The Graphic Monitoring of Labour*

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SUMMARY

A graphic method of monitoring labour is presented. The literature concerning recent trends in assessing foetal well-being and the progress of labour are briefly reviewed. Based on the latter, the Addington Labour Observation Chart was designed and provides a concise and objective method of measuring the variable parameters in labour. Clinical application of the chart was assessed during a 2-year period, involving over 4 000 deliveries. The labour chart is of particular value in units where sophisticated monitoring equipment is not available. It is suitable for use by relatively inexperienced personnel.

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Every foetus has the right to be well born. In modern-day obstetrical practice, it is not only mandatory that every attempt be made to ensure that the infant is born alive, but that its future intellect should be intact as well.

Of the three crucial phases of intra-uterine life, implantation, development, and birth, it is often the latter phase which is responsible for much preventable morbidity and mortality. Yet most practising obstetricians, having personally and carefully monitored the pregnant subject during her entire antenatal period, rarely observe what is probably the most important 12 hours of any individual's life — the clinically recognizable state of labour.

Desirable as it may seem, it is nevertheless impossible for busy doctors to be in attendance throughout labour. During the past 2 years, a system of monitoring labour was evolved at Addington Hospital, based on our own experience and that of clinicians and research workers elsewhere. As a result, it has been possible to consolidate recent trends into a practical clinical approach to the intensive observation of the unborn child during labour. Since all the relevant details are recorded in simple graphic form, reliable, intelligent and accurate interpretation of the labour process is now possible by even the most junior midwife.

BASIS OF THE MONITORING SYSTEM

There are three distinct aspects which require monitoring during labour: the presence/absence of foetal distress; the progress of labour; and the response of the mother to the stress of labour. In order to appreciate the rationale of our system of monitoring, a brief review of some of the changes which occur is deemed necessary.

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Foetal Well-being

Intra-uterine foetal anoxia is a potent cause of perinatal mortality and morbidity. When severe, it can produce permanent damage to nerve cells in the brain. Death results if vital areas such as the respiratory centre are involved, and mental defect, palsies and less apparent learning difficulties and other mental aberrations, if the cortex is affected.

During the height of a contraction, blood flow through the uterus and placenta is arrested for a variable time.[1,2] Consequently, a 'physiological' degree of foetal asphyxia during labour is always present. Since the margin of safety is often very narrow and unpredictable, 'pathological' asphyxia is liable to occur, particularly when labour is prolonged, when contractions are powerful and sustained, or when placental function is compromised, e.g. in postmaturity.[3] The foetus reacts to hypoxia by the passage of meconium in the liquor and by alterations in the rate and rhythm of the heart — the classical signs of foetal distress. These are usually elicited by auscultation of the foetal heart between contractions and by vaginal observation, once membranes have been ruptured. Although by no means infallible, these signs (especially when gross) correlated fairly well with the condition of the baby at birth, and were accepted parameters in everyday obstetrical practice.

In 1958, James *et al.*[4] established that neonatal acid-base measurements were reliable criteria in assessing the degree of asphyxia. This was adapted by Saling,[5] who described a technique of foetal blood sampling and used the pH value as a guide to the well-being of the foetus *in utero* during labour. The clinician, by determining the pH of foetal blood could now obtain a more specific index of hypoxia than the subjective evidence provided before by the usual clinical signs of foetal distress. Once projected into practice, it soon became apparent that the previously accepted signs of foetal distress provided an exaggerated index of significant foetal hypoxia. In one well-documented study, for example, foetal acidaemia (pH of less than 7.25) occurred in only 15% of patients who showed clinical signs of foetal distress. Foetal tachycardia (foetal heart rate more than 160 beats per minute), was the only consistently important sign. Meconium staining of the liquor in the absence of any foetal heart abnormality rarely denoted hypoxia.[6]

On the credit side, it was noted that no cases of acidaemia were detected in any of the foetal blood samples performed routinely on 'at risk' cases, in the absence of clinical foetal distress.[6]

With the introduction of sophisticated electronic monitoring equipment such as the cardiotocograph, it became possible to measure the behaviour of the foetal heart

