ORIGINAL ARTICLE

GROSS ANATOMY AND BLOOD SUPPLY OF SMALL INTESTINE IN FOETUSES

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ABSTRACT: AIM OF STUDY: To develop charts of length and width of small intestine, origin, length and branching pattern of celiac trunk and Superior mesenteric artery. This will help us to know any congenital anomaly in the small intestine, and abnormal origin, length, variation in the branching pattern. **MATERIALS AND METHODS:** The material used for the present study of 100 foetuses of different stages of gestation collected from Government maternity Hospital, Hanamkonda, ChandaKantha Memorial Hospital Warangal and private nursing homes of Warangal District of Andhra Pradesh within 10 hours of death. The dead foetuses were preserved in the hospital in 10% formalin. The foetuses were embalmed by injecting with 20cc to 100cc 10% formalin in to the cranial cavity and trunk depending on the stage of gestation. Foetuses were dissected to expose small intestine and the blood vessels which supply it systematically in the following manner. **OBSERVATIONS:** The present study conducted has shown that length, width of small intestine was found to be increasing with foetal age. The length of celiac trunk, the length of superior mesenteric artery was found to increase proportionality with the foetal age. The causes of death in foetuses related to small intestine are intussusceptions intestional malrotation such as ladd's bands, volvulus, cystic fibrosis, intestional infections and necrotizing enterocolitis. Knowledge related to gross anatomy and blood supply of small intestine is important because of these causes which may lead to death in foetuses. In the present study no anomalies related to small intestine are found.

KEYWORDS: Coeliac Trunk, Superior, Mesenteric Artery, Branching Pattern.

INTRODUCTION: The life of defined as a metabolic autocatalytic and self-replicating process. This process is carried out by various complex systems in the body. One of the most important system is the gastro intestinal system which is also known as food processing plant of the body. In gastro intestinal systems small intestine is essential for life as most of the digestion and absorption takes place in small intestine. Neonatal intestinal obstruction has an approximate incidence of 1:2000 live births. Congenital atresia and stenosis are the most common causes.(1) Failure of recanalization of lumen after solid phase of intestinal development in 4th and 5th week of gestation results in atresia and stenosis. Complete occlusion results in atresia and partial in stenosis. Atresia and stenosis are common in duodenum than in jejunum and ileum. Volvulus neonatorum, meconium ileus and Hirschprung's disease may also be responsible for neonatal intestinal obstructions.(2)

The embryonic artery of foregut is celiac trunk and mid gut is the superior mesenteric artery. There are variations both in origin and branching pattern of both these vessels. Apart from this there may be variation in gross anatomy of small intestine like congenital segmental

dilatation of duodenum. There is a need of in depth and thorough knowledge of gross anatomy and blood supply of small intestine and also acknowledge of its variation which help for planning appropriate surgical approach by operating surgeons for successful outcome of surgery, counseling of parents, planning early treatment of new born there by helping the child survival. Surgical maneuvers on neonates are on the increasing side with availability of advanced and sophisticated investigation tools and establishment of separate pediatric surgery departments. Hence an attempt is made to study the anatomy and blood supply of small intestine in foetuses.

MATERIALS AND METHODS: The materials used for the present study are 100 foetuses (photo 1) of different stages of gestation collected from Government maternity Hospital, Hanamkonda. ChandaKantha Memorial Hospital, Warangal and private nursing homes of Warangal district of Andhra Pradesh within 10 hours of death. All the foetuses collected were of the ages of 20 weeks to full term and they were either still born on spontaneously aborted as mothers were of low socio economic status with minimum antenatal care.

The foetuses once certified as dead were preserved by injecting 20cc to 100cc of 10% formalin into the abdomen, thorax and cranial cavity through orbits and then immersed in a container filled with tank solution.

Chemicals Required:

a) 10% formalin (As preservative).
b) Glycerin (To maintain soft texture of tissues).
c) Copper sulphate (As anti-fungal agent).

Tank Solution per 1000ml:

a) 800 ml of 10% formalin.
b) 150 ml of glycerin.
c) 50 grams of copper sulphate.

Instruments:

1.	Scalpel	:	6” in length with detachable pointed blades -6 Nos.
2.	Forceps	:	4” in length with pointed tip-2 Nos.
3.	Scissors	:	a) small pointed and curved – 1 No. b) 10” long and straight with blunt tip – 1 No.
4.	Twine	:	1 Bundle
5.	Divider	:	from geometry box – 1 No.
6.	Measuring Scale	:	Plastic scale 12” long – 1 No.
7.	Balance	:	Simple balance, digital weighing machine
8.	Weight	:	From 1 gram to 1000 grams -1 box
9.	Syringes	:	20 CC disposable syringes with 21 bore needle 10 No.
10.	Preservation Containers	:	Plastic Containers to preserve 100 foetuses.

11. Beakers : Two plastic beakers
    a) One large 1000 ml capacity
    b) One small 100 ml capacity
12. Cotton : Big bindles – 2x10 = 20 No
13. Gloves : 6½ size – one box
14. Measuring tape : One No
15. Vernier Calipers : One no

METHODS: The dead foetuses were preserved in the hospital in 10% formalin. The foetuses were embalmed by injecting with 20cc to 100cc 10% formalin in to the cranial cavity and trunk depending on the stage of gestation.

