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Influence of vagus nerve traction on perinatal cervix maturity and on the occurrence of spontaneous labor in female primiparous in physiological pregnancy

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Abstract

Objective: Operational aim: To assess the impact of vagal nerve traction on perinatal maturity of the cervix, among female primiparous in physiological pregnancy. Cognitive aim: Evaluation of the influence of vagus nerve traction on the occurrence of spontaneous labor in primiparous women in physiological pregnancy. Moreover, it was assumed that the technique of traction on the cervical intervertebral spaces between the base of the occipital bone (C0) and the first cervical vertebra (C1) will release and optimize the functioning of the vagus nerve, and consequently accelerate perinatal maturation of the cervix, thus favorably preinducing the delivery.

Method: In the research work, the comparative studies were the operational basis, and they were also cross-sectional studies, which consisted of observation. An objective tool – the Bishop scale - was used in the examination of the perinatal cervix maturity. 70 women with physiological pregnancy, 39 + 0 Hbd were qualified for the analysis.

Results: The comparative analysis of the subjects showed a statistically significant differentiation in the evaluation of the cervical maturity in favor of GE women, which additionally gave birth closer to the date. Similarly, in the area of opening parameters, shortening of the cervix and the position of the leading point, women performed better on the background of the GK.

Conclusion: In comparative studies, it was revealed that traction of the vagus nerve accelerates perinatal maturity of the cervix and spontaneous systolic function occurred closer to the planned date of delivery. The traction of the vagus nerve has a significant impact on the parameter of shortening, opening and lowering of the point of the leading cervix in assessing its perinatal maturity.

Keywords: childbirth, vagus nerve, cervical maturity

Introduction

Observable changes in the body of a pregnant woman are the result of adaptation of all body systems to different conditions during pregnancy. They mainly concern respiratory, circulatory, muscular, metabolism, and even mental health. Compensatory changes as a result of the developing pregnancy result in the evolution of the body and posture of the pregnant woman. The consequences of changes in body posture are not the only dysfunctions that result in the discomfort of a pregnant woman and in addition can affect the course of delivery. At the same time, excessive body weight is associated with the risk of complications in both the mother and the child. Pathological, excessive body weight adversely affects the course of pregnancy and abnormalities of the perinatal period, including surgical deliveries, prolonged delivery, poor birth condition of the newborn, injuries of genital tracts, difficulties in passing an active labor (Banaszak-Żak B., Dobrzyń D. 2004; Boch -Kmieciak J. et al. 2012, Foti T. Davids JR Bagley A. 2000, Kandys W., 1998). Thus, the effects of the lifestyle are revealed in the construction and posture of the body, and thus in the general appearance of the pregnant woman. In addition, pro-health behavior will translate into better quality of perinatal care provided to pregnant women. However, these changes as factors do not determine the childbirth success and only can have a better or worse influence on it. Nowadays, women want to professionally prepare for pregnancy and collision-free delivery with the forces of nature (Piziak W., 2009). Women have an increasing awareness and are interested in the osteopathic approach to their changing state during pregnancy.

Assessment of perinatal maturity

In the sixties, Edward Bishop developed a system of assessing the maturity of theperinatal cervix in the aspect of pre-inductive readiness. Nowadays the Bishop scale is successfully used by midwives to determine the changes occurring in the vaginal part during pregnancy, as well as to assess the maturity of the cervix during delivery (Bishop E.H.,1964). Physiologically, 4 to 6 weeks before delivery, the cervix begins to scarify, becomes soft and susceptible. Five characteristics of the cervix are evaluated: cervical position, consistency, placement of the part of the leading fetus, loosening, opening in points from 0-3 (Table 1). With this it is possible to predict in advance whether the childbirth activity will be successfully completed. The vaginal part is considered to be mature for parturition when it is open to the finger, shortened, soft and located in the axis of the birth canal or forward. The cervix is prepared for delivery with a score of at least 9 points in the exam (Brębowicz G.H.,2015). Musculoskeletal activity and cervical compliance are coordinated with each other, under the influence of contractile function of the uterine body, the diameter of the cervical canal increases to approximately 10 cm at the end of the first stage of delivery, heralding the next phase of delivery.

Table 1

Bishop's scale in the assessment of perinatal cervix maturity

Parameters	0	1	2	3
Opening (cm)	0	1-2	3-4	5-6
Shortening (%)	0-30	40-50	60-70	
Position of the leading point	-3	-2-1		
Consistency	hard	intermediate	soft	
Ratio of cervix axis to vaginal axis	backward	In the axis	forward	

Proper appointment of the delivery date undoubtedly affects the perinatal care of the pregnant woman and possible medical interventions. The exact setting of the date is not without significance for the result of delivery, and Naegel's rule is now a commonly used method of estimating the date of delivery.