(FHR) during uterine contractions. As mentioned previously, every contraction produces an 'hypoxic stress' to the foetus, and, depending upon the integrity of the foetoplacental unit, a variable pattern will result. These have been well documented by both Hon[7] and Caldeyro-Barcio *et al.*[8] More recently, assessment of foetal hypoxia during labour was made by comparing the various patterns of continuous FHR recordings with the pH of foetal scalp blood collected at the same time.[9,10] In practical, if somewhat oversimplified terms, the interpretation of these tracings depends on the following features: (*a*) the base-line foetal heart rate between contractions; (*b*) the increase (acceleration) or the decrease (deceleration) of the heart rate during a contraction; (*c*) the timing of this change in relationship to the uterine contraction (for example, if the foetal heart is slowed at the commencement of a contraction, this would be termed an early deceleration pattern; if it occurred later, the term late deceleration would be applicable); (*d*) the recovery of the foetal heart rate at the end of the contraction.

Normally, the base-line foetal heart rate should range between 120 - 160 beats per minute; there should be some variability in the beat-to-beat rhythm;[9] during a contraction the foetal heart rate should either remain the same, or develop an early acceleration or deceleration pattern of low amplitude (not above 160 or below 120 beats per minute); the foetal heart rate should return to the base-line at the end of the contraction phase.

The following patterns are usually associated with significant degrees of foetal acidaemia and, by inference, hypoxia:[9,10] (*a*) a base-line foetal tachycardia (> 160 beats/minute) especially if there is a loss of beat-to-beat variation; (*b*) the appearance of late deceleration patterns, i.e. slow recovery of the foetal heart rate after a contraction; (*c*) a progressive increase in the amplitude of the deceleration; and to a lesser extent (*d*) base-line brachycardia (<120 beats/minute).

From the above it may be concluded that clinical signs of foetal distress are not infallible indices of foetal hypoxia. However, one rarely gets significant foetal acidosis without preceding foetal heart irregularities[6,11] provided the foetal heart rate pattern is interpreted in relationship to a uterine contraction.[9,10] Thus an early and fairly accurate sign of foetal distress can be easily established. This is particularly true if there are co-existent 'at risk' obstetric factors. The presence of meconium staining of the liquor *per se* is a poor reflection of foetal acid-base status.

Progress of Labour

Prolonged labour carries with it attendant risks to both mother and foetus. It is generally accepted that the average duration of the first stage of labour in normal primigravidae is 12 hours.[3,12] Yet prolongation of this stage in the absence of any obvious abnormality, such as foetal malpresentation or major disproportion, is often and somewhat surprisingly accepted by many obstetricians with 'watchful expectancy'. Because aetiological factors to account for inefficient uterine action cannot be found, it does not mean that they do not exist. Early recognition and early treatment can only be of ultimate benefit to both mother and foetus.

Progress of labour is best assessed by monitoring the pattern of cervical dilatation, the progressive descent of the presenting part, and the behavioural pattern of the uterine contractions.

Cervical dilatation: Following the course of labour by frequent and serial vaginal examinations, it has become possible to define and quantitate the interrelationships between time and cervical dilatation in normal human pregnancy.[13-15] The cervix dilates progressively during the final 4 weeks before the patient goes into clinical labour. The curve of dilatation during late pregnancy is one of constant but slow acceleration. Consequently the average dilatation of the cervix during the last week of pregnancy (in both nulliparous and multiparous) is approximately 1 cm.[15] The mean cervical dilatation during the 3 days before the onset of labour, advances to about 2 cm. The average dilatation of the nulliparous and multiparous cervix when admitted in early labour is about 2,5 and 3,5 cm, respectively.[15] From this phase of 'pre-labour', the patient now progresses into what is known as 'active labour', i.e. the time when both the patient and the attendant doctor are aware that labour has commenced. This period is characterized by painful contractions, which occur at intervals of 5 minutes or less. The rate of cervical dilatation is surprisingly predictable and should not be less than 1,2 cm per hour in nulliparae or 1,5 cm per hour in multiparae.[14] Shortly before full dilatation, a phase of 'deceleration' is said to occur, and marks the onset of the 'pelvic' division of labour, i.e. the period when the foetus negotiates the pelvis.[14] Hendriks *et al.*,[15] however, rarely see this phase in otherwise perfectly normal labour, and when present, regard deceleration as an early manifestation of dysfunctional labour.

