable to detect the heart's sound at a period of pregnancy when they are usually audible, and if the same result be obtained on repeating most carefully the examination of the patient, and on placing her in different positions, there can then be no reason for doubting the death of the foetus.

It may be interesting to detail a few cases in which auscultation was of great service in detecting the death of the foetus, and which will further illustrate the nature of the changes produced in the uterine sound by that occurrence.

#### § XXXVI.

The death of the foetus takes place, either in consequence of causes which act upon the mother, as external injury, over-exertion, or violent mental emotion; or it is produced by some disease which affects only the child. In all of these cases, the vital intercourse between

the uterus and the placenta remains undisturbed, and the uterine sound continues audible; but the pulsations of the foetal heart, which before were distinctly heard, are no longer to be detected. Sometimes, as in the following case, the foetal heart ceases to beat immediately on some powerful mental emotion affecting the mother.

*Josephine Haeffner*, from N——, twenty-eight years old, of middle stature, and weak frame, was pregnant for the first time. She had previously suffered much from hysteria and chlorosis, and had been subject to attacks of convulsions during her pregnancy. When she was first examined, on the 28th of May, 1837, the foetal heart was heard in the left inferior abdominal region, beating at the rate of one hundred and forty-two pulsations in the minute, and the uterine sound was distinguishable in the left lumbar and inguinal regions. On the 20th of June, auscultation was repeated, when the foetal heart was found to have changed its situation, and was now detected pulsating one hundred and thirty-six times in a minute in the right middle and inferior abdominal regions, but not extending at all beyond the linea alba.

On the night of the 27th of June, the patient

was suddenly waked by a loud noise in the ward, which greatly startled her ; and as soon as her momentary fear had subsided, she observed that the movements of her child, till then very frequent, had altogether ceased. She mentioned this circumstance on the following morning, when auscultation was repeated ; and although the uterine sound was heard as before in the left inferior abdominal region, the pulsations of the foetal heart could not be detected. The neck of the uterus was found not to have lost its nipple-like form, and the os uteri was perfectly closed. The patient then felt perfectly well ; but, in the course of a day or two, she experienced slight rigors, her breasts became flaccid, and on turning in bed at night she experienced a sensation as of something weighty falling from one side of the abdomen to the other. At length, on the evening of the 2d of July, labour pains came on ; the liquor amnii which flowed away, was offensive and discoloured with blood ; and at two A.M. on the following day, the patient gave birth to a female foetus, weighing three pounds twelve ounces, which presented every mark of having been long dead. The placenta, which was soon expelled, was perfectly natural in its appearance,

with the exception of the covering it receives from the amnios: both that and the umbilical cord presented marks of putridity.

Several other cases might be related, in which the fœtus, together with the membranes and the umbilical cord, were far advanced in decomposition, in which, too, even the membranous covering of the placenta was green, and easily torn, while that organ itself was of a bright red colour, and presented no trace of having lost its vitality. From this it would appear, that the close contact into which the placenta is brought with the maternal blood, serves to maintain it in all the freshness of life, even when the other contents of the uterus have undergone decomposition.

Hohl \* has stated, that the uterine sound diminishes in intensity after the death of the fœtus; but the following case is one of many which might be adduced in support of the opposite opinion. In some instances, indeed, in which the expulsion of the fœtus did not take place till a considerable time after its death, the uterine *souffle* was heard with greater intensity than usual; a circumstance in perfect accordance

\* Loc. cit. p. 281.

with the fact above referred to, that, in numerous cases of abortion, the placenta has retained its vitality long after the expulsion of the foetus.

*Anna Weinlein*, from H—, twenty-six years old, remarkably robust and healthy in appearance, stated, on her admission into the hospital on the 9th of December, 1836, that three weeks previously she had been severely beaten by a person, who had also stamped upon her, and struck her on the abdomen, and that since then she had not felt the movements of the foetus, which up to that time had been vigorous. The os uteri was sufficiently open to admit the top of the forefinger for a short distance, but higher up the neck of the uterus was perfectly closed, and no presenting part could be detected. The uterine *souffle*, which was very loud, was heard in both inguinal regions, whence it extended, though with less intensity, over the whole abdomen. Neither the pulsations of the heart of the foetus, nor the movements of its limbs, were distinguishable. On the 15th of December, labour pains came on, but continued slight until the following morning, when they suddenly became very violent, and were so effective that at nine A. M. the os uteri was perfectly dilated, and the breech



was found to be the presenting part. Auscultation was repeated, but with the same result as on the previous examination. At eleven o'clock, the body of the child was expelled, still enveloped in the membranes, which, on bursting, gave exit to liquor amnii of a brownish colour. The fœtus was so advanced in decomposition that the epidermis peeled off from the head as it was expelled; the membranes were green, and the umbilical cord was quite putrid, but the placenta was of a uniformly red colour, and showed no sign of decay. The weight of the child was two pounds twelve ounces, that of the placenta sixteen ounces.

