deviation of the eyes to the side of the lesion, paralysis of the seventh nerve on the same side, and a hemiplegia of the opposite limbs. The lesion is in the pons.

4. The *Millard-Gubler syndrome* is the same, but without the paralysis of the conjugate deviation of the eyes. The lesion is lower down in the pons, the nucleus of the sixth nerve escaping damage.

Frequent reference has been made in the course of my remarks to the Argyll Robertson pupil. Although I have been dealing more especially with affections of the external ocular muscles I feel obliged to make more than a passing reference to this symptom, whose importance certainly deserves a paper to itself. The Argyll Robertson pupil consists in an absence or a gross diminution of the reaction of the pupil to light, with the preservation of the reaction on convergence-accommodation. It was originally described in association with cases of tabes, and it is in this disease that it is still best recognized and most widely known. The characteristic pupillary reactions were described by Argyll Robertson in cases of spinal disease with myosis or contracted pupils. It is, however, now a matter of common agreement *not* to restrict the term to cases with contracted pupils. There has been a tendency at times to regard this reaction as specific evidence of syphilis of the nervous system. This view cannot now be upheld, although it may be granted at once that syphilis is by far the most common cause. Those who are interested in the subject will do well to consult Wilson's⁵ paper in the *Journal of Neurology and Psychopathology*, where an admirable review of the whole question is set out. This author mentions the following different conditions where the Argyll Robertson pupil has been recorded:

1. Epidemic encephalitis.
2. Disseminated sclerosis.
3. Cerebral tumours in the vicinity of the third ventricle, aqueduct, or anterior corpora quadrigemina.
4. Syringomyelia or syringobulbia.
5. Chronic alcoholism.
6. Traumatic cases.

In cases from my own personal experience, which I have already quoted, there have been three examples of the Argyll Robertson pupil, in all of whom syphilis was excluded. These were as follows: (1) a tumour of the midbrain; (2) a vascular lesion; and (3) a case in which the condition appeared to have originated during an attack of typhoid fever. Wilson and de Rudolf⁶ have lately published a case of a mesencephalic tumour with Argyll Robertson pupils, and Natrass⁷ one of bullet wound of the midbrain. De Monchy⁸ also records a highly interesting case of tumour of the pineal gland with ocular disturbances, including Argyll Robertson pupils.

Some general remarks on the diagnosis of the site of the lesion may be attempted. Ocular palsies due to lesions in the orbit do not come under the notice of the physician or neurologist so much as those due to lesions in the skull. But some characteristics of orbital lesions may be mentioned: (1) They are apt to be unilateral. (2) A single muscle may be affected. (3) The internal muscles are not as a rule affected so much as the external. (4) Proptosis is common. (5) A complete paralysis of all three ocular nerves is perhaps in favour of an orbital lesion.

Palsies due to lesions at the base of the brain tend to show the following characters:

1. Other cranial nerves are often affected.
2. A paralysis affecting all branches of the third nerve, and especially if bilateral, is usually due to a basal lesion.
3. In cases of trauma other signs, such as bleeding at the nose or escape of cerebro-spinal fluid, will of course speak for a basal lesion.
4. Signs of meningitis, such as severe headache with head retraction and fever, naturally will suggest a lesion at the base of the brain.

Pontine lesions are suggested by a paralysis of the conjugate lateral movements of the eye, especially if associated with a paralysis of the fifth and seventh nerves as well and with a crossed hemiplegia.

Palsies due to lesions in the midbrain—that is, affecting the oculomotor nuclei in the region of the anterior corpora quadrigemina—may be distinguished by some of the following characters: (1) Other signs and symptoms of intracranial

tumour, especially optic neuritis. (2) Various affections of the movements of the eyes governed by the third nerves. In the earlier stages these affections tend not to be complete, but to pick out some of the movements, while others are spared. Thus, ptosis may be present alone, or a defect in the upward movements only. Holmes,² speaking of the existence of supranuclear centres for the vertical movements of the eyes, mentions "the frequency of disturbance of conjugate vertical movements of the eyes by tumours growing from the pineal body or from the splenium of the corpus callosum, which readily compress the anterior colliculi, and by the observation during the war of three cases of injury of the tectum alone by small penetrating missiles in which the vertical movements of the eyes were affected."

