

A study of 132 pregnant women using a Preamplifier and a standard Electrocardiograph.

Introduction.

by LANCE MILLER '66

During this past summer, a series of 132 fetal electrocardiograms were recorded to study the feasibility and accuracy of using a simple preamplifier with a standard EKG. In this group of 132, there were 116 vertex presentations, 1 transverse lie, 8 breech presentations, 1 set of identical twins and 1 anencephalic fetus recorded. Five EKG's failed to show fetal QRS complexes.

Although the study of the human heart by electrocardiography has been well established for many years, the science of electrocardiography of the in utero heart is a relatively new technique in the past two decades. The purpose of fetal electrocardiography is not to replace our standard clinical methods of studying the fetal heart but only to act as another parameter in assessing the status of the fetal heart during pregnancy and labor. Also, the diagnosis of multiple pregnancies can be made by fetal EKG, and in the earlier stages of pregnancy, this method would probably be better than using X-ray if one is in doubt clinically. Further, in the later stages of pregnancy, if one is in doubt about the presentation, a fetal EKG will readily reveal this factor. This does not mean that fetal EKG should take the place of X-rays or clinical techniques, for as can be readily seen, the fetal EKG will not tell one where the presenting part lies, nor if the fetus will come through a particular pelvis. Therefore this technique has its own advantages and disadvantages, but it does, I feel, have a place in furthering our knowledge and understanding of the unborn.

Before proceeding, I would like to thank all those who assisted me in any way — especially Drs. S.T. Laufer and M. G. Thompkins of the Halifax Infirmary without whose financial and technical assistance this study would have been impossible.

Technique.

A Sanborn Model No. 55 Preamplifier and a Sanborn EKG machine were used for this study. The EKG patient leads were connected to the input of the Preamplifier, and the output lead of the preamplifier to the EKG. A ground wire was connected from the Preamplifier to the EKG. Welsh 30 m.m. suction electrodes were connected to the RA and LA leads of the EKG and placed on the maternal abdomen using standard electrode paste; the R,L. lead was used as the ground electrode. The R,A. electrode was placed approximately 3 cm. above the umbilicus in the mid line, and the L,A. electrode supra-pubically also in the mid line. The R,L. electrode was connected to the right calf. The procedure was explained to the mother by the Obstetrical Nursing Staff. They were told that this was a routine procedure and that no ill effects would be received by either mother or baby. The greatest fear the mothers held was that of receiving a shock when the electrodes were placed on the abdomen.

All but three fetal EKG's were recorded at the patient's bedside. The other three were recorded in the Delivery Room and the R,L. electrode was placed on the right thigh of the Mother, the R,A. and L,A. electrodes remaining in the same position. In no way did the electrodes interfere with the delivery.

The typical fetal EKG shows only the fetal QRS complex, as the fetal P and T waves cannot be distinguished. When the electrodes are placed in the mid-line, the fetal presentation is readily diagnosed. Since the mean electrical QRS axis of the fetus is "upside down" in relation to that of the mother, a Vertex presentation for example will show upward fetal spikes and downward maternal spikes on the EKG. A breech presentation therefore, will show a downward deflexion of both maternal and fetal complexes. This relationship of fetal to maternal spikes in diagnosing the presentation, holds true only when the electrodes are in the mid-line. Larkin also notes various other electrode positions, but only the mid-line, position was used for this study except in 2 cases - #22 and #35.

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Results.

After the patient was made to feel at ease and the electrodes placed in position, the electrocardiogram was checked for standardization. The preamplifier was then set as follows: either the .75 or 1.5 position for high frequency cut-off, low or medium position for the low frequency cut-off, and either the 2.5 or 1 position for the attenuator, depending, of course, upon which combination gave the best results. The two most favored combinations in our series were .75 by M by 2.5 and 75 by M by 1, as these constantly gave the best results.

The earliest recording of fetal QRS complexes was at 19 weeks gestation and the latest was two minutes before birth. In between were the various weeks of gestation and stages of labour during which the fetal EKG's were recorded. Of the 132 cases, there were only 5 cases in which we were unable to record a fetal QRS complex in which, clinically, there was a live fetus. Therefore our accuracy in recording was 96.2 %. In two of these cases, the mother had not yet reached 14 weeks gestation. The earliest recorded fetal QRS complex in one study was 11 weeks gestation.

In Case #1, a fetal heart rate of 70/min was noted which over the next few minutes increased to 150 beats per minute. We were unable to obtain a follow up EKG on the baby after delivery.

Cases #18, 44, 74, 98, 113, 115, 127, and 129 showed breech presentations which were confirmed at delivery.

Case#95 reveals the presence of twins both in the Vertex position, one fetus having a heart rate of 120 beats per minute, and the other with a heart rate of 125 beats per minute. This was confirmed at delivery with the birth of two live, identical twin girls.

