

Effect of spasmoeanalgetic Dolantin on the electromyographic activity of the cervix during labour

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Summary: The influence of spasmoeanalgetic Dolantin on electrical activity of the smooth musculature of the cervix during labour was studied in 50 primiparous women after induction of labour. The highest electrical activity was measured at the time of uterine contraction (AC) and between contractions (BC). The basic pattern of Dolantin-produced changes in muscular contractions in the cervix observed via EMG activity is that of the EMG activity diminishing with contractions of the uterine corpus and even more so in the period between contractions. Dolantin administered during the latent phase of induced labour did not accelerate cervical dilatation either in the latent or in the active phase of amniotomy – and Oxytocin – induced labour.

Key words: Spasmoeanalgetic Dolantin; Cervix electromyographic activity; Labour.

INTRODUCTION

Although a number of obstetricians believe there is not enough smooth muscle in the cervix to play any role during labour in recent literature relatively more smooth musculature in the cervix prior to labour has been reported⁽³⁾. This musculature has been found to contract actively and the contractions can be acted upon by various agents^(1,2). In our previous studies^(4,5) active contraction of musculatures in the cervix during labour was reported which was sometimes different in the longitudinal and circular directions, different in ripe and unripe cervixes. Some reactive-

ness to Oxytocin was observed as well. The aim of the present study is to explore whether the administration of spasmoeanalgetic Dolantin results in changes of electrical activity in unripe cervixes in Oxytocin-induced labours.

MATERIALS AND METHODS

The study involved 50 primiparous women coming to the delivery room with unripe cervixes for induction of labour. After admission to the delivery room an estimation of cervical ripeness according to the Bishop (1964) scores and an amniotomy were performed. Then a catheter for measuring intrauterine pressure was inserted, and an ECG (electrocardiograph) electrode was attached to the infant's head to monitor the fetal heart rate. Within 30 minutes after the amniotomy an Oxytocin solution (Syntocinon) was administered by the drip method in a dose of 6.75 mEQ/min.

The duration of the latent and the active phases of labour was registered.

Besides this routine procedure EMG activity of the cervix was recorded simultaneously with intrauterine pressure. Two spiral needle EMG

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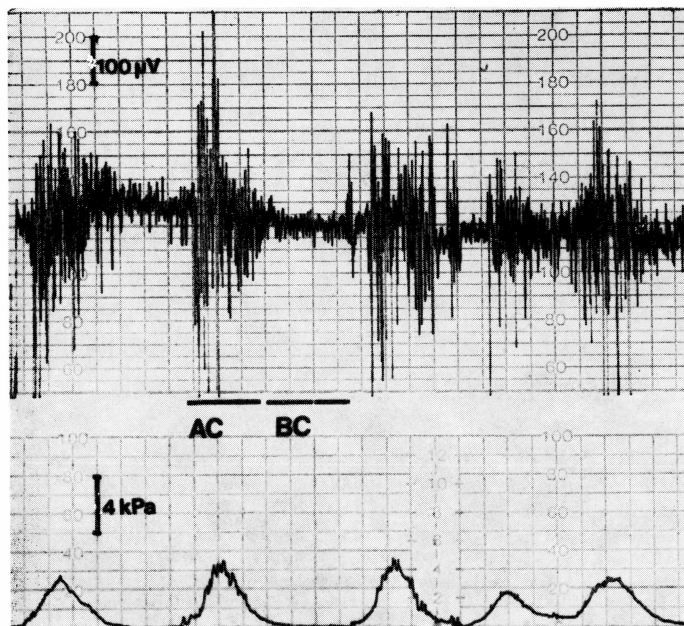


Fig. 1. — Cervical electromyographic activity (upper trace) and intrauterine pressure (lower trace) in a primiparous patient. AC = at contraction, BC = between contractions.

electrodes were attached to the cervix for bipolar detection of the EMG activity in the circular direction, with a reference electrode placed on the woman's thigh. The procedure is described more in detail in our earlier reports (4).