In conclusion I must record my best thanks to my colleagues on the staff of the Western Ophthalmic Hospital, for their kindness in giving me the opportunity of seeing many of their cases, a number of which are included in the personal series which I have quoted.

REFERENCES.

- ¹ Bing: *Compendium of Regional Diagnosis*, London, 1921. ² Holmes: *Brit. Journ. Ophthalmol.*, 1921, 5, p. 241. ³ Sherrington: *Brain*, 1915, pt. 3, vol. 38, p. 191. ⁴ Paton: *Brit. Journ. Ophthalmol.*, 1921, 5, p. 250. ⁵ Wilson: *Journ. Neurol. and Psychopathol.*, vol. ii, No. 5, p. 1. ⁶ Wilson and de Rudolf: *Ibid.*, vol. iii, No. 10, p. 140. ⁷ Natrass: *Ibid.*, vol. iv, No. 14, p. 162. ⁸ Posey and Spiller: *The Eye and the Nervous System*, Philadelphia, 1906. ⁹ de Monchy: *Brain*, 1923, pt. 2, vol. 46, p. 179.

Three Lectures

ON

CONTRACTED PELVIS.

DELIVERED IN THE UNIVERSITY OF LONDON,
FOR ADVANCED STUDENTS,

BY

GIBBON FITZGIBBON, M.D., F.R.C.P.I.,
MASTER, ROTUNDA HOSPITAL.

II.

DIAGNOSIS AND CLINICAL EXAMINATION IN CONTRACTED PELVIS.

Diagnosis.

THE diagnosis of contracted pelvis is easy and can be made at any time before or during pregnancy or in labour. In the nulliparous woman it is made from physical characters and facts; in the parous it is often suggested by the history of previous labours.

Ante-natal clinics establish the fact of contraction, and by so doing serve a useful purpose by preventing a number of cases from entering or continuing in useless labour before the condition is recognized, but owing to the absence of any method of accurately classifying such cases it is impossible to define the treatment in more than a very few.

Contracted pelvis should always be suspected in women of small stature, quite irrespective of any maldevelopment. The majority are under 5 ft. in height; this or the previous history, in women free from maldevelopment, is all that is likely to suggest contraction before the thirty-sixth week; the actual contraction will be established by measurements.

External Measurements.—There are three principal measurements to be taken. The external conjugate, which is normally 20 cm.; and I think it may be accepted that reduction below 19 cm. is chiefly at the expense of the cavity, while when the external conjugate is reduced to 18 cm. the true conjugate is below the average biparietal diameter. There are two transverse measurements—the interspinous and the intercrystal; of these the intercrystal is the truer indicator of the transverse diameter of the brim; it is normally 29 cm., and reduction to 27 cm. means diminution of the cavity. The interspinous is normally 3 cm. less than the intercrystal, but as it is subject to outward splaying in cases of rachitic origin, it is often misleading as to the internal dimensions. From these measurements some idea of the type and degree of contraction is obtained, but little else.

Internal Pelvimetry.—The internal measurements of the pelvis can be taken with special pelvimeters—the best

is Skutsch's: the flexible arm is best made of copper, which is easy to bend and remains in place. When the promontory is difficult to reach there is some difficulty in taking this measurement, but with a conjugate under 9 cm. it can be obtained with fair accuracy. There is never any difficulty with the transverse, and this, in my opinion, is the most important, as the relation of the head to this diameter is always somewhat indefinite.

Radiography.—The estimation of the diameters of the pelvis by radiography has been suggested, and excellent results have been obtained in the non-pregnant state, but for the management of cases it seems to me impracticable. The foetal head and state of pregnancy will obscure the pelvis, and, besides, the cases actually in labour when first seen cannot be carried round for radiography; the facts require to be ascertained without delay, and it is essential that an expert should elicit the facts from the photograph. I doubt if many radiographers will approve of being called upon at night, or even in the day, and asked for a complete report within a few hours.

Influence of Contracted Pelvis during Pregnancy.