The foetus is studied in the following manner:

a) Crown-Rump length: Foetuses have been measured in centimeters to assess the approximate age as shown in table 1.
b) Weight: Foetuses weighed by simple balance before injecting formalin.
c) Bi-parietal diameter: All foetuses have been measured and noted.
d) Foetuses were dissected to expose small intestine and the blood vessels which supply it systematically in the following manner.

STEPS OF DISSECTION INCISION:

a) A median incision extending from xiphisternal joint to the superior margin of public symphysis.
b) An upper transverse incision extending from xiphisternal joint tills the mid axillary line.
c) A lower transverse incision extending from superior margin of public symphysis along the line of inguinal ligament to the highest curvature of iliac crest.

Reflection of the Flaps: The incision is extended into all the layers of anterior abdominal wall i.e., superficial fascia, muscles, transversal is fascia and peritoneum. The flaps were reflected laterally to expose the abdominal organs.

Removal of the liver: All the peritoneal connections of the liver to the diaphragm were cut. The lesser omentum was cut with all its contents i.e., hepatic artery, portal vein and bile duct. The liver was removed by cutting the hepatic veins.

REMOVAL OF THE STOMACH: A pair of ligatures was tied at the abdominal part of oesophagus and at the pyloric end of stomach. The stomach was removed by cutting between the ligatures and peritoneal folds i.e., the gastro phrenic ligament and anterior layer of the greater omentum.

OBSERVATION OF THE CELIAC TRUNK: The celiac trunk is observed and the following parameters were studied.

1. Site of origin: The vertebral level of origin of celiac trunk was noted.
2. Branches: The branches of celiac trunk were observed namely the left gastric, common hepatic and splenic arteries.
3. Blood supply to the duodenum was observed.
4. The length of celiac trunk was measured in millimeters from the origin to the point where it was dividing in to branches.

OBSERVATION OF THE SUPERIOR MESENTERIC ARTERY: The mesentery of the small intestine was exposed by turning the loops to the left. The right layer of mesentery was removed to expose superior mesenteric artery. The following parameters were considered and studied in detail.

1. **Site of origin:** The origin of superior mesenteric artery in relation with the verterbral level was noted.
2. **Branches:** The branches of superior mesenteric artery were observed namely middle colic, right colic, inferior pancreatico duodenal artery, ileocolic artery, the jejuna and ileal branches.
3. **Length:** The length of superior mesenteric artery was measured in millimeters from its point of origin from aorta to a point where it anastomoses with a branch of ileocolic artery i.e., at right iliac fossa.

Carefully observed for variation in branching, dilatation and for AV fistulae.

REMOVAL OF SMALL INSTESTINE: A pair of ligatures was tied at the pyloric end of the stomach and another pair at the ileocaecal valve. The mass of small intestine was removed enbloc by cutting between each pair of ligatures and by dividing the mesentery close to the intestine. Length and width of the small intestine was measured.

Length: Measuring tape is used to measure the small intestine in centimeters by stretching it.

Width: It is measured in millimeters with the help of a divider and scale after cutting it transversely. After taking the parameters, the small intestine was preserved in a labeled container containing 10% formalin.

OBSERVATIONS: Normal parameters of small intestine i.e. length and width were measured in 100 foetuses. Every foetus has been measured and weighed after 48 hours of preservation in 10% formation. The following parameters were studied to determine and confirm the gestational age of foetus. The observations were shown in (Table 1 page no. 38-40)

1) Crown-Rump length.
2) Biparietal Diameter.
3) Head circumstances.

4) Abdominal circumference.
5) Weight and
6) Sex.

Out of 100 foetuses 54 were male and 46 were female. These 100 foetuses were divided in to groups according to their gestational age and trimester.

I group 20 to 24 weeks.
II group 25 to 28 weeks.
III group 29 to 32 weeks.
IV group 33 weeks to full term.

Every specimen was systematically dissected to expose small intestine and observed its blood supply by the branches of celiac trunk as well as the branches of the superior mesenteric artery. The length and width of the small intestine were measured with the help of scale, thread and divider. The length of celiac trunk and superior mesenteric artery were measured with divider and scale. Average of all the parameter was calculated for the 100 foetuses. The length & width of small intestine was tabulated for male and female foetuses according to their gestational age.

Length: The length of the small intestine in foetuses between 20-24 weeks ranged between 105-160cm. Their mean value was 127.5 and the width was ranging between 0.4-0.6 cm with mean value of 0.46cm. Between 25-28weeks the small intestine length was ranging between 120-185 cm. with a mean value of 147.72. The width of the small intestine ranged between from 0.4-0.7 cm. Its average was 0.509cm. Between 29-32 weeks, small intestine length was ranging between 162-224cm, with an average of 196.71cm, the width of small intestine ranged again between 0.4-0.7cm, with a mean value of 0.511cm.

Between 33 weeks to full term, the small intestine length ranged between 128-272cm. its average was 238.18cm and the width of the small intestine were ranging between 0.5-0.9cm. Their mean was 0.793cm. The average length of small intestine in foetuses of 20 weeks to full term ranged between 127.5 cm to 238.18 cm its mean was 177.52.

The length of the small intestine was found to be increasing gradually and uniformly from 20 weeks to full term. The average width of small intestine in foetuses of 20 weeks to full term ranged from 0.46 to 0.793 cm, its average was 0.563 cm. It has been observed that the width of the small intestine was increasing gradually and uniformly from 20 weeks to full term.