It is a curious circumstance, that some pregnant women fancy that they continue to feel the movements of the child, even for a long time after its death has been most satisfactorily ascertained by the stethoscope. Indeed, this delusion continues with some even during labour, and until they have given birth to a fœtus so decomposed as to show that it must have been dead at least three or four weeks.

A striking instance of this is afforded by the case of *Maria Hoffmann*, from H——, twenty-two years old, of a healthy appearance, who had never undergone any illness, and was pregnant for the second time. Two years before, she had

given birth to a putrid foetus, but could assign no reason for its death. She stated, on her admission on the 3rd of December, 1837, that she was within three weeks of the full period of her pregnancy, and that she felt the movements of the child at the left side of her abdomen. The os uteri admitted the point of the finger, but was closed a little higher up: on examination with the stethoscope, the foetal heart was heard in the right inferior abdominal region, not extending beyond the linea alba, and beating at the rate of one hundred and twenty in the minute, and the uterine sound was distinctly audible in the left lumbar and inguinal regions. The examination was repeated on the 8th of December, when the uterine sound was heard over the same extent of surface as before, but the action of the foetal heart was more feeble, and was diminished in frequency to eighty-four beats in the minute. On being questioned, the patient said she was perfectly well, that no accident had happened to her, and that she continued to feel the movements of the child in the usual situation. Auscultation on the following day showed that the pulsations of the foetal heart had ceased, although the loudness of the uterine sound was not at all diminished.

This examination was occasionally repeated; each time the uterine *souffle* was found more intense; and on the 24th of December, at two P.M., when labour began, the sound was heard distinctly over the whole abdomen. At three P.M., the os uteri was dilated to the size of a shilling, and the head, which presented in the second position, was found to be so softened and flaccid as to resemble a large bladder in which the bones of the head were floating. The patient still persisted most positively in her assertions that she felt the movements of the child; and when told that it had been dead three weeks, she laughed and said, "How is it possible that a child which is struggling now, can be dead?" Half an hour afterwards, she gave birth to a male child weighing five pounds four ounces, and in a state of the most complete putrefaction, as were the membranes and the umbilical cord, though the placenta, which weighed fifteen ounces, showed no trace of decomposition.

#### § XXXVII.

It is well known that the life of the child is exposed to great danger, if, after the escape of the liquor amnii, any cause should protract the remaining stages of labour much beyond the

usual time, and especially if, at last, a state of tonic contraction of the uterus should be thereby induced. In such a case, the foetus, especially when the presentation is unnatural, becomes so compressed by the uterus contracting around it with increasing force, that the circulation of the blood through it is greatly impeded, and at last even totally prevented. The detail of a case will be the best way to exhibit the successive changes that take place in the circulatory system of a foetus, the death of which is thus produced.

*Kunigunda Rigel*, from N——, thirty years old, a healthy woman, of middle stature, and who had already given birth to three small children at the full term of pregnancy, was admitted into the hospital, where, two years before, she had been delivered of her youngest child. Measurement of the pelvis with the *compas d'épaisseur* led to the conclusion that the conjugate diameter of the brim of the pelvis did not exceed three and a half inches. The patient having arrived at the end of her fourth pregnancy, labour pains came on, on the 29th of January, 1838. The number of the pulsations of the mother's heart was then one hundred and twelve, that of the beatings of the foetal heart one hundred and sixty-six in the

minute; and the latter were most distinct in the right superior abdominal region; while the uterine sound was heard in either groin. At eight A.M. on the 30th of January, the membranes ruptured; at nine A.M. the os uteri was dilated to rather more than the size of a crown piece, and the head, which was situated forwards, and very high up, could be reached by the finger only with great difficulty. With each recurrence of the pains, which were regular and energetic, a considerable quantity of liquor amnii escaped between the head and the os uteri; a large caput succedaneum formed by degrees, and completely occupying the os uteri, extended into the vagina. As the quantity of the liquor amnii diminished, the pulsations of the foetal heart, which were now one hundred and forty-eight in the minute, became audible lower down, and at three P.M. were heard most distinctly in the right inferior abdominal region. The uterine action, though exceedingly violent, and assisted by the patient's own energetic efforts, exerted no influence upon the situation of the head, which was found at seven P.M. situated above the brim of the pelvis in the second position, the little fontanelle being directed to the right and a little backwards, and