In the majority of cases contracted pelvis has no influence upon the characters of pregnancy until the thirty-sixth week. Up to that time the uterine ovoid has sufficient space in the upper abdomen, but when the fundus has reached its maximum height in the abdomen the pressure from above drives the foetus down and the lower pole looks for space in the lower uterine segment inside the brim of the pelvis. The reduced bony space is unable to accommodate the foetal head with the uterine tissues around it and consequently the foetus is kept at a higher level than normal. This gives rise to the most salient feature of contraction—a head high and free above the pelvic brim at a time when in most primiparae and many multiparae the head is already engaged in the brim. Subsequent to this, with the increase of the long axis, the uterus attempts to rise higher than normal, the lower pole cannot descend, and so the fundus gets thrown forward more than normal. It is only in very marked degrees of contraction that actual pendulous belly develops in primiparae, but in multiparae who have previously gone to term the anterior abdominal wall may be overstretched. The incidence of breech presentations is somewhat increased by contracted pelvis, but this is due to its occurrence in multiparae with relaxed abdominal walls, which deprives the uterus of support and allows the cavity to distort before the foetus has taken up its final polar position. In the same way the deflexion of the uterine axis promotes abnormal head presentations and oblique presentations in multiparae. In primiparae, when the degree of contraction is very marked, and particularly when associated with much shortening of the abdominal cavity, the uterine axis is deflected and oblique presentations are likely to develop after the thirty-sixth week, but are very rare before that time.

The average foetus at the thirty-sixth week weighs about 5 lb. and the biparietal diameter is 3 to 3½ in.; this is quite compatible with a pelvic brim of 8 to 9 cm., but when about 2 cm. of the available space are taken up by soft tissues the head cannot enter.

The best time to examine a case is at the end of the thirty-sixth week; the above effects are beginning to show in the marked degrees of contraction or when the foetus is definitely above the average size. The external measurements of the pelvis require to be known so as to consider the type of contraction with other facts. The shape of the abdomen should be noted; in the majority of cases it is quite normal. The head will be found high and mobile above the brim of the pelvis; it should be pushed downwards and backwards into the brim; it will nearly always pass behind the top edge of the pubis. When the head appears to bulge the lower part of the abdomen forwards above the pubis, or when pushed down impinges against the top edge of the pubis, the beginning of disproportion between the head and the true conjugate is suggested. The dimensions of the transverse diameter of the pelvis must then be taken into consideration. If the intercrural diameter is large, as in simple flat pelvis, a considerable amount of forward overriding is permissible, but transverse contraction reduces

the margin of safety. Those cases in which disproportion is evident require a more complete examination under an anaesthetic; this will only be indicated in 10 to 15 per cent. of cases. The other cases may safely carry on for another two weeks and should then be palpated again. At this time another 10 to 15 per cent. of cases will indicate the need of examination under anaesthesia, while the remaining 70 per cent. of all cases will still show good proportions and may safely continue to term. These cases should be told to come into hospital on a certain date calculated as term, if labour has not occurred, as a few may tend to prolongation of pregnancy, and this should be avoided unless the proportions are still perfectly satisfactory.

Now this has only entailed the external measurement during pregnancy of cases suspected of having contracted pelvis, and one or two palpations of the abdomen, but from this it is possible to select the cases likely to develop difficulty, and these require fuller examination.

Examination under Anaesthesia.

Under anaesthesia it is possible to make a more accurate estimate of how the head enters the brim. If there is a breech presentation it can be changed to a cephalic by external version, and this will always be advisable where there is doubt about proportions. It is also possible to take the internal measurements of the pelvis and to palpate the brim and promontory. This is called for at any time from the thirty-sixth week to term, or even in labour if the proportions, as estimated by palpation through the abdomen, indicate that the head is becoming too large for the conjugata vera.

The patient is placed in the dorsal cross-bed position or in a gynaecological chair. Complete relaxation is required. Two fingers are passed into the vagina, and the promontory located; if this can be done at all easily the conjugate is certainly down to 9 cm. The second piece of the sacrum is easily reached, but in a primipara the actual promontory is difficult or impossible; the promontory is only positively reached when the vertebral column is definitely recognized to be receding from the finger-tip. In parous women it is often better to use the half-hand. The diagonal conjugate is estimated by measuring from the promontory to the lower edge of the pubis as estimated on the fingers. My own experience of this measurement is that it is extremely difficult to obtain, and requires considerable skill to be certainly obtained. The majority of junior interns fail to reach the promontory at all. When the measurement is obtained the necessary corrections to find the true conjugate are so speculative as to render the result useless. Therefore the main observation to be made is whether the promontory can be reached or not.

Next the lateral edges of the brim should be palpated and ease or difficulty noted. If the brim is felt with any ease behind the level of the ischial spines there is a considerable reduction in the transverse diameter of the pelvis.