The length of celiac trunk and superior mesenteric artery were also measured and tabulated together for male and female foetuses according to their gestational age.

The length of celiac trunk in fetuses between 20-24 weeks ranged between 2 mm-3.4 mm. Its average was 2.70 mm. The length of superior mesenteric artery in the same group was ranging from 12-16 mm. Its average value was 13.8 mm.

Between 25-28 weeks the length of celiac trunk was ranging from 2.8-5.4 mm and its average was 4.06 mm. The length of superior mesenteric artery in this group was ranging between 13.5-18mm. Its average value was 15.72.

Between 29-32 weeks the length of coeliac trunk was ranging from 4.6-6.4 mm. Average was 5.5 mm. In the same group the length of superior mesenteric artery was ranging from 16.8-21.5 mm. Average value was 18.88 mm.

Between 33 weeks to full term the length of the coeliac trunk was ranging from 5.8-7.4 mm. Its average was 6.75 mm. The length of superior mesenteric artery in the same group ranged between 26.2-28.2 mm. Its average value was 27.09 mm.

It has been observed that the length of both coeliac trunk and superior mesenteric artery were increasing gradually and uniformly throughout the pregnancy till term.

The vertebral level of origin of coeliac trunk and superior mesenteric artery was also observed.

In 1st group of foetuses the origin was at the level of upper border of T11 and in other three groups it is at the level of lower border of T11. No variation was seen in branching pattern and no dilation was observed in the artery.

Site of origin of superior mesenteric artery corresponded to the first lumbar vertebra in all the groups of foetuses. There were no variations in branching pattern. In all the groups the artery was left to the vein. No dilation and A-V fistulae were observed.

Sl. No.	Foetus No.	Age in Weeks	Origin of coeliac trunk in relation to vertebral level	Length of coeliac trunk in m.m	Braches of coeliac artery	Any dilation observed on artery	Origin of superior mesenteric artery	Length of superior mesenteric artery in m.m	Branches of superior mesenteric artery	Any dilation observed on artery	Relation to veins	Presence or absence of A-V fistula
1	23	20	Upper border of T11	2	Gastorduodenal and Pacreaticoduodenal artery	No	At the Level of L.1 Vertebra	12.5	Inferior Pancreaticoduodenal, Middle Colc, Ileocolic, right colic, ileal, Jejunal	No	Artery lies left to the vein	No
2	27	20	-do-	2.5	-do-	-do-	-do-	12.2	-do-	-do-	-do-	-do-
3	29	20	-do-	2	-do-	-do-	-do-	12	-do-	-do-	-do-	-do-
4	35	24	-do-	2.6	-do-	-do-	-do-	12.8	-do-	-do-	-do-	-do-
5	36	24	-do-	2	-do-	-do-	-do-	12.5	-do-	-do-	-do-	-do-
6	37	24	-do-	2.5	-do-	-do-	-do-	12.4	-do-	-do-	-do-	-do-
7	42	24	-do-	2.2	-do-	-do-	-do-	12.6	-do-	-do-	-do-	-do-
8	43	24	-do-	2	-do-	-do-	-do-	14.5	-do-	-do-	-do-	-do-
9	45	24	-do-	2.6	-do-	-do-	-do-	15	-do-	-do-	-do-	-do-
10	46	24	-do-	2	-do-	-do-	-do-	16	-do-	-do-	-do-	-do-
11	48	24	-do-	3.2	-do-	-do-	-do-	14.5	-do-	-do-	-do-	-do-
12	50	24	-do-	2.8	-do-	-do-	-do-	16	-do-	-do-	-do-	-do-
13	52	22	-do-	3.1	-do-	-do-	-do-	12.5	-do-	-do-	-do-	-do-
14	57	24	-do-	2.5	-do-	-do-	-do-	14.8	-do-	-do-	-do-	-do-
15	60	24	-do-	3.4	-do-	-do-	-do-	15.5	-do-	-do-	-do-	-do-
16	62	22	-do-	3	-do-	-do-	-do-	16	-do-	-do-	-do-	-do-
17	64	24	-do-	2.6	-do-	-do-	-do-	14.7	-do-	-do-	-do-	-do-
18	65	20	-do-	3.2	-do-	-do-	-do-	12.5	-do-	-do-	-do-	-do-
19	72	20	-do-	2.8	-do-	-do-	-do-	13.2	-do-	-do-	-do-	-do-

20	77	24	-do-	3.8	-do-	-do-	-do-	14.4	-do-	-do-	-do-	-do-
21	80	24	-do-	3.2	-do-	-do-	-do-	13.4	-do-	-do-	-do-	-do-
22	81	20	-do-	2.8	-do-	-do-	-do-	15.4	-do-	-do-	-do-	-do-
23	93	20	-do-	3	-do-	-do-	-do-	12.8	-do-	-do-	-do-	-do-
24	95	24	-do-	3.2	-do-	-do-	-do-	13.6	-do-	-do-	-do-	-do-
			Average	2.7								

Table 1: Showing blood supply of small intestine group 1 (20-24 weeks)