Proceedings in pregnancy after the planned date of delivery -preinduction of delivery

The methods of preinduction are designed to prepare the pregnant woman for essential induction or to induce uterine systolic function. These include: administration of prostaglandins, separation of the lower pole of the fetal egg, amniotomy, Foley catheter and Cook's double-balloon catheter (Nicholson J.M. et al., 2015; Karkowska D., 2004). The most popular methods of induction are the intravenous infusion of oxytocin. Historically, for the first time in 1948, Theobald et al. Described the use of an extract from the posterior pituitary gland - oxytocin, which was administered intravenously to induce labor (Theobald G.W., et al. 1948). Oxytocin activates the C-inositol phospholipase pathway, thereby causing intracellular calcium to increase. It works on specific receptors in the uterine muscle membrane, the number of which increases during pregnancy, reaching the maximum before the date of the solution. Hormone does not work on the uterus beyond pregnancy. Oxytocin causes an increase in the tone of the uterine muscle, especially its trunk (Alfirevic et al., 2009, Arias F., 2000). The oxytocin infusion according to the recommendations should be administered after the cervix has matured. After obtaining uterine contraction and starting the active labor phase, there is no benefit of maintaining intravenous infusion of oxytocin. The most frequent complications resulting from the supply of synthetic oxytocin, which include abnormal records of fetal heart activity and hyperstimulation of the uterine muscle (Daniel-Spiegel E et al. 2004) should be emphasized.

The above factors led to own research in which dependence was sought between selected osteopathic techniques and cervical cervix maturity in the aspect of spontaneous labor. Numerous medical research provides knowledge about physiology as well as the correct course of pregnancy and delivery. Similarly, scientific publications indicate the positive effects of osteopathic techniques in pregnancy regarding the basic functions of the woman's body systems (Hensel K.L. et al., 2015). The above information was a motivation to look for actions in the field of osteopathy, which would best affect the preinduction of labor among women with a physiological course.

Aim of the study

1. Operational aim: To assess the impact of vagal nerve traction on perinatal maturity of he cervix, among women, the firstborn in physiological pregnancy.
2. Cognitive aim: Evaluation of the influence of vagus nerve traction on the occurrence of spontaneous labor in women with pregnancies in physiological pregnancy.

It was assumed that the technique of traction on the cervical intervertebral spaces between the base of the occipital bone (C0) and the first cervical vertebra (C1) will release and optimize the functioning of the vagus nerve, and as a result, accelerate perinatal maturation of the cervix, thus favorably preinducing the delivery.

Materials and methods

The research base was based on comparative research. They were also crosssectional studies that consisted of observation. For the purpose of the study, a comparative analysis of pregnant women with a control group was made. Objective methods verified in terms of accuracy, reliability and accuracy were used, and at the same time commonly used in health sciences. The objective methods of measuring somatic traits were: anthropometer, medical weight. An objective tool - the Bishop's scale - was used in the examination of the perinatal cervix maturity.

Population

The study involved women in the third trimester of pregnancy with normal physiological course in spring and summer of 2018 in the Silesian agglomeration. 94 pregnant women were enrolled in the initial study. However, some of the participants were excluded from the analysis because not all of them met the requirements and criteria during the research process. Finally, 70 women with physiological pregnancy were qualified for the analysis (Table 2). All pregnant women were examined at 39 + 0 Hbd.

Table 2

The age and somatic features of the surveyed women

Feature	Min-max	x	s
Recordable age (years)	18-41	28,9	3,6
Body height (cm)	154-182	166,9	5,7
Body weight before pregnancy (kg)	40-107	62,3	12,8
Body weight in pregnancy (kg)	55-115	74,2	12,1
Weight gain (kg)	3-16	11,9	3,5
BMI before pregnancy	16-38	22,3	4,2
BMI in pregnancy	20-41	26,6	4,1

The study excluded pregnant women with non-physiological course, multiparous women, multiple pregnancies. Co-morbid chronic diseases of the

pregnant woman, taking permanent medications. Pregnancy threatened by preterm delivery (<36 Hbd). Fetal macrosomies (fetal biometry above 4200g), the position of the child other than the longitudinal head. Weight gain of a pregnant woman over 16 kg.