The foetal head is next felt; it is high, away from the brim, but can be made out, usually lying symmetrically over the brim. The left hand then defines the head through the abdominal wall and pushes it down in the axis of the brim. When this has been done it is often well to get someone else to steady the head and apply a little pressure, but the direction must be controlled by the examiner. The fingers in the vagina are then slipped up to the top of the pubis or as high as they can go till they reach the head. If the head fits behind the pubis, the fact will be recognized by the want of space, while when the head impinges on the top edge of the pubis the fingers can pass up high and the angle between the head and the pubic bone is fairly wide. The fingers are then swept round the head where it comes in contact with the pelvic brim, and the amount of space at the sides is estimated. Unless the lateral contraction is marked there will appear to be considerable room towards the lateral walls.

The external measurements of the pelvis will have supplied data as to the transverse diameter, and as this diameter is practically never the obstructing one it is chiefly the antero-posterior relations that require to be tested.

When the head impinges against the top of the pubis the

two vaginal fingers are pushed up into the angle between the pubis and the head and the thumb is placed over the front of the pubis to feel the top edge; if the head does not impinge against the thumb it will easily pass the brim without alteration of its diameters. If the head impinges against the thumb, the biparietal diameter has reached the limit that will pass in the conjugate, and the dimensions of the transverse diameter must be taken into count, as a normal transverse will allow the head to move laterally and bring the smaller bitemporal diameter into the conjugate. This estimation gives a very excellent basis for treatment; there is always the space occupied by the soft tissues around the head which cannot be displaced, on the side of safety.

Conclusions to be Drawn.

When the head enters the brim the case may safely continue for another ten or fourteen days irrespective of the type of pelvis.

When the head impinges against the pubis but not against the thumb it will pass easily although big enough for the conjugate, but may be allowed to continue for ten to fourteen days if the transverse is large.

When the head impinges against the thumb it will only come through easily if the transverse is large so that the bitemporal can take the place of the biparietal. With this condition induction of labour, if adopted as treatment, must be done at once in any type of pelvis, and in all except the simple flat type there is the possibility of difficulty arising; if this is not to be faced it will be best to let the case carry on to term for section, or if already at or near term to fall into labour and be given a trial.

The essence of examination is to establish the relative size of a particular foetal head with the individual pelvis through which it has to pass.

The investigation I have described applies particularly to cases in the last few weeks of pregnancy. But even when labour has started and the size of the head and pelvis have to be taken as they are, a full examination under anaesthesia should be made in practically all cases before deciding that pelvic delivery is not possible.

INFLUENCE OF CONTRACTED PELVIS IN LABOUR.

The entire question in treatment of contracted pelvis is to decide which cases are capable of safe delivery through the pelvis; this can only be decided, in the majority of doubtful cases, by an actual trial of labour, and for that purpose it is essential to understand the effects produced by contracted pelvis in the process of labour at all its stages, and upon the foetal and maternal parts.

First Stage of Labour.

I have pointed out that malpresentation is not greatly increased by contraction, so that when labour starts the head nearly always presents as a vertex, it is high above the brim, but the lower uterine segment applies itself to the head in quite the normal manner. The dilatation of the cervix proceeds in proportion to the pains and the bag of membranes acts upon the internal os. The membranes are protected from abnormal tension by the lower segment of the uterus applying itself to the head. The internal os dilates and then the cervical canal begins to be taken up, but the head comes down very slightly as it is still unable to enter the brim on account of the surrounding tissues and recedes in the intervals between the pains. It is only when the disproportion between the head and the brim is great, so that the head overrides markedly or lies obliquely, or is deflected by pendulous belly from previous pregnancies, that the lower segment does not apply normally to the head; so when the cervix reaches two to three fingers' dilatation the membranes are subjected to uncontrolled pressure and rupture prematurely as the result of labour. There are the same accidental causes of premature rupture of the membranes not due to labour as in normal cases, and these must be distinguished from premature rupture in the first stage the result of a faulty process. On the whole the first stage is not affected by contraction except with marked disproportion, or by secondary conditions. It proceeds normally in proportion to the uterine action and is completed within the normal time

When the membranes rupture prematurely in the first stage as the result of some associated condition, such as pendulous belly, the escape of the liquor amnii frequently will allow the head to come down better, and if the associated condition is removed the head will enter the internal os and complete the dilatation quite as well as the bag of waters. On the other hand, when the disproportion is the actual cause of the early rupture the head cannot enter the internal os, dilatation comes to a standstill or even recedes, while stretching of the lower segment progresses.

