Challenges and Techniques available to Predict Preterm Delivery and effectiveness of Eletrohysterogram: A Survey

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*Abstract :*Preterm birth is still the biggest unsolved obstetrical problem. As much as 70% of perinatal mortality is due to prematurity and many of the surviving preterm infants suffer serious lifelong morbidity.The purpose of this study is to propose Eletrohysterogram as a best means to detect preterm delivery . Uterine electrical activity recorded by electrohysterography (EHG) from abdominal electrodes during pregnancy provides trustworthy information about uterine contractions that can detect the onset of preterm delivery.Results from previous author works is taken in support of this study and it can be concluded that Electrohysterogram is indeed a better option than the traditional methods used to predict preterm delivery.

IndexTerms **- Preterm Labor , Gestation, Uterine electrohysterography, Myometrial, Progesterone, antepartum haemorrhage.**

I.INTRODUCTION

Presently, there are about 15 million babies born prematurely in the world among a total of about 150 million births per year . More than 1 in 10 babies are born preterm, affectingfamilies all around the world. Over 1 million children die each year due to complicationsof preterm birth. Many survivors face a lifetime of disability, including learning disabilities and cerebral palsy, intellectual impairment, chronic lung disease ,visualalong withhearing problems and are at greater risk of developing Non Communicable Diseases(NCD) like hypertension, diabetes and other significant healthconditions later in life, creating an intergenerational cycle of risk. They are physically not ready to face the world and often require special care [1]. In a systematic analysis and implications, India was given the highest rank with the highest numbers of preterm births in year 2010 with approximately 1 in 8 babies being preterm.In general most preterm births occur after 32 computed weeks of gestation. More than 90% of babies born before 28 weeks of gestation survive in high income countries but in low-income settings, only 10% of these babies or less survive[2]. Current approaches to prevention and treatment of preterm labor have been shown to be disappointingly unsuccessful[3]. Preterm Labor (PL) defined as labor before completing the 37th week of gestation is the main cause of newborn morbidity and mortality[4].Recent studies show that even babies born at 34–37 weeks have an increased risk of immediate complications[5]. Even after lots of research, we are still unable to diagnose, prevent and treat preterm labor. Checking efficacy of involvements that would allow this is largely influenced by the inability to accurately identify true labor with the currently used crude technology. In the case of progestin treatment for prevention of preterm birth, uterine EMG and cervical LIF are essential tools to obtain the critically needed comparative data on effectiveness of various progestin formulations and their routes of administration in different patients at high risk for preterm delivery .To find an effective prevention and treatment for preterm labor , we must find a method that will allow targeting the treatment only to patients who would, if not treated, really deliver preterm[6]

II.CAUSES OF PRETERM

There are three main reasons for Preterm births. According to P.N. Baker et al. almost one-third are medically indicated or induced delivery is brought forward for the well being of the mother or baby. Another third occurs because the membranes rupture prior to labour called as Preterm premature rupture of membranes (PPROM). The third reason can be, spontaneous contractions (termed preterm labour or TPL)[16].However, there is still a great deal of uncertainty about the level of risk each factor presents, and whether they are causes or effects. Some of the causes of preterm labour, that may or may not lead to preterm birth, have been discussed. These include infection,over-distension,burst blood vessels,surgical procedures ,illnesses and congenital defects of the mother's uterus and cervical weakness[2] These include a previous preterm delivery(20%);the last two births have been preterm (40%), and multiple births(twin pregnancy carries a 50% risk).Other health and lifestyle factors also include cervical and uterine abnormalities, recurrent antepartum haemorrhage, any invasive procedure or surgery ,underweight or obese mother[17]. Following a medical diagnosis of TPL, only 50% of all women with TPL actually deliver within seven days[16] In support of this,

McPheeters et al.,carried out study that showed 144 out of 234 (61.5%)women diagnosed with preterm labour went on to deliver at term [18]. This can potentially add significant costs and unnecessary interventions to prenatal care.

III. DIAGNOSIS OF PRETERM LABOR

3.1 TOCOGRAPHY

This measures the change in shape of the abdominal wall as a function of uterine contractions.Contractions are recorded by tensometric transducer attached to abdomen. It has been shown in several studies that monitoring uterine activity with tocography is not helpful in identifying patients in true (active) labour, both at term and preterm [7].Despite this the identification of preterm labor today still often depends on presence of contractions assessed by tocodynamometry (TOCO) and cervical change assessed by digital cervical examination. Nevertheless, contractions occur commonly in normal pregnancy and their detection through maternal perception with TOCO has a low sensitivity and positive predictive value for preterm delivery[8,9]. The other way of predictions on the basis of date of last menstrual period(LMP) previously the most widely used method and remains the only available method in many settings. Many countries now use "best obstetric estimate",combining ultrasound and LMP as an approach to estimate gestational age.. Some other approaches include clinical assessment of the newborn after birth, fundal height or birthweight as a surrogate[1].