Sl. No.	**Foetus No.**	**Age in Weeks**	**Origin of coeliac trunk in relation to vertebral level**	**Length of coeliac trunk in m.m**	**Braches of coeliac artery**	**Any dilation observed on artery**	**Origin of superior mesenteric artery**	**Length of superior mesenteric artery in m.m**	**Branches of superior mesenteric artery**	**Any dilation observed on artery**	**Relation to veins**	**Presence or absence of A-V fistula**
1	3	28	Lower border of T11	3.8	Gastroduodenal and Pacreaticoduod-enal artery	No	At the Level of 1st Lumbar Vertebra	14.5	Inferior Pancreaticoduodenal, Middle Colc, Ileocolic, right colic, ileal, Jejunal	No	Artery lies left to the vein	No
2	7	28	-do-	3.6	-do-	-do-	-do-	14.8	-do-	-do-	-do-	-do-
3	24	28	-do-	4.0	-do-	-do-	-do-	14.2	-do-	-do-	-do-	-do-
4	30	28	-do-	4.2	-do-	-do-	-do-	15.8	-do-	-do-	-do-	-do-
5	31	28	-do-	3.8	-do-	-do-	-do-	14.4	-do-	-do-	-do-	-do-
6	32	28	-do-	3.4	-do-	-do-	-do-	15.2	-do-	-do-	-do-	-do-
7	38	28	-do-	3.2	-do-	-do-	-do-	13.5	-do-	-do-	-do-	-do-
8	39	26	-do-	2.8	-do-	-do-	-do-	14.6	-do-	-do-	-do-	-do-
9	47	28	-do-	3.0	-do-	-do-	-do-	13.8	-do-	-do-	-do-	-do-
10	54	28	-do-	3.8	-do-	-do-	-do-	15.5	-do-	-do-	-do-	-do-
11	55	28	-do-	4.8	-do-	-do-	-do-	15.8	-do-	-do-	-do-	-do-
12	56	28	-do-	5.2	-do-	-do-	-do-	16	-do-	-do-	-do-	-do-
13	63	26	-do-	5.0	-do-	-do-	-do-	16.5	-do-	-do-	-do-	-do-
14	67	28	-do-	4.2	-do-	-do-	-do-	16.2	-do-	-do-	-do-	-do-
15	68	26	-do-	4.0	-do-	-do-	-do-	15.4	-do-	-do-	-do-	-do-
16	69	28	-do-	4.5	-do-	-do-	-do-	16.8	-do-	-do-	-do-	-do-
17	71	26	-do-	4.4	-do-	-do-	-do-	17	-do-	-do-	-do-	-do-
18	75	28	-do-	5.4	-do-	-do-	-do-	17.5	-do-	-do-	-do-	-do-
19	79	28	-do-	4.8	-do-	-do-	-do-	16.8	-do-	-do-	-do-	-do-
20	85	28	-do-	4.6	-do-	-do-	-do-	18	-do-	-do-	-do-	-do-
21	87	26	-do-	3.4	-do-	-do-	-do-	17.4	-do-	-do-	-do-	-do-
22	91	26	-do-	3.6	-do-	-do-	-do-	16.2	-do-	-do-	-do-	-do-
			Average	4.0			Average	15.72				

Table 2: Showing blood supply of small intestine group II (25-28 weeks)

Sl. No.	Foetus No.	Age in Weeks	Origin of coeliac trunk in relation to vertebral level	Length of coeliac trunk in m.m	Braches of coeliac artery	Any dilation observed on artery	Origin of superior mesenteric artery	Length of superior mesenteric artery in m.m	Branches of superior mesenteric artery	Any dilation observed on artery	Relation to veins	Presence or absence of A-V fistula
1	8	32	Lower border of T11	5.5	Gastorduodenal and Pacreaticoduodenal artery	No	At the Level of 1st Lumbar Vertebra	18.4	Inferior Pancreaticoduodenal, Middle Colc, Ileocolic, right colic, ileal, Jejunal	No	Artery lies left to the vein	No
2	11	32	-do-	5.7	-do-	-do-	-do-	16.8	-do-	-do-	-do-	-do-
3	15	32	-do-	4.8	-do-	-do-	-do-	17.4	-do-	-do-	-do-	-do-
4	16	30	-do-	5.2	-do-	-do-	-do-	21.5	-do-	-do-	-do-	-do-
5	17	32	-do-	6	-do-	-do-	-do-	19.6	-do-	-do-	-do-	-do-
6	18	32	-do-	5.6	-do-	-do-	-do-	18.6	-do-	-do-	-do-	-do-
7	19	32	-do-	4.6	-do-	-do-	-do-	19.2	-do-	-do-	-do-	-do-
8	20	32	-do-	5.4	-do-	-do-	-do-	18.2	-do-	-do-	-do-	-do-
9	25	32	-do-	5.8	-do-	-do-	-do-	17.8	-do-	-do-	-do-	-do-
10	26	32	-do-	5.2	-do-	-do-	-do-	17.6	-do-	-do-	-do-	-do-
11	28	30	-do-	4.8	-do-	-do-	-do-	16.4	-do-	-do-	-do-	-do-
12	40	32	-do-	5.4	-do-	-do-	-do-	16.6	-do-	-do-	-do-	-do-
13	53	32	-do-	5.8	-do-	-do-	-do-	18.8	-do-	-do-	-do-	-do-
14	66	32	-do-	6.2	-do-	-do-	-do-	18.4	-do-	-do-	-do-	-do-
15	73	32	-do-	5.5	-do-	-do-	-do-	17.8	-do-	-do-	-do-	-do-
16	82	30	-do-	6	-do-	-do-	-do-	20.2	-do-	-do-	-do-	-do-
17	83	32	-do-	5.2	-do-	-do-	-do-	20.4	-do-	-do-	-do-	-do-
18	84	30	-do-	6.2	-do-	-do-	-do-	22	-do-	-do-	-do-	-do-
19	86	30	-do-	6.4	-do-	-do-	-do-	18.8	-do-	-do-	-do-	-do-
20	89	32	-do-	5	-do-	-do-	-do-	20.6	-do-	-do-	-do-	-do-
21	97	32	-do-	5.4	-do-	-do-	-do-	21.4	-do-	-do-	-do-	-do-
			Average	5.5			Average	18.88				