Second Stage of Labour.

It is after the rupture of the membranes that the influence of contraction is noticed best. In the majority of cases the cervix reaches full dilatation before the membranes rupture, the head remains high and free till then, but when full dilatation is reached the cervix, by slipping up, is removed from in front of the head and is retracted, while the head advances and the membranes are ruptured by the increased pressure. The drawing up of the cervix removes the uterine tissues and a considerable amount of parametric tissue from between the head and the brim, thus increasing the available space. The head enters the brim, and with the next few pains the greatest diameter passes and the head slips easily into the cavity of the pelvis to reach the constriction of the outlet.

Moulding.

During the first stage of labour the head is only gripped by the uterine tissues; even when the membranes are ruptured, if the cervix is undergoing dilatation, the head is only subjected to pressure by the soft tissues during contraction of the fundal pole, but as the lower segment and cervix are giving way and progressively dilating, this takes up the pressure from the fundus and the head is little or not at all affected.

When the second stage is reached, if the removal of the soft tissues leaves sufficient room for the head in the brim it advances as the result of contraction of the fundus. On the other hand, if the brim is too small for the head it comes down against the firmly resisting bony brim and the action of the fundus is all applied to the head and results in moulding. When the cervix is not fully dilated and the membranes rupture, if the brim is too small for the head it supports the soft tissues and slight moulding occurs during the pains, but never amounts to much if the cervix continues to dilate, as this takes up most of the effect of the uterine action. When the cervix does not continue to dilate, the lower segment progressively stretches and maintains a constant pressure on the head, while the fundal contractions drive the head into the narrow brim, compressing the interposed soft tissues and producing even considerable moulding.

Moulding must be looked upon as evidence of disproportion between the head and the brim; it only really begins when the head is maintained in contact with the resistant bony walls. It progresses in proportion to the uterine action and distorts the head according to the presentation until it has produced sufficient reduction in the obstructing diameter to enable the head to pass the obstruction, and if this point is not reached moulding only terminates when the uterine action ceases to be strong enough to overcome the resistance of the tissues of the head. Moulding beyond the degree of taking up the slack in the tissues of the head must always be considered evidence of obstruction. The alteration in the contour of the head takes some time and does not disappear with the removal of the compression. When the moulded head passes the brim it enters the relatively more roomy cavity and comes against the pelvic outlet. The outlet has to be dilated, but in my opinion it is only in very rare types of contracted pelvis that more moulding is required for the passage of the outlet. The perineal tissues then have to be dilated, and delay in the advance of the head through the outlet or over the perineum is invariably due to falling off of the expulsive forces, which have been used up in the difficulty at the brim, rather than from disproportion calling for further reduction of the head by moulding.

Changes in Vertex Presentation.

Before the onset of labour the head, unless deflected by some associated condition, lies over the brim of the pelvis in what is best called the quiescent state or flexion—that is,

with the middle of the sagittal suture in the axis of the brim.

The first effect of uterine action is to press down the fundal pole of the foetus and increase flexion of the head on the shoulders, thus producing the normal flexion of a vertex presentation. The fundal action is then transmitted through the head to the lower segment and cervix, which dilate and no more flexion occurs, and when the cervix reaches full dilatation the tissues slip up and the head enters and passes the brim as a vertex. When the brim is too small the head is delayed and abnormal flexion or movement of the head on the shoulders occurs as it is forced into or against the brim.

Posterior Fontanelle Presentation.—In the generally contracted, transversely contracted, and generally contracted flat pelvis with slight flattening, the head remains in the middle line of the pelvis and the force transmitted through the cervical vertebrae produces hyperflexion. The degree to which this occurs depends upon the amount of resistance after the head has entered the brim. Thus, when the disproportion is slight the head comes through as a vertex with very little moulding, when the disproportion is great the head becomes a posterior fontanelle presentation, the chin is pressed firmly into the sternum, and the tissues at the back of the neck are under severe tension. The head may not be capable of reduction sufficient to pass the brim or may come through greatly moulded. In this case the moulding has the effect of considerably reducing the angle between the occipital and parietal bones and greatly elongating the supra-occipito-frontal diameter of the head.

