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Morphological Study of Caecum with Its Arterial Supply in Adult Cadavers and Dead Fetuses

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Abstract

The caecum is involved in many surgical conditions such as carcinoma of caecum, lipoma of Caecum and volvulus of caecum. In spite of availability of modern diagnostic investigations, abdominal emergencies diagnosis mainly depends on clinical examination skills of the surgeon, who requires through knowledge of human anatomy; hence the present work is aimed to study the Caecum, its interior and arterial supply. *Material and methods:* Study includes 78 specimens, the dead foetuses (62) are obtained from labour rooms of the department of Obstetrics & Gynaecology, Government General Hospital and adult cadavers(16) are from dissection hall, Guntur medical college, Guntur. *Results:* Position of caecum in fetuses is mostly in the right lumbar region (70.96%) in some it is subhepatic, right iliac fossa and umbilical positions. In adults bodies it is in right iliac fossa 87.5%, and in 12.5% in the right lumbar region. Two fetuses showed Jackson's veil. In 9.67% of fetal specimens the anterior caecal artery is arising directly from the inferior division of ileo-colic artery and in 1.61% anterior caecal artery is directly arising from ileal artery. In 6.45% fetal specimens, posterior caecal artery is arising directly from inferior division of ileo-colic artery and in 3.22% it is arising directly from ileal artery. In 1.61% it is arising directly from colic artery. *Conclusion:* The present study of caecum showed variations from the literature available in position and arterial supply. These findings may help the surgeons in avoiding the complications while performing the abdominal surgeries.

Keywords: Caecum; Arterial Supply; Ileo-Caecal Junction.

Introduction

A thorough knowledge about Anatomy of caecum and ileocaecal junction is essential for the surgeon who performs regular abdominal surgeries. Though there are advances in modern radiographic imaging and diagnostic laboratory investigations, the diagnosis of abdominal emergencies remains essentially clinical, requiring a mixture of observation, clinical acumen and surgical science [1,2].

The word caecum actually means blind in Latin, reflecting the fact that the bottom of the caecum is a blind pouch [a dead - end (or) cul- de- sac][3]. In order to reach right iliac fossa the caecum and appendix undergoes 270 ^{o} rotations. If they fail to rotate due to any mechanical obstruction in their course such as peritoneal adhesions or any other Mal-developments, the caecum and appendix may lie in the left iliac fossa, umbilical region, sub hepatic region or in the right lumbar region. Some times ileocaecal junction may lie in the right colic flexure if the ascending colon is congenitally absent. The Caecum acts as a guide in the operation of intestinal obstruction. If the Caecum is distended, the obstruction occurs in large gut; if it is empty it indicates that the obstruction is of small gut [2,4-8].

The caecum is supplied by the branches of ileocolic artery which is in turn a branch of superior mesenteric artery. Hence the variations and anomalies pertaining to these vessels having greater importance while studying the caecum and ileocaecal junction. Considering the significance of anatomy in the field of modern surgery, we made an attempt to study in detail about morphology of Caecum and its arterial supply.

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Materials and Methods

The present work is aimed to study the Caecum with arterial supply. The material of our study includes 78 specimens, out of which 62 are dead fetuses of both sexes and 16 are adult cadavers (male & female). The dead fetuses are obtained freshly from labour rooms of the department of Obstetrics & Gynecology, Government General hospital, Guntur. The adult cadavers included in our study are from dissection hall in the department of Anatomy, Guntur medical college, Guntur.

The age of the fetuses is determined by measuring crown-rump length. The features such as development of nails, subcutaneous tissue, and distribution of hair and vernix- caseosa are taken into consideration to determine the age if crown- lump length of the fetuses is less. All the fetal specimens are preserved as per the standard methods.

Mode of Dissection

An incision is made vertically extending from xiphisternum to pubic symphysis and abdomen is opened. The greater omentum is cut; the coils of small intestine, transverse colon and transverse mesocolon are mobilized towards the upper abdomen to visualize the ileocaecal junction and vermiform appendix. The position and shape of the caecum are noted with its peritoneal and general relations. The length and breadth of the caecum are measured. The entry of terminal part of ileum into the caecum is noted. The mesentry is cleaned, ileocolic artery branches are traced and their variations are noted. The caecum is opened as per the dissection guidelines of Russell T. Woodburne, by giving a window incision on its anterior wall. The ileocaecal and appendicular orifices are identified. The distance between the two orifices is measured. Their position, shape and diameter are noted. The measurements of superior and inferior labia, medial and lateral frenulae are taken.