Due largely to the efforts of Friedman,[19] a system of 'graphico-statistical analysis' of labour was developed. By plotting cervical dilatation against time, a mean curve of labour could be drawn, thus making it possible to follow labour critically as it progressed.[16]

Earlier work undertaken by Friedman[13] noted that the mean duration of the 'latent' phase, before active dilatation of the cervix, i.e. up to a cervical dilatation of 2,5 cm, took 7,3 hours; cervical dilatation from 2,5 cm to 4 cm accelerates slightly, taking approximately 90 - 110 minutes;[15] while the 'active' phase of cervical dilatation from 4 cm to 10 cm (full dilatation) progresses at a constant rate of approximately 1,5 cm per hour.[14,15] Based on the above data, a modification of the original Friedman curve was designed (Fig. 1.).

Once active dilatation has been established, cervical stasis (as elicited by failure of the cervix to dilate progressively according to the curve discussed above) is indicative of some abnormality. This can only be due to foetopelvic disproportion and/or inco-ordinate uterine action.

Descent of the presenting part: Progress of labour is also assessed by the descent of the foetal presenting part. The pattern of foetal descent reflects directly on the interaction and adaptation between the four factors necessary

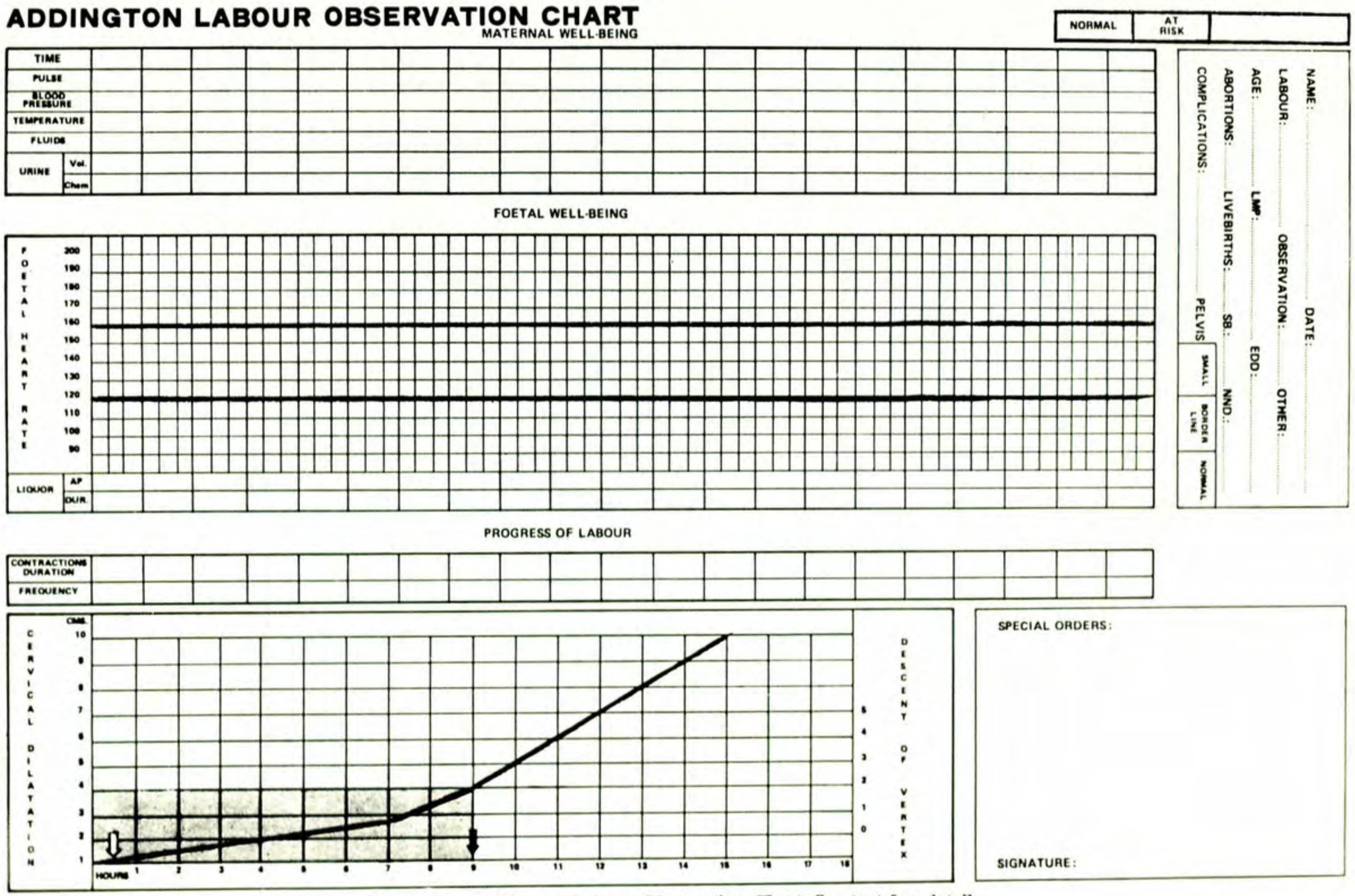

Fig. 1. The Addington Labour Observation Chart. See text for details.