Anterior Fontanelle Presentation.—In the simple flat and generally contracted flat pelvis with a relatively marked degree of flattening, the head, when it is arrested at the brim, is held up by the conjugate but unsupported at the sides. Owing to the sinciput being narrower than the occiput the head moves towards the side of the pelvis occupied by the occiput; this may allow the head to pass with the bitemporal diameter in the conjugate, while the head remains in the vertex position, or, as a result of slight relative delay of the occiput against the lateral brim of the pelvis, the head may move into unflexion—that is, with the anterior third of the sagittal suture in the axis of the brim. If the occiput moves too far it is arrested against the side of the brim and the force of the uterus drives the sinciput down, so that the head moves out of flexion into extension and becomes first an anterior fontanelle presentation and later may become a brow. In my opinion anterior fontanelle presentation never occurs as the result of the occiput moving to the side of the pelvis, if the head can pass; it is always the result of actual arrest of the head after excessive lateral movement.

Asynclitism: Parietal Presentations.—With or without hyperflexion or extension the uterine action in driving the foetal body down against the arrested head may make the head bend laterally on the shoulders, so that the sagittal suture leaves the axis of the brim and one or other parietal bone comes to lie lowest. This movement of the head has been claimed as an aid in the passage of the head through a contracted brim. I hold most emphatically that this is not so; there is no diameter of the head from a point above the parietal eminence to a point below the opposite eminence which is shorter than the biparietal diameter. When asynclitism develops it is the result of obstruction; the head may be forced through the brim in an asynclitic position, but this will only result from moulding and the head would have moulded through more easily if it had remained synclitic. I have never known a head to come through as a parietal presentation; I have known a head brought through by upper strait forceps as an anterior parietal presentation, but I have not known a foetus survive. Anterior parietal presentation is considered more favourable than posterior. The belief that asynclitism helps the passage of the head arises from mistaken observations. When the head moulds, one parietal bone overrides the other—most commonly the anterior over the posterior. In marked moulding the edge of the lower bone at the sagittal suture comes nearer the promontory or the pubis and gives the impression that the sagittal suture has moved out of the axis of the pelvis, but in reality the head is synclitic, and the middle line of the head is in the axis of the pelvis. Asynclitism occurs when the head is markedly arrested and

is unable to enter the brim sufficiently to become fixed; it is also promoted by deflexion of the axis of the uterus, as occurs in marked degrees of contraction or when pendulous belly is associated.

Mechanism.

Two forms of mechanism are described in contracted pelvis; both are the result of obstruction at the brim, and not properly due to the contraction. Mechanism is normally nothing more than the simple mechanical adaptation of the long axis of an irregular solid body to the available diameters of an irregular passage. It is quite spontaneous and when force is applied is likely to result in jamming.

In contracted pelvis, when there is loss of space in the transverse diameter of the brim, the head lies in the middle line and resistance to its passage results in hyperflexion; then if the head is able to be forced through by moulding, it passes the brim with the posterior fontanelle lying lowest. The fontanelle may come very low in the cavity before the greatest diameter is past the brim, but as soon as the obstruction is passed, if the head becomes free in the cavity, internal rotation takes place and delivery is by extension. The only variation from the mechanism of normal vertex is a movement towards hyperflexion in proportion to the obstruction. If the moulding required is great, even when the head passes the brim there is a relative impaction, and this is likely to prevent spontaneous movement; the advance of the head depends upon crushing past the narrow parts instead of mechanism.

In the simple flat pelvis there is available space in the transverse of the brim, and, following the simple law of mechanics, the head moves laterally towards this space; this may result in the head being able to pass the narrow conjugate, the occiput may be slightly delayed by close apposition to the side of the pelvic brim, and so the head undergoes a slight unflexion and passes the brim with the anterior third of the sagittal suture lowest; but, having entered the cavity, it finds free space and again flexes normally, to be born as a vertex by the normal mechanism. This is all simple mechanics, and only varies from the normal mechanism of a vertex by the lateral movement and slight unflexion as the head enters the brim, and the passage through with the sagittal suture in the transverse of the pelvis. If after the lateral movement has occurred and the head enters the brim it has to be reduced in size by moulding, it is flattened transversely, and this flattening may have to be maintained all through the pelvic canal, so that normal mechanism is interfered with and the advance depends upon crushing of the head through; but the occiput is no longer delayed, and so the head may move secondarily into hyperflexion, which will improve the chances of internal rotation taking place.

