Anatomical peculiarities of the iliocecal junction at the prenatal period of ontogenesis

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Abstract

The sequence of macro- microscopic and spatial-temporal transformations of the ileocecal junction of the intestine at fetus and newborn has been studied by means of modern methods of anatomical investigation. The staging of the formation of the ileocecal papilla has been determined.

Key words: ileocecal segment, anatomy, perinatal period.

Анатомические особенности подвздошно-слепокишечного перехода в перинатальном периоде онтогенеза

С помощью современных методов анатомического исследования изучена последовательность макромикроскопических и пространственно-временных анатомических превращений составляющих компонентов подвздошно-слепокишечного сегмента у плодов и новорожденных. Установлена стадийность формообразования подвздошного сосочка.

Ключевые слова: подвздошно-слепокишечный сегмент, анатомия, перинатальный период.

Introduction

Modern medicine requires accurate information about age-related anatomic variability of the human organs and systems. The effect of perinatal disturbances on the development of systemic diseases of the internal organs is well-known [1,2]. Ileocecal invaginations in children make up 93.7% of the overall number of intestinal invaginations.

The death rate from this pathology is 5% [3, 4]. A major part of developmental abnormalities occurs in the large intestine, in particular, in the ileocecal segment (ICS) [5]. Surgical interferences for ICS pathology constitute the greatest share of interventions on the organs of the abdominal cavity.

The majority of its lesions are a direct indication for a resection whose consequences very often cause dyspepsias [6]. A great number of publications deals with anatomical research of ICS [7, 8], however the published findings are largely fragmentary [9, 10].

Material and methods

The study was carried out on 125 cadavers and the organocomplexes of human fetuses and newborns. The authors used the methods of macromicropreparation, morphometry, photodocumenting [11], an injection of the arterial vessels, and topographoanatomical sectioning. The relative position of the constituent components of the ICS, its relation to the peritoneum and the right kidney were studied. Following a macroscopic investigation, roentgenography was performed.

The results of the researches and their discussions

The form, measurements, structure and interrelation of the ICS components among themselves and the adjacent organs change during the fetal period.

The absence of a functional load and the functional immaturity of tissues do not enable structural differentiation in its constituent parts. The initial segment of the large intestine represents an elongated, uniformly narrowed cone which is convoluted in the form of a vortex at the beginning of the fetal period (4-5 months) (fig. 1. A), the form of a loop in the middle of the fetal period (6-7 months) (fig. 1. B), at the end of the prenatal development (8-10 months) it has the form of a hook (fig. 1. C).

The cecum in fetuses is bent and uniformly narrowed in the form of a cone. The obturative incompetence of the ileal papilla (IP) [12], the absence of an anatomical boundary between the vermiform appendix and the blind gut [13] are indicative of the absence in fetuses of the cecum as a separately formed organ.

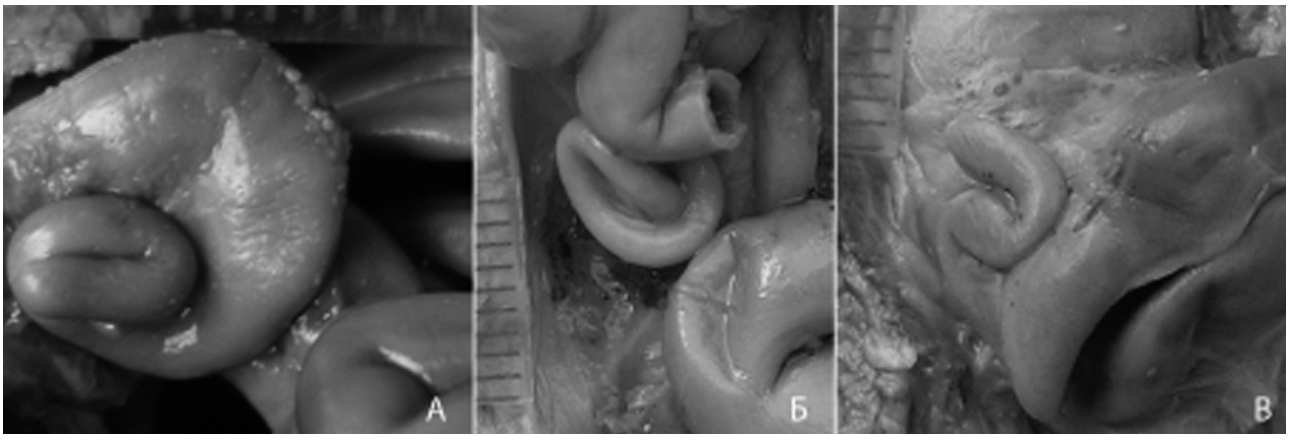

Fig. 1. The initial portion of large intestine in fetuses (explanations are in the text).

The vermiform appendix in fetuses represents the apex of the cone with a relatively large length, and is characterized by a variability of the form and position. Thus, it is necessary to regard the cecum and the vermiform appendix as one anatomical structure. A narrowing of both the lumen and the external diameter of the cecum near the base of the appendix in newborns is a sign of the formation of an anatomical border between them. Folds of the mucous coat are observed in the region of the narrowing.

It has been obserbed that the IP of oval and round shapes as well as a bilabial IP are the succestive stages of its structure. Accordingly, the ileocecal valvulosphincteral apparatus in the process of its morphogenesis passes through the stages of the papilla (the sphincteral structure) and the fold of the mucous membrane (the valvular structure).

Thus, such names as "Bauhin's valve", the "ileocecal valve" or the "ileal papilla" does reproduce a complex of the morphophysiological characteristics of this particular structure. As our investigations have demonstrated, IP is part of the ileum which invaginates into the lumen of the large intestine.

These anatomical facts are indicative of V. N. Vataman et al.'s groundlessness assertion (1985) about the the formation of IP only at the expense of the large intestine and its final formation at the early stages of the fetal period.

Anatomical changes of the ICS proceed after the type of "intussusception" during the fetal period. Its lumen closes partially in the IP region in the 4th month which is evidenced by its form and the form of the ileal ostium. At the beginning of the fetal period, (4-5 month) the IP has a round form with a pinhole orifice. In the 7th month, a maximal amount of meconium accumulates in the afferent loop (it's the terminal position of the ilium), resulting in the formation of an ampula-like expansion of the ilium.

Over the period from month 5 to month 7, we can observe an accelerated increase in the diameter of the terminal portion of the ilium which coincides with the period of a more gradual increase of the large intestine. In the middle of the fetal period (the 7th month), the diameter of the ampula-like dilated terminal segment of the ilium exceeds the diameter of the initial portion of the large intestine. A subsequent increase of the meconium quantity results in a distension of the "neck of the invaginate" (the ileal papilla).

In the 7th and 8th months of the intrauterine development, the width of the IP wall decreases, whereas its diameter increases, the shape changes from round to oval (along the axis of the ascending colon), and the pinhole shape of the ileal orifice becomes oval shaped. These processes lead to a restoration of intestinal patency. Starting from the 8th month, there occurs a filling of the large intestine with meconium that is evidenced by its increased diameter that starts exceeding the diameter of the small one (fig. 2).

The "head of the invaginates" (IP) partially restrains reflux. At the same time, an intestive increase in the diameter of the large intestine is observed, coinciding in time with an increase in the diameter of the small intestine. A more intensive dilatation occurs opposite and below the IP, and an anatomical boundary is formed between the cecum and the vermiform appendix. A distension of the walls of the large intestine brings about a distension of the IP. At the beginning, it acquires an oval shape perpendicular to the axis of the ascending colon. The ileal orifice at that point is slit-like, whereas with the beginning of an active filling with meconium, the ileal orifice is of a labelloid form (fig. 3, 4). Thus during an early stage of ontogenesis the IP shape changes gradually. In the process of its development it goes through five successtive stages.

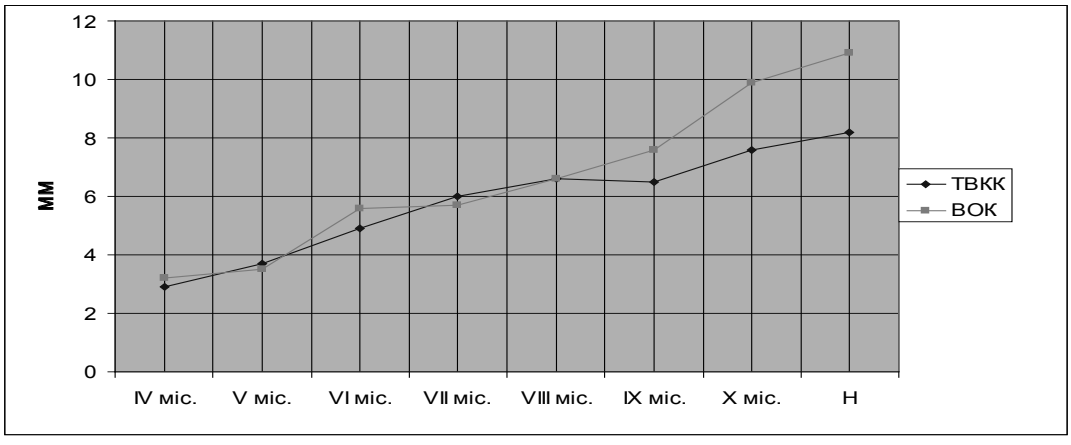

Fig. 2. The dynamics of a change of diameters of the terminal position of the ilium (TPI) and the ascending colon (AC) in the perinatal period of ontogenesis.

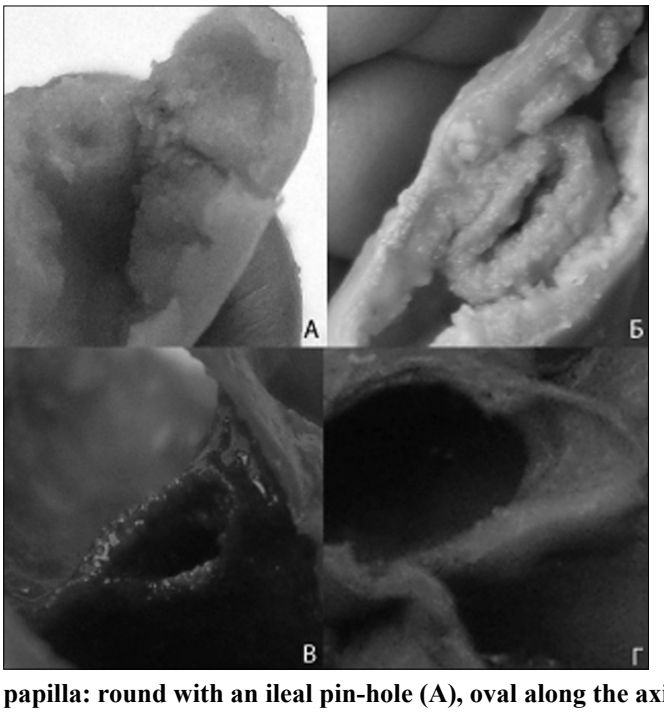

Fig. 3. The form of the ileal papilla: round with an ileal pin-hole (A), oval along the axis of the ascending colon (B), oval perpendicularly to the ascending colon, labelloid (C).

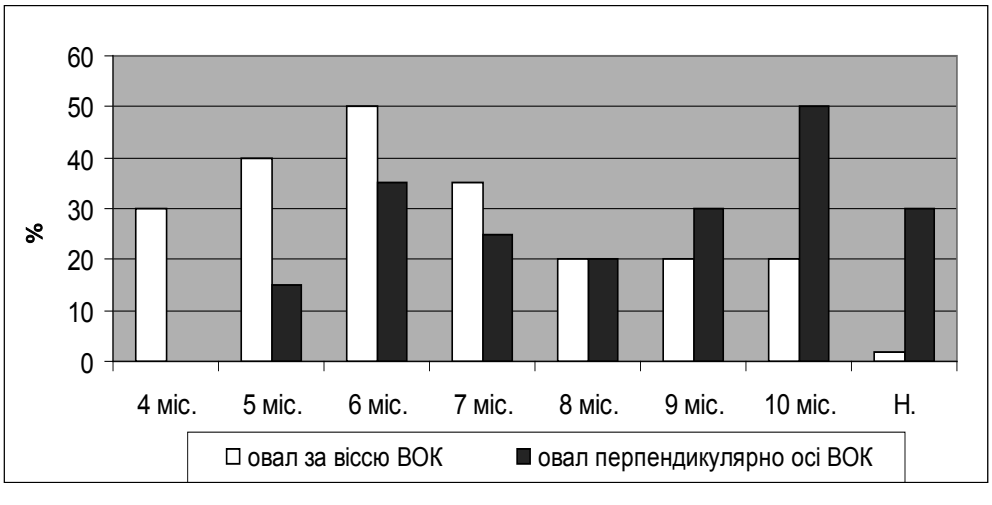

Fig. 4. The dynamics of the form of the oval ileal papilla relative to the axis of the ascending colon (AC) in the fetal period.

The dynamics of changes of the morphometric parameters of the fetal ICS are presented in the table. The skeletopy of the ICS alters from the level of the body of the 1st lumbar vertebra (at the beginning of the fetal period) to the level of the inferior border of the 5th lumbar vertebra (at the end of the fetal period). The skeletopic projection of ICS changes within the range of the height of the body of the 5th lumbar vertebra (fig. 5).

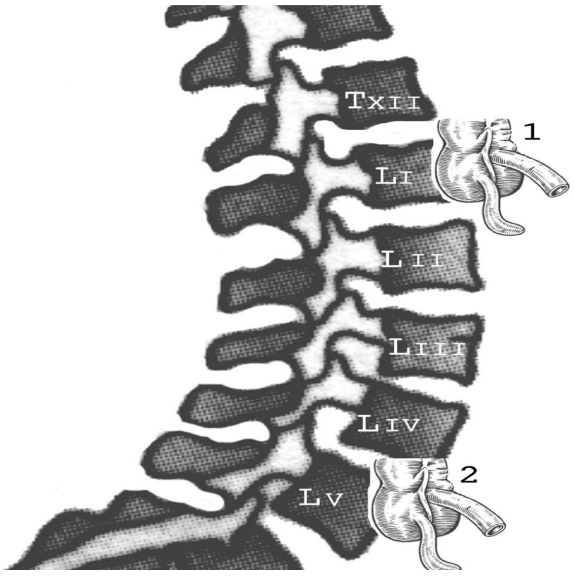

Fig. 5. The dynamics of altered skeletopy of the ileocecal segment in fetuses (1) and newborns (2).

Conclusions

1. Five consecutive form-building stages are intrinsic to the morphogenesis of the ileal papilla: 1) An oval papilla with the pin-hole orifice in the 4th-5th months; 2) An oval papilla, positioned longitudinally in the 6th-7th months; 3) A round papilla with a gaping orifice in the 8th-9th months; 4) An oval papilla located transversely in the 10th month; 5) A labelloid (bilabial) papilla during the neonatal period.

2. The morphogenesis of the obturative – valvular mechanism of the ileocecal segment proceeds after the invagination type that is accompanied with a temporary closure of the small-large intestinal junction and, as a consequence, a dilatation of the terminal position of the ileum in the 7th and8th months whose diameter (6.0 ± 0.4 mm – in the 7th month; 6.6 ± 0.3 mm – in the 8th month) exceeds the diameter of the proximal segment of the large intestine (5.4 ± 0.8 mm and 6.1 ± 0.3 mm, respectively).

3. The formation of the definitive structure of the components of the ileocecal segment and variants of their structure depends to a greater extend on the degree of a meconium filling of the intestine.

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Aspecte noi asupra inervaţiei bronhiilor şi a plămânilor

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Some features of nerve supply of the bronchi and lungs

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Actual research presents the multilateral views of morphological investigations of the nervous apparatus of the bronchi and lungs. Using special adequate morphological methods of exploration, the specificity of organization, morph-functional features and rules of nerve distributions of nervous apparatus of bronchi and lungs were observed. This complex picture permits us to establish, improve and increase the present view of structure and functions of thoracic organs, its interrelations and correspondent clinical importance.

Key words: bronchi, lungs, vegetative innervations, nerve plexuses.

Новые данные об иннервации бронхов и лёгких

Работа представляет собой многогранное исследование морфологии нервного аппарата бронхов и лёгких. Используя ряд адекватных морфологических методов исследования были установлены специфика организации, морфофункциональные особенности и закономерности распределения нервов, что позволило получить комплексную картину вне- и внутриорганного нервного аппарата бронхов и лёгких и межорганных связей данной области, углубить и расширить современные представления о их функциональной роли, что имеет важное значение для медицинской практики.

Ключевые слова: бронхи, лёгкие, вегетативная иннервация, нервные сплетения.

În cadrul organelor, care asigură funcţiile vitale ale organismului, un loc deosebit îl deţin plămânii, reglarea funcţională a cărora este complexă, dat fiind faptul, că la acest nivel sunt reprezentate, ca ansamblu morfofuncţional, complexele alveolocapilare, căile respiratorii extra- şi intrapulmonare, vasele sangvine ale circulaţiei pulmonare şi celei corporale etc.

Interesul vădit privind problemele referitoare la reglarea nervoasă a activităţii bronhiilor şi vaselor circulaţiei pulmonare e dictat de un număr impunător de cercetări care denotă, că modificările patologice în plămâni, de regulă, sunt condiţionate de dereglările funcţii ale aparatului lor nervos [2, 3, 4, 5, 7, 8, 9, 10, 11, 12].

Problema inervaţiei bronhiilor şi a vaselor pulmonare s-a aflat în atenţia multor cercetători, fapt care a dus la acumularea unui bogat material faptic referitor la structura surselor de inervaţie, plexurilor intra- şi extraorganice, componenţei aparatului nervos intramural etc. [1, 6, 13, 14].

Actualmente nu există un concept unic şi definitivat referitor la natura conexiunilor inter- şi intraorganice, nu dispunem de date suficiente privind interacţiunea elementelor nervoase din pereţii bronhiilor cu cele ale vaselor circulaţiei pulmonare. Studiul de faţă prezintă o investigaţie morfologică a surselor de inervaţie a plămânilor, a particularităţilor de inervaţie senzitivă, vegetativă (simpatică şi parasimpatică), evidenţierea şi analiza minuţioasă a plexurilor nervoase extra- şi intraorganice pulmonare şi cardiace, precum şi aprecierea aspectului aplicativ al acestor interrelaţii nervoase intratoracice.