Observations

Position of the Caecum

out of 62 foetuses in 44 (70.96%) the Caecum is found in the right lumbar region. In 12(19.35%) – sub-hepatic region, 5 (8.06%)- right iliac fossa and Umbilical position is seen only one foetal specimen (1.6%), Where as in adult specimens 14 (87.5%) it was in the right iliac fossa. In 2 (12.5%) it was found in the right lumbar region (Figure 1).

Fig. 1: Adult specimen showing: Asymmetrical shaped caecum in the ***right lumbar region,*** entry of ileum in to the caecum from postero-medial aspect, and ileo-colic artery with normal arterial distribution. (C- caecum, I.C.A- Ileo-colic artery)

Shape of the Caecum

Conical shape in 56(90.32%), Quadrate in 4(6.45%), Asymmetrical in 2(3.22%) of the fetal specimens, whereas it was Asymmetrical in shape in all 16 adult specimens (100%).

When the peritoneal reflections over the Caecum were observed all 16 adult specimens and in 60 (96.77%) fetal specimens it is completely covered by the peritoneum and was freely mobile in the abdominal cavity. But when it comes to 2 fetal specimens (3.22%) the upper part of posterior surface of the Caecum is non peritoneal and comes in contact with fascia illiaca that is in-complete. We also found Jackson's veil in 2 fetuses (3.22%) (Figure 2).

Fig. 2: Fetal specimen showing: Conical shape caecum in the right lumbar region and upper part of caecum showing Jackson's veil. (C- Caecum, J.M- Jackson's Membrane or veil)

Entry of Ileum into the Caecum

In 64.51% that is 40 fetuses the entry of ilum in to the Caecum is from posteromedial aspect, in 29.03% (18) from ileal aspect, 4.83% (3) anterio-medial aspect

as in adult bodies posterior-medial entry is seen in 75% (12 bodies). Medial and antero-medial entry was found in 2 bodies each (12.5% and 12.5%).

The length and breadth of Caecum: (Table 1)

Interior of the Caecum:-

- Position of ileocaecal orifices – (Tables 2)
- Shape of ileocaecal orifice- (Table 3)
- Diameter of ileocaecal orifice- (Table 4)
- Position, diameter of Appendicular orifice and distance between Appendicular and ileocaecal orifice- (Table 5).

Appendicular orifice is guarded by semicircular mucus fold know as valve of Gerlach. It is not seen in fetal specimens but it was found in all adult specimens. This valve is attached to the lower margin in 10 adult specimens, where as in 6 adult specimens it was attached to the upper margin.

Arterial Supply

The course of ileocolic artery is varied according to the position of the caecum & appendix.

Origin of the ileocolic artery- (Table 6)

Origin of caecal artery: (Table 7)

Table 1: The length and breadth of Caecum

specimen	Average Length In mm.	Average Breadth In mm.
Fetal specimens N-62	7.69	9.43
Adult specimens N=16	61.25	70.83

Table 2: Position of the ileo-caecal orifice

Specimen	Postero-medial wall of the Caecum	Medial wall of the Caecum	Antero -medial wall of the Caecum
Fetal specimens (n=62)	64.51%	29.03%	6.45%
Adult specimens(n=16)	75%	12.5%	12.5%

Table 3: Shape of the ileocaecal orifice in adults

Specimen	Oval		Circular
	Horizontal	Oblique	
Fetal specimen (n = 62)	3.22 %	12.9 %	83.87 %
Adult specimens (n = 16)	100 %	-	-

Table 4: The diameter of the ileocaecal orifice in adults

Specimen	Circular	oval	
		Average Long diameter In mm	Average Short diameter In mm
Fetal specimens (n=62)	2.75	5.2	2.25
Adult specimens (n=16)	-	17.25	7.12

Table 5: The position & diameter of Appendicular orifice & the distance between appendicular and ileocaecal orifices

specimen	Position Posteromedial wall of Caecum	Position Medial wall of Caecum	Dependent part between two saccules	Circular Appendicular orifice diameter In mm	Distance between Appendicular orifice & ileocaecal orifice In mm
Fetal specimens n=62	85.24%	11.47%	3.27%	1.83	4.77
Adult specimens n=16	50%	37.5%	12.5%	8.37	25

Table 6: Origin of the ileocolic artery

specimen	From superior mesenteric artery			Common with right colic artery
	Right side	Left side	Anterior surface	
Fetal specimens n=62	95.16%	-	1.61%	3.22%
Adult specimens n=16	87.5%	12.5%		

Table 7: Origin of caecal artery:

specimen	From inferior division of ileo-colic artery	Absent, where anterior and posterior caecal arteries arising separately
Adult cadavers N-16	100%	-
Fetuses N-62	88.7%	11.29%

Course of Caecal Artery

In 55(88.7%) fetuses and all 16 adult specimens the caecal artery arising from the inferior division of ileocolic artery, is passing towards the ileocaecal junction and a little above the level of the upper border of the ileocaecal junction it is divided into an anterior and posterior caecal branches which supply the corresponding surfaces of the caecum.