Impaction.—When the proportions of the head to the pelvic brim are such that by hyperflexion or lateral movement it is enabled to engage but is not capable of sufficient reduction by moulding to pass the brim, impaction occurs and the head remains with a varying amount through the brim but the greatest diameter still above the constriction. When, as the result of marked moulding, the greatest diameter is forced past the brim, the head may be greatly distorted and requires the maintenance of the reduction in the pelvic cavity, mechanism fails, and impaction occurs in the pelvic cavity or at the outlet.

Effects upon Uterine Action and Condition of the Uterus.

In all the above conditions the uterus is called upon to exert more force than normal in obtaining the passage of the head through the brim. If the demand is moderate the progress of labour is not much affected, but where the difficulty is great the uterus may develop inertia, or the prolonged and excessive action without advance of the presenting part and reduction of the uterine contents may produce excessive stretching of the tissues—threatened or even actual rupture of the uterus or fornices. If the cervix has reached full dilatation it is the vaginal fornices and cervix that are overstretched, but when the cervix ceases to dilate the lower segment is the part affected.

When impaction has developed a large amount of the head will have been forced past the brim and the cervix will have

reached a considerable degree of dilatation, if not fully dilated. The impacted head produces severe pressure effects upon the soft tissues of the cervix, or vaginal fornices, and the parametric tissue between the head and the bony pelvis. If this pressure is allowed to persist for long the vitality of the tissues is reduced, and they may subsequently undergo necrosis while the risk of infection is increased.

All these influences of contracted pelvis on labour are the result of actual disproportion of the head to the pelvis; they arise indirectly from the contraction but directly from the obstruction.

Variations of the vertex presentation result from delay in the head entering the brim after it has come against the bony wall. Moulding begins when the head has engaged in the brim but is too large to pass.

Mechanism depends upon the ability of the head to move so as to adapt its diameters to the available space; it follows the ordinary laws of mechanics, and when these fail to enable the head to pass jamming occurs. Further advance depends upon crushing of the head through the narrow parts; if this fails impaction results, and the effects of impaction progressively advance even though secondary uterine inertia sets in and persists.

Alterations of the vertex and moulding and arrest of the head do no harm of themselves, but it is essential to understand their import, as they indicate obstruction, and when that persists serious effects are produced on the mother and infant.

THE DIET DURING INSULIN TREATMENT OF DIABETES MELLITUS:

THE NEED FOR CAREFUL CONTROL.

BY

K. S. HETZEL, M.B., B.S. ADELAIDE, M.R.C.P. LOND.,
ASSISTANT IN THE MEDICAL UNIT, UNIVERSITY COLLEGE HOSPITAL.

SINCE the introduction of insulin into clinical practice several comprehensive lectures and papers have been published in the *BRITISH MEDICAL JOURNAL* on the principles which should guide the use of this remedy. These papers reflected the scientific thought of the writers, and they naturally analysed in close detail the changes in the blood sugar of patients under treatment, while the building up of the dietaries was also considered in reference to the somewhat intricate formulae that are required for accurate metabolic work. Frequent blood sugar estimations are obviously impracticable for many of the diabetic patients who may be under medical treatment in Great Britain, and it is not unlikely that some of those medical practitioners who have hitherto been unfamiliar with the calculation of foodstuffs according to their energy equivalents may be inclined to put aside the accurate measurement of these foods as being a matter of troublesome scientific complexity, like that of determining the blood sugar, and to decide that practical purposes can be sufficiently served by ordering insulin and merely giving some general instructions with it about the need still to be careful with food.

Insulin is not an all-powerful remedy, nor is it cheap. Provided that its use is accompanied by a firm and intelligent control of the diet, it has the most astonishing power to arrest the downhill progress of a case of diabetes; but if the diet is carelessly managed the diabetic will in all probability get worse despite the insulin, and the costly remedy is simply wasted. The diet must always continue to be limited in such a way, especially in respect of carbohydrates, that glycosuria shall not persist. Insulin makes this possible on a slightly more generous supply of food than could otherwise be allowed, and it can thus be used to abolish excess of blood sugar and give the islets in the pancreas a chance to recover their proper function when they are spared the continual exhaustion which the stimulus of excessive blood sugar seems to induce in them.

