ELECTROMYOGRAPHY OF THE HUMAN UTERUS

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ABSTRACT

The quantity of smooth musculature in the human cervix is small. To determine the role of this musculature during labor, its electromyographic activity was studied. In 130 parturient women of d1fferent parity and with various degrees of cervical ripeness at the onset of labor, the cervical electromyographic activity was measured throughout the entire course of labor in synchronization with intrauterine pressure measurements and 1n some cases in synchronization with measurements of the uterine corpus electromyographyc activity. The conditions necessary for successful measurements are descr1bed. Differences were found between cervical EMG act1vities 1n primiparas and multiparas, ripe and unripe cervices. the uterine corpus and the cervix and changes in cervical EMG activities after application of oxitocin and spasmoanalgetics. Changes in cervical EMG records after application of oxytocin and spasmoanalgetics and power spectral analyses are shown.

INTRODUCTION

Although the activity of human cervical smooth muscles is one of the relevant factors for its dilatat10n during labor it has not been yet sufficiently studied. It is still believed that there are not enough smooth muscles in the human cervix to have any important role during pregnancy and labor. The smooth muscles of the ewe's cervix contract vigorously even late in gestation - the cervical and uterine smooth musculatures appear to act independently, possibly reflecting their independent functioning/l.1 To confirm the role of the smooth muscles in the human cervix, their electrical activity during labor was studied. The results in 60 parturient women showed .a dependency of the registered EMG activity on the cervix ripeness, parity and the detection technique implemented/2.1 Further 70 cases confirmed our first results and served to study the influence of some medicaments on electrical activity of the cervix.

METHOD AND EMG DETECTION TECHNIQUE

Bipolar registration of cervical electrical activity was implemented. using fetal spiral scalp electrodes,which are a part of standard CTG equipment in a delivery room. In most cases the electrodes were inserted on the cervix circularly

. to the cervical canal,in some case longitudinally.

Surface Ag-AgCl disc electrodes were used to measure the abdominal uterine corpus activity. A miniature two channel differential preamplifier was designed to amplify low amplitude EMG potentials with fixed gain of 1000 and bandwidth of 0.3 to 5kHz (3dB). EMG was further amplified by a two channel galvanically isolated amplifier with an adjustable gain, an adjustable DC level, and a built-in low-pass filter (5Hz). The signals were recorded by a two channel chart recorder and for further processing by a four channel tape recorder. Intrauterine pressure giving information on uterine contractions was also registered.

The cervical EMG activity was registered

throuth the entire course of labor in 130 parturient women with different parity, various degrees of cervical ripeness and different medication.

RESULTS

The EMG records were visually evaluated with respect to: EMG peak-to-peak amplitude, shape of bursts, synchronization with uterine contractions synchronization between uterine corpus and cervix~ activity. and the way of detection. In some cases spectral analysis was performed on selected intervals of records to determine the dominant frequencies of the EMG signal.

Significant differences were found between cervical EMG activity in pr1m1paras and multiparas, ripe and unripe cervices, corpus and cervix activities and changes in EMG activity after application of oxytocin and spasmoanalgetic (Dolantin).

The changes of cervical EMG activity du ring oxytocin -induced labor in an unripe cervix are shown in Fig.l,2,and 3. Great EMG activity in the beginning of labor, unsynchronized with uterine contractions, (Fig.l) diminished 40 minutes after application of spasmoanalgetic (Fig.2) and was small and synchronized with ute rine contractions when the cervix was in dilatation (Fig.3),

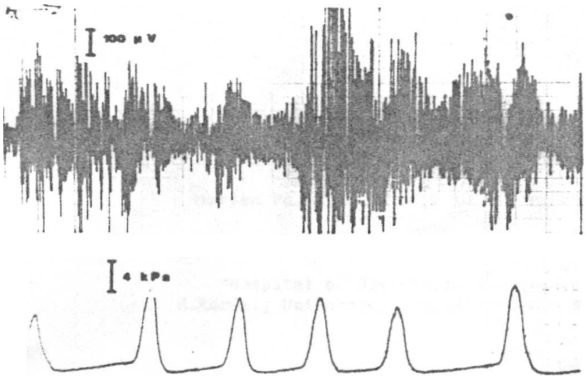
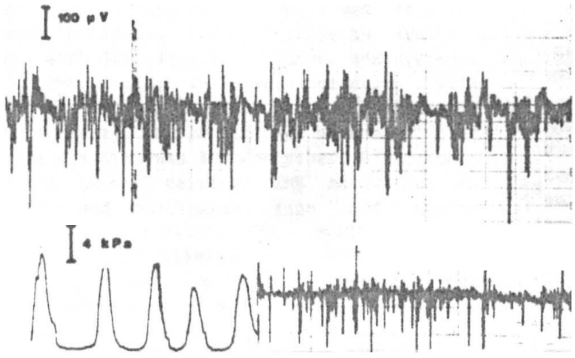


Fig.1. Cervical EMG activity (upper trace): and intrauterine pressure (lower trace). Beginning of induced labor-after oxytocin application



F1g.2. Cerv1cal EMG act1v1ty (upper trace), and intrauterine pressure (lower trace first part)corporeal EMG activity (lower trace second part). 40 min. after application of spasmoanalgetic.

Fig.3. Cervical EMG activity (upper trace) , and intrauterine pressure (lower trace)in cervical dilatation - active phase of labor

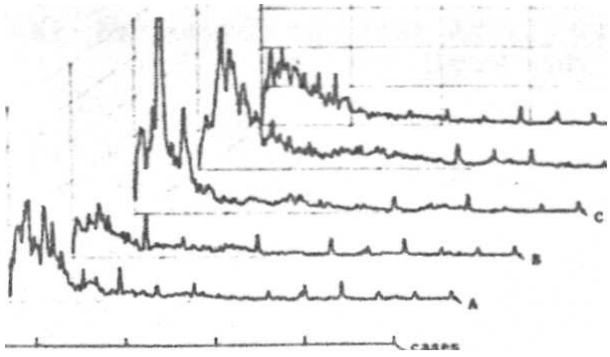


Fig.4. Three-dimensional presentation of cerv1cal EMG power spectra for alabor with unripe cervix. A- before oxitocin application, B- 30 min. after oxitocin application, C- 60 min. after oxitocin application/before application of spasmoanalgetic, D- 30 min. after spasmoanalgetic. and E- 60 min. after spasmoanalgetic application.

Power spectra for five 8-minutes intervals of EMG activity in different periods of labor are presented in Fig.4. The changes of the cervical activity are reflected also in the EMG frequency domain. EMG of 8-minutes intervals was sampled and the FFT algorithm was used to determine power spectral density function(PSDF). Changes of the frequency distribution were observed and proved by the shift of the mean frequency and the power spec trum area changes. It my be concluded that the work of smooth cervical muscles is different dependent on the influence of various drugs

DISCUSSION

The results obtained so far have shown that the detection and registration method implemented reflects the cervical smooth musculature activity. It also enables quantification and objective classification of the level of cervical activity in different stages of cervix ripeness, changes in activity during labor, and changes due to drug application.

LITERATURE

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