Origin of the Anterior Caecal Artery

In 55(88.5%) foetal specimens and all 16 adult specimens the anterior Caecal artery is arising in common with posterior caecal artery from caecal artery which in turn arising from inferior division of ileocolic artery. In 6 (9.67%) foetal specimens the anterior caecal artery is arising directly from inferior division of ileocolic artery. In one fetal specimen (1.61%) anterior caecal artery is arising directly from ileal artery which in turn a branch of inferior division of ileocolic artery. In one adult specimen the caecum is receiving an additional branch from the colic artery.

Origin of Posterior Caecal Artery

In 55(88.7%) fetal specimens and all 16 adult Specimens it is arising in common with anterior caecal artery from caecal artery which in turn is a branch from inferior division of ileocolic artery. In 4(6.45%) foetal specimens the posterior caecal artery

Fig. 3: Fetal specimen showing: Anterior caecal artery independently arising from inferior division of ileo-colic artery, and posterior caecal artery arising from ileal artery. (A.C.A- Anterior Caecal Artery, P.C.A- Posterior Caecal Artery)

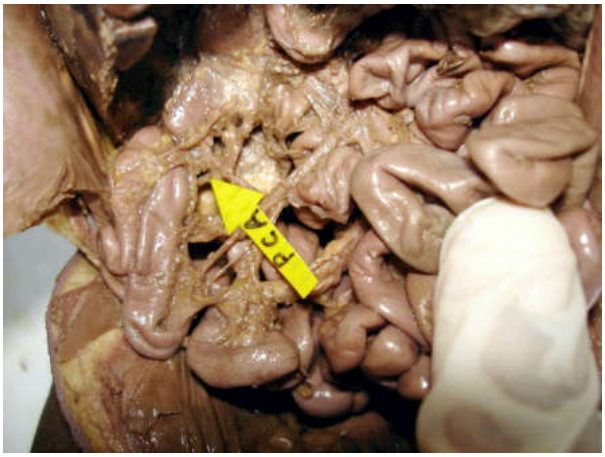

Fig. 4: Fetal specimen showing: Posterior caecal artery arising from colic artery and anterior caecal artery directly from inferior division of ileo-colic artery. (P.C.A- Posterior Caecal Artery)

is arising directly from inferior division of ileocolic artery. In 2(3.22%) posterior caecal artery is arising directly from ileal artery which in turn a branch of inferior division of ileocolic artery. In one (1.61%, fetus), the posterior caecal artery is arising directly from colic artery which in turn a branch of superior division of ileocolic artery. (Figure 3 and Figure 4).

Discussion

Position of the Caecum

In 14 (87.5 %) out of 16 adult cadavers the caecum is in the right iliac fossa, where as in two (12.5 %) it is in the right lumbar region and this study is in agreement with the descriptions of many standard text books and recent researchers (Table 8). In 44(70.96 %) fetal specimens with crown rump length ranging from 170mm-340 mm, the caecum is situated in the right lumbar region and in 12(19.35%) fetuses with C R length ranging from 200mm – 350mm, it is situated in the sub-hepatic position. In 5(8.06%) fetuses with CR length ranging from 220mm- 365mm, it is situated in the right iliac fossa. In one (1.61 %) fetus with a CR length of 290mm, it is situated in the umbilical position (Table 9). According to Datta [6] and Treves'[13] the variation in the position of the caecum may be due to the failure of the rotation of the embryonic intestinal loop or its incomplete rotation.

Position of Caecum in adult specimens (Table 8).

Position of Caecum in foetal specimens (Table 9).

Shape of the Caecum

In all 16 (100 %) adult bodies it is asymmetrical, which is nearly coinciding with the descriptions of the standard text books.

Shape of the Caecum in fetuses

Table 10

Peritoneal reflections of the Caecum

Out of 62 foetuses in 60 (96.77 %) it is complete, and in 2(3.22%) foetuses it is incomplete. In all 16(100%) adult specimens, the caecum is completely covered by peritoneum and is freely mobile in the abdominal cavity which is coinciding with the literature.

