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Indian Journal of Anatomy

Volume 11 Number 4
October – December 2022

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The Prevalence of Atrial Septal Defect in Human Adult Cadavers with its Clinical and Embryological Correlations

¹Padmalatha K, ²Shyamala B Y, ³Hema N, ⁴Seema S R, ⁵Amruth S K

How to cite this article:

Padmalatha K, Shyamala B Y et. al./The Prevalence of Atrial Septal Defect in Human Adult Cadavers with its Clinical and Embryological Correlations/Indian J Anat. 2022;11(4):73-106.

Abstract

Introduction: An Atrial Septal Defect (ASD) is a persistent interatrial communication, accounts for approximately 6-10% of congenital defects. ASD types include Ostium Secundum, Ostium Primum, Sinus Venosus, and Coronary sinus defects. Small ASDs may not have significant clinical consequences, while a large defect may lead to life threatening symptoms. The objective of the study is to estimate the prevalence of ASD in the hearts of adult human cadavers.

Materials and Methods: The present study was conducted on a total of 25 Hearts obtained from cadavers allotted to the undergraduate medical students and preserved specimens from the Department of Anatomy.

Results: The presence of Ostiumsecundum ASD was seen in 1 out of 25 specimens (4%). It was an elliptical opening measuring 10×8 mm.

Conclusion: ASDs are associated with the risk of Stroke, Transient Ischaemic Attack, and Paradoxical Embolism. The Anatomical knowledge of the position of the ASD and its morphometric knowledge enables it to differentiate between various Septal Defects. ASDs are usually closed by surgical intervention or by Percutaneous Transcatheter Closure.

Keywords: Foramen ovale; Atrial septal defect; Septum secundum; Cadaveric study.

INTRODUCTION

Isolated atrial septal defects (ASD) represent 7% of all cardiac anomalies and can present at any age.¹ They usually have left to right shunt. There are 4 types of ASD. The most common one is Ostiumsecundum type, where the defect is noted in septal tissue of fossa ovalis. The Ostiumprimum type is usually large in size located in the anterior portion of the lower part of the atrial septum.

Can lead to mitral insufficiency when it involves its anterior leaflet. Other rare variants are Sinus venosus ASD, here majority of defects are situated in the posterior superior portion of the interatrial septum often very close to opening of superior vena cava. Coronary sinus ASDs are the most rare of the ASD types. Here the defects lie close to the opening of the coronary sinus. Patent foramen ovale seen in 25 to 30% of normal individuals is considered as type five and different from secundum defect. It is due to incompetence of fossa ovalis valve which has right to left shunt and it may lead to paradoxical embolism.^{1,2}

The outcome of such defects are related to the size of the defect and duration of shunting. Small defects (<5mm) resolve spontaneously or may be treated with medical or expectant management. Moderate to large defect need surgical intervention.^{2,3} In the present study we made an attempt to study

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Received on: 27.08.2022 **Accepted on:** 26.09.2022

morphometric analysis and prevalence of ASD.

MATERIALS AND METHODS

The study was conducted on 25 hearts from the Department of Anatomy over a period of 3 years. The hearts were procured from the bodies given to students for dissection and also the preserved specimens were used. Hearts from both sexes were used.

The dissection was carried following the steps in Cunningham's dissection manual.⁴ After opening the rib cage vertical cut was made on pericardium anterior to phrenic nerve on either side and a horizontal cut just above the diaphragm and the heart was exposed. Heart was removed after making a cut on great vessels. Exterior of right and left atrium was defined. Cut was made just behind the sulcus terminalis extending from inferior vena cava to superior vena cava exposing the right atrium. A horizontal cut posterior to the ascending aorta will expose the left atrium. The chambers were cleaned by removing the blood clot. Interatrial septum was observed for any defect and noted. The defect when present was measured using digital verniercaliper and photographs were taken. Statistical measures like Mean, Median and Average was used.