Table 3: Showing blood supply of small intestine group III (29-32 weeks)

Sl. No.	Foetus No.	Age in Weeks	Origin of coeliac trunk in relation to vertebral level	Length of coeliac trunk in m.m	Braches of coeliac artery	Any dilation observed on artery	Origin of superior mesenteric artery	Length of superior mesenteric artery in m.m	Branches of superior mesenteric artery	Any dilation observed on artery	Relation to veins	Presence or absence of A-V fistula
1	1	36	Lower border of T11	6.8	Gastroduodenal and Pacreaticoduodenal artery	No	At the Level of 1st Lumbar Vertebra	26.2	Inferior Pancreaticoduodenal, Middle Colc, Ileocolic, right colic, ileal, Jejunal	No	Artery lies left to the vein	No
2	2	FT	-do-	6.4	-do-	-do-	-do-	27	-do-	-do-	-do-	-do-
3	4	FT	-do-	7	-do-	-do-	-do-	27.2	-do-	-do-	-do-	-do-
4	5	FT	-do-	7.2	-do-	-do-	-do-	28	-do-	-do-	-do-	-do-
5	6	FT	-do-	6.6	-do-	-do-	-do-	26.5	-do-	-do-	-do-	-do-
6	9	FT	-do-	6.2	-do-	-do-	-do-	27.5	-do-	-do-	-do-	-do-
7	10	FT	-do-	6	-do-	-do-	-do-	26.8	-do-	-do-	-do-	-do-
8	12	FT	-do-	5.8	-do-	-do-	-do-	27.4	-do-	-do-	-do-	-do-

9	13	FT	-do-	6.4	-do-	-do-	-do-	28.2	-do-	-do-	-do-	-do-
10	14	FT	-do-	7.2	-do-	-do-	-do-	26.4	-do-	-do-	-do-	-do-
11	21	FT	-do-	6.8	-do-	-do-	-do-	27.6	-do-	-do-	-do-	-do-
12	22	FT	-do-	5.8	-do-	-do-	-do-	27.4	-do-	-do-	-do-	-do-
13	33	FT	-do-	6	-do-	-do-	-do-	26.6	-do-	-do-	-do-	-do-
14	34	FT	-do-	7.2	-do-	-do-	-do-	27.2	-do-	-do-	-do-	-do-
15	41	36	-do-	7.2	-do-	-do-	-do-	28.2	-do-	-do-	-do-	-do-
16	44	FT	-do-	7.4	-do-	-do-	-do-	26.8	-do-	-do-	-do-	-do-
17	49	36	-do-	6.8	-do-	-do-	-do-	27.5	-do-	-do-	-do-	-do-
18	51	FT	-do-	7.2	-do-	-do-	-do-	27.4	-do-	-do-	-do-	-do-
19	58	36	-do-	6.6	-do-	-do-	-do-	26.4	-do-	-do-	-do-	-do-
20	59	36	-do-	6.4	-do-	-do-	-do-	27.2	-do-	-do-	-do-	-do-
21	61	FT	-do-	7.2	-do-	-do-	-do-	28	-do-	-do-	-do-	-do-
22	70	FT	-do-	7.4	-do-	-do-	-do-	26.8	-do-	-do-	-do-	-do-
23	74	FT	-do-	6.2	-do-	-do-	-do-	26.5	-do-	-do-	-do-	-do-
24	76	36	-do-	6.4	-do-	-do-	-do-	26.2	-do-	-do-	-do-	-do-
25	78	FT	-do-	6.8	-do-	-do-	-do-	27.8	-do-	-do-	-do-	-do-
26	88	36	-do-	7.2	-do-	-do-	-do-	27.8	-do-	-do-	-do-	-do-
27	90	36	-do-	7.2	-do-	-do-	-do-	26.2	-do-	-do-	-do-	-do-
28	92	FT	-do-	6.8	-do-	-do-	-do-	26.8	-do-	-do-	-do-	-do-
29	94	FT	-do-	7	-do-	-do-	-do-	27	-do-	-do-	-do-	-do-
30	96	FT	-do-	7.2	-do-	-do-	-do-	26.4	-do-	-do-	-do-	-do-
31	98	FT	-do-	6.8	-do-	-do-	-do-	26.2	-do-	-do-	-do-	-do-
32	99	FT	-do-	6.6	-do-	-do-	-do-	27.2	-do-	-do-	-do-	-do-
33	100	FT	-do-	7.2	-do-	-do-	-do-	27.6	-do-	-do-	-do-	-do-
			Average	6.75			Average	27.09				

Table 4: Showing blood supply of small intestine group IV (33 weeks full term)

Sl. No.	Parameter	Age groups	20-24 Weeks	25-28 Weeks	29-32 Weeks	33- Full term
		No. of fetuses	24	22	21	33
1	Length in cm.	Small Intestine	127.5 cm	147.72 cm	196.71 cm	238.18
2	Width	Small Intestine	0.46	0.509	0.511	0.793
3	Length	Oleic trunk	2.7	4.06	5.5	6.75
4	Length	Superior mesenteric artery	13.8	15.72	18.88	270.09

Table 5: Showing mean values of various parameters of small intestine and its blood vessels

DISCUSSION: Parameters of small intestine celiac trunk and superior mesenteric artery were obtained from 100 foetuses of different age groups ranging from 20 weeks to full term.