Jackson's membrane is anomalous peritoneal fold containing fine blood vessels may pass from the front of the ascending colon and caecum to the lateral part of the posterior abdominal wall. It may be continuous on the left with the greater omentum. In these cases the caecum is fixed. This thin sheet of peritoneum is called Jackson's veil [7,16]. Henry Hollinshed [8] described it as a broad, highly vascular membrane usually attaching to the whole length of the ascending colon but not the caecum. Gray [7] and Cunningham [16] described pericolic bands reduce the normal mobility of colon. Jackson's membrane is generally considered to be arising as a result of adhesions of peritoneum in fetuses. It may be due to normal sequence of shifting relations of ascending colon and might be due to the result of hyper rotation of the colon.

In the present study, Jackson's veil is found in 2 (3.22%) fetuses. It is appeared as a thick sheet of peritoneum extending from front of the upper part of the caecum and proximal part of the ascending colon to the lateral part of the posterior abdominal wall. This pericolic band is not seen in the 16 adult specimens dissected.

Table 8: Position of Caecum in adult specimens

Name of the author	Right iliac fossa	Right lumbar	Sub-hepatic	Umbilical
S.N.Sahana [9]	Common	Few	Few	-
Kavimani. M [3]	96%	-	4%	-
Umamaheswar rao.S [10]	100%	-	-	-
W.J.Hamilton [11]	Common	Rare	-	Rare
Gray [7]	Common	-	-	-
Datta [6]	Common	Rare	-	-
Arindom Benerjee [12]	96%	-	4%	-
Present study	87.5 %	12.5 %	-	-

Table 9: Position of Caecum in foetal specimens

Name of the author	Right Lumbar	Sub-hepatic	Right Iliac fossa	Umbilical
Treves'[13]	common	common	-	-
Janardhan Rao.M [14]	60%	10%	30%	-
Morris [15]	-	-	-	Rare
Present study	70.96 %	19.35 %	8.06 %	1.61 %

Table 10: Shape of the caecum in fetuses

Name of the author	Conical	Quadrate	Asymmetrical
S. N. Sahana [9]	Common	-	-
Treves' [13]	Common	-	-
Morris [15]	Common	Few	-
Present study	90.32 %	6.45 %	3.22 %

Entry of Ileum into the Caecum

In 40 (64.5%) fetuses and in 6(75%) of adult specimens, the entry of ileum into the caecum is from posteromedial aspect. In 18 (29.03%) fetuses and in one (12.5%) adult specimen the entry is from medial aspect. In 3 (4.83 %) fetuses and in one (12.5%) adult specimen it is from anteromedial aspect. In one (1.61%) fetus, the ileum is entering the caecum from the anterior aspect. Normally the ileum enters the caecum posteromedially, sometimes medially and occasionally from the posterior aspect [6,15]. But Datta[6] and Hamilton [11] stated that the ileal entry will be usually from the medial side. Whereas Sahana [9] and Inderbir singh [17] stated that ileum enters

the caecum from postero medial aspect.

Measurements of the Caecum

According to Cunningham[16] and Quain [5] its length is 60mm and the breadth is 70mm. In the present study of the adult specimens, the average length is 61.25mm and the breadth is 70.83mm, which are in consistence with the descriptions of most of the standard text books [9,17]. In fetuses [62] the average length of the caecum is 7.69mm and the breadth is 9.44mm. In the present study, it is observed that the average breadth of the caecum is more than that of length of the caecum in both adult and foetal specimens.

General Relations of the Caecum

The relations of the caecum vary depending on the position of the caecum in the abdominal cavity. The relations of the caecum observed in the present study are correlating with the descriptions of the standard text books [7, 16].

Position of the Ileocaecal Orifice

In 40 (64.51%) foetal and 12(75%) adult specimens, the ileocaecal orifice is situated in the posteromedial aspect of the wall of the caecum. These observations are in agreement with descriptions of Datta [6], Gray [7].

In 18 (29.03%) foetuses and in two (12.5 5) adult specimen it is situated in the medial aspect of the wall of the caecum. These observations are coinciding with the descriptions of Gray [7]. In 4 (6.45%) fetuses and one (12.5%) adult specimen it is situated in the anteromedial aspect of the wall of the caecum which is correlating with the description of Morris [15].

Shape of the Ileocaecal Orifice

In 52(83.87%) fetal specimens it is circular and it is oval in 10(16.12%) fetuses and in 16(100%) adult specimens. This is consistent with the statement of Cunningham16. The change in the shape of the ileocaecal orifice from circular in the fetuses to oval in adults may be due to functional adaptation to the changed food habits like, from fluid diet to solid diet and also asymmetrical growth of the saccules of the caecum as age advances.