In all 50 women the EMG paper recordings were visually and mathematically analyzed. In Fig. 1 a typical EMG paper recording is presented. The upper trace relates to the electrical activity of the cervical muscle. The intensity of the signals is expressed in microvolts. Peak-to-peak values of the highest electrical activity (the largest amplitudes) at the time of uterine contractions (time mark AC) and between two contractions (time mark BC) were estimated.

Sample intervals were taken for the first time 60 to 90 minutes after beginning of the labour (amniotomy and Oxytocin) and 30, 60 and 120 minutes later. After the first sampling, 30 women (Group 1) received 50 mg of spasm-analgesic Dolantin intravenously, while the remaining 20 women (Group 2) served as the control group. The differences between the arithmetical means values of the greatest EMG amplitudes measured (in microvolts) were assessed by the "t" test for small dependent samples, small independent samples and populations with abnormal distribution.

RESULTS

Groups 1 and 2 differed neither in Bishop scores nor in the duration of the latent and active phases of labour (Group 1: Group 2; Bishop in scores $M=4.35:4.53$, $P=0.622$; Latent phases in hours $M=3.84:3.61$, $P=0.797$; Active phases in hours $M=3.71:3.98$, $P=0.670$).

Intrapartal changes in EMG and difference between the two groups

Measurements of the maximal amplitudes in paper recordings of EMG yielded the following results:

The greatest EMG activity in Group 2 (without Dolantin) during observation oscillated both at contraction (AC) and between contractions (BC). At contraction (AC) these oscillations were smaller, while between contractions (BC) they were greater. Thirty minutes after the beginning

EMG ACTIVITY OF THE CERVIX - WITHOUT DOLANTIN (N = 20)

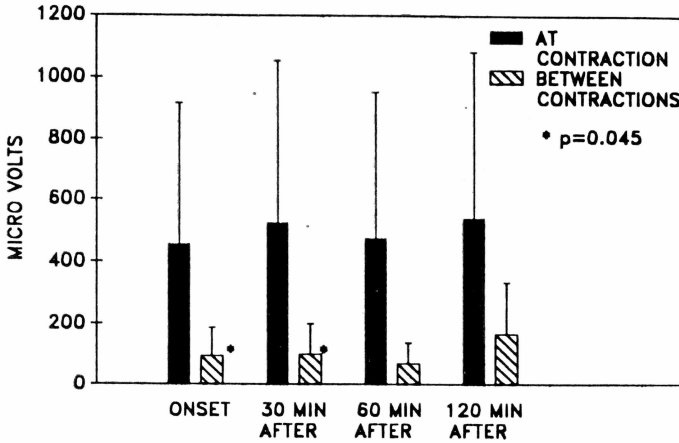


Fig. 2. — Electromyographic activity in unripe cervixes (without Dolantin).

of observation the BC activity was significantly greater, within the next 30 minutes it decreased, but intensified again during the last phase of observation (Fig. 2).

In group 1 (with Dolantin) the entire activity after Dolantin administration decreased. The decrease in electrical activity at contraction (AC) was most pronounced at 30 minutes, but it was statistically

insignificant. Afterwards electrical activity increased, but even at 120 minutes it did not reach the initial value. Between contractions (BC) the decrease in electrical activity was perceivable although not statistically significant immediately after Dolantin administration, attaining the lowest significant value at 92 V 60 minutes after Dolantin administration. Within the next

EMG ACTIVITY OF THE CERVIX - WITH DOLANTIN (N = 30)

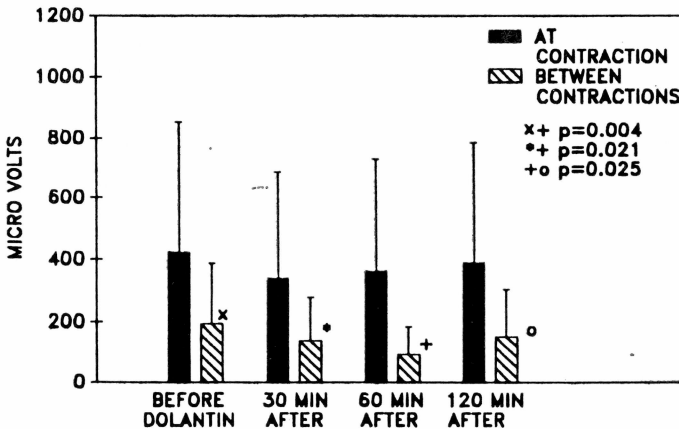


Fig. 3. — Electromyographic activity in unripe cervixes after administration of spasmolytic Dolantin.