3.2 TRANSVAGINAL ULTRASOUND AND CERVICOVAGINAL FLUID FETAL FIBRONECTIN

Measuring the cervical length by transvaginalultrasound and testing for fetal fibronectin in cervicovaginal fluid can help to identify patients at particularly high-risk for preterm delivery[10,11]. Any method using ultrasound requires skilled technicians.First-trimester antenatal clinic attendance digital cervical examination is subjective, and not accurate in predicting preterm delivery[12,13]. Though birth weight is closely associated with gestational age, it cannot be taken in an interchangeable way as there is a range of "normal" birth weight for a given gestational age and sex .A baby born preterm has a higher risk of death than a baby of the same birth weight born small for gestational age at term. Babies who are both preterm and small for gestational age are at even higher risk than babies with one of the other conditions[14].Disruption of collagen in the cervical extracellular matrix may also occurs prior to delivery at term and preterm[15]

3.3 PREDICTION OF PRETERM WITH ELECTROHYTEROGRAM

EHG is a promising study for preterm birth prediction, because it is low cost and accurate compared to other preterm birth prediction methods[19]. Monitoring of uterine activity can be accomplished using the electrical signals of uterine muscle by electrodes placed directly on the uterus as well as by surface electrodes on the maternal abdominal wall[22] as shown in Fig.1. Fig.2 shows one EHG signal and a TOCO signal.Electromyogram orElectrohysterogram recordingsand their analysis have been performed quite extensively since the 1950s,but there are several problems associated with measurement of EMG. Firstly It is important to place electrodes properly.Also quantitative interpretation of results can be rendered difficult by the perturbation induced with a reference electrode located too close to the active electrodes[20]. Catherine K Marque et al. found that in women, the best electrode position was the median vertical axis of the abdomen. It is possible to detect the risk of preterm birth (identification of high risk contractions) by using EHG processing at stages as early as at 27 weeks of pregnancy [21]. Many studies have shown that different uterine EMG parameters can indicate myometrialproperties that distinguish physiological preterm contractions from true preterm labour, which is something that the other contraction monitoring devices cannot[6].A very high Accuracy, Sensitivity and Specificity can be achieved with the help of various computer-based approaches to predict Preterm.U Acharyaet al.proposed a novel algorithm using empirical mode decomposition (EMD) combined with wavelet packet decomposition (WPD) and obtained accuracy of 96.25%, sensitivity of 95.08% and specificity of 97.33%[23] Krzysztof Horobaetal. showed that the spectral features of EHG signals and among them especially the median frequency have the best efficiency to distinguish the recordings with symptoms of threatening preterm labour from those acquired during the term pregnancy[24].Accuracy of [23,25,26,27] in table 1.shows that EHG signal can successfully be used to detect preterm delivery.
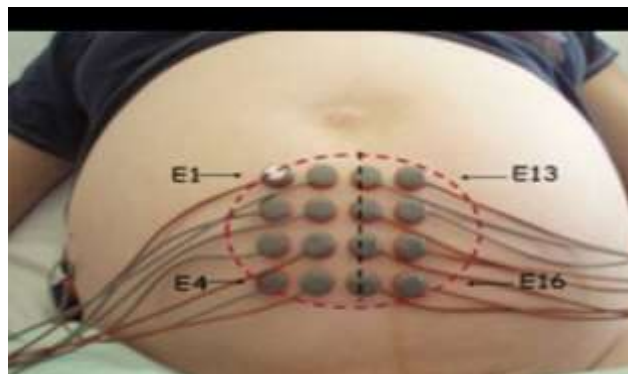

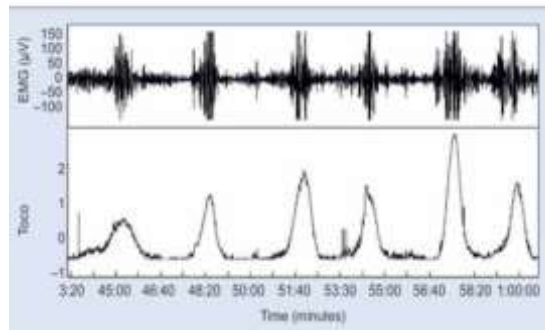**Fig.1 EHG signal acquisition using Electrodes**

Fig.2 Raw EHG/ EMG signal and TOCO signal

Table 1. Summary of few research work on prediction of term and preterm pregnancies using EHG signals.

Author,Year	Accuracy
Diab et al.,2007[27]	91.7%
Maner et al.,2007[28]	92%
Naeem et al.,[29]	85.3%
Achrya etal.[25]	96.25%

IV. MANAGEMENT OF PRETERM LABOR

The three key interventions that can be delivered during the pregnancy period with evidence of effectiveness in improving health outcomes in the premature baby are antenatal corticosteroids, antibiotics for PPROM and magnesium sulphate .The administration of antenatal corticosteroids to pregnant women at high risk of preterm birth possibly as early as 23 weeks can significantly reduce the premature baby's risk of death, respiratory distress and developmental problems. The administration of magnesium sulphate to women at risk of preterm birth helps to protect the baby's brain, reduce rates of cerebral palsy and improve long-term neonatal health outcomes .Premature rupture of the membranes is strongly associated with infection of the amniotic membranes contributing to preterm birth and other poor fetal outcomes such as cerebral palsy and chronic lung disease. Antibiotic treatment for pPROMcan be used to delay onset of labor [1].Progesterone also prevents myometrial activity by several mechanisms by suppressing number of genes which are essential for effective uterine contractions[6]

V. CONCLUSION

In an early term of pregnancy, thedifferentiation between women delivering at term from women delivering preterm can be made and it can be shown that these two kinds of pregnancy are of different evolutions. For several decades, tocolysis was used to detect preterm labour .The results from Tocography and Transvaginal Ultrasound and Cervicovaginal fluid fetal fibronectinare not convincing but the results obtained from analysis of Electrohyterogram are encouraging becauseuterine EHG parameters indicate myometrialproperties that would permit in a follow-up medical study to diagnose a possible preterm delivery as well as the proximity of the delivery.The problems in successful recording of EHG signals need to be addressed carefully . Early and accurate detection can be done using EHG signals that can save prematured children from life threat and severe lifelong health hazards by right management of the Preterm labour using various means.

VI. REFERENCES

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