Experimental technique

The technique of traction of the cervical intervertebral space between the base of the occipital bone (C0) and the first cervical vertebrae (C1). Starting position of the patient: supine with the head resting on a pillow and popliteal roller aligned under the knee. Starting position of the therapist: The therapist stands or sits behind the patient.

Processing

The obtained results were subjected to statistical analysis, in which, apart from the mean, minimum, maximum and standard deviation, the distributions of data were verified based on the Kolmogorov-Smirnov distribution agreement, and, in addition, outliers based on skewness and kurtosis were identified. In studies, the level of statistical significance was assumed to be $p < 0.05$.

Comparing the somatic features of women in the experimental (GE) and control (GK) groups, the results were interpreted using the Shapiro-Wilk test to check the normality of the distribution of the examined traits. The differences between the groups were examined with the parametric of the t-Student test and its non-parametric counterpart - the U-Mann Whitney test. In the analysis of the Bishop's scale norms, a one-way ANOVA test was used to verify the homogeneity of the studied groups with respect to the factor. In verifying the correlation between the date of spontaneous delivery and somatic values, Spearman rank correlation coefficient was used.

Results

Considering the features and somatic indicators, it can be assumed that both groups of women were homogeneous, because the analysis of somatic features of pregnant women did not show statistically significant differences ($p<0.05$) between the GE and GK groups. Women from the GE and GK groups did not significantly differ in body weight, BMI and weight gain (Table 3). Only statistically significant differences concerned the week of pregnancy termination. In women from the experimental group, spontaneous systolic action occurred earlier in comparison to the control group.

Table 3

Age and somatic characteristics as well as outcome of pregnancy week of the surveyed women in the experimental and control group

Feature	Experimental group			Control gropuGrupa kontrolna			P
	Min-max	x	s	Min-max	x	s	
Recordable age (years)	18-41	274	5,3	18-39	28,7	4,9	0,59
Body height (cm)	154-182	166,7	5,9	156-178	167,1	5,1	0,66
Body weight before pregnancy (kg)	40-107	62,9	13,6	40-81	60,3	9,7	0,64
Body weight in pregnancy (kg)	55-115	74,1	12,9	60-90	72,6	9,2	0,74
Weight gain (kg)	3-16	11,7	4,9	5-16	12,2	4,1	0,69
Week of termination of	39+6 –	39+6	2,3	36+6 –	40+3	4,7	0,03

pregnancy (Hbd)	40+2			41+3			

In addition, in the control group, 7% of the surveyed women had to report at 40 + 6 for hospitalization to induce labor. Another analysis showed no effect of somatic features on the week of pregnancy termination. In addition, the analysis of univariate variance evaluating the association of the occurrence of systolic action due to the somatic features of women did not show statistically significant differences between the women of the experimental and control group. Both examined women from the experimental and control groups were characterized by similar perinatal maturity of the cervix. There were no statistically significant differences between the two groups (Table 4).

Table 4

Examination of perinatal cervical maturity at 39 Hbd according to Bishop's scale - before therapy

Parameters Points	Grupa eksperymentalna			Grupa kontrolna			P
Opening (cm)	0-1			0-1			
Shortening (%)	0-1			0-1			
Position of the leading point	0-1			0-1			
Consistency	0-1			0-1			
Ratio of the cervix axis to the axis of the vagina	0			0			
The sum of points	Min-max	x	s	Min-max	x	s	
	0-4	2,3	1,2	0 - 4	2,4	1,1	0,98

The comparative analysis of the obtained results showed a significant statistical differentiation in the assessment of the delivery maturity in favor of women from the experimental group, at the moment of spontaneous contraction. Women obtained more points in the Bishop’s scale (Table 5).

Table 5

Examination of cervical maturity during the onset of spontaneous contraction – after Therapy

Parameters Points	Grupa eksperymentalna			Grupa kontrolna			P
Opening (cm)	2-3			1-3			
Shortening (%)	2-3			1-3			
Position of the leading point	1-3			0-2			
Consistency	0-2			0-2			
Ratio of the cervix axis to the axis of the vagina	0-2			0-1			
The sum of points	Min-max	x	s	Min-max	x	s	
	5-13	10,5	1,7	2-11	6,8	2,3	0,04

The analysis for the existence of interdependence showed an inverse correlation with a high binding force (r = (-0.7), p = 0.04), between the cervical abatement parameter and the date of delivery. Thus, the more the cervix is shortened, the more spontaneous part of the childbirth occurs faster.