EMG ACTIVITY OF THE CERVIX - AT CONTRACTION (N = 50)

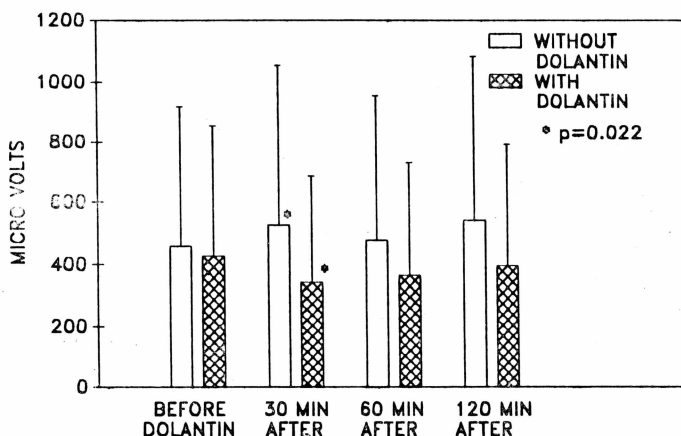


Fig. 4. — Comparison of electromyographic activity in unripe cervixes with contraction between Groups 1 (with Dolantin) and 2 (without Dolantin).

hour the activity grew significantly, but did not reach the initial value (Fig. 3).

Fig. 4 presents electrical activity at contraction (AC) for Groups 1 and 2. It can be clearly seen that the cervical electrical activity in the Dolantin groups significantly diminished already at 30 minutes after the administration and remained lower throughout the observation period.

Although in the Dolantin group the electrical activity between contractions (BC) was even slightly greater at the onset, after Dolantin administration it remained constantly lower than in the control group. Sixty minutes and 120 minutes after Dolantin administration the differences were found to be statistically significant (Fig. 5).

EMG ACTIVITY OF THE CERVIX - BETWEEN CONTRACTIONS (N = 50)

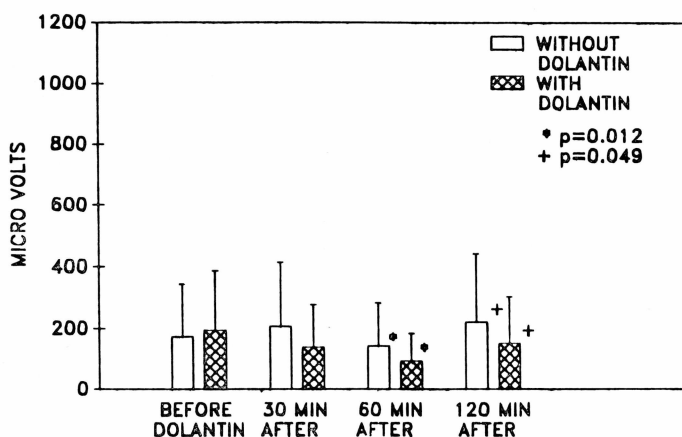


Fig. 5. — Comparison of electromyographic activity between contractions in uripe cervixes between Groups 1 (with Dolantin) and 2 (without Dolantin).