Mean of all parameters i.e., length and width of small intestine, length of celiac trunk and superior mesenteric artery were calculated and noted. Values were compared with those of previous studies.

According to the study of weaver. L.T., Austin S., Cole T.J., the mean length of small intestine at 20 weeks gestation was 125 cm at 30 weeks 200cm and at term it was 275cm.[3] In the present study the values were as follows. During 20-24 weeks it was 127.5, during 25-28 weeks it was 147.72, during 29-32 weeks it was 196.71, and during 33 weeks to full term it was 238.18.

Sl. No.	Author	Mean length at different gestational ages		
1)	Weaver L.T Austin. S Cole T.J65(Weaver LT, Austin S. Cole TJ, Small intestinal length: a factor essential for gut adaptation in GUT an Int: Jr of gastroenterology and Hepatology (1991); 32 1321-1323)	20 Weeks	30 Weeks	Full term
		125 cm	200 cm	275 cm
2)	Present Study	20-24	25-28 29-32	33-Full term
		127.5 cm	147.72 196.71cm	238.18

The values of the present study were almost correlating with the previous study.

The average values of width of the small intestine from 20weeks to full term were as follows.

During 20-24 Weeks	**It was 0.46 cm**
25-28 Weeks	0.509 cm
29-32 Weeks	0.511 cm
33- Full term	0.793 cm

In the present study the average values of width are increasing gradually and uniformly with the gestational age. As previous literature was not available, these values could not be compared.

Coeliac Trunk: A rare case of absence of celiac trunk was noted by Yammaki et al in 1995.[4]

Formation of coeliaco mesenteric trunk was observed by SAFIYE CAVADAR et al in 1997.[5]

In the present study the site of origin of coeliac trunk was found to be at the level of upper border of T11 in 1st group of fetuses and at the level of lower border of T11 in other three groups.

The branching pattern of coeliac trunk was tripodal, where the three branches i.e., lest gastric, common hepatic and splenic were arising from the same point.

Average length of the coeliac trunk in four groups of fetuses was noted as follows in the present study.

Group-I	Group-II	Group-III	Group-IV
2.70 mm	4.06 mm	5.5 mm	6.75 mm

It has been observed that, the length of coeliac trunk was increasing gradually from 20 weeks to full term. So there is proportional increase of length with increasing gestational age.

Reference regarding the length of the coeliac trunk was not available.

Superior mesenteric artery: Clusen in 1955[6] and Barlow 1955[7] reported variation in the origin and branching of superior mesenteric artery.

In the present study the site of origin of superior mesenteric artery was corresponding to L1 in all the four groups of fetuses.

No variation in the branching pattern was seen.

The branches supplying the small intestine i.e., inferior pancreatico duodenal artery, jejuna and ileal arteries were observed.

10-12 branches were comparatively larger, which is correlating with the study of Dwight. T et al in 1903.[8]

Average length of the superior mesenteric artery was noted in all the group of fetuses in the present study.

Group-I	Group-II	Group-III	Group-IV
13.8 mm	15.72 mm	18.88 mm	2.09 mm

The length of superior mesenteric artery is increasing gradually with increase of gestational age.

Literature concerned with the length of the arteries in fetuses is the still deficient.

CONCLUSION AND TAKE HOME MESSAGE: The present study was undertaken to study the parameter of small intestine i.e., length, width, and the length of the arteries and their branching pattern supplying the small intestine in fetuses of second and third trimester.

100 dead fetuses were collected from Government Maternity Hospital, Hanamkonda, ChandaKantha Memorial Hospital, Warangal, and few private nursing homes in the city of Warangal for the present study.

Parameters of small intestine like the length, width were calculated. The length of the coeliac trunk and superior mesenteric artery were calculated and their values have been organized as per groups. i.e., 20-24 weeks, 25-28 weeks, 29-32 weeks and 33 weeks to full term.

The present study conducted has shown that length of small intestine was found to be increasing with that of foetal age. The mean length of small intestine between age groups of 20 weeks to full term were ranged between 127.5 to 238.18 cm which was correlated with the available literature and found to be close to their values.

The width of small intestine was found to be increasing with foetal age. The average values were ranging between 0.46 to 0.793 cm. As previous literature was not available these values could not be compared.