for successful delivery, namely, the size and position of the foetal presenting part; the diameters and shape of the bony pelvis; the efficiency of the uterine contractions and the resistance of the soft tissues of the pelvic floor. Although some of these parameters, e.g. the pelvic size, may be measured before the onset of labour, the eventual outcome is unpredictable until labour has supervened.

It is usually taught that non-engagement of the presenting foetal head at term is a sign of cephalopelvic disproportion. This sign, which was thought to be particularly true in primigravidae, is now known to be less formidable. For example, Stipp[17] recently studied a group of primigravidae who had entered hospital in labour. These patients were divided into two groups; those with engaged foetal heads, and those with unengaged foetal heads. When these two groups were compared, no statistical difference was found in the length of the first and second stages of labour, the method of delivery and the Apgar rating at birth. The same experience has been shared by many others.[18-20] Abnormal delay in descent of the foetal presenting part, however, is an important prognostic sign. Friedman and Sachtleben[21] showed that if the descent of the foetal head in a nullipara was arrested for an hour or more during active labour, 26% of the patients were later shown to have cephalopelvic disproportion. Moreover, infant respiratory depression at birth and perinatal mortality increased 3- to 4-fold when descent of the foetal head was delayed.[21]

How can one reliably measure foetal descent during labour? 'Engagement' refers to the entry of the foetal head into the pelvis. Engagement and descent are correlated, but are not the same. Engagement cannot take place without descent, but descent can occur without the foetal head necessarily being 'engaged'. By definition, when the foetal head is engaged, the maximum bi-parietal diameter of the foetal skull has passed the plane of the brim of the pelvis. Consequently bony cephalopelvic disproportion (with the exception of the pelvic outlet) is unlikely to be present. The 'station' of the vertex on pelvic examination will then be found to be at or below the level of the ischial spine. Descent of the vertex beyond this anatomical point is used as a 'pelvic assessment' of progress in labour.

Crichton[22] showed that this method was liable to error, as variable degrees of caput formation and moulding give false impressions of the level of the presenting part and mask 'true' descent from 'apparent' descent. He defined engagement according to the number of 'fifths' of the foetal head that could be palpated above the pelvic brim. If no more than two-fifths of the head could be felt above the level of the brim (as judged by the superior margin of the pubic symphysis), the head was said to be engaged. This method of recording the level of the head also allowed for a better assessment of progressive descent as a sign of progress of labour.

Because of considerable variation in the interpretation of this technique, a modification was introduced.[23] Briefly, the method is as follows: the precise position of the sinciput and occiput is determined by lateral palpation (Fig. 2.); the middle finger and thumb of the left hand are then positioned over these two bony prominences (Fig. 3.); the fifths of the foetal head above the pelvic brim may now be determined by observing the number of fingers' breadth of the right hand that can be placed between the upper margin of the pubic symphysis and the thumb or middle finger of the left hand.

Fig. 2. Assessment of engagement. The precise position of the occiput and sinciput is determined by lateral palpation.

Fig. 3. The tips of the middle finger and thumb of the left hand are positioned over the occiput and sinciput. The superior margin of the pelvic symphysis is identified.

With this simple method the clinician is provided with an excellent means of determining the descent of the foetal head, and therefore the functional capacity of the pelvis relative to the presenting part, and the efficiency of labour. Further, when delay in labour occurs, the level of the head above the brim of the pelvis (together with the degree of moulding) will indicate whether vaginal delivery is feasible, or whether it would be safer for the foetus to be delivered abdominally (see later).