Similarly, the analysis shows that there is an inverse correlation with moderat binding force (r = (-0.4), p = 0.03) between the uterine end point and the date of delivery. Thus, the more the leading position of the cervix lowered, the spontaneous part of the delivery took place faster.

However, in the other analyzed parameters of cervical maturity, no statistically significant correlations were obtained, what is interesting, there was no correlation with the cervical dilation parameter.

On the other hand, inside the group analysis of Bishop scale parameters, showed a strong and positive correlation between the shortening of the cervix and the position of the leading point (r = 0.7, p = 0.02). Thus, there is a correlation that, the more the leading point decreases, the cervix shortens.

Analysis of the one-way variance evaluating the relationship between the Bishop's scale parameters and the occurrence of spontaneous labor, showed statistically significant differences between the women of the experimental and control group. The differences related to the parameters of dilation, shortening of the cervix and position of the leading point in favor of women from the experimental group. In contrast, in the other parameters examined, no statistical significance was found determining the solution's date.

Discussion

Pregnancy and the birth of a child is one of the greatest phenomena of nature. This is a precise process, designed to positively affect the health and life of the mother and the child. Modern research indicates that the most important tasks of caregivers is to patiently accompany and closely observe these processes. Science unambiguously confirms that the less medical intervention, the better for the health of mother and

child. Modern technologies allow us to observe and interfere, but it is worth to use them only in justified cases. Unfortunately, technology is often misused in unjustified situations. This affects the health of two people at one time and unnecessarily increases the costs associated with health protection. It seems that the beginning of the medicalization of both pregnancy and childbirth may be the fact that in most cases the care of a healthy woman is exercised by doctors - a profession prepared for treatment, focused on interventions and assistance in situations of pregnancy pathology (Report by Give birth humanly Foundation, 2018). The competences of other specialists are not used too much, including not only midwives whose job is to support health and physiological processes. In parallel, physiotherapists and osteopaths have the skills and professional knowledge of the human body, and are able to offer help and high quality care to pregnant and nursing women. Thus, relieving physicians from physiological births will allow them to redirect their attention, competence and time to women who actually require medical intervention and medical help. The quality of perinatal care is a multidimensional concept presented in literature in various perspectives. According to one definition, the quality of perinatal care is the extent to which maternal health care provided to a particular woman and population increases the likelihood of proper and timely treatment to achieve desired results that are consistent with current scientific knowledge and respect fundamental reproductive rights (Hulton LA, et al., 2000). According to this sentence, the competences of osteopaths and physiotherapists are marginalized, and the knowledge of related specialists in the fields of human and health sciences is not common and widely available. In the context of holistic treatment of a woman, both pregnant and giving birth, there is a lack of a joint therapeutic team that looks after obstetrics and gynecology.

The date of delivery is associated with the readiness to start labor, however, the maturity of the cervix is not always indicative of this. Studies reveal that the date of birth estimated by Naegeli's rule is not reliable and accurate, indicating a measurement made using ultrasound more reliable (Olesen A.W., 2006; Taipale P., 2001). Unfortunately, our own research was mainly based on the date of delivery calculated from Neagel's rule, which could have contributed to an inadequate assessment of the perinatal maturity of the cervix. This factor could have a significant impact on perinatal results of the cervix and preinduction of delivery. Similarly, the Bishop’s scale, which evaluates the perinatal readiness of the cervix, is currently not identified with high credibility, because research indicates the advantage of transvaginal research (BastaniP. Et al. 2011).

Up to a week after the set date of delivery, both pregnant and medical staff are interested in initiating childbirth. Natural methods of preinduction or induction of labor work when the woman's body is almost ready for delivery. They are safe because they will not cause premature birth. Natural methods of induction are uncommonly the subject of scientific research. It is also not known why in some women the method gives a great result, while in others it has no effect. Among the most commonly used are sexual act, because male semen contains prostaglandins - hormones that accelerate the maturation of the cervix, cause its destruction and dissection (Arias F., 2000). In addition, during an orgasm, oxytocin, a hormone responsible for causing cramps, is secreted. Nipple stimulation also causes excretion of oxytocin. Walking, rocking your hips, climbing and going down the stairs helps your child to get in the birth canal. Thus, the movement supports the appearance of contractions. Other commonly used methods include pressure on the body of acupuncture points, drinking herbal infusions, including raspberry leaves or evening