both the head and neck closely grasped by the lower segment of the uterus. In order to diminish the great vascular excitement under which the patient laboured, she was bled and placed in a warm bath, which produced very copious perspiration, and was soon followed by the recurrence of violent labour pains. The pulsations of the foetal heart now began to be more feeble; at midnight their frequency had fallen to sixty-six in the minute, and soon afterwards they completely ceased. The application of the forceps was attempted without success, and at last it was necessary to diminish the head, when the extraction of the child was afterwards completed by means of the forceps. The child, which was a boy, weighed seven pounds six ounces.

A similar diminution of frequency and intensity in the action of the foetal heart is likewise observed in cases, by no means rare, in which the uterine contractions are very powerful, and succeed each other, after the escape of the liquor amnii, with such rapidity as scarcely to allow the patient time to fetch her breath. Instances indeed occur, in which the action of the heart becomes slower by even thirty or forty beats in the minute, and yet perfectly healthy children

are born ; a circumstance probably owing to the very short duration of this violent uterine action, which, did it continue longer than fifteen minutes or half an hour, would most likely prove fatal to the child. This may be illustrated by the case of *Caroline Klar*, from S——, thirty-two years old, a small woman of delicate frame, but in the enjoyment of good health, who, having arrived at the end of her third pregnancy, experienced the first labour pains on January 16th, 1837. At ten A.M., although the pains were inconsiderable, the os uteri was sufficiently dilated to admit the finger, and the membranes were becoming tense. The pulsations of the foetal heart were heard everywhere on the left side of the abdomen, most distinctly in the left inferior abdominal region, passing a little beyond the mesial line at the pubes, and beating one hundred and forty times in the minute. The uterine sound was loud in both inguinal regions, and extended for some distance on the left side of the abdomen as far as the linea alba. The pains, which had been slight until noon, then suddenly became exceedingly violent, and returned at intervals of scarcely a minute ; the os uteri dilated completely ; the membranes ruptured ; the liquor amnii flowed

away, and the head descended in the first position into the cavity of the pelvis. The stethoscope was applied almost constantly to the abdomen during this storm of uterine action; and every interval, however short, was employed to count the frequency of the foetal heart's pulsations, which were found to become slower every minute, sinking from 140 to 134, 136, 128, 130, 122, 120, 116, 110, 108, 100, 94, 86, 80; and at last, just before the expulsion of the head, they had fallen to 75 in the minute. It was now supposed that a child would be born too weak to be capable of living; but, after these violent pains had lasted nearly three quarters of an hour, the foetus was expelled; and although the umbilical cord pulsated very slowly and feebly, yet the heart began to beat vigorously, as soon as the child had made a few efforts at respiration, and in a few minutes it cried loudly. The heart now beat 120 strokes in the minute, and a few hours afterwards, when the child was asleep, 110; on the following day, 126 during sleep, and 136 when the child was awake. The child, a girl, weighed at birth seven pounds two ounces.

It may sometimes be noticed in a tedious labour, that the uterine sound, which before had



been of natural strength, becomes by degrees weaker and weaker, and at last entirely disappears. This phenomenon, occasioned by partial separation of the placenta, is soon followed by a similar change in the action of the foetal heart. As the uterine *souffle* diminishes in intensity, the latter becomes slower, and often sinks in frequency below the maternal pulse; at last the heart beats a few times violently, and the foetus is dead. If, during this time, an internal examination is made, and the head is pushed a little upwards or to one side, a small quantity of dark blood, proceeding from the partially detached placenta, will generally trickle by the side of the head. If delivery is now left to nature, putridity will affect both the foetus and the placenta, and their expulsion will often be accompanied by the escape of large quantities of gas. The following observations may be brought forward in attestation of this fact.