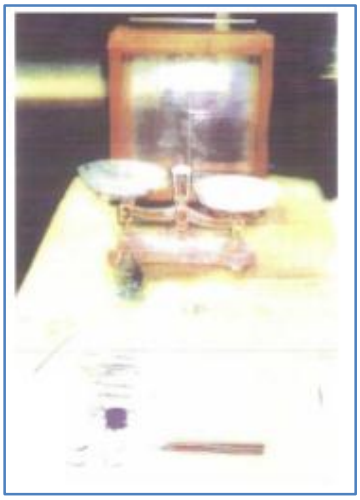
The length of coeliac trunk was also found to be increasing with the foetal age. The average length of coeliac trunk was ranging between 2.70 mm to 6.75mm. References regarding the length of coeliac trunk were not available.

The length of superior mesenteric artery was found to increase proportionately with the foetal age. The average length of superior mesenteric artery was noted in all the age groups of fetuses in the present study, and it was in the range of 13.8 mm to 27.09 mm.

The study will help us to diagnosis other fetal abnormalities associated with abnormal small intestine and its blood supply.

Prenatal and early neonatal small intestine abnormality will help us in planning appropriate surgical correction with better outcome.

Foetuses used for the present study



Instruments used for the present study

Showing the incisions taken for the study

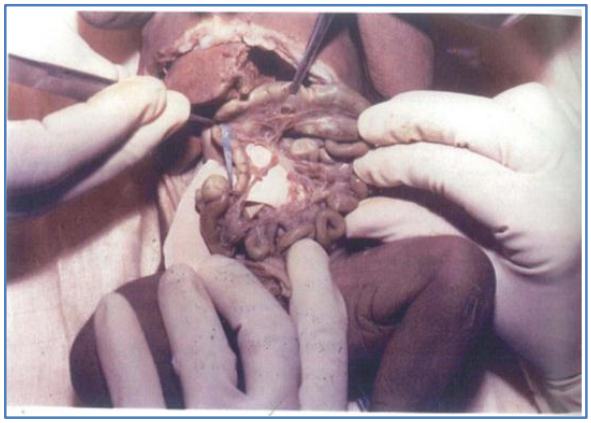
Showing intestines after reflection of flaps

Showing the origin of superior mesenteric artery

Showing small intestine enbloc

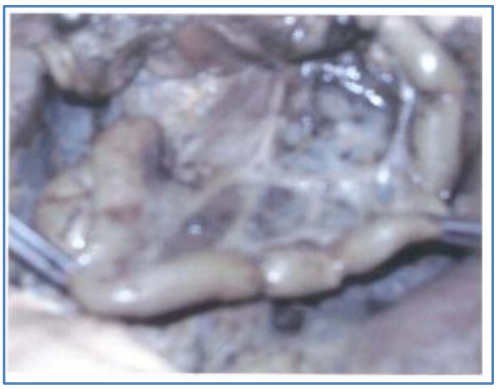
Showing blood supply of small intestine

Showing coeliac trunk

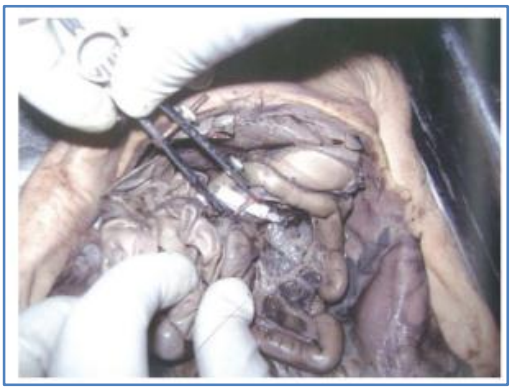


Showing superior mesenteric artery

Showing branches of coeliac trunk



Showing blood supply to jejunum

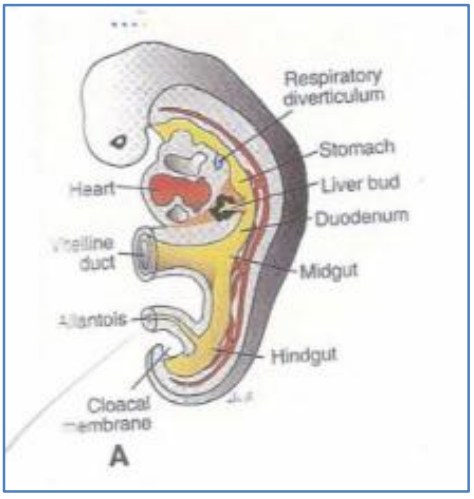


Showing length of superior

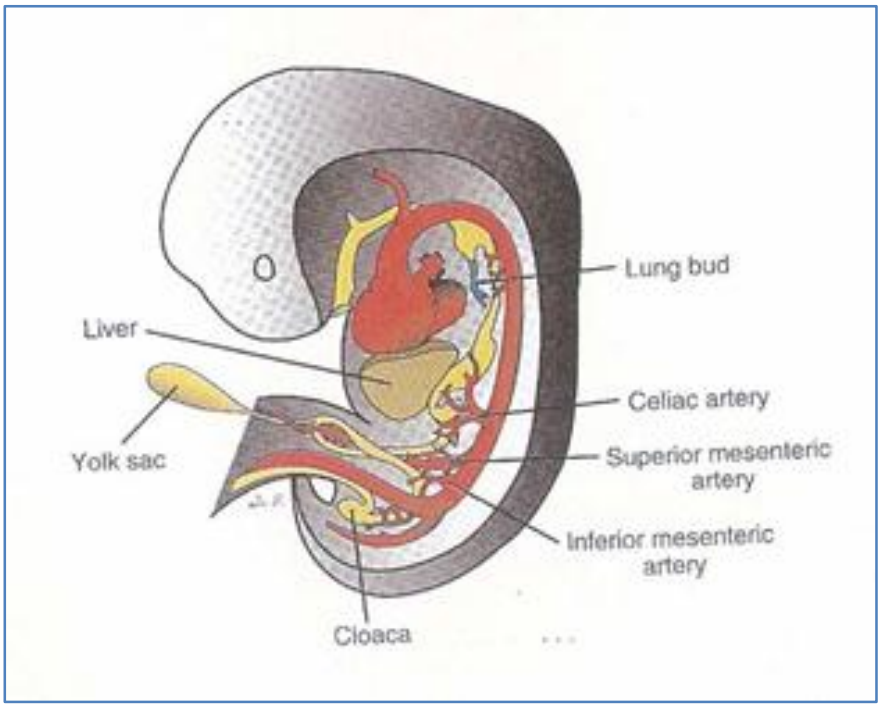
Showing length of superior mesenteric artery in foetus no. 60