DISCUSSION

The electromyogram (EMG) is a complex electrical pattern arising from active muscle. Its amplitude is heavily influenced by several factors, among them: type of electrodes implemented, recording electrodes arrangement, the distance between them, electrode distance to the recorded muscle fibres, fibre distribution (number of muscle fibres sensed by electrodes) as well as the number of active motor units (MU's) that are firing, and their frequency of discharge. Higher frequency of discharge results in higher intensity of muscle fibre contraction. Contraction of the whole muscle is a consequence of several muscle fibres' interaction. Since the EMG signal, as picked up in our measurements, actually reflects the superimposition of many MU simultaneous discharges, the EMG amplitude increases with the intensity of muscle contraction. The discharge pattern generated by such a recording does not retain the shape of the individual MU activity.

We proceeded on the assumption that the methods of signal conditioning and acquisition were fairly similar in the majority of the cases. With a good electrode fixation in the cervix, we tended to keep the position of the electrodes stable at least during the first part of the labour. Because of rather different electrode arrangement in different patients we believe our analyses of results within groups to be more reliable than inter-group comparisons.

The following comment on the results obtained is based on our hypothesis that longitudinally arranged muscular fibres are active during contractions of the uterine corpus and thus contribute to cervical dilatation, while circularly arranged fibres are active also between contractions, causing resistance in dilatation of the cervical canal. We are aware of certain prevalence of longitudinal electrical activity in the

cervix during labour, therefore we picked up the maximal possible quantity of muscular activity running in the circular direction (^{4, 5}).

Spasmolytic Dolantin administered to parturient women with unripe cervixes in the latent phase of labour appears to have an important influence on the muscular activity in the cervix. Dolantin, which is in our hospitals the most common spasmolytic given to women in labour, reduces the activity of smooth muscles in the cervix, both at contraction and between contractions. The decrease is greater between contractions, i.e. at the time when we believe the circular musculature to be prevalently active. Although the possible differences in electrode positioning in different women diminish the reliability of comparisons among patients, the significant differences between Groups 1 and 2 (Figures 3 and 4) seem to confirm a clear influence of spasmolytics.

On the basis of our hypothesis (⁴) that the activity of longitudinal cervical muscles during labour contributes to cervical dilatation while the circular muscles build up resistance, the conclusion in the present experiment may be that spasmolytic Dolantin, when administered in the specific dose used in this case, has a certain effect on both types of musculature. It decreases muscle activity during contractions, which within our hypothesis would be to say that it stimulates the activity of circular fibres, thus reducing cervical resistance, while its contribution to a diminished activity of cervical muscles during contraction is of a more limited scope. According to our hypothesis, it reduces the activity of longitudinal fibres and with it the active component in cervical dilatation. The result – at least in our experimental group of 30 women – was mutual annulment, which is well seen in the similar length of latent and active phases of labour in both groups. Since Oxytocin has a triggering effect on the activity

of cervical muscles at contraction and a regressive one between contractions of the uterine corpus⁽⁶⁾, we believe when a spasmolytic is applied primarily for an analgetic effect it would be advisable to increase the dosage of Oxytocin to stimulate cervical dilatation, if necessary.

REFERENCES

- 1) Bryman I., Norstrom A., Lindblom B.: "Influence of prostaglandins and adrenoceptor agonist on contractile activity in the human cervix at term". *Obst. Gyn.*, 67, 574, 1987.
- 2) Huszar G., Walsh P.M.: "Biochemistry of the myometrium and cervix". In: *Biology of the uterus*. Plenum medical book company, New York, London, 1989.
- 3) Minamoto T., Arai K., Hirakawa S., Nagai Y.: "Immunohistochemical studies on collagen types in the uterine cervix in pregnant and nonpregnant states". *Am. J. Obst. Gyn.*, 156, 691, 1987.

- 4) Pajntar M., Roškar E., Rudel D.: "Electromyographic observation on the human cervix during labor". *Am. J. Obst. Gyn.*, 156, 691, 1987.
- 5) Pajntar M., Roškar E., Rudel D.: "Longitudinal and circularly measured EMG activity in the human uterine cervix during labour". *Acta. Physiol. Hung.*, 71, 497, 1988.
- 6) Pajntar M., Rudel D.: "Changes in electromyographic activity of the cervix after stimulation of labour with oxytocin". *Gyn. Obst. Invest.*, 31, 204, 1991.

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