*Magdelene Schmidt*, from F——, twenty-two years old, of middle stature and strong frame, had reached the end of her first pregnancy. Her abdomen was very pendulous, the os uteri was high up and directed much backwards, and the head, which presented, could be detected with difficulty. Labour began in the night of

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March 6th, 1837; the uterine sound was then heard extending from the right inguinal region to the umbilicus; the pulsations of the foetal heart were loudest in the left inferior abdominal region, though audible also (as is usually the case in venter propendens) over a large surface on the right side, and beating one hundred and thirty-six times in the minute. The pains continued with but slight intermission during the 7th and 8th; they caused much suffering, and produced but little influence on the dilatation of the os uteri. In the night of the 8th of March, a small quantity of turbid, greenish, but not offensive liquor amnii escaped; and on the following morning, the os uteri was dilated nearly to the size of a crown piece, but was very unyielding. The head was situated in the first position above the brim of the pelvis; the uterine sound was natural; and the heart acted one hundred and thirty times in the minute, the labour pains continuing as before. It was now thought advisable to bleed the patient, and place her in a warm bath. At noon, when the stethoscope was again applied, the uterine sound was feebler than before, and the action of the foetal heart, though undiminished in intensity, had sunk in frequency to one hundred

and eight, while the heart of the mother beat one hundred and twenty times in the minute. The forceps could not then be applied, on account of the rigid state of the os uteri. Soon the uterine sound disappeared, and the contractions of the foetal heart, after having become less frequent, at length entirely ceased. Liquor amnii of a brownish red colour drained from the vagina, and was occasionally accompanied with discharges of very offensive flatus. Four hours after the action of the foetal heart had become imperceptible, a dead female child, weighing six pounds, was expelled; and at the same time, a loud discharge of flatus took place, which spread a most nauseous smell through the room: the placenta was removed from the vagina; it was discoloured, and its odour was most offensive.

#### § XXXVIII.

Similar alterations take place in the action of the foetal heart, when labour is unfortunately complicated with prolapsus of the umbilical cord. The particulars of two cases may be of interest; in both of which the injurious influence of prolapsus of the cord upon the life of the child, was traced step by step with the stethoscope. Both

cases are also interesting in another point of view.

*Anna Dietrich*, from Z——, twenty-eight years old, a well-formed, middle-sized woman, who had given birth to her first child three years before, after an easy labour, was admitted into the hospital on the 14th of February, 1837. On the 14th of March, having arrived at the full term of her second pregnancy, labour-pains commenced, and, on a vaginal examination, the head was found to present, but to be very high and moveable above the brim of the pelvis. The foetal heart, which was audible over the whole of the right side of the abdomen, (as on the patient's admission,) and not extending beyond the mesial line, beat at the rate of one hundred and thirty-two pulsations in the minute; the uterine *souffle* occupied both inguinal regions; on the left side it was limited to a small spot, but extended on the right side over the greater part of the inferior abdominal region, and was especially loud about the right os pubis. The os uteri dilated gradually, and at midnight the bag of the membranes protruded through it. On the 15th of March, at three A.M., the os uteri was dilated to about two and a half inches in diameter; the

membranes projected in a conical form, but were not tense; a pulsating coil of the funis was felt forwards and to the right; and on passing the finger within the os uteri in this direction, the edge of the placenta, which was attached very low down, could be distinctly felt. The head, enveloped in the membranes, continued to descend, while the quantity of umbilical cord which was in front of it increased. At noon, the head became visible between the labia; the foetal heart was then beating with tolerable regularity at the rate of one hundred and thirty-six strokes in the minute, though it became somewhat slower during each pain, but recovered its usual frequency in the intervals. At three P. M., the uterine contractions became more violent, and forced the head to the outlet of the pelvis: during their continuance, the pulsations of the foetal heart sank to fifty in the minute, but afterwards became more frequent. The membranes ruptured at ten minutes past three P. M., and a large coil of the funis, pulsating feebly, immediately pro-lapsed, while almost at the same instant the head was expelled. This last interruption to the passage of the blood, although momentary, was more than the foetus could endure, and all at-

tempts to restore animation were unsuccessful. The placenta could now be distinctly felt, situated on the right side of the uterus, and with its edge reaching to the os uteri. In the course of a few minutes, it was expelled by the powers of nature, when it was discovered that the vessels did not unite to form the umbilical cord till they were an inch distant from the margin of the placenta; which circumstance would necessarily tend to produce prolapsus of the funis. The child, a boy, weighed seven pounds seven ounces, the placenta twenty ounces; the length of the cord was twenty inches.