Showing loops of small intestine

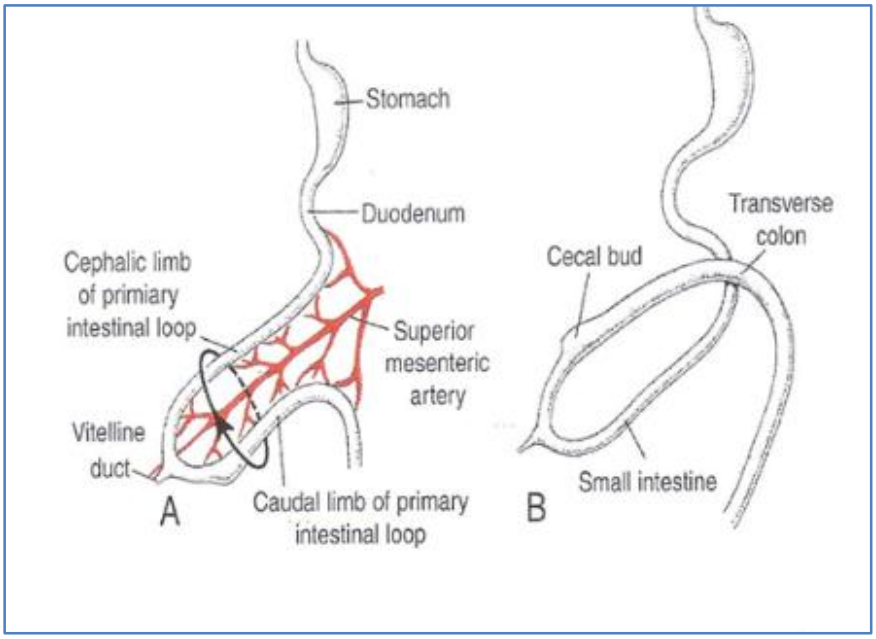
Showing branching pattern of superior mesenteric artery



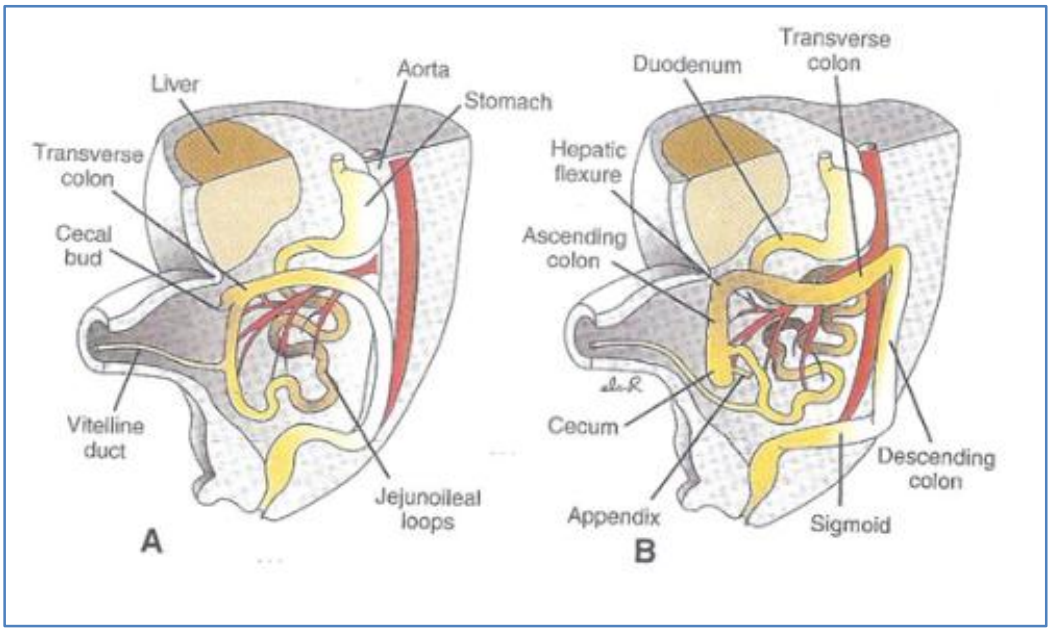
Showing primitive gastrointestinal tract



Showing blood supply to the segments of the gut



Showing primary intestinal loop before and after rotation



Showing the intestinal loops after 270^0 counter clock wise rotation and final position

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