

# Research Journal of Pharmaceutical, Biological and Chemical Sciences

## The course and perinatal outcomes of rapid delivery in women.

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### ABSTRACT

This paper presents the clinical characteristics of pregnancy course and the features of uterine contractions during rapid delivery. The character of perinatal complications of rapid delivery has been studied. The morphological characteristics of the cervix in women with shortened delivery period have been presented. It was revealed that the vast majority of rapid delivery is not accompanied by excessively strong labor. Adverse perinatal outcomes for both a mother and a newborn are caused not by the nature of labor, but by infectious-inflammatory processes, on which background an actual pregnancy had occurred and developed, which has been evidenced by both clinical observations and the results of histological examination of cervix tissue of rapidly delivering women.

**Keywords:** rapid delivery, perinatal complications, maternal complications, infectious pathology of pregnancy

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## INTRODUCTION

A distinctive feature of modern obstetrics is a gradual reduction in the duration of delivery process. It has been shown, that each decade it becomes one hour shorter [1]. Naturally, the proportion of rapid delivery on this background continues to grow, and, according to modern authors, accounts for 8-10% of the total number [2,3]. By now, the main pathogenetic mechanism of rapid delivery is considered the uterine hyperactivity and excessively strong labor, presented in this section in the ICD 10. However, the question of full combination of concepts of "anomalies of labor and rapid delivery" seems to us debatable. Probably, too rapid opening of the cervix in the I stage of labor may be associated not only with the tumultuous labor, but also with the structural features of the cervix, when the moderate labor pains result in a maximum opening of the uterine mouth. This was mentioned by Russian authors [2,3]. The question about the possible causes of this state of the cervix seems to be interesting. These causes have been poorly studied to date. It would be logical to assume that the structural and functional specificity of the cervix may result from features of connective tissue metabolism, which accounts for the bulk of this body. Indirect evidence of this possibility is the high frequency of rapid delivery in women with undifferentiated dysplasia of connective tissue [4]. Another possible reason for the low resistance of the cervix can be the effect of infectious factors. There is evidence that the natural mechanisms of labor preparation and delivery in many respects resemble the model of inflammation [5]. To date, it has been proved that the process of preparation of the cervix is mediated by the mechanisms that involve the inflammatory cytokines [6]. Having studied 5,758 cases, Chambers et al. [7] concluded that the cervicovaginal infection contributes to early shortening and opening of the cervix. Endotoxins lead to the appearance of neutrophils, reduction in collagen concentration and increase in glycosaminoglycan content in the cervix [8,9]. The role of IL - 8, IL - 1beta, hyaluronic acid, fibronectin has been determined [10,11]. Today, the role of infectious pathology in the genesis of threatened abortion and premature labor is not under dispute. There is evidence of a significantly high rate of rapid delivery in women with infectious and inflammatory diseases in their history and during pregnancy. It is known that most of the rapid delivery is accompanied by adverse perinatal outcomes for both a mother and a newborn. However, to date, there are no studies addressing a number of questions relating to the rapid delivery, namely, what proportion of births with a shortened duration can be attributed to the category of pathological obstetrics, and what proportion is a normal variant, and what the leading cause of pathological perinatal outcomes of rapid delivery is.

## MATERIALS AND METHODS

We have analyzed the gestation features in 110 women having rapid delivery on gestation week 38-41 (main group I). The control group included 35 patients with the standard duration of delivery (group II). To clarify the nature of labor, in addition to clinical observation the partogram management and labor pain monitoring were conducted using cardiotocograph Avalon FM-30 (Phillips) with their subsequent quantitative assessment in Montevideo units. Morphological and immunohistochemical study of biopsy specimens of vaginal part of the cervix, obtained in the early postpartum period. Biopsy was taken upon authorization of the Ethic committee and patients' informed consent. Histological sections were stained with Van Gieson's hematoxylin, eosin and picro-fuchsin. Immunohistochemical examination of biopsy specimen was performed using monoclonal antibodies to epithelium-specific pancytokeratine, endothelium-specific CD31, muscle tissue-specific desmin, fibroblasts and connective tissue-specific vimentin, and basement membrane-specific collagen IV (Lab Vision, BioGenex).