*Caroline Bläuler*, from L——, twenty-six years old, a strong, healthy, middle-sized woman, experienced the first labour pains at noon on the 30th of April, 1837, having completed the full term of her first pregnancy. She had been examined before, on the 9th of April, when the pulsations of the foetal heart, which were one hundred and fifty-six in the minute, were heard over the whole of the left side of the abdomen, especially loud above the pubes, and extending far beyond the linea alba in the inferior abdominal region; the uterine sound extended from the right lumbar to the right pubic region. Auscultation

now gave exactly the same results as before, thus proving that the child had not altered its position. At noon, the membranes were ruptured by a person who was examining the patient awkwardly, and immediately a large coil of the funis fell through the os uteri into the vagina. Unsuccessful attempts were made to replace it, both with the hand, and with the instrument recommended by Michaelis for this purpose : during their continuance, the stethoscope was constantly applied to the abdomen, and the gradual extinction of the life of the foetus was watched with the greatest accuracy. The pulsations of the foetal heart were found to sink with the recurrence of each pain ; and thirty minutes after the escape of the liquor amnii, they beat for the last time : the child, which till then had been perfectly quiet, made a few violent convulsive movements, and the heart's action then ceased for ever. The expulsion of the child was now left to nature, and at three P.M. a male foetus weighing five pounds was born. The expulsion of the placenta, the edge of which had been felt during labour near to the right side of the os uteri, soon followed. On examining it carefully, it was found that the umbilical vessels ran separately for an inch between

the amnion and the chorion ; they then united, but still continued their course for nearly three inches further between the two membranes, before they became enveloped by the amnion; and as that very spot corresponded to the os uteri, the escape of the funis, when the membranes ruptured, was inevitable. The weight of the placenta was thirteen ounces, the length of the umbilical cord thirty inches.

One or two remarks upon marginal insertion of the umbilical cord, as a circumstance disposing to its prolapse, may be here perhaps not altogether out of place. Levret had observed that, when the placenta is situated near the os uteri, the umbilical cord is usually inserted into the lower edge of that organ; and he details a case\* of prolapsus of the funis, which occurred to him under circumstances very similar to those described as existing in the two instances above related. Now, although the marginal insertion of the umbilical cord may not so invariably attend the situation of the placenta near the os uteri as Levret supposed, yet it is often met with, and deserves especial notice, since it evi-

\* *Suite des Observations, etc.* Paris, 1751. p. 113. *Observation xxviii.*



dently predisposes the cord to prolapse. It must be at once evident, that the funis is more likely to become prolapsed in proportion to the proximity of the placenta to the os uteri; and if to this there be conjoined marginal insertion of the funis, the danger is rendered still greater: even before the rupture of the membranes, the cord is scarcely safe from pressure, while its prolapse is certain so soon as they give way, and any attempt to return it is almost always fruitless.

It may be interesting to give the particulars of a case in which, notwithstanding the existence of these circumstances, the child was born alive.

*Margaret Boehmer*, from M——, came into the hospital at the end of her third pregnancy, and labour began on the morning of the 24th of March, 1838. At half past one P.M., the os uteri being fully dilated, the membranes ruptured, and a large coil of umbilical cord fell out of the vagina. The hand was introduced to replace it; the cord was supported during the following pain, which forced the head in the first position into the brim of the pelvis; and two more pains sufficed to expel a large healthy child, weighing eight pounds two ounces, which at once began to cry loudly. The funis was coiled once round its

neck. The placenta soon came away: the funis was inserted into its margin, and it was evident that this part of the organ had been close to the os uteri, from the circumstance that the rent in the membranes was only one inch distant from this side, but fourteen inches from the opposite side of the placenta. The funis was thirty-two inches long.

The fortunate result of this case was undoubtedly owing to the unusually rapid course of the labour after the liquor amnii had escaped, and would probably have terminated equally favourably for the child, even though the funis had not been returned.

#### § XXXIX.

Another by no means unusual cause of the death of the foetus is, the draining away of the liquor amnii before the onset of labour pains, or when the uterine contractions, after having once begun, cease completely for a long period.