Pattern of uterine contractility: The pain of labour relates to uterine action. For that reason 'contractions' and 'pains' are used synonymously.[9] Not all contractions of

Fig. 4. The 'fifths' of the foetal head above the pelvic brim is determined by observing the number of fingers' breadth of the right hand that can be placed between the upper margin of the pelvic symphysis and the thumb of the left hand.

the uterus are painful. When contractions are painful however, the pain is largely proportional to the intensity and increase in intra-uterine pressure. It has been shown that the intra-uterine pressure during the first stage of labour is 5 - 10 mm of mercury between contractions, rising to 35 - 60 mm of mercury at the height of a contraction. During the second stage of labour the resting pressure rises to 10 - 12 mm of mercury, and may reach levels as high as 110 mm of mercury at the acme of the contraction phase. Pain is usually experienced when pressure reaches a level of 25 - 35 mm of mercury, so that normally it is present only when the contraction is well established, and disappears before the contraction is finished.[3]

At first, the contractions of labour last 20 to 30 seconds and occur every 7 to 15 minutes. If labour progresses normally, they become progressively stronger and more frequent, until at the end of the first stage they last for 40 to 90 seconds, with an interval of 2 to 3 minutes.[3] In order for the uterus to attain its maximal efficiency for dilating the cervix and lower segment, the contractile wave should be such that it should cover the whole of the uterus at the height of the contraction. Between contractions relaxation of the uterus should be complete.

By abdominal palpation and observation of the patient's subjective response to a uterine contraction, the above pain/contraction relationship should be elicited. Together with regular vaginal assessment of the dilating cervix, a clinical assessment of co-ordinate labour will thus be possible.

Effect of Labour on the Mother

Labour subjects the mother to considerable physiological and psychological stress. It has been stated[3] that the energy expanded during an average labour, is greater than that needed for heavy manual work. If the supply of calories (usually in the form of carbohydrate) is insufficient, the energy requirement is met by the metabolism of fat and the inevitable development of ketosis. If neglected, electrolyte imbalance with depletion of the potassium content of tissues and depression of muscle activity will result.[3] The foetus may also be affected. Beard[24] in a study of foetal pH just before delivery — when maternal acidaemia is likely to be most marked — found that the incidence of foetal acidosis originating in the mother, was in the region of 10%.

The cardiac output rises by about 30% with each contraction, and may be increased further by voluntary bearing down efforts, pain and anxiety. The systolic blood pressure may rise by 10 - 20 mm mercury with each contraction, probably because about 250 - 300 ml of blood is forced from the uterine sinuses into the general circulation.[25] The pulse rate may be increased, but should not normally exceed 100 beats per minute, even during the second stage.[26] A rise in temperature should not occur. If ketosis develops, a mild pyrexia not exceeding 0,5°C may result.[3]

Intrapartum proteinuria due to the process of labour, has been noted in some 30 - 50% of patients whose urines were negative on admission to the delivery suite. The degree of proteinuria is usually slight, being less than 0,5 g/litre.[12] Provided hydration is adequate, a normal urinary output should occur.

The 'At Risk' Factor

Clinical foetal distress has been noted to occur 4 times more frequently in foetuses at risk, than in those whose mothers were obstetrically normal.[6,27] Furthermore, once foetal distress has appeared, the 'at risk' foetus is twice as liable to develop acidaemia as is the obstetrically normal. The chance of an 'at risk' foetus developing acidaemia is therefore 8 times greater than that of a normal foetus.[6] Particularly vulnerable is the 'small-for-dates' baby, as it is liable to die during labour with little or no warning. This problem is compounded by the difficulty of recognizing the 'small-for-dates' baby during pregnancy.

Other obstetric factors which place the foetus at risk are associated with 'placental insufficiency'. This ubiquitous term, while lacking in precise definition, is used in the clinical sense to indicate that the foetal environment has been compromised, and that the foetus is in jeopardy. Conditions associated with placental dysfunction include post-maturity; maternal age of 35 years or more; grand multiparity; pre-eclamptic toxaemia; antepartum haemorrhage; diabetes mellitus; prolonged and/or hypertonic dysfunction of labour. In some patients none of the above factors are present, the only suggestion of potential placental malfunction being a poor previous obstetrical history—unexplained abortions, stillbirths and neonatal deaths associated with premature labour.

Absolute or relative pelvic contracture is an important 'at risk' factor, relating more to the progress of labour and method of delivery, than to the foetal condition.

INTERPRETATION OF THE LABOUR OBSERVATION CHART

Based on the above information and our own clinical experience, a labour observation chart was designed (Fig. 1). The object was to provide a graphic record of the essential features of labour, and to plot them against predecided values of normality.