RESULTS

SVC: Superior vena cava, IVC: Inferior vena cava, ASD: Atrial septal defect

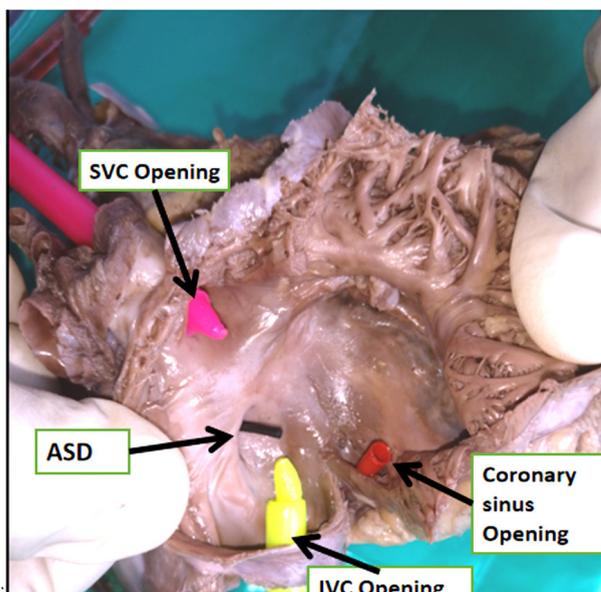


Fig. 1: Shows the elliptical septum secundum type Atrial septal defect.

Interatrial septum was observed in 25 heart specimen. In one heart, ostiumsecundum type ASD was noted (Fig. 1). It was elliptical in shape, was able to pass a thread through the defect (Fig. 2). Its mean transverse diameter was 10.37mm and antero-posterior diameter was 8.11mm (Fig. 3). The prevalence rate from the study was 4%.

DISCUSSION

Atrium develops from primitive atrial chamber. Right atrium also receives contribution from Sinus venosus which is absorbed into atrium and guarded by right and left venous valve, which fuse cranially and form marked projection septum spurium. While left atrium receive contribution from proximal part of pulmonary veins. By about 4th week atrioventricular (AV) cushion starts developing and fuse later to narrow atrioventricular orifice. At the end of 4th week a sickle shaped crest grows from roof of the common atrium called septum primum. It extends towards the endocardial AV cushion. The opening between septum primum and AV cushion is now called Ostiumprimum, which progressively narrowed. Before closure of ostiumprimum, perforations appear in the upper portion of septum primum which is called Ostiumsecundum which ensures that the blood flow from right to left atrium.

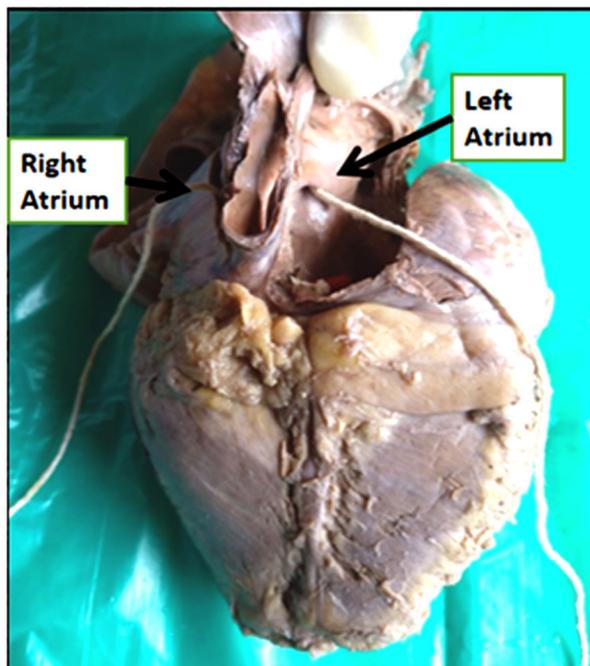


Fig. 2: Shows a thread passing through the atrial septal defect.