This occurrence takes place in women who have had several children, as well as in those who are pregnant for the first time: in the latter, it is more frequent, but less dangerous to the child than in the former, owing perhaps to the follow-

ing circumstances. In women who have had several children, not merely does the external os uteri remain patulous during the whole of pregnancy, but the internal orifice also opens several weeks before the commencement of labour. If, in them, the membranes should be ruptured from any cause, not merely does a large quantity of liquor amnii at once flow from the vagina, but atmospheric air enters readily into the uterus; hence result the death and decomposition of the fœtus and its appendages, which probably are not expelled until their putrid condition has excited contraction of the uterus. In persons, on the contrary, who are pregnant for the first time, it is by no means unusual for the liquor amnii to drain away several days before the commencement of labour, without the slightest injury to the child. The os uteri opens but slightly, and consequently renders the discharge of the liquor amnii very gradual, while at the same time the contraction of the uterus, as it loses its fluid contents, and the narrowness and close apposition of the external parts, render the entrance of air very difficult, if not impossible.

This subject may be elucidated by an account of the case of *Elizabeth Wetzel*, from G——,

twenty-five years old, a strong and healthy countrywoman, who had already given birth to two children after easy labours, and had arrived safely at the end of her third pregnancy, when, on the evening of February 7th, she complained of pain in her back, and at two A.M. on the following day, liquor amnii escaped in large quantities. There was then no uterine action; the os uteri was tumid, unyielding, open to about half an inch in a transverse direction, so that the finger could reach the head, which was moveable above the brim of the pelvis. The pulsations of the fetal heart were audible, beating one hundred and forty-six times in the minute over the whole right side of the abdomen, but scarcely reaching the linea alba, and most distinct posteriorly: the uterine sound was feeble in the right, more intense in the left inguinal region. A repetition of the auscultation at six P.M. gave the same result. The patient continued to feel well, and had no pains, although liquor amnii drained away occasionally, and she slept quietly through the night. At nine o'clock on the following morning, the water had ceased to flow, the patient felt perfectly well, and had no pains, but the uterus was found closely enveloping the child. The uterine

sound was still distinct in the left inguinal region, but on the right side had disappeared ; and the pulsations of the foetal heart had become more frequent, being now one hundred and sixty-eight in the minute. In the afternoon, the heart's action gradually became slower, and its energy had so diminished, that it was evident the death of the child must speedily ensue. A little before three P.M., the heart beat fifty-five strokes in the minute ; and, at three, the patient suddenly felt a very violent movement of the child, such as she had not felt before during that day. Auscultation was immediately repeated, and the beating of the foetal heart could no longer be heard, but a gentle *souffle* was still audible in the left inguinal region. Labour soon came on, and at seven P.M. a dead male child, weighing eight pounds four ounces, was born. Immediately afterwards, the placenta was expelled, which was green, and gave forth a most offensive odour.

## CHAPTER IV.

## VALUE OF AUSCULTATION IN OPERATIVE MIDWIFERY.

## § XL.

None of the various sources of doubt and perplexity which beset the practitioner of midwifery, are so calculated to embarrass him, as those circumstances which render it difficult to decide whether, in a certain case, he is warranted in having recourse to instruments, what will be the most proper time to employ them, or how he may apply them in the best manner.

These are questions which the ordinary methods of examination are often insufficient to solve; and most fortunately, the very points they leave uncertain are, in many instances, decided by means of auscultation. It is often desirable, in cases of preternatural presentation, to ascertain most exactly the position of the child; and while internal exploration affords us no information, and external examination none that is satisfactory, the stethoscope corrects, confirms, completes our previous knowledge. Or, again, in a case of tedious labour, where the liquor amnii has long drained away, the head is known to present, but

the most practised hand would be unable to determine its exact position, so much are the integuments swollen; while our ear acquaints us most correctly with its situation, and we are thus enabled to apply the forceps in a manner that shall be most effective, and at the same time least dangerous for the child. Where manual interference is necessary, it is also, in many cases, most desirable to know the point of insertion of the placenta.

But, how important soever this information may be, still auscultation renders a much more valuable service, when it determines whether a foetus is alive or dead, or whether the protracted labour has begun to act injuriously upon its system; thus enabling the practitioner not merely to decide on the propriety of employing the perforator, or forceps, but also to ascertain the most suitable time for applying the latter instrument.