## RESULTS

The women in both groups did not differ in age (mean  $28.3 \pm 3.6$  and  $27.8 \pm 3.2$  years, respectively, ( $t = -0.6$ ,  $p = 0.53$ ). In addition, body mass indices were identical. No differences were also revealed in parity, that is the proportion of primiparous and multiparous women in groups was similar ( $t = -0.9$ ,  $p = 0.32$ ). This means that, contrary to the traditional view of a higher average duration of the first delivery, it nevertheless could be as rapid as the repeated labor with the same degree of probability ( $r^s = -0.08$ ,  $p < 0.05$ ).

As the indicating criteria of morbidity and unfavorable outcome of childbirth in the study group, we selected the following: intrapartum fetal hypoxia, premature placental abruption, abnormal blood loss, maternal soft tissue injuries, early neonatal complications of any origin. Among all women of the first group, only 32% did not have any of these signs, so they were assigned to the subgroup Ia (uncomplicated rapid delivery). The subgroup Ib included patients with a variety of intra- and perinatal complications. They were a substantial

majority - 68% ( $p=0.00$ ). The study the different characteristics of women from these two subgroups found their absolute identity in a number of signs, but revealed at the same their difference from the comparison group. In particular, the collection of family history revealed that the vast majority (64%) of women of the main group, who were able to answer the question of whether there were rapid delivery among the maternal relatives, gave an affirmative answer. None of 25 women of control group, who participated in the survey, noted this anamnestic feature ( $\chi^2=32.3$ ,  $p=0.00$ ). A significant correlation ( $r^s=0.45$ ,  $p<0.05$ ) has been established between the presence of rapid delivery in family history and in women. The chances of rapid delivery increased by 13 times ( $b=2.59$ , Wald's  $\chi^2 = 6.05$ ,  $p=0.01$ ).

An extragenital pathology was found in most of the women in both groups, but in the case of rapid delivery the combination of diseases was found in 54% of cases (compared with 27.2% in the control group,  $\chi^2=7.29$ ,  $p=0.006$ ). At the same time, the dominant diseases were respiratory, cardiovascular and gastrointestinal diseases. Similar features of physical health in combination with other symptoms allowed us to establish the presence of signs of non-differentiated connective tissue dysplasia (NDCTD) in the absolute majority of patients in both study groups (87%). However, the main difference was not in the frequency, but in the severity of dysplastic manifestations. In particular, 71% of the women of the main group had a combination of several signs of multiple organ manifestations of NDCTD [12] and the average score was 5.3 [13]. In group II, only 10% of the patients simultaneously had two features of DCTD, and the average score was 1.57. The significance of the differences of these indicators ( $\chi^2 = 30.3$ ,  $p=0.000$ ) allows for evaluation of the pathology of connective tissue as a symptom closely related to pregnancy and childbirth in women of the main group. Gynecological and obstetrical history did not differ in frequency of genital diseases in patients of study groups ( $\chi^2 = 2.8$ ,  $p=0.00$ ,  $\chi^2 = 0.29$ ,  $p=0.034$ ). However, 53% of multiparous women of group I had the history of rapid labor, while in the study group, this indicator was only 7% ( $\chi^2 = 9.8$ ,  $p=0.01$ ).

