



HUMAN PANCREAS IN PERINATES AND ADULTS- A CADAVERIC STUDY

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ABSTRACT

Background: Literatures are available on study of both macroscopical and microscopical anatomy of adult pancreas. Microscopical study of fetal pancreas are also found. Very few studies are available on macroscopical study of pancreas in perinates. Macroscopic anatomy of the pancreas in perinates is important for surgical and investigative procedure. **Objectives:** The present study aimed to record anatomical variation of the pancreas in perinates and adults. **Methods:** The study was done in Anatomy department, Assam Medical College, Dibrugarh, Assam. 35 perinatal and 15 adult specimens from cadaver were collected. A thorough morphological study was done and the results were recorded. **Results:** Normal macroscopic anatomy & variations, if any, of the pancreas were noted and discussed with previous studies. **Conclusion:** Knowledge of the anatomy of the pancreas will be added to the previous study for future reference. It will be helpful for planning a safe surgery in pediatric age group and for diagnostic procedures, provide a comparison with the adult and provides data for evolutionary changes.

KEYWORDS : pancreatic morphology in perinates, anomalies of pancreas, gross anatomy of pancreas

INTRODUCTION

Cadaveric study of the human organs gives an accurate perspective of morphology, location and possible variation of structures. Prior anatomical knowledge helps to differentiate pathologic conditions of different organs and structures for successful accomplishment of surgical, oncologic or transplantation procedures.

In radiographic study of the pancreas, it was observed that there was a great variation in the size, shape and position of the pancreas and its ducts. The shape of the pancreas was either oblique or L- shaped in most of the cases. Less often it was sigmoid, horse shoe or in occasional cases it was transverse or inverted V. Variations in the duct size and shape were also observed. [1]

Normal fetal growth is the result of equilibrated interplay between environmental and genetic factors. Morphometric examination of fetal pancreas and correlation with gestational age has provided ample evidence that an abnormal intrauterine environment can induce alterations in fetal metabolism and its effect on fetal endocrine pancreas. [2] The usage of the pancreatic tissue formation and the functional ability has been increasing in the modern field of medicine. An important outcome of this is the usage of fetal pancreatic tissue in organ culture techniques where the tissue is capable of net synthesis and release of insulin up to 60 days. [3] The fetal medicine units are rapidly developing and recorded parameters of the organ helps in planning new therapeutic strategies thus helping in reducing the mortality and morbidity of the fetus.[4] Hence, perinatal cadavers are included in the study to see various foetal pancreatic variables.

The aim of the present study is to study morphology of pancreas in adult and perinates including pancreatic ducts and their anatomical variations.

MATERIALS AND METHOD

The specimens were collected from the cadavers provided to the students in the department of Anatomy, few from the department of Forensic medicine and perinatal cadavers collected from the department of Obstetrics and Gynaecology, AMCH. Perinatal period is defined as the period extending from 20th week of gestation (or weighing 500 gm or more at birth) to less than 7 days of life. (Ghai et al, 2010).

Inclusion Criteria:

Approximately healthy perinates of 36 weeks Gestational age and above and adult cadavers were selected as the subject of specimen.

Exclusion Criteria:

Perinates before 36 weeks of Gestational age.

Cadavers with gross congenital anomalies and having suspicion of pancreatic disease or trauma or abdominal operation were excluded from the study.

The dead perinates were preserved by injecting 10% formalin solution into the pleural, peritoneal and cranial cavities. The specimens were taken out en bloc with the duodenum and the spleen. After removal from the body, unwanted tissues were cleared from the specimen and gently washed out with normal saline. They were preserved in 10 % formalin to dissect later.

METHOD OF STUDY:

At first, shape and position of tail were noted down. Then dimensions of different parts of the pancreas were recorded using measuring tape and Vernier caliper. After removing unwanted structures and tissues related to the pancreas, then soaking with blotting paper, the weight of the specimen was recorded in perinates. The length of the pancreas was measured with the help of measuring tape. The length of the pancreas was taken from the duodenal margin of the head to the tail in its different surfaces and the average length was taken.

The width of the head and body of the pancreas were measured from superior border to inferior border using Vernier calipers.

The thickness of head and body were measured using a Vernier caliper.

Once the pancreatic duct was identified adjacent to the posteromedial wall of the second part of duodenum, piecemeal dissection of the pancreas was started from head to tail to see the ductal system.

Results were photographically recorded. Data were tabulated according to the variables in study and then analyzed statistically with mean and SD.

