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## REGULARITIES OF MORPHOLOGICAL TRANSFORMATIONS IN THE VAGINA OF EARLY FETUSES

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Vaginal pathology constitutes a considerable part from a general amount of congenital and acquired pathology of the reproductive organs, which is indicated in the works of leading world scientists. The study is devoted to the determination of the anatomical features of the vagina of the fetus at the beginning of the perinatal period. The terms of the formation of the longitudinal and transverse folds of the mucous membrane of the vagina, the visualization of the vaults, its canalization and the breakthrough of the hymen are set.

**Keywords:** vagina, fetus, anatomy, human.

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According to different data defects of the internal female reproductive organs constitute from 4 to 7% of cases of all congenital pathology. Timely screening and correction of the pathology are considerably complicated by the fact that certain defects are found only when a woman becomes of a fertile age. Defects of the reproductive system result in infertility in 7,3 % of cases, and in 16,7 % the outcome of pregnancy is miscarriage [1, 2].

The problem of diagnostics and correction of congenital pathology of the internal female reproductive organs has become more and more attractive for the scientists all over the world, which is evidenced by a number of scientific reports published in periodicals. Ultrasound diagnostics is a method of choice to diagnose the pathology, although sometimes it fails to differentiate certain types and variants of developmental defects adequately. Magnetic-resonance tomography is more informative but the results of the investigation do not enable to determine the degree of permeability of the tubular structure. At the same time, such methods as hysterosalpingography and hysterosalpingoscopy provide comprehensive information concerning permeability of the uterine (fallopian) tubes, vagina and uterine cavity, but they do not indicate probable disorders of the external uterine outline, uterine tubes, ovarian pathology, ligaments, blood supply and blood outflow available. In spite of numerous scientific works dealing with elaboration of diagnostic methods and investigation of causes promoting the development of congenital pathology of the internal female reproductive organs, information concerning fetal anatomical standards and methods of perinatal correction of congenital pathology is mostly fragmentary and incomplete. In the developed countries the issues of modern surgery and anatomy today mostly deal with elaboration of methods of perinatal surgery and its anatomical substantiation. Meanwhile in Ukraine scientists do not pay much attention to them. In their scientific works leading European specialists pay much attention to both elaboration of new methods in the treatment of congenital pathology of the reproductive organs, and anatomical substantiation of surgical treatment of the acquired pathology [6]. Vaginal pathology constitutes a considerable part from a general amount of congenital and acquired pathology of the reproductive organs, which is indicated in the works of leading world scientists [3-7].

**The purpose** of the work was to investigate the dynamics of morphological and morphometric parameters of the vagina at the beginning of the fetal period; to determine perinatal variants of the vaginal structure of early fetuses.

**Materials and methods.** To achieve the objective of the study concerning investigation of typical and variant anatomy of the vagina at the beginning of the fetal period 30 specimens of human fetuses 4-6 months of age without external signs of anatomical deviations or developmental defects were examined.

The material was distributed into age groups according to the classification of the human ontogenesis periods by B.M. Patten, B.P. Khvatov, Y.N. Shapovalov tables on the basis of parietal calcaneal length measuring considering "Instructions on Determining the Criteria of Perinatal Period, Live Birth and Stillbirth" approved by the Order of the Ministry of Health of Ukraine № 179 dated 29.03.2006. The study was performed according to the major bioethical principles of the European Convention on Human Rights and Biomedicine (dated 04.04.1997), the Declaration of Helsinki developed by the World Medical Association (WMA) as a statement of ethical principles for medical research involving human subjects, including research on identifiable human material and data (1964-2008), and the Order of the Ministry of Health of Ukraine № 690 dated 23.09.2009.

**Results of the study and their discussion.** In 4-month female fetuses the posterior surface of the bladder borders on the uterine body and cervix. The latter is forward inclined at an obtuse angle to the vagina. The vagina looks like a tube filled with pasty white mass. Supravaginal part of the uterine cervix is covered with the peritoneum and separated from the lower part of the posterior wall of the bladder by a thin layer of spongy cellular tissue. In male fetuses the peritoneum from the upper posterior surface of the bladder passes from the back to the anterior surface of the rectum and forms rectovesical depression, and in female fetuses – on the anterior surface of the uterus forming vesicouterine depression. The latter looks like a slit 6.5-8.5 mm deep on the sagittal section. Longitudinal folds of the mucous membrane of the uterine cavity are lacking. The uterine fundus in 4-month fetuses is not developed and located lower the level of the uterine tubes emerging. In the majority of fetuses the upper inconsiderable part of the vagina is adjacent to the lower part of the posterior wall of the bladder and separated from it by a thin layer of the spongy cellular tissue. In the pelvic region the vagina forms an inflection curved backward, and while passing into the perineal portion – curved backward. The rectum forms two lateral inflections in the frontal plane directed by their convexity to the right and left. The rectum is filled with meconium to some extent. The contraction muscle of the vagina 2.2-4.6 mm long is presented with single fibers which embrace the vaginal vestibule and cover vestibule bulbs in the form of a tape. The levator muscle of the anus is usually tetragonal in shape. Internal (middle) bundles of the pubococcygeal muscle, as a part of the levator muscle of the anus, are closely adjacent to the lateral walls of the urethra and vagina, and are attached to the anterior and lateral walls of the rectum. In 6 out of 10 examinations of 4-month female fetuses the middle bundles of the pubococcygeal muscle grow together with the posterior part of the lateral vaginal walls.

In 5-month female fetuses the vagina is located in the inferior portion of the minor pelvis, the fundus of the urinary bladder is in front of it, and the urethra – lower. The peritoneum covering the upper part of the posterior vaginal wall passes onto the rectum. Major labia look like skin folds located in the sagittal plane. Minor labia are located medially from the major ones, and the clitoris is near their superior extremities. At this stage of development the head, body and crus of clitoris are found. The latter are attached to the lower branches of the pubic bones. The clitoris is divided into two halves – cavernous bodies and surrounded by a thin fascia passing to the pubic symphysis. The vagina is supplied with blood by means of the branches of the uterine, lower vesicular, middle rectal and internal pudendal arteries. The external female reproductive organs are supplied with blood by the branches of the internal and external pudendal arteries.

At this stage longitudinal folds of the uterine mucous membrane are found. The uterine cervix concerning the vagina is forward inclined at the angle of 110-160°. Supravaginal part of the cervix is covered with the peritoneum and separated from the inferior part of the vesicular posterior wall by an inconsiderable layer of the spongy cellular tissue. The distance from the fundus of the vesicouterine depression to the anterior vault ranges from 3.4 to 4.5 mm. The vesicouterine depression on the sagittal section looks like a slit. The rectum is adjacent to the posterior surface of the uterus. It is separated from it by the peritoneum passing onto the vagina. It should be noted that the peritoneum covers only 1/3 of the posterior vaginal wall. The rectouterine depression is 5.8-8.8 mm deep. The upper part of the uterus is located 2.3-4.6 mm higher from the entrance into the minor pelvis, and the uterine cervix is 4.6-7.2 lower from the cavity of the entrance into the minor pelvis. The vaginal cavity is in the shape of a slit. The anterior wall of the vagina is closely adjoined with the posterior wall of the urethra. The female urethra is in the shape of a short tube from 7.6 to 8.0 mm long (fig. 1).

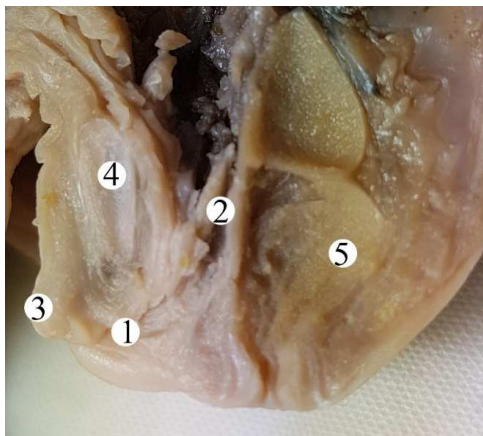


Fig. 1. Sagittal section of the pelvic organs of the female fetus, 230,0 mm of parietal calcaneal length. Microslide, lens 8, oc. 10: 1 – vaginal vestibule, 2 – cervix uteri, 3 – clitoris, 4 – pubic bone, 5 – rectum.

The rectum adjoins the posterior vaginal wall. On the anterior and posterior vaginal walls one and sometimes two longitudinal folds of the mucous membrane are found. The lower part of the posterior vaginal wall and the lower part of the rectum are closely joined with the tendon center of the perineum. The latter passes between them in the form of a wedge. A thin layer of the spongy cellular tissue touches on the vagina from the sides. At this stage of development the anterior and posterior vaginal vaults with similar depth are formed.

To the end of the 5th month of the intrauterine development (fetuses of 150,0-200,0 mm of parietal calcaneal length) vaginal canalization is determined in the caudal-cranial direction, a clear border between the uterine-vaginal canal and urogenital sinus (UGS) is not found. The vaginal epithelium in the upper third passes from the uterine-vaginal

canal, and in the lower two thirds of the vagina – from UGS. The fibrous-muscular vaginal wall is formed from the surrounding mesenchyme.

In 6-month fetuses in front from the urinary bladder the pubic symphysis is determined, and posteriorly from it – body and cervix of the uterine, ovaries, and rectum. The peritoneum extends between the urinary bladder and uterus forming the vesicular-uterine depression. On the sagittal section between the urinary bladder and uterine cervix the vesicular-cervical slit is determined, which is bounded superiorly by the peritoneum of the vesicular-uterine depression, anteriorly – by the fascia of the urinary bladder, posteriorly – by the fascia of the uterine cervix, and downward – adhesion of the vesicular fascia and uterine cervix. The vesicular-vaginal slit is directed downwards and forwards concerning the vaginal position. The vesicular-vaginal slit reaches the adhesion of the vesicular fascia with the uterine cervix upward. It should be noted that on the level of the urethral beginning the vesicular-vaginal slit is not determined, since the urethra is closely joined with the vaginal fascia. The vesicular-cervical and vesicular-vaginal slits are bounded by the connective tissue taeniae forming the vesicular-uterine ligaments.

The rectovaginal slit is narrow, located frontally and filled with spongy cellular tissue. Upward the rectovaginal slit is bounded by the peritoneum of the uterorectal depression, anteriorly – vaginal fascia, and posteriorly – rectal fascia. From the sides the rectovaginal slit passes into the rectal taeniae containing rectal vessels and lymphatic vessels of the uterine (fig. 2). The distance from the fundus of the vesicular-uterine depression to the anterior vaginal vault is 4,2-6,7 mm. At this stage of development the transverse folds of the uterine mucous membrane are first determined. The uterine cervix is located 5,2-7,1 mm lower from the entrance cavity to the minor pelvis. It should be noted that the uterine cervix concerning the vagina is inclined at the angle of 110-160°. Only superior small part of the vagina adjoins the lower part of the posterior vesicular wall. We have found variability of the vaginal cavity shape in 6-month fetuses. Thus, in the upper and middle thirds of the vagina the following shapes are found: oval (6 cases), elongated-oval (3 cases), stellate (1 case); in the lower third H-shape is mostly found (6 fetuses). The transverse folds are found along the whole length of the mucous membrane of the vagina. They are more marked in the portion of the upper vaginal third. In two cases (fetuses 260,0 and 290,0 mm of parietal calcaneal length) out of two examined 6-month fetuses the vaginal vault was not found on the sagittal section. The anterior vaginal wall is closely adjoined with the posterior urethral wall. In female fetuses venous outflow occurs in the vaginal venous plexus.

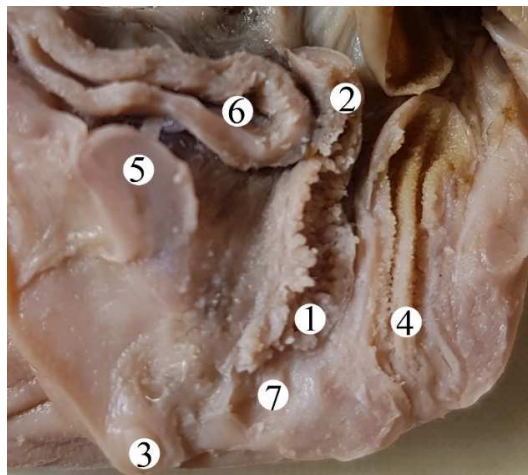


Fig. 2. Organs of the pelvis and perineum of a female fetus 290,0 mm of PCL. Microslide. Right view. Magnification x 3.6: 1 – vagina, 2 – cervix uteri, 3 – clitoris, 4 – rectum, 5 – pubic symphysis, 6 – urinary bladder, 7 – vaginal vestibule.

The virginal septum is formed due to dilation of the caudal portions of the vagina followed by invagination of the posterior UGS wall, and to the end of the fetal period of human ontogenesis it serves for separation of the vaginal lumen and UGS cavity. In the perinatal period the virginal septum is ruptured, and its remains form a thin duplicate of the mucous membrane. Literary sources contain the data that the virginal septum is a part of the urogenital septum. The virginal septum is ruptured at the end of the 6<sup>th</sup> – beginning of the 7<sup>th</sup> month of the intrauterine development (fetuses 300,0-350,0 mm of parietal calcaneal length). It should be noted that in case the virginal septum is not ruptured in time, it can result in its atresia, or preterm rupture of the virginal septum causes appearance of the transverse septa of the vagina.

Thus, analyzing the results of our studies, we can conclude that in general they are consistent with the results obtained by other scientists involved in the study of anatomical features of some internal female genital organs [3, 6, 7]. However, it should be noted that such studies, mentioned by the above authors, were carried out in view of the establishment of anomalous morphogenesis in the objects of the study or authors studied groups of objects in the embryonic and adulthood periods [1, 2, 4]. Whereas our studies are devoted to detecting anatomical features of a particular organ, the vagina, at various stages of the fetal period.

## Conclusions

1. At the beginning of the fetal period we have found the signs of formation of the longitudinal (4-month fetuses) and transverse (6-month fetuses) folds of the vaginal mucous membrane. 2. The vaginal vaults begin to form on the 5<sup>th</sup> month of development (in 3 cases out of 10). The vaults are clearly seen on the 6<sup>th</sup> month in the majority of cases (8 out of 10). 3. Canalization (recanalization) of the vagina begins on the 5<sup>th</sup> month of the fetal period. 4. The virginal septum is ruptured in the majority of cases till the end of the 6<sup>th</sup> month.

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## Реферати

**ЗАКОНОМІРНОСТІ МОРФОЛОГІЧНИХ ПЕРЕТВОРЕНЬ ПІХВИ РАННІХ ПЛОДІВ**

Проняєв Д.В., Булик Р.С., Хмара Т.В.

Вагома частка від загальної кількості природженої та набутої патології органів репродуктивної системи припадає на патологію піхви, про що йдеться у роботах провідних світових вчених-анатомів. Дослідження присвячене визначенню анатомічних особливостей піхви плодів на початку плодового періоду. Встановлені терміни формування поздовжніх та поперечних складок слизової оболонки піхви, візуалізації склепінь, її каналізації та прориву дівочої перетинки.

Ключові слова: піхва, плід, анатомія, людина.

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**ЗАКОНОМЕРНОСТІ МОРФОЛОГІЧЕСКИХ ПРЕВРАЩЕНИЙ ВЛАГАЛИЩА РАННИХ ПЛОДОВ**

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Значительная часть случаев общей врожденной и приобретенной патологии органов репродуктивной системы приходится на патологию влагалища, о чем говорится в работах ведущих мировых ученых-анатомов. Исследование посвящено определению анатомических особенностей влагалища плодов в начале плодового периода. Установлены сроки формирования продольных и поперечных складок слизистой оболочки влагалища, визуализации сводов, ее каналізації и прорыва девственной плевы.

Ключевые слова: влагалище, плод, анатомия, человек.

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Українська медична стоматологічна академія, м. Полтава****ВПЛИВ 1% ЕФІРУ МЕТАКРИЛОВОЇ КИСЛОТИ І ФУЛЕРЕНУ С60  
НА МОРФОФУНКЦІОНАЛЬНИЙ СТАН ПЕЧІНКИ ЩУРІВ**

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В роботі вивчено вплив Фулерену С60 як можливого гепатопротектора на структурну організацію печінки щурів у порівнянні з мономером для пластмас гарячої полімеризації. Встановлено, що тривале надходження залишкового мономеру з базису акрилових протезів спричиняє дистрофічні зміни гепатоцитів та розлади гемомікроциркуляції в печінці щурів. Застосування Фулерену 60 на тлі дії 1 % ефіру метакрилової кислоти зменшує дистрофічні зміни в гепатоцитах і дисциркуляторні прояви в печінкових часточках, тому може розглядатись на перспективу в якості протектора органів травної системи при користуванні повними та частковими знімними протезами.

Ключові слова: фулерен С60, ефір метакрилової кислоти, печінка, щури.

Робота є фрагментом НДР «Застосування сучасних технологій діагностики та лікування для реабілітації стоматологічних хворих ортопедичними методами» (№ державної реєстрації 0117U004778).

Потреба у протезуванні знімними зубними пластинковими протезами, за даними різних авторів, коливається від 50 до 75 %. Кількість хворих з знімними протезами постійно зростає у зв'язку зі значним поширенням стоматологічних захворювань і прогресуючим старінням населення всієї земної кулі, особливо, в індустріально розвинених країнах де тривалість життя збільшується [10, 15].

З віком збільшується як кількість видалених зубів, так і кількість людей з повною відсутністю зубів. По даним різних авторів, у 60 – 69- літніх повна утрата зубів складає 8-17%, у 70 – 79 – літніх – 29 - 34 %, у 80-89-літніх- 10-36 % [8].

Для виготовлення базисів пластинкових протезів в основному використовуються похідні акрилової та метакрилової пластмаси. Їх відсоткова частка у всіх видах знімних конструкції складає від 91 до 98%.