Differences between the patients in the main group were found in the study of the characteristics of the present pregnancy course. In particular, despite the fact that among the pregnancy complications in general in all women of the main group the prevalent was the infectious pathology of the lower genital tract, it was substantially less common in the subgroup Ia (21% of cases,  $\chi^2 = 3.8$ ,  $p=0.00$ ) and was usually represented by a single episode of vaginitis. In the subgroup Ib, this indicator reached 80%, every fourth woman mentioned two or more foci of urogenital infections ( $\chi^2 = 4.5$ ,  $p=0.01$ ), and the frequency of relapsing forms here was 50% (against 12% in the subgroup Ia,  $\chi^2 = 6.7$ ,  $p=0.03$ ). The second typical complication was the threat of termination of pregnancy. It was recorded in 39% and 58% of cases in the subgroups Ia and Ib, respectively ( $\chi^2 = 3.6$ ,  $p=0.00$ ), which is significantly higher than the study group rate (15%,  $\chi^2 = 4.2$ ,  $p=0.00$ ). The main feature was that a threatened miscarriage in women with perinatal complications was usually of a recurrent nature, and was observed in 15% of cases during all three trimesters. Assessment of placental system helped us to identify a number of characteristic differences between the patient of subgroups of uncomplicated and complicated rapid delivery. In the subgroup Ib, the ultrasound markers of feto-placental insufficiency (FPI) were detected in 34% of cases, and a half of these cases was diagnosed with fetal growth retardation syndrome (FGRS) ( $\chi^2 = 6.8$ ,  $p=0.009$ ). Whereas, the subgroup Ia had pathological echomarkers of placental complex detected in 12% of patients ( $\chi^2 = 2.8$ ,  $p=0.00$ ) and FGR syndrome was diagnosed in only one patient. There was found another one significant difference in the subgroup of complicated rapid delivery, such as the early appearance of signs of feto-placental insufficiency, which were found already during the second screening ultrasound on week 20-22 of gestation. In the subgroup Ia, first signs of FPI were observed on later dates (week 30-34). Only in the subgroup Ib, the amniotic fluid abnormality in the form of hypamnions or polyhydramnios was found in 11% of women ( $\chi^2 = 3.7$ ,  $p=0.05$ ).

Study design intended the analysis of rapid delivery course on week 38-41. Evaluation of pre-delivery cervical state showed that the highest degree of its maturity was in the subgroup Ia. Cervical maturity on a Bishop's scale was on average  $8.7 \pm 0.12$  points, and did not differ from the study group characteristics. In the subgroup Ib, this figure was significantly lower -  $6.9 \pm 1.4$  points ( $\chi^2 = 4.8$ ,  $p=0.00$ ). Another difference was the fact that in 83% of women with a favorable labor outcome the labors began spontaneously and developed under preserved amniotic fluid. On the contrary, 42% of women in the subgroup Ib had either labor induction (routine amniotomy) for various indications or a premature discharge of amniotic fluid before the onset of labor ( $z=3.7$ ,  $p=0.005$ ). The relationship between the induction of labor and perinatal complications was not strong, but statistically significant ( $r^s = 0.26$ ,  $p<0.05$ ). In general, late discharge of amniotic fluid was observed in this subgroup in 75% of cases, which significantly exceeded the level of both subgroup Ia and study group ( $\chi^2 = 4.9$ ,  $p=0.01$ ).

The question of the nature of labor in women with rapid delivery was of fundamental importance. Up to now, there is no information about the extent to which the rapid delivery is associated with uterine hyperactivity and severe labor pain. Analysis of labor revealed that the labor pain in the majority of the observations was physiological in nature and not excessive either in frequency or duration, or force. Stormy labor pain was recorded only in the subgroup Ib and only in 1 case. In relation to the entire group I, this figure was 0.9%. Consequently, most women had rapid delivery determined not by the nature of labor, but particularly by their cervical state caused apparently by their own interstitial pre- and peri-labor processes. And the pain usual in its characteristics converts completely into the process that opens the uterine mouth. The average duration of labor in group I, without differing by subgroups, was  $226.5 \pm 78.3$  minutes and  $218.7 \pm 81.5$  minutes, respectively ( $t = -0.11$ ,  $p = 0.9$ ).