RESULTS AND OBSERVATION

Shape of the pancreas 4 different shapes of pancreas were observed. 90% Oblique shaped, 4% Transverse shaped, 4% Sigmoid shaped and 2% Inverted V shaped. (Table 1, Figure 1,2,3,4)

Table 1- Shape Of Pancreas

SHAPE	NUMBER (n)	PERCENTAGE (%)
Oblique	45	90%
Transverse	2	4%
Sigmoid	2	4%
Inverted V	1	2%
TOTAL	50	100.00



Figure 1: Showing Oblique Shaped Pancreas



Figure 2: Showing Sigmoid Shaped Pancreas In Perinates



Figure 3: Showing Sigmoid Shaped Pancreas In Adults



Figure 4: Showing Inverted V Shaped Pancreas

Position of the tail of the pancreas

Position of tail of pancreas normally shows 3 types, viz. hilum, suprahilum and infrahilum. In this study tail of only 2% specimen showed an infrahilum/subhilum position while rest 98% of the specimens the tail reached the hilum. (Figure 5, 6)



Figure 5: Showing Tail Of Pancreas In Hilum Of Spleen



Figure 6: Showing Tail Of Pancreas In Subhilum Of Spleen

Weight of the pancreas in perinates Minimum and maximum body weight of the perinates was ranging from 1.006 kg to 3.6 kg.

Weight of the pancreas in the perinatal cadavers ranged from 1.1gm to 4.1gm. (Table 2)

Table 2-weight Of The Perinatal Pancreas In Relation To Weight Of Perinatal Cadavers

	MEAN	S.D.	RANGE	
			Minimum	Maximum
Weight of perinate (in Kg)	2.51	0.64	1.006	3.6
Weight of Pancreas (in gms)	2.80	0.66	1.1	4.1

Length, width and thickness of the pancreas in perinates- (Table 3)

The minimum length of perinatal pancreas was 2.5 cm and the maximum length was 5.8 cm. The range of minimum and maximum width of the perinatal pancreas at the level of head and body was 1cm - 2.3cm and 0.2cm - 1.9 cm respectively.

The range of minimum thickness of the pancreas at the level of head was 0.4 cm to 1.5 cm whereas the range of maximum thickness at the level of body was 0.2 cm to 0.9 cm.

Table 3-Measurements Of Pancreas In Perinatal Cadavers

	MEAN	S.D.	RANGE	
			Minimum	Maximum
Length (in cm)	3.52	0.70	2.5	5.8
Width (in cm)				
Head	1.64	0.40	1	2.3
Body	0.74	0.33	0.2	1.9
Thickness (in cm)				
Head	0.74	0.29	0.4	1.5

Body	0.45	0.20	0.2	0.9
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Length, width and thickness of the pancreas in adults- (Table 4), (Figure 7,8)



Figure 7: Measuring Length Of Pancreas



Figure 8: Measuring Width Of Pancreas

The length of pancreas in adult cadavers was in the range of 8.2 to 21 cm. The shortest pancreas measured was only 8.2 cm.

The width of head and body of the adult pancreas was in the range of 4.2 to 6.2 cm and 2.5 to 4.9 cm.

The thickness of head and body of the adult pancreas was in the range of 1.1 to 3.8 cm, 1.1 to 2.9 cm, respectively.

Table 4- Measurements Of Pancreas In Adult Cadavers

	MEAN	S.D.	RANGE	
			Minimum	Maximum
Length (in cm)	15.23	2.91	8.2	21
Width (in cm)				
Head	5.52	0.56	4.2	6.2
Body	4.02	0.60	2.5	4.9
Thickness (in cm)				
Head	2.83	0.67	1.1	3.8
Body	2.01	0.77	1.1	2.9

Pancreatic Ductal System

The pancreatic ductal system comprises of the main pancreatic duct (duct of Wirsung) and the accessory pancreatic duct (duct of Santorini) when present. In the tail region, duct of Wirsung is formed by the union of 2 or more tributaries. About 15 to 30 tributaries drain from both above and below into duct of Wirsung.



Figure 9: Showing Descending Course Of Pancreatic Duct

The Main Pancreatic Duct

The course of main pancreatic duct was of 2 types. 10% of the specimens showed a sigmoid course of main pancreatic duct and remaining 90% showed a descending course. (Figure 9,10)



Figure 10: Showing Sigmoid Course Of Main Pancreatic Duct

Accessory Pancreatic Duct

Out of total 35 perinatal pancreas in the present study, the Accessory pancreatic duct was present in 25.71%. In adult 66.67% showed presence of an Accessory pancreatic duct. (Table 5), (Figure 11)



Figure 11: Showing Both Main & Accessory Pancreatic Duct

Table 5- Percentage Of Accessory Pancreatic Duct

AGE GROUP	TOTAL NO. OF SPECIMEN (n)	PRESENCE of Accessory Pancreatic Duct	PERCENTAGE (%)
PERINATES	35	9	25.71
ADULT	15	10	66.67
TOTAL	50	19	38.00

Classification Of Pancreatic Duct:

In the present study depending on the duct of Santorini, pancreatic duct system in the adult specimens were classified into 3 groups according to Bermann et al in 1960. [5]

Group A: without Santorini: 33.33%

Group B: with Santorini: 53.33%

Group C: blind Santorini: -13.33%

Length of pancreatic duct:

In the perinatal cadavers, the range of length of main pancreatic duct was 2 cm to 5.5 cm and range of accessory pancreatic duct was 0.4 cm to 1.2 cm. (Table 6)

Table 6- Length Of Main And Accessory Pancreatic Ducts In Perinatal Pancreas

LENGTH (in cm)	MEAN	S.D.	RANGE	
			Minimum	Maximum
Main Pancreatic Duct	3.17	0.70	2	5.5
Accessory Pancreatic Duct	0.64	0.28	0.4	1.2

In the adult cadavers, range of length of main pancreatic duct was 6 cm to 19 cm and range of accessory pancreatic duct was 1.5 cm to 3 cm. (Table 7)

Table 7-Length Of Main And Accessory Pancreatic Ducts In Adult Pancreas

LENGTH (in cm)	MEAN	S.D.	RANGE (in cm)	
			Minimum	Maximum
Main Pancreatic Duct	12.66	3.09	6.00	19.00
Accessory Pancreatic Duct	2.71	1.41	1.50	3.00

Small tributaries arising from the substance of the gland drained into the main pancreatic duct. Depending upon the length of the tributaries, they were grouped into long, short and mixed type. Percentage of long, short and mixed varieties were 20%, 26% and 24% respectively. (Figure 12)

**Figure 12: Showing Tributaries Of The Pancreatic Duct**

DISCUSSION

The study was done by dissection method and meticulous effort was made to study and find the morphology of the pancreas and the ductal pattern.

Oblique, transverse, sigmoid, inverted shaped pancreas were described by Sulochana et al [6] with almost similar findings.

Position of tail of the pancreas in different parts of the hilum of spleen was described by L N Pina 52% in hilum and 48% infrahilum. [7]

Very few literatures were available regarding the morphology of perinatal pancreas. The minimum weight of perinatal pancreas in present study is less than the record of previous study by Abhijeet SD et al [8] and the maximum weight in present study was more than the previous study.

The minimum length of pancreas 2.5cm in perinates in present study corresponds with study of Manupati S et al [9] and the maximum length of 5.4cm of present study is slightly higher than the previous study. Immanuel N K B et al [4] described average length of pancreas 3.30 cm in perinates.

Regarding width of the perinatal pancreas, the result of present study was almost similar with the results of Manupati S et al [9].

The thickness of the perinatal pancreas at the level of head and body were similar with L N Pina [7] and Manupati S et al. [9]

Morphology Of The Adult Pancreas

The weight of adult pancreas (Mean-79.36gm) was similar with findings by Manupati S et al. [9] and K S Basnet et al [10].

On correlating with results of previous studies the minimum length of adult pancreas in the present study was slightly less than the findings of Sulochana S et al [6], Baro B et al [11] whereas the maximum length of 19 cm found in this study is similar to Mulholland et al [12], higher than Baro B et al. [11]

Findings of the present study regarding the width of the adult

pancreas at the region of head and body were same as Sulochana et al. [6]

The minimum thickness of the adult pancreas at the level of head was similar with the study of Manupati S et al [9], whereas the maximum thickness was slightly more than previous study.

PANCREATIC DUCTS

Two variations in the course of the main pancreatic duct descending and sigmoid were observed in this study. No other author described about the course except Narayana G et al [13] who described a slightly curved course of main pancreatic duct.

Percentage of presence of accessory pancreatic duct was found to be lower than Gosavi and Gaikwad [14] and Lokadulalu CP et al [15]. Sunjida et al [16] quoted slightly lower level of percentage of presence of accessory pancreatic duct.

Narayanan G et al [13] studied the pancreatic ductal system based on the classification by Bermann et al. [5] They observed that type A was seen in 52%, type B in 40 % and type C in 8 % in their study of 50 pancreas with cast.

The mean length of Main pancreatic duct (12.66 cm) in adult was found to be similar with the study of Narayanan G et al. [13]

The mean length of accessory pancreatic duct in adult was same with the previous study done by Kamisawa T [17].

The mean length of main pancreatic duct and accessory pancreatic duct in the perinates were not mentioned in the available literature.

CONCLUSION

Morphological study gives information about the range of variation found in a species. Without morphological data it is impossible to determine the similarities and differences properly between races or to understand the history of formation of races; it would also be impossible to evaluate the relationship between contemporary man and fossil ancestors. It should not be inferred however, that even the human body, which has been extensively studied, has been so completely explored, that nothing remains to be discovered. [18] Therefore, it is necessary and useful to carry out such morphological study to see if any evolutionary change occurs.

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