It has been disputed by some, whether auscultation is capable of giving such information with regard to the state of the child, as can determine the propriety of interfering in order to accelerate the labour, or of leaving it longer to nature.\* It has been urged that children are frequently born,

\* Dubois. *Loc. cit.* p. 34, seq.

whose heart had been heard to act with the greatest regularity, in force and frequency, and who yet are unable to survive their birth ; while, in other cases, perfectly healthy children are born, although changes had been detected both in the rhythm and in the intensity of the heart's action. Children, it is true, sometimes do not survive their birth, although the action of the heart was natural during labour ; they, however, are for the most part either premature, or else very weak, ill-developed fœtuses, who were not sufficiently strong to exist separated from the mother. But such cases cannot diminish the value of auscultation ; for, even if their existence could be ascertained before birth, it is not within the power of art to prevent the death of the children ; while it is especially in instances where strong, healthy children are subjected to the injurious influences of a preternatural labour, that the stethoscope is of the greatest service in affording a guide to practice. Dubois admits, that although he noticed these changes in the heart's action, he did not count the alterations in its frequency. Now since, as has been already shown, the pulsations of the heart of a healthy fœtus vary during pregnancy from ninety to one hundred and eighty beats in a minute, it is absolutely necessary,



before drawing any conclusions from changes in their rhythm during labour, that the frequency of the heart's action at its commencement, or at any rate before its regularity was disturbed, should be most accurately ascertained.

The cases which have been detailed in §§ xxxvii, xxxviii, xxxix, sufficiently prove, that the approaching death of the fœtus, from protracted labour, or from any of the causes above described, may be satisfactorily ascertained by means of the stethoscope. It now remains to adduce some instances in which judicious interference saved the life of the child, after the evidence of auscultation had proved it to be endangered.

*Eva Lech*, from S——, twenty-two years old, of middle stature, clumsy frame, and exceedingly awkward gait, but having always enjoyed good health, was admitted into the hospital on the 6th of July, 1837, being then pregnant for the first time. Measurement with Baudelocque's *compas d'épaisseur* gave an external conjugata of six inches four lines; but, on internal examination, the promontory of the sacrum could not be reached with the finger, probably in consequence of the great development of the pudendum: the head, however, was ascertained to be the present-

ing part. During the patient's stay in the hospital, she was frequently examined by means of the stethoscope, and the foetal heart was heard sometimes on the right, at others on the left side of the abdomen, and generally pulsating one hundred and forty times in the minute.

Labour began on the afternoon of the 13th of September. The foetal heart was then audible over the whole of the left side of the abdomen, and extending considerably beyond the mesial line; its pulsations were strong, and one hundred and thirty-eight in the minute. A few inches the left os pubis, the funis was heard encircling the neck of the foetus. The uterine sound was loud in the left inguinal region, whence it was diffused over the whole left side. At nine P.M. the os uteri was sufficiently open for the finger to pass through it, and distinguish the head, which presented in the first position. The pains continued at intervals through that night and the following day; and at six P.M. on the 14th of September the os uteri was dilated to the size of a crown piece, and the membranes were very tense. The pulsations of the foetal heart were still unaltered in strength, but had sunk in frequency to one hundred and twenty-eight in the minute. At eight o'clock, the mem-

branes ruptured, the pains became very violent, and the head turned from the oblique more into the transverse diameter of the brim of the pelvis, where it remained, notwithstanding the most violent pains, and a large caput succedaneum formed. The foetal heart, which at six P.M. beat at the rate of 128, now sank gradually to 116, 110, 96, 84, and at ten o'clock to 75 strokes in the minute, so that, in the course of four hours, its pulsations had fallen fifty beats in frequency. The forceps \* were now applied, and the head was brought through the brim of the pelvis with difficulty, but no great obstacle was offered to its passage through the pelvic cavity. When first born, the child appeared very feeble; but it soon recovered on being placed in a warm bath; an hour after which its heart beat one hundred, and in the course of a day or two, its frequency rose to one hundred and thirty strokes in the minute. The weight of the child at birth was six pounds six ounces, and the length of the umbilical cord eighteen inches.

\* Hohl observes very justly, (loc. cit. p. 268,) that when the forceps are applied with care, no alteration takes place in the foetal circulation. It is particularly important, in using this instrument, to close the lock slowly, and to relax the pressure upon the handles after each traction.

Had it not been for the information derived from the use of the stethoscope, the application of the forceps would have been delayed still longer, since no change had taken place in the condition of the patient to call for their employment, and scarcely two hours had elapsed since the escape of the liquor amnii. This case may then be referred to, as one in which auscultation was of the greatest use, and in which, but for it, the life of the child would have been inevitably sacrificed.