Intra- and perinatal complications in patients with rapid delivery were noted in 68% of cases. It should be emphasized that, according to the study design, all observations have been attributed to the subgroup Ib. The structure of complications was as follows. The delivery was accompanied by fetal hypoxia in 40% of cases. Two patients had a partial premature abruption of normally positioned placenta. Injuries of soft tissues of maternal passages were present in 54% of cases. Perineal rupture was the leading type of injury, which occurred almost in every third mother, and accounted for more than 50% of all injuries. Vaginal rupture occurred in 17% of women, and cervical injury - in 5%. Abnormal blood loss was detected in 6% of cases, its average volume was  $571.4 \pm 40.3$  ml. All bleedings were of hypotonic nature, not massive and observed in the early postnatal period. In general, the average blood loss in subgroup Ib was  $244.7 \pm 26.2$  ml and did not differ from the control group ( $234.8 \pm 23.6$  ml,  $p > 0.05$ ). All the children of the women under study were born alive. The average weight at birth in the subgroup Ib was  $3,478.9 \pm 472.9$  g and did not differ from the subgroup Ia and the control group ( $t = 1.66$ ,  $p = 0.09$ ). At the same time, the number of infants with low birth weight or, conversely, large varied. Such children in the subgroup Ib accounted for 34%, which is two times higher than in other two groups ( $\chi^2 = 2.68$ ,  $p = 0.03$ ). Average Apgar score during the first minute in the subgroup Ib was  $6.17 \pm 1.7$  points. The neonates born in the state of hypoxia were 57%. 16% of newborns had its severe form. Complications of early neonatal period occurred in 68% of children. In the structure of complications the prevalent were cerebral disorders (47%), hemorrhagic syndrome (36%), and neonatal jaundice (26%). Intraperiventricular hemorrhage was diagnosed in 11% of cases, the symptoms of intrauterine infection - in 10%. More than half of children (59%) had a combination of complications of early neonatal period. This required an intensive monitoring and treatment, and in 31% of cases the transfer of a child to the second stage of nursing was performed. The obtained data showed an interesting situation. The dramatic differences in the outcomes of rapid delivery in women of subgroups Ia and Ib are, above all, in a state of the newborn and the nature of the early neonatal development. It seems that the difference is primarily determined by the factors that have a negative impact on the further stages of pregnancy. Maternal infectious diseases, development of CFPI and FGRS, fetal chronic hypoxia, apparently, are crucial in the development of pathological perinatal outcomes in rapid delivery, rather than the nature of the labor pain.

Our findings showed that the cause of the rapid delivery in most cases was not caused by excessively strong labor activity, but by the high rate of intrapartum cervical dilatation on the background of normergic pain. In this regard, it was necessary to evaluate the structural features of the cervix in this category of women. Morphological and immunohistochemical study of biopsy specimen of vaginal part of the cervix, obtained in the early postpartum period from 70 patients with fast and rapid delivery (24 of subgroup Ia, 46 of subgroup Ib) and from 18 women of control group. Women with normal vaginal delivery duration had typical histological structure of the cervix completely covered with a stratified non-squamous epithelium with the presence of sub-epithelial connective tissue papillae. Immunohistochemical analysis revealed in the epithelial lining the uniform expression of monoclonal antibodies to pancytokeratine. The basal epithelial membrane was clearly contoured by MCAb to collagen IV in the form of continuous thin strip. Cervical stroma was loosened, edematous, with the presence of diffusely scattered neutrophils, lymphocytes and monocytes. It included both muscle and connective tissue structures with a predominance of the latter. Immunohistochemically, this was confirmed by reaction of MCAb to desmin and vimentin. This is a natural process, since, despite the increase in the proportion of smooth muscle cells in the cervix during labor, the dominant structural unit is the connective tissue. The blood vessels of the stroma were sharply dilated, full-blooded, sometimes with the formation of cavernous structures. The vascular endothelium had a pronounced expression of MCAb to CD 31 antigen, and the basal membranes - to type IV collagen. Patients of subgroup Ia ( $n = 24$ ) had significant changes found in the epithelial lining and stroma. Thus, stratified squamous epithelium in 20 women was replaced some areas with

single-layer prismatic cervical epithelium. And in some cases, the epithelium was located only on the surface (typical ectopia), while in other cases ( $n = 8$ ) it was immersed in the depth of the cervix, forming the branched glands (which indicates the inflammation-induced ectopia). This morphological pattern has found its clinical evidence. These patients were those having complications of pregnancy in the form of cervicitis. Sometimes the glandular structures projected above the surface and formed the papillary structures. Immunohistochemical analysis revealed the prismatic epithelium of uniform color using MCAB to pancytokeratins, indicating the intact cell structure. At the same time, there was a significant increase in expression of MCAB to vimentin in the gland-surrounding stroma. In 16 cases, the symptoms of epidermization were found when a simple prismatic epithelium began to be displaced by the stratified squamous epithelium. Immunohistochemical analysis determined the expression of MCAB to pancytokeratins in some areas of epidermization, and in basement membranes - MCAB to type IV collagen. The epithelium-surrounding stroma had prevalent fibroblastic elements, with a low content of the muscle cells, that was revealed by MCAB to vimentin and desmin. Women of subgroup Ib ( $n=46$ ) had almost all changes described above, but expressed to a greater extent. Along with the fixed and healing variants of ectopia, its progressive form was often observed characterized by an increase in the number of erosion glands ( $n=32$ ). They formed laminated layers with round or oval gaps in the form of cribriform structures. Immunohistochemical analysis of these formations showed an uneven expression of MCAB to pancytokeratins in various epithelial cell. Basal membranes, at the same time, were fragmented, irregularly thickened or split, which was revealed by MCAB to type IV collagen. The MCAB response to vimentin, along with the proliferating glands demonstrated a large number of fibroblasts and connective tissue fibers, tightly surrounding the glandular structures. These immunohistochemical features indicate significant damage to epithelial cells and reveal the cell skeleton disorders, a compromised state of the basement membrane and the expression of various structural units of the connective tissue. The epidermization process had certain features in this group. Stratified squamous epithelium was often considerably thickened with signs of keratinization. There were cases of its dysplasia with basal cell hyperreactivity. Inflammatory reaction with severe neutrophil infiltration, accompanied by desquamation of the epithelium with the formation of the true erosion in certain areas, was revealed in 34 cases. A distinctive feature was the discovery of the expressed sclerotic changes. At the same time, the immunohistochemical study showed a significant expression of the MCAB to vimentin and a reduced one to desmin, in both the vascular and perivascular walls. Thus, the patients of subgroup Ib had pathological manifestations defined as cervicitis according to the WHO classification. It was accompanied by a decrease in the number of desmin-expressing cervical muscle components, with a simultaneous increase in the connective tissue structures, detected by the presence of vimentin. Perhaps, this is a set of events that determine the functional state of the cervix in women with complicated rapid delivery.

### CONCLUSION

Thus, the leading factor of high-speed cervix opening with a rapid delivery can be considered a change in the structural organization of the cervix, which lies in the increased proportion of connective tissue in its stroma and the epithelium features.

Shortened deliveries have favorable outcomes only in 32% of cases. a typical complication is a perinatal pathology of the fetus and the newborn, which is observed in 68%. Maternal soft tissue injuries were recorded in 54% of women.

The main predictor of the adverse perinatal outcomes of rapid delivery is an infectious pathology in pregnant women, with preferential localization of lesions in the lower genital tract. The infectious pathology is the most likely cause of feto-placental insufficiency, threatened abortion, intrauterine growth retardation, premature discharge of amniotic fluid and intrapartum hypoxia.

The confirmation of the hypothesis of the decisive significance of infectious pathology as a cause of perinatal complications is the morphological features of the cervix in women with complicated rapid delivery. In particular, it is about such severe manifestations of cervicitis as true erosion, severe neutrophil infiltration of the stroma, and basal cell activity until the formation of epithelial dysplasia.

### ACKNOWLEDGEMENTS

The work is performed according to the Russian Government Program of Competitive Growth of Kazan Federal University.

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- [14] This work is performed at the expense of subsidies allocated in the framework of the state support of Kazan (Volga region) Federal University in order to improve its competitiveness among the world's leading research and education centers.
- [15] The work is performed according to the Russian Government Program of Competitive Growth of Kazan Federal University.