When insulin was first introduced stress was laid on the need to measure blood sugar changes, because there was some apprehension that fatalities might occur from

overdosage. Practical experience has shown that this danger is relatively slight, because the patient's own symptoms generally give early warning of overdosage in time for sugar to be given and serious collapse averted. Blood sugar measurements are, therefore, not essential for the ordinary management of a case, though they cannot be neglected if the best results in treatment are desired. But the accurate knowledge and control of the diet allowed to a patient under insulin treatment is of bed-rock importance; and now that the supplies of insulin have become abundant enough for the preparation to be used widely in various types of medical practice, panel or otherwise, there is some occasion to fear that it may be used wastefully through neglect of dietetic control. In 1922 there were rather more than 4,500 deaths from diabetes in England and Wales, which, on an average expectation of life of rather less than four years from the onset of the malady, would suggest a total of something approaching 16,000 diabetics in England and Wales alone. The weekly sales of insulin in Great Britain average nearly 500,000 units, which would amount, at the recently lowered price, to an annual cost of over £150,000; and that would suffice for the treatment of perhaps 4,000 out of the total number of diabetics. It is obvious from these general figures that all possible economy must be exercised in the use of insulin if the medical profession is to realize its desire that this remedy shall be employed for the help of all sufferers from the disease.

The case of which details are given in this paper, by the kind permission of the medical practitioner concerned, is an outstanding example of the waste that may occur when an entirely new remedy is made generally available without adequate instruction in its use.

CASE.

A bricklayer, aged 43 years, first came to University College Hospital early in March, 1923. He was complaining of ravenous appetite, thirst, and polyuria of six to seven months' duration, together with loss of weight. The urine contained a large amount of glucose. There were no complications. Owing to the scarcity of insulin at the time his doctor was advised to try to abolish the glycosuria by dieting. This was done for about a month and the symptoms and the glycosuria disappeared.

Nothing further was heard of this patient until November 27th, when he again came to the out-patient department with a letter from his panel doctor. Early in June the patient had been put on insulin, three injections daily, each of 10 units. There was no attempt to restrict the diet, the patient being permitted simply to choose his own food. The results at first seemed satisfactory, for in two months he gained over a stone in weight. The urine continued to contain large amounts of glucose despite the insulin. The man returned to work, for which, however, he soon became quite unfit, and then steadily lost weight. He was admitted to hospital on November 28th. He was a spare man, weighing 7 st. 11½ lb., instead of his normal 10 st. There were no abnormalities of health apart from the simple diabetes mellitus. The urine (specific gravity 1038) contained 6 per cent. of glucose and abundant acetone bodies.

The next day his glucose tolerance was ascertained. He had fasted after supper on the previous evening, and at noon 40 grams of glucose in 150 c.cm. of water were given by the mouth. The blood sugar was estimated every half-hour for three hours and the urine collected every hour. The fasting blood sugar at noon was 0.20 per cent.; the percentage rose to 0.37 half an hour later, and then fell progressively to 0.25 at the end of three hours. The blood sugar curve revealed a clear defect in the storage and utilization of carbohydrate. In three hours the blood sugar was still above its initial level and it was falling very slowly. The maximum excretion of glucose in the urine was 12.6 grams in one hour, the leak point of the kidney being below 0.20 per cent. All the specimens of urine gave heavy reactions for acetone and aceto-acetic acid.

He was then given a diet of 820 calories, composed of 22 grams of carbohydrates, 42 grams of protein, and 63 grams of fat. He had only partaken of two meals when he complained of a "load on his chest causing difficulty in breathing," and had abdominal discomfort with vomiting. He was not constipated. He then felt dizzy and was drowsy and unable to think clearly. His breath smelt very strongly of acetone, but there was only slight air hunger. He had received no insulin since admission to hospital three days previously and was undoubtedly drifting rapidly into diabetic coma; 20 units of insulin were injected immediately, and he was able to take some carbohydrate food. The insulin was repeated every four hours and the house-physician was instructed that if a fresh specimen of urine became sugar-free while still showing ketosis the patient was to be given 15 to 20 grams of glucose by the mouth immediately before giving the insulin. After five injections of insulin, each of 20 units, and one administration of 20 grams of glucose the urine was free from sugar and contained no acetone or aceto-acetic acid. The patient felt much better; he was bright and hungry, and there were no symptoms or signs of excess of ketone bodies.

After this critical attack his diet was steadily increased to one