In this way, a simple yet scientifically accurate assessment of the maternal response to labour, foetal well-being and progress of labour, can be charted and interpreted.

Obstetrical History

On admission of the patient to the labour theatre, it is essential that the patient be screened for any 'at risk' factors. These are noted in the top right-hand corner of the chart (Fig. 1) and include: maternal age; the expected date of confinement, to determine prematurity and postmaturity; previous obstetrical history (it is more informative to note the actual number of abortions, live births, stillbirths, and neonatal deaths, rather than the patients' parity and gravidity); any obstetrical or medical complication, such as pre-eclamptic toxaemia or diabetes; and a clinical assessment of the pelvis. If there are no abnormal features, the patient is classified as being 'normal,' and is then supervised by the nursing staff. Where 'at risk' factors are present, the respective block is marked, and the reason annotated in the space provided. These patients are kept under constant medical surveillance.

Frequency of Observations

The frequency of observations will obviously vary according to the clinical situation. During normal labour, the following observations are made: the maternal pulse, uterine contractions, foetal heart rate and pad check, are noted every half hour, The blood pressure is measured hourly. The time of observation is recorded in the appropriate column.

Abdominal examination, to monitor the level of the presenting part, and vaginal examination, are performed at 4-hourly intervals. These are recorded separately under 'progress of labour'.

If an abnormality is present and more frequent observations are required, the necessary orders are written in the 'special orders' block. This space is also utilized for prescribing analgesics, sedatives and any other specific medication which may be required.

Maternal Response to Labour

In a patient who is well hydrated, who is receiving sufficient calories, and who is adequately sedated (for her particular needs), there should be no variation in either the pulse rate, the blood pressure or the temperature. To exclude changes caused by the physiological increase in cardiac output during contractions, the maternal observations should be recorded when the uterus is relaxed.

Although mild degrees of proteinuria are acceptable, the presence of ketonuria and a decrease in the urinary output are early signs of 'maternal distress', and require active correction.

The patient's fluid balance can be easily checked by comparing the fluid intake (oral and intravenous) with the urinary output. Urine should be voided every 4 hours. Failure to do so may mask a potentially harmful negative fluid balance, and the full bladder is reputed to have an inhibitory effect on uterine contractions.

By merely running the finger along the appropriate line, alterations indicative of maternal distress will thus be readily apparent.

Foetal Well-being

Foetal well-being is best monitored by noting the reaction of the foetal heart rate to the hypoxic stress of uterine contractions. This can be elicited quite simply by counting the foetal heart rate before, during and immediately after a contraction. No sophisticated equipment is required other than a foetal stethoscope, and, for greater precision, a stopwatch. Where difficulty is encountered in listening to the foetal heart tones, a portable electronic foetal pulse detector (Doptone; Sonicaid), is invaluable. Because the foetal heart often becomes inaudible at the height of a contraction, and since changes in the foetal heart rate at this moment are critical for the rational interpretation of foetal well-being, it is strongly recommended that all Maternity Units be equipped with a foetal pulse detector.

In the absence of 'at risk' factors, the foetal heart rate is recorded half-hourly in the column provided. Each column allows for three observations relating to the basal heart rate, the changes (if any) which occur during the contraction, and the ability of the foetal heart to 'recover' at the end of the contraction. A graphic foetal heart rate pattern will result.

The foetal heart rate early in labour may be well within normal limits. With the passage of time, due to the greater anoxic stress of advancing labour, early placental decompensation may be revealed by alterations in the foetal heart rate response. Therefore, although an individaul recording may be normal, the more important prognostic feature is to note the pattern produced with the passage of time. This is particularly true of patients who have a superimposed obstetric 'at risk' factor.

For greater clarity and easy interpretation, the range of normality is indicated by the area between two red lines, i.e. between 120 and 160 beats/minute (Fig. 1). Bearing in mind the importance of the various 'patterns' discussed previously, any recording beyond these limits must be regarded as abnormal. By simply scanning the graph, it will be possible to screen foetal well-being into three categories: obviously normal (little or no change); potentially abnormal (progressive changes but still within normal limits); abnormal (base-line tachycardia >160 beats/minute, failure of the foetal heart rate to reach base-line levels at the end of a contraction; persistent brachycardia and deceleration amplitudes exceeding the normal base-line).