Labia

In 62 fetuses, the average length of the superior labium is 2.06mm and the average length of the inferior labium is 3.06mm. The average length of the superior labium in all adults is 19.75mm and that of the inferior labium is 23.87mm. Thus, the superior labium is shorter than inferior labium in both fetuses and adults, which are in consistence with the descriptions of Henry Hollinshed [8].

Frenulae

in 9 fetal specimens the medial frenulum is absent (Figure 5), in 5 both medial and lateral frenulae are absent. In 4 adult cadavers the medial frenulum is absent and in the rest the average length of the medial frenulum is 19 mm, and that of the lateral frenulum is 21.12mm. By these observations it is clear that lateral frenulum is longer than the medial frenulum. According to Buirge (quoted by Henry Hollinshed [8]) the medial or lateral or both the frenulae may be absent. These findings are in agreement with the Buirge's descriptions.

Fig. 5: Fetal specimen showing: Medial frenulum absent and presence of left frenulum. (L.F- Left Frenulum)

Appendicular Orifice

In 52(85.24%) fetuses and in 8(50%) adult specimens it is present in the posteromedial aspect of the wall of the caecum. The present study is correlating with the standard literature 16. In 7(11.47%) fetuses and 6 (37.5%) adult specimens showed the appendicular orifice in the medial aspect of the wall of the Caecum. Where as in 2(3.27%) fetuses and 2(12.5%) adult specimen, it is in the dependent part between two saccules of the caecum and this is in consistent with the description of Hamilton11. When it comes to shape both fetus and adult specimens it is circular, which is similar to the descriptions of standard text books [15,16].

Diameter of the Appendicular Orifice

In 61 fetuses (appendix is absent in one fetal specimen), the average diameter of appendicular

orifice is 1.83mm where as in 16 adult specimens it is 8.37mm. This study is coinciding with the descriptions of Quain [5].

Distance between Appendicular Orifice and Ileocaecal Orifice

In 61 fetal specimens, the average distance between two orifices is 4.77mm. In the adult specimens, the distance between two orifices is 25mm and this value is coinciding with the descriptions of Morris [15] and Cunningham [16].

Valve of Gerlach Is not seen in any of the fetal specimens studied, but it is found in all the adult specimens. In 10 adult specimens, it is found attached to the lower margin of the orifice. This finding is coinciding with the statement of Datta [6]. In 6 adult specimens, it is attached to the upper margin of the orifice and this is in agreement with the description of Quain [5].

Arterial Supply of the Caecum

Origin of the ileo-colic artery in adult & fetal specimens (Table11).

Origin of caecal artery in adult and fetal specimens (Table 12).

Table 11: Origin of the ileo-colic artery in adults & foetuses

Name of the author		Independently From superior mesenteric artery			Common with right colic artery
		Right side 0f S.M.A	Anterior surface 0f S.M.A	Left side 0f S.M.A	
Gray [7]		Present	-	-	present
W. Henry Hollinshed [8]		Present	-	-	Present
S. N. Sahana [9]		Present	-	-	-
Presen t study	Adults	87.5%	-	12.5%	-
	Foetuses	95.16%	1.61 %	-	3.22 %

Table 12: Origin of caecal artery in adults and fetuses

Name of the author		From inferior division of ileo-colic artery	Absent, where anterior and posterior caecal arteries arising separately
Gray [7]		Present	-
W. Henry Hollinshed[8]		Present	-
Morris [15]		Present	-
Present study	Adults	100 %	-
	Foetuses	88.7 %	11.29 %

Origin of the Anterior and Posterior Caecal Arteries

In 55(88.7%) fetuses and 100% of the adult specimens both anterior and posterior caecal arteries are arising from inferior division of ileocolic artery. This finding is similar to that of Gray[7]and Morris[15]. In 6(9.67%) foetuses, the anterior caecal artery is arising separately from the inferior division of ileocolic artery. In 4(6.45%) Foetuses, the posterior caecal artery arising separately from the inferior division of ileocolic artery, and these findings are in agreement with the description of Henry Hollinshed [8].

In one (1.61%) foetus, the anterior caecal artery is arising separately from the ileal artery. In 2(3.22%) foetuses, posterior caecal artery is arising separately from ileal artery. In one (1.61%) foetus, posterior caecal artery is arising separately from colic artery. And comparison of this pattern cannot be made because no literature is available.

Conclusion

The present detailed study of caecum with its arterial supply in 62 dead fetuses and 16 adult cadavers showed variations in structure when compared to standard books; like position of caecum in the foetuses, these alterations can be attributed to the embryological basis of gut rotation. Adult and fetal specimens showed variation in the branching patterns in the arterial supply of the Caecum. These findings may be of help to the surgeon while performing the surgeries and prevent the complications.

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