Fig. 3: Use of Vernier Calliper for measuring the width of the atrial septal defect

At about sixth to seventh week a crescent shaped thicker ridge appear in the roof called septum secundum between left venous valve and septum primum. It extends till it covers the ostium secundum. The lower crescent shape of this forms the sharp rim covering superior, anterior and posterior border of fossa ovalis in adults.

An oblique opening foramen ovale maintains the blood flow from right to left atrium in foetal life. After birth physiologically this foramen ovale will be closed by approximation of septum primum against rigid septum secundum brought about by the pressure difference in both atrial chambers. By approximately about 3 months valve of septum primum fuses with septum secundum, forming oval fossa. In 20% of cases, this fusion is incomplete forming patent foramen ovale. Excessive resorption and cell death of septum primum or by inadequate development of septum secundum will lead to ASD. Also mutations in heart specifying gene NKX 2.5 on chromosome 5q35 can produce ASD.⁵⁻⁷

In a study done on 60 cadaveric hearts probe patency of foramen ovale was found in 15% cases.⁸ Another study done on 106 cadaveric hearts shows 4.71% of patent foramen ovale where as in 10.37% has probe patency.⁹ Another study done on 50 cadaveric heart, 2 cases (4%) showed patent foramen ovale, whereas 9 cases (18%) had only probe patency.¹⁰ In another study on Japanese population, the autopsy reports and clinical backgrounds of 103

hearts were reviewed using medical records. They found prevalence of PFO was 13.6% (14/103).¹¹ Another cadaveric study done on 50 hearts, FO was patent in 3 (6.0%), whereas 24.0% had only probe patency.¹² In the present study the we found a septum secundum type ASD in 4% cases.

A study done over a period of 10 years where 117 ASD patients were reviewed. 78.4% were asymptomatic. Symptomatic usually complained of dyspnoea on exertion which increase with age.¹³ Pathophysiologic consequences of ASDs noted were arrhythmia, paradoxical embolism, cerebral abscess, pulmonary hypertension, and right ventricular failure. Early diagnosis and tratment when symptomatic will prevent the fatal complications. Two-dimensional transthoracic echocardiography with Doppler is a central aspect of the morphometric evaluation of the defect and to plan any surgical intervention.¹⁴ From an anatomoclinical point of view, ASD and PFO might be considered at the edge of a single continuum which pass throughout flat elliptical ASD and cribrosus ASD.¹

CONCLUSION

The study of atrial septal defects of prime importance, if left undiagnosed, it can lead to major complications some of which may even be lethal. Septum secundum is the most common type

of ASD on a long run can lead to patent foramen ovale. The understanding the embryological basis and early intervention in symptomatic individual can prevent fatal complications.

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Teaching Radiological Anatomy to the First Year MBBS Students By Using Questionnaire and Analyzing Their Perception

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How to cite this article:

Madhuri Avinash Mahendrakar, Kishore Dattatray Khushale/Teaching Radiological Anatomy to the First Year MBBS Students By Using Questionnaire and Analyzing Their Perception/Indian J Anat. 2022;11(4):107-111.

Abstract

Background: The Radiological Anatomy is a clinically oriented subdivision of Human Anatomy, but as observed, it is largely neglected by the undergraduate first year MBBS students. This study is undertaken to find a suitable method to teach as well as generate interest in learning this subdivision of Anatomy.

Aim and Objective: To facilitate the first year MBBS students to study Radiological Anatomy and improve the understanding of the subject and thereby enhance their performance. To analyze their performance and study their perception.

Materials & Methods: This is a prospective study, seeking preference for method of teaching Radiological Anatomy among first year MBBS students. Data collection was done with a structured questionnaire containing questions pertaining to their preference, perception as well as their attitude for learning Radiological Anatomy after taking an informed consent.

Results: In this study, majority of the students preferred the teaching method of using questionnaire booklet of Radiological Anatomy then the conventional way.