*Elizabeth Müller*, from S——, thirty-four years old, a thin woman, of middle stature, had safely reached the end of her first pregnancy. The ear detected the pulsations of the foetal heart over the whole of the left side of the abdomen, extending beyond the linea alba in the superior abdominal region, and beating one hundred and thirty-four times in the minute. The uterine sound was audible in both inguinal regions, and reaching partly into the lumbar region, so as to render it probable that the placenta was attached to the posterior part of the uterus. At eleven A.M., on the 22nd of July, the liquor amnii began to drain away without any labour pains, the os uteri being quite closed; and it was not till the evening of the 23rd that it had become sufficiently dilated, by the

almost imperceptible uterine contractions, to admit the tip of the finger. At one P.M. on the 24th, labour pains became more sensible ; and at seven P.M. the os uteri, though still rigid and unyielding, was dilated one inch and a half, and the finger could detect the head presenting in the first position. The uterine sound and foetal heart were both perfectly natural, and the latter beat one hundred and thirty-two times in the minute. At nine P.M., the os uteri was fully dilated, and the scalp of the child began to be perceptible during each pain, between the external parts. The liquor amnii had now long since drained away ; the uterus was firmly contracted around the child, whose powers of life began rapidly to diminish ; and at eleven P.M. the contractions of the heart were only eighty in the minute. The forceps were now applied, and as they were introduced, a little dark blood trickled out of the vagina, thus showing that the separation of the placenta had already commenced. A few tractions with the forceps sufficed to complete the delivery ; and the child, which weighed five pounds thirteen ounces, breathed, and cried very soon after being placed in a bath. An hour after birth, the heart beat one hundred and eighteen ; on the third day, one hundred and thirt

two times in the minute ; and continued to pulsate at that rate so long as the mother remained in the hospital.

This and the preceding case exhibit the benefits of auscultation, as making us acquainted with the moment when the life of the child becomes endangered, and thus teaching us when to interfere, and how we may avoid needless meddling or hazardous delay. Of course, before proceeding to manual interference, it will be necessary not merely to consider the results of auscultation, but also to examine the case in all its bearings, and duly to regard the condition of the mother as well as that of the child.

#### § XLI.

Allusion has been made, in preceding paragraphs, to the great advantages of employing auscultation in prolapsus of the funis, to ascertain the state of the foetal circulation ; a few remarks may be added, upon its value when any attempt is made to return the funis.

So long as the funis continues prolapsed, the force and frequency of the foetal circulation may be ascertained by the hand ; but when the cord has been returned into the uterus, and placed beyond the reach of the fingers, it can be dis-

covered only by the stethoscope, whether the foetal circulation has resumed its activity, or whether the cord is still subject to pressure.

The case of *Elizabeth Meier* strikingly displays the benefits of auscultation in this respect. She was a pale, but healthy woman, twenty-six years old, and pregnant for the second time. Labour began on the morning of the 3rd of April, 1837, but it was not until evening that any very evident dilatation of the os uteri occurred; the distention of the uterus with liquor amnii probably retarding the first stage of labour. The pulsations of the foetal heart were heard, one hundred and twenty in the minute, on the left side of the abdomen, and passing but little beyond the mesial line, The uterine *souffle* was loud in both inguinal regions, and extended thence over the whole anterior wall of the uterus. At seven P.M., the os uteri was open rather more than an inch in a transverse direction; it was soft and yielding, and the finger being passed through it detected the head presenting in the first position. At half past eight P.M., the os uteri being then dilated to an inch and a half, the membranes ruptured, and a coil of the funis descended by the side of the head; immediately upon which the pulsations of the foetal heart were found to have sunk from

one hundred and twenty-four to eighty-four in the minute. The funis was returned within the uterus, but it was twenty minutes before sufficient activity was excited in the lower segment of that organ to retain the cord; the hand was then withdrawn, and the beatings of the heart were found to vary from one hundred and twenty to one hundred and thirty in the minute. At half past ten P.M., the os uteri was fully dilated, the head descended into the pelvis, and at midnight, a female child, weighing seven pounds and a half, was born, and immediately began to cry. After the replacement of the cord, auscultation had been repeated from time to time, and indicated the undisturbed continuance of the foetal circulation. The placenta, which weighed twenty-two ounces, was soon afterwards expelled: the funis was twenty-four inches long, and its insertion was central.

In this case, had it not been for the satisfactory evidence which auscultation afforded, attempts would probably have been made to hasten the lingering labour by the application of the forceps, and recourse would have been had to an unnecessary, if not injurious, operation.

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