primrose oil (Kostrzewa M., Kalinka J. 2012, Polish Gynecological Society, 2009, PTG Recommendations, 2009). In our own studies, a positive effect of vagal nerve stimulation was demonstrated through traction of the cervical intervertebral space between the base of the occipital bone (C0) and the first cervical vertebrae (C1) for cervical maturation. The cervix of the examined women in the group subjected to nerve traction significantly shortened and gaped more frequently. Importantly, the shortening of the neck is related to the lowering of the child's head in the birth canal, and thus the leading point. Undoubtedly, the research problem is the original one, at the same time attempts to evaluate the impact by stimulating the vagus nerve have already been described in the current paper (Howland 2014, Frangos et al. 2015, Hein et al., 2013). Investigations of non-invasive, transcutaneous vagus stimulation confirmed the significant increase in oxytocin in the brain and plasma (McEwen, 2004). Thus, the dissemination of methods based on safe stimulation of the vagus nerve is worth popularizing among the therapeutic team that takes care of a pregnant and giving birth woman. Proven anatomical and physiological relationships of the vagus nerve have a potential role in the course of labor, however the problem requires further multifaceted observations and tests.

Unfortunately, pharmacological induction of labor is a frequent medical intervention performed in hospitals both in Poland and abroad. According to the Give birth humanly Foundation, it happens in more than 60% of births, although only a small percentage of women really need it for health reasons. Pharmacological induction often initiates a cascade of adverse interventions. As a result, it disturbs the physiological mechanism of delivery, contributing to many perinatal problems. The number of pharmacologically induced deliveries is still growing, both in Poland and in the world. Although the side effects of the use of artificial oxytocin are unfavorable for mothers and children, the percentage of labor induction does not decrease at all. What's more, the number of indications for induction increases, including the "gray zone" of indications that have little to do with the health situation of a woman giving birth. The latest results of Give birth humanly Foundation show that birth was caused in 43.4% of respondents giving birth to nature or having an unplanned caesarean section. Over half of the respondents (60.6%) had an oxytocin drip - 54.9% to speed up labor and 39% to induce labor. The more often delivered births were taken by the first-born (45.2% vs 39.9%), as well as the administered oxytocin (68.2% vs 45.4%). It is widely misleading that intravenous oxytocin is also the same hormone that is secreted in the pituitary gland of a woman giving birth. Unfortunately, artificial oxytocin is released in a different way than natural. Endogenous oxotocin (i.e. natural), responsible inter alia for uterine contractions, is secreted in a pulsatile manner and its amount varies depending on the stage of delivery. In our research, births of women from the experimental group began significantly closer to the estimated date. Perhaps through a positive effect on the secretion of endogenous oxytocin and its increased concentration or sensitization to the hormone of the muscle cells of the uterus. Synthetic oxytocin is given in a drip and is given to a woman in a continuous manner. It causes longer and stronger cramps, with which the uterus and the child sometimes it is difficult to cope. In addition, artificial oxytocin blocks the secretion of endorphins, natural opiates that reduce the sensation of pain. Artificial oxytocin is not as effective in setting the cervix as natural. In addition, it does not stimulate the fetal reflex as a result of the peak of its secretion during the last phase of pressure (ACOG, 2004; Glantz, J.C., 2005). One of the most important goals of perinatal care standards should be to reduce the physiologicalisation of the physiological labor, which is still worryingly very high. The results of the monitoring

confirm that in many places in the delivery rooms and obstetric wards there are still harmful procedures and outdated routines.

Expectations of pregnant women and standards of work with pregnant women require holistic prenatal and perinatal care. Cooperation of a team of specialists: gynecologistobstetrician, midwife, osteopath, physiotherapist, dietitian and psychologist allow to protect the needs of women and reduce her anxiety through professional education in pregnancy and the range of services of all specialties. The above work was an attempt to indicate the significance of non-invasive and painless osteopathic technique on only some perinatal parameters related to perinatal maturation of the cervix. After completing own research, you can easily list its limitations, such as: too little representative research group, lack of analysis of other important perinatal factors, or the Naegeli rule, burdened with a large error in estimating the date of delivery. On the basis of comparative analysis, good obstetric results were obtained in the work regarding the preparation of the perinatal cervix, i.e. the opening, shortening and position of the point of the leading uterus. This theme, due to the need for holistic care and reduction of medical interventions during childbirth, should be subject to a more detailed analysis.

Conclusion

1. In comparative studies, it was revealed that traction of the vagus nerve accelerated perinatal maturity of the cervix, and spontaneous systolic function occurred closer to the planned date of delivery.
2. Traction of the vagus nerve significantly affects the parameters of shortening, opening and lowering the point of the leading cervix in the assessment of perinatal maturity.

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