Conclusion: Questionnaires should be incorporated in those subdivisions of Anatomy which are neglected by the students for understanding of the subject, improve thinking ability and thereby performance.

Keywords: Radiological Anatomy; Questionnaire; Performance; Perception; Attitude.

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Received on: 01.08.2022 **Accepted on:** 26.08.2022

INTRODUCTION

In the undergraduate first year MBBS medical course as per NMC guidelines the time allotted for study of basic sciences is approximately only one year. They study three disciplines Anatomy, Physiology and Biochemistry in first year. The subject Human Anatomy is a very vast subject and has many subdivisions as Gross Anatomy, Neuroanatomy, Microanatomy, Embryology, Genetics, General Anatomy and Living Anatomy. Their curriculum also includes Radiological

Anatomy. Lot of their time, attention is taken by the subject Anatomy. They give emphasis on studying the gross, micro, embryo, neuro, and general anatomy subdivisions which are undoubtedly major subdivisions of anatomy. These subdivisions have lot of weightage in theory as well as practical in terms of marks.

It is observed that studying Radiological Anatomy is given secondary preference or preferred to be kept as option by the students. It has marks weightage mainly in the practicals. Radiological Anatomy is a informative, clinically oriented and so a interesting part of Anatomy. This study is done to facilitate students to study Radiological Anatomy and enhance their performance in the radiology examination. Also studying Radiological Anatomy helps understanding the Gross Anatomy.

MATERIALS & METHODS

This is a prospective, mixed (qualitative and quantitative) study seeking preference for method of teaching Radiological Anatomy, among undergraduate first year MBBS students. The study was initiated after taking requisite clearance from Institutional Ethics Committee. The students were explained about the purpose of the study, its usefulness for academic improvement and informed consent was taken from each student.

A questionnaire booklet of Radiological Anatomy was prepared.¹ The radiographs which are included in the first year MBBS syllabus were photographed. These photographs were then titled and labelled to incorporate them in the radiology questionnaire booklet.

The title of the photograph included following things:

1. Weather the radiograph is a plain or contrast study?
2. View of the radiograph - antero-posterior, postero-anterior, lateral or oblique.
3. The radiograph is taken to study which part of the body, or to study joint, vessels or organs etc.

The bony features and the soft tissues seen in the radiograph - vessels, organs, tubes e.g. gastro-intestinal tract and muscles were labelled.

Below the photograph a description of the

radiograph was given with a list of structures seen in it. This was followed by questions on the radiograph. The questions were on the Radiological Anatomy of the radiograph as well as on related relevant Gross Anatomy. Below each question a space was given to write answer to the given question. This radiology questionnaire booklet was then given to the students.

The radiographs were taught to the students in DOAP classes. In these classes the questions from the questionnaire and their answers were discussed. The students were asked to study the radiology questionnaire booklet and pen down answers of the questions given to them. The answers written by them were then analyzed by the teachers.

After the students appeared for the Evaluation-Assessment Examination they were given a questionnaire. Data collection was done with structured questionnaire containing questions pertaining to their preference of use of radiology questionnaire booklet for learning, perception as well as attitude for learning Radiological Anatomy. Feedback from the students on nine parameters was collected and analysed. The parameters were based on their preference and perception for the radiological anatomy booklet given to them.

RESULTS

Following parameters were studied: Weather the radiology questionnaire booklet helped them to understand radiographs and in turn understand Gross Anatomy and improve thinking ability for studying the subject. Did the radiology questionnaire help to build confidence by improving presentation skills and answering ability during evaluation? Did the questionnaire make learning Radiological Anatomy more interesting? Does a questionnaire booklet be made of all the topics in Anatomy to assist teaching and learning Anatomy or weather the conventional method of teaching without a questionnaire was better?

A total of 158 undergraduate first year MBBS students participated in this study. Feedback from students on preference of teaching method and learning for Radiological Anatomy was analysed through the questionnaire results are shown in