Case #68 shows a fetal heart rate of 200/min. In this case, X-ray and delivery revealed an anencephalic fetus which died shortly after birth.

Case #35 revealed a transverse lie: with electrodes in the mid-line we were unable to pick up any fetal QRS complexes; however, by placing the right arm electrode to the right and below the umbilicus and the L.A. electrode to the left and below the umbilicus at the same level as the R.A. electrode, fetal QRS complexes were readily recorded.

Case #106 is that of a woman of 20 weeks gestation in whom it was felt clinically that the fetus was dead. A fetal EKG revealed what appeared to be questionable isolated fetal spikes. However, a pitocin drip was started and on expulsion of fetus it appeared that at no time was this baby alive during recording of the fetal EKG.

Case #121 was that of a patient who entered hospital at 31 weeks gestation with painless bleeding. A fetal EKG revealed a heart rate of 300-400/min., definitely indicating fetal distress. Clinically, the heart was auscultated at 140 beats /min.

The remaining cases showed no peculiar abnormality of either fetus or EKG.

Summary.

A simple Preamplifier and Standard EKG were used to study 132 pregnant women. Of the 132 cases, there were 127 positive recordings and 5 cases in which we were unable to pick up fetal QRS complexes giving us an accuracy of 96.2%. There were 116 Vertex presentations, 8 Breech presentations, 1 set of identical twins, 1 transverse lie, and 1 anencephalic fetus recorded. The actual technique is simple and clinically is of value in determining: 1. fetal life from 19 weeks gestation on. 2. presentation of the fetus. 3. single or multiple pregnancy. 4. fetal heart rate during labor. 5. the actual fetal heart rate in cases where the heart rate is so rapid that clinically it is almost impossible to interpret the rate.

Also by this technique, it appears that the fetal EKG is easier to interpret as compared to the fetal electrocardiograms noted in the literature. It may be further noted that we were unable to record the Fetal QRS complexes during a uterine contraction because of the increased baseline interference, which overshadowed any possibility of identifying fetal spikes. Also, movement of the fetus interferes with the position of the stylus, causing it to wander to the top and bottom of the graph paper, thus abolishing the fetal spikes. Sample tracings of a Vertex and Breech presentation are shown below.

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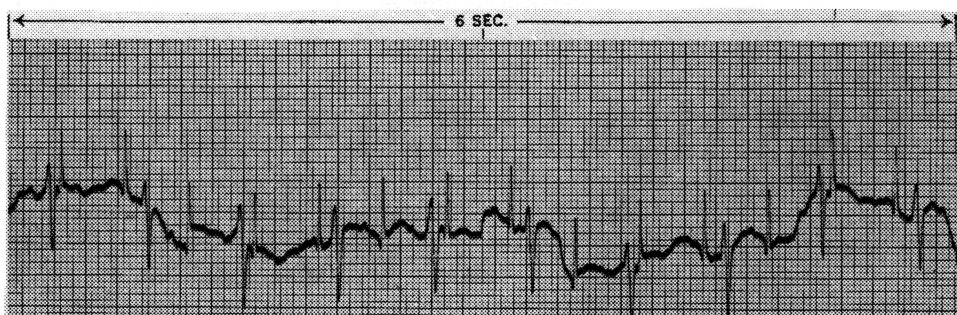
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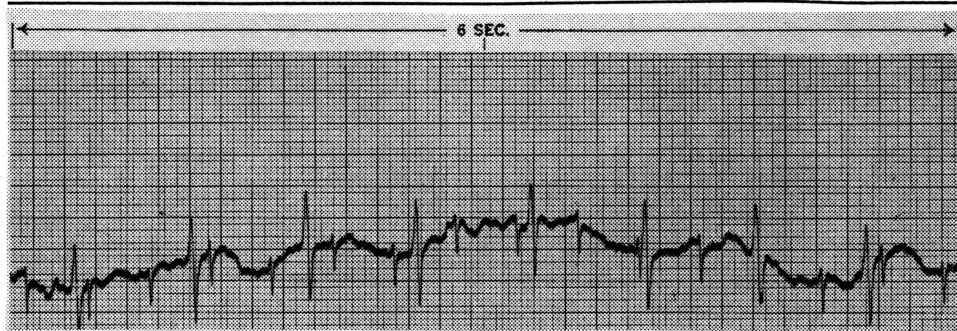
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A STUDY OF 132.



TRACING A : Vertex Presentation With a Fetal Heart Rate of 148/min. And A Maternal Heart Rate of 98/min.



TRACING B: Breech Presentation With a Fetal Heart Rate of 152/min. and a Maternal Heart Rate of 84/min.

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