Less significance is paid to the presence of meconium staining of the liquor. However, when present together with foetal heart irregularity, it does increase the possibility of foetal hypoxia being present. It therefore serves as an additional clinical feature in assessing the foetus's response to the rigor of labour. The presence/absence of liquor at the vulva and its appearance is summarized as follows: 'I' indicates that the membranes are intact; 'C' membranes have ruptured and the liquor is clear; 'M' membranes are ruptured and meconium is present. The degree may be arbitrarily designated by + to +++. Of equal importance is the duration of ruptured membranes. Prolonged rupture of membranes predisposes to the development of intra-uterine sepsis and foetal bronchopneumonia. To guard against this potential danger the time in hours should be noted accurately, and taken into consideration whenever 'progress of labour' is assessed. The duration of ruptured membranes is recorded in hours and noted in the space provided.

The management of foetal distress will depend upon the clinical situation, the degree of foetal distress and the facilities of the Maternity Unit. In the absence of specialized monitoring equipment, particularly when 'at risk' factors are present, it is safest to assume that abnormal foetal heart rate patterns are due to biochemical acidosis. Expeditious delivery of the foetus is then advocated. A more conservative approach may be adopted in units where accurate and reliable foetal scalp sampling is available. Management will be dictated by repeated pH measurements of the foetal scalp blood.

Progress of Labour

Of the three parameters used for measuring progress of labour, cervical dilatation is the easiest to determine, and possibly the most reliable and accurate. This is particularly true once the 'active phase' of cervical dilatation has been reached.

It is often extremely difficult to establish the onset of early 'active' labour. This difficulty is compounded by prelabour cervical dilatation, which in multiparae frequently reaches 3,5 - 4 cm.[15] The dividing line is usually 4 cm. Patients who present with a cervical dilatation of 4 cm or more, in the presence of regular painful contractions, can usually be regarded as being in 'true' labour. In the presence of normal co-ordinated uterine contractions, cervical dilatation should then proceed at the rate of 1,5 cm per hour. To compensate for individual variations, the 'acceleration phase' in the Addington Labour Graph allows for a cervical dilatation of only 1 cm per hour.

All patients on admission must have an accurate assessment of their cervical dilatation. If the cervix is 4 cm (2 fingers) dilated or more, the patient must be regarded as being in 'active' labour, and the degree of dilatation plotted in line with the black arrow (Fig. 1). Repeated vaginal examinations should show a cervical dilatation pattern which either parallels or keeps to the left of the curve. Failure to keep within these limits (cervical stasis), is indicative of either inco-ordinate uterine action, cephalopelvic disproportion or a combination of both. Reexamination of the patient will invariably reveal the basic fault.

It is somewhat more difficult to assess whether patients with a cervical dilatation of less than 4 cm are in prelabour or active labour. To compensate for this difficulty, a 'shadowed' area has been included in the design of the labour graph. When cervical dilatation on admission is less than 4 cm, it is recorded in line with the white arrow. If the cervix has failed to dilate when examined 4 hours later, the patient is unlikely to be in active labour. If the *status quo* is confirmed with the next examination, i.e. 8 hours after admission, the patient can be safely regarded as 'not in labour', and, provided membranes are intact, be discharged. Evidence of progressive cervical dilatation at the 4- and 8-hour examination, however, is indicative of active labour. The patient's subsequent cervical progress should then follow the labour curve.

The duration of labour given by the patient is disregarded. Her arrival at hospital is regarded as 'zero time'. From this point onwards, successive vaginal examinations must show increasing cervical dilatation. If this does not occur, the patient is either not in labour or dysfunctional labour is present.

A fairly accurate assessment of the normality of uterine activity can be determined by noting the duration of the contraction, the frequency, and the characteristic relationship between the hardening of the uterus and the patient's pain. When considered in conjunction with the pattern of cervical dilatation, one should normally observe an increase in both the frequency and the duration of the contractions. The uterus should relax completely between contractions. The length of each observed contraction is measured in seconds. The frequency refers to the interval between contractions. For example, if contractions occur once every 5 minutes, the frequency will be recorded as 1:5. The space allocated for these observations is situated just above the labour graph.

