ISSN 2509-4327 (print)
ISSN 2510-4780 (online)

Deutscher Wissenschaftsherold
German Science Herald

№ 5/2017

Die Zeitschrift „Deutscher Wissenschaftsherold" ist eine Veröffentlichung mit dem Ziel ein breites Spektrum der Wissenschaft allgemeinverständlich darzustellen. Die Redaktionsleitung versteht sich als Vermittler zwischen Wissenschaftlern und Lesern. Durch die populärwissenschaftliche Bearbeitung wird es möglich unseren Lesern neue wissenschaftliche Leistungen am besten und vollständigsten zu vermitteln. Es werden Untersuchungen, Analysen, Vorlesungen, kurze Berichte und aktuelle Fragen der modernen Wissenschaft veröffentlicht.

Impressum
Deutscher Wissenschaftsherold – German Science Herald
Wissenschaftliche Zeitschrift
Herausgeber:
InterGING
Sonnenbrink 20
31789 Hameln, Germany
Inhaber: Marina Kisiliuk
Tel.: + 49 51519191533
Fax.:+ 49 5151 919 2560
Email: info@dwherold.de
Internet:www.dwherold.de
Chefredakeur/Editor-in-chief:
Marina Kisiliuk
Korrektur:
O. Champela
Gestaltung:
N. Gavrilets

Auflage: № 5/2017 (September) – 30
Redaktionsschluss September, 2017
Erscheint vierteljährlich
Editorial office: InterGING
Sonnenbrink 20
31789 Hameln, Germany
Tel.: + 49 51519191533
Fax.:+ 49 5151 919 2560
Email: info@dwherold.de
Deutscher Wissenschaftsherold - German Science Herald is an international, German/English language, peer-reviewed, quarterly published journal.
№ 5/2017
Passed in press in September 2017
Druck: WIRmachenDRUCK GmbH
Mühlbachstr. 7
71522 Backnang
Deutschland

INDEXING: Google Scolar, WorldCat, Index Copernicus, InfoBase Index, Journal Index, Citefactor, International Scientific Indexing, JIFACTOR, Scientific Indexing Services, International Institute of Organized Research.

DDC-UDC 611.344/.346.012:616.34-007.272 DOI:10.19221/201753

Proniayev D.V.,
PhD, Associate Professor, Department of , anatomy, topographical anatomy and operative surgery of the Higher State Educational Institution of Ukraine "Bukovinian State Medical University", Chernivtsi, Ukraine, topikabsmu@i.ua
Tymchuk K.Yu.,
Assistant, Department of Medical Biology and Genetics of the Higher State Educational Institution of Ukraine "Bukovinian State Medical University", Chernivtsi, Ukraine
Shandro K.D.
Municipal Regional Out-of-School Educational Institution "Bukovinian Small Academy of Sciences of Students"

PERINATAL ANATOMY OF THE ILIOCECAL TRANSITION UNDER CONDITIONS OF INTESTINAL OBSTRUCTION

Abstract. *The significance of the study is stipulated by the absence of objective data concerning perinatal anatomy of the ileocecal transition and an integral conception about chronological succession of anatomical interrelations of its components in the early period of ontogenesis. We have determined successive changes of morphological signs of the constituents of the ileocecal segment of fetuses. This dynamic algorithm of spatial-temporal changes of the ileum-caecum segment structures is evidenced on the sample of the fetus with congenital intestinal obstruction. We have determined 6 successive age variants of the iliac papilla structure peculiar for a certain age period: the fetuses of the 4-5th months are characterized by a round iliac papilla with an iliac pinhole; at the 6-7th month it becomes oval along the axis of the ascending colon with a slit-like iliac opening; at the 8-9th month – round with a gaping iliac opening; at the 10th month – oval transversally from the axis of the ascending colon with a slit-like iliac opening; labelloid papilla characteristic for newborns.*
Key words: *fetus, iliac papilla, anatomy, man.*

Introduction. The term "irritable bowel syndrome" includes a number of pathological conditions caused by functional failure of the iliac papilla, and as a result, reflux-ileitis (retrograde regurgitation of the content of the colon into the ileum). This pathology which is likely caused by disorders of perinatal morphogenesis of the iliac papilla occurs in 20-30 % of adult population and in 3,2 % of children [1].

The ileocecal intestinal segment is one of the most important links of the digestive tract. It is responsible for the direction, cycling, and portion filling of the colon with chymus. This segment undergoes effect of variable lesions more often than other portions of the digestive tract.

In general ileocecal segment contains the following sphincter, valvular and/or sphincter-valvular closing apparatus: valve of vermiform appendix (Gerlach's valve), ileocecal valve, cecal sphincter, cecal-ascending sphincter [56, 38]. According to the conception concerning the regularity of the structure and functions of the digestive tract, its hollow organs form a construction containing three macro-segments. Each of these segments is subdivided into smaller segments, the extreme of them form segmental complexes in the composition of tertiary three segments, and the number of sub-segments of the central segments can reach several dozens. A dynamic sphincter is located between every segment – thickening of the mucous membrane, and static sphincter – circular fold of the mucous-submucous layer of the organ wall. This anatomical-functional regularity should be considered in planning and performing surgery on the intestines. Modern clinic requires accurate information concerning age anatomical changeability of the human organs and systems: their shape, size, location, number etc. [9], since this segment is often used in reconstructive surgery as allograft after resection of the esophageal-gastric segment [2]. Although development of new and improvement of present surgery using this intestinal segment is a little complicated considering the fact that this portion is of a unique human structure, which makes it

impossible to use experimental surgical animal sample. Therefore, appearance of new physiological and anatomical surgical methods should be closely connected with investigation of clinical anatomy of the ileocecal segment [3].

Objective: to observe spatial-temporal dynamics of morphological components of the ileocecal segment in the perinatal period; to examine shape-forming effect of meconium.

Materials and methods. The study was conducted on 125 dead fetuses and organs of fetuses and newborns without evident macroscopic signs of defects in the structure of the gastrointestinal tract. The specimens from the Anatomical museum of the Department of Anatomy, Topographic Anatomy and Operative Surgery and M.G.Turkevych Department of Human Anatomy were used for the investigation. The periods of the intrauterine development were systematized according to G.A. Schmidt's classification. Age structure of the examined objects was determined according to the combined tables by Б.М.Patten, В.Р.Khvaotv and Yu.N.Shapovalov on the basis of measuring of the parietal-calcaneal and parietal-coccygeal length. Specimens of fetuses and newborns were measured first, and then fixed in 10-12% formaldehyde solution during 2-3 weeks, after that they were kept in 3-5% formaldehyde solution. Age structure of the examined objects is presented in the table.

Table

Age structure and number of examined objects

Age	Parietal-calcaneal length, PCL	Number of objects
Fetuses		
4 months	165,0-200,0	20
5 months	220,0-250,0	20
6 months	255,0-295,0	20
7 months	310,0-350,0	20
8 months	351,0-395,0	10
9 months	405,0-440,0	10
10 months	460,0-500,0	10
Newborns		
Since 10 months	505, mm and more	15
TOTAL:		125

In our opinion the selected material completely satisfies the conditions of achieving the purpose to observe the dynamics and regularities of morphological changes in the components of the ileocecal transition of human fetuses and newborns, since we have not selected a separate age group but observed the dynamics of anatomical development of the ileocecal transition during the fetal period and newborns. The following methods of the study were used: macroscopy – to determine the location, shape and topographic-anatomical interrelations of the ileoceal transition components between themselves, adjacent structures, age dynamics and their changes; injection of the arterial vessels with further preparation under the microscope – to study the peculiarities of blood supply of the ileocecal segment; histological examination – to clarify microscopic structure of the ileocecal segment; making topographic-anatomical cuts – to determine syntopy of the ileocecal transition with the organs and structures of the abdominal cavity; preparation under the microscope – to determine microanatomical peculiarities of the structure of the ileocecal segment components; radiologic examination – to determine skeletopia and radioanatomy of the ileocecal segment; statistical processing of the digital data – to determine the range and dynamics of distribution of morphometric parameters of the ileocecal segment components in the perinatal period.

Results and discussion. The ileac papilla during the fetal period of development changes its shape and structure. At the fourth month of the intrauterine development it looks like a round papilla. Till the seventh month the ileac papilla becomes oval in shape. An oval shape of the ileac papilla is characterized by the direction of a bigger diameter parallel to the axis of the ascending colon. At the eighth month the ileac papilla becomes round in shape and enlarges in the diameter at the expense of dilation of the ileac opening. At the ninth and tenth months the ileac papilla becomes oval in shape, but the ileac papilla is already characterized by a longer diameter perpendicular to the axis of the ascending colon. In newborns the ileac papilla of a bilabial type with well-expressed folds of the mucous membrane – lips and frenula – and slit-like ileac opening.

The processes occurring in the ileocecal

segment during the fetal period are similar to those occurring in case of invagination. The lumen of the ileocecal transition at the fourth month of the intrauterine human development is partially obstructed in the place of the ileac papilla which is indicated by its shape and the character of the ileac opening. At the beginning of the fetal period the ileac papilla is round in shape with an iliac pinhole. Till the eight month in the adduction loop (terminal segment of the ileum) maximum amount of meconium is accumulated. It results in the formation of an ampule-like dilation of the colon, decreased thickness of its wall, flattening and dilation of crypts and villi of the mucous membrane. At this period of time the diameter of the terminal portion of the ileum is quickly enlarging. This time coincides with the period of slow enlargement of the colon diameter. In the middle of the fetal period during formation of an ampule-like dilation of the terminal portion of the ileum the diameter of the latter is bigger than that of the colon. The direction and spatial location of the ileocecal segment components change, which in its turn, depends on its interrelation with the right kidney. At the beginning of the fetal period the ileocecal transition is located close to the medial surface of the upper pole of the right kidney which stipulated dorsal-lateral direction of the terminal portion of the colon. Till the middle of the fetal period the ileocecal transition descends to the middle and lower third of the ventral-medial surface of the right kidney promoting the ventral direction of the terminal portion of the colon.

Further increase of meconium volume results in extension of “invagination neck”, which is the ileac papilla. At this time the width of the ileac papilla wall decreases, its diameter increases, its shape changes from round to oval along the axis of the ascending colon and changes of the character of the ileac opening from the dot to oval. All these changes result in restoration of the intestinal permeability beginning with the 8th month. Since this period the colon is filled with meconium which is evidenced by enlargement of its diameter that prevails over the diameter of the jejunum (Fig.1), flattening and dilation of crypts and villi of the mucous membrane, and decrease of the thickness of its walls. At the same time the shape of the appendix changes from the curl at the beginning of the fetal period to the loop in the middle. “The head of invagination” (ileac papilla) partially restrains reflux and due to extension the walls of the colon become thinner. At this period the diameter of the colon intensively increases, and the diameter of the jejunum is slowly enlarging. The colon is dilated most intensively opposite and lower from the ileac papilla, and the base of the appendix expands which is the beginning of formation of the ceacum.

Along with intensive filling the colon with meconium its location is changed. Dislocation of the ascending colon from the ventral-medial surface of the upper pole of the right kidney to the ventral surface of its middle and lower thirds causes the change of the location of the ascending colon from the dorsal-medial to ventral-medial position. Reduced pressure in the terminal portion of the colon results in increased thickness of its wall.

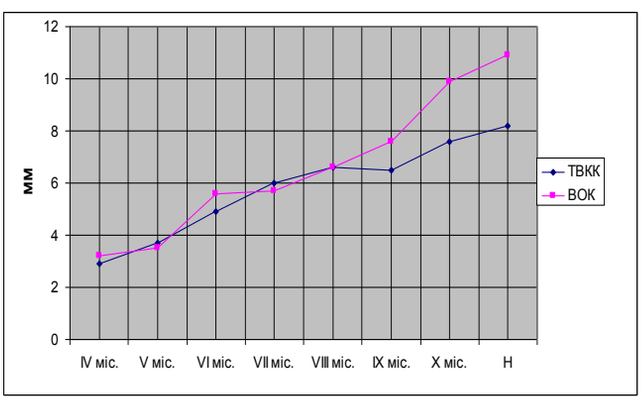

Fig. 1. Dynamics of changes of the diameter of the terminal portion of the ileum and ascending colon during the early period of human ontogenesis.

In its turn, extension of the colon walls leads to the extension of the ileac papilla, which is oval in shape at first perpendicular to the axis of the ascending colon. At this time the ileac opening becomes slit-like, and later at the beginning of active functioning of the digestive system, cyclic periodical filling the intestine with dejection, it becomes labelloid in shape (Fig. 2). The appendix becomes a hook-like.

In newborns location of the ileocecal transition components is close to definite. The ileocecal transition descends caudolaterally and occupies the position under the right kidney, which promotes cranial and ventrolateral direction of the terminal portion of the colon, cranial and dorsolateral direction of the ascending colon.

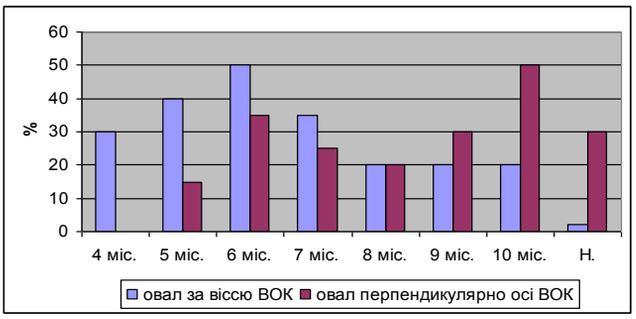

Fig. 2. Dynamics of the oval ileac papilla concerning the axis of the ascending colon during the fetal period

This suggestion is evidenced by anatomical peculiarity of the fetal ileac papilla. During autopsy colon obstruction was found, namely, considerably dilated portion of the colon filled with meconium (Fig. 3). The size and morphological signs of the ileac papilla of this fetus correspond to the fetus of the 4th month of development. The portion of the colon located distally from the area of obstruction and to the ileac papilla is considerably thinned. The colon diameter does not correspond to the morphometric parameters characteristic for the 6th-month fetuses. It can be suggested that these morphological peculiarities are the result of absence of sufficient meconium contact with the ileac papilla, and as a result, the absence of its formation action on the ileocecal segment.

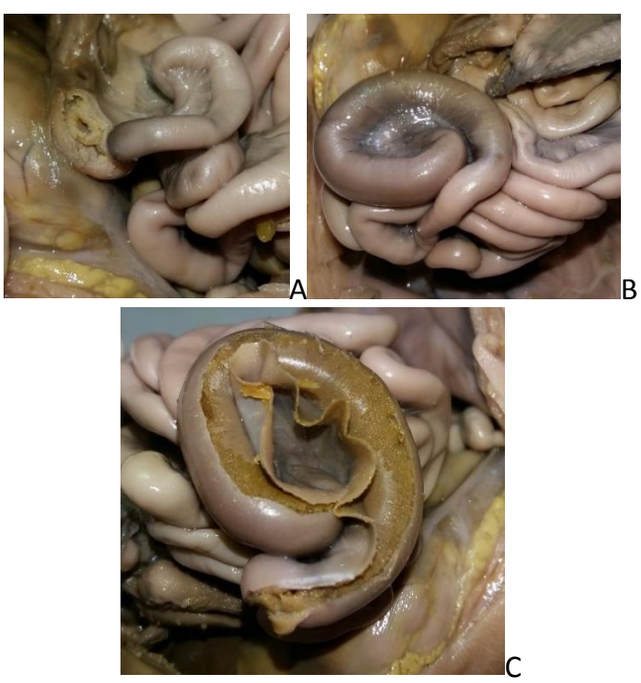

Fig. 3. Intestine of the fetus 280 mm of PCL. A. – round ileac papilla characteristic for the 4th-month fetuses; B. – ischemic and dilated portion of the colon; C. – lumen and content of the colon (the wall is unbent)

Prospects of further studies. The major principles of this study are reasonably to be evidenced by means of experimental simulation of intestinal obstruction on laboratory animals.

Conclusions.

1. Macroanatomical signs of the ceacum are clearly determined in the neonatal period, which is evidenced by dilation of the primary segment of the colon proximally from the ileac papilla and formation of anatomical border between the colon and appendix.

2. Morphogenesis of the ileac papilla is characterized by five successive shape-generating stages: 1) round papilla – at the 4-5th months; 2) oval papilla located longitudinally – at the 6-7th months; 3) round papilla with a gaping iliac opening – at the 8-9th months; 4) oval papilla located transversally – at the 10th month; 5) labelloid (bilabial) papilla – in the neonatal period.

3. Retardation of the developmental processes of the ileac papilla structure results in the formation of its anatomical variants – round papilla with stellate opening or oval papilla with slit-like opening. In case the ileac papilla is absent the ileocecal segment becomes funnel-shaped, anatomical base of possible occurrence of reflux-ileitis.

4. Morphogenesis of the closing-valvular mechanism of the ileocecal segment occurs according to invagination type, which is accompanied by temporal closing of the ileocecal connection, and as a result, dilation of the terminal portion of the colon, which diameter at the 7th month (6,0±0,4 mm) prevails over the diameter of the proximal segment of the colon (5,7±0,8 mm).

5. Development of a definite structure of the ileocecal segment components and variants of their structure are influenced by a syntopic effect of the right kidney, processes of fixation of the colon to the posterior abdominal wall and degree of filling the colon with meconium.

References:

1. Vorobyev V.V. Khirurgicheskaya korrektsiya nesostoyatelnosty ileotsekalnogo zapiratelnogo aparata (NIZA) u detey po metodu Ya.D. Vitebskogo pri funktsionalnykh kishechnykh zabolevaniyakh / V.V.Vorobyev. E.G.Gandurova. O.G. Korobova // Dalnevostochnyy meditsinskiy zhurnal. – 2004. - № 2. – S. 15-19.

2. Lazirskiy VA, Lykhman VN. Gastroplastika ileotsekalnym segmentom kishechnika v eksperimente. Kharkivska khirurgichna shkola. 2015;72(3):118-21.

3. Sotnikov AA, Kazantsev IB. Krovosnabzheniye ileotsekalnogo klapana Byulleten sibirskoy meditsiny. 2011;(4):45-8.

4. Dronenko V.G. Klubovo-slipokishkoviy viddil kishechniku ta mozhlivosti yogo vidtvorennya pislya pravobichnoï gemikolektomiï. Visnik morfologiï. 2007;13(2)459-63.

5. Okino Y, Kiyosue H, Mori H. Root of the small-bowel mesentery: correlative anatomy and CT features of pathologic conditions. Radiographics. 2001;21(6):1475-90.

6. Shadiyev ET. Morfologicheskaya kharakteristika odinochnykh limfoidnykh uzelkov slizistoy obolochki ileotsekalnoy zaslonki. Tezisy dokladov VII Kongressa Mezhdunarodnoy assotsiatsii morfologov. Morfologiya. 2004;126(4):137.