The recording of the level of the head is also plotted on the labour graph, and is repeated every 2 to 4 hours. The scale of 'fifths above the brim' is to the right of the graph (Fig. 1). Because moulding is often indicative of cephalopelvic disproportion, its presence must be noted. It is our practice to designate the level of the head on the graph by ◢. If moulding is present, the degree is indicated by M— to M+++. For example, if the foetal head is found to be four-fifths above the pelvic brim and there is a moderate degree of moulding, the level will be plotted in the appropriate square and recorded as ◢ M++. In the presence of normal uterine contractions and in the absence of cephalopelvic disproportion, progressive descent of the foetal presenting part should be noted.

Provided the above observations are diligently and accurately recorded, both the presence and cause of dysfunctional labour will be readily recognizable at a very early stage. The first warning sign will usually be a delay in cervical dilatation. If this occurs *ab initio*, it may be a sign of primary uterine inertia. Reference to the clinical pattern of uterine activity will then show if the contractions are compatible with normal labour, or if they are suggestive of hypo- or hypertonic inertia. Weak, ineffectual contractions of short duration occurring infrequently, are indicative of the former condition, while hypertonicity of the uterus is characterized by painful, powerful and frequent contractions with poor relaxation. In the absence of disproportion, the treatment is usually by stimulation with an oxytocin infusion, appropriate sedation and hydration. Secondary cervical stasis is most commonly due to absolute or relative cephalopelvic disproportion. Failure of the level of the head to descend and the presence of moulding are warning signs. If present, thorough reassessment of the pelvis, the size of the baby, and position of the presenting part will usually indicate the fault. If disproportion is found, the degree must be assessed. A Caesarean section may well be indicated.

It is not feasible to describe the various types of clinical presentations of dysfunctional labour. These have recently been reviewed in detail elsewhere.[24,25] Suffice it to say, that normal labour is characterized by a reproducible pattern of cervical dilatation, descent of the present foetal part and uterine contractility. Failure to progress accordingly is indicative of some abnormality. To ensure a successful outcome, the cause must be found, and early appropriate treatment instituted.

Monitoring in the Second Stage of Labour

Reference has only been made to monitoring the first stage of labour. It is essential that the same observations be continued during the second stage of labour as well.

The second stage of labour in primigravidae should last approximately 30 minutes, and that of multiparae no longer than 20 minutes. Failure to progress and/or the presence of foetal distress, necessitates thorough reassessment of the patient and an urgent review of the mode of delivery.

Crichton's method[22] of assessing 'fifths above the brim' is most helpful under these circumstances. He described the following 'rule of thumb': if no more than one-fifth of the foetal head is felt above the brim, a vaginal delivery can be safely anticipated (provided outlet disproportion is excluded); if two-fifths of the head is palpable, a trial of forceps or vacuum may be undertaken; if three-fifths or more of the presenting part lies above the pelvic brim, attempt at vaginal delivery is contra-indicated and the patient must be delivered by Caesarean section. This practical approach has been applied extensively in both White[23] and non-White[22,24] practice, and has proved to be invaluable.

Monitoring During the Induction of Labour

Induction of labour by artificial rupture of the membranes and oxytocin infusion is a well-recognized and accepted practice. The administration of oxytocin may however produce some uterine hypertonus.[30] This will be reflected in the type of uterine contraction produced. Since labour is usually induced for some underlying medical or obstetrical complication, foetal hypoxia may also result. This is particularly true in instances of foetal dysmaturity. Both of these potential complications will be detected by monitoring the patient according to the method described above.

Once active labour has been stimulated, further progress should follow the normal labour curve.

CONCLUSION

The practice of obstetrics has long been regarded as an 'art', governed as much by 'experience' as by 'clinical impression'. With the advent of new techniques and advances in bio-engineering, it is now possible to measure scientifically and objectively the various changes which involve mother and foetus during labour. As a result, a more precise range of physiological norms has evolved.

To meet the needs of everyday clinical practice, where costly and sophisticated equipment is not readily available, the above information was adapted and incorporated into the Addington Labour Observation Chart. By providing all the necessary relevant information in a simple, concise and graphic form, it is now possible to monitor progress of labour according to the highest present-day standards.

A minimum of equipment and capital outlay is required.

Experience with these charts over the past 2 years has led to various modifications and improvements. In its present form the chart has reduced the monitoring of labour to one of objective and arithmetic simplicity. Provided observations are recorded meticulously, their rational interpretation will detect developing abnormalities early, and so allow for corrective measures. The well-being of both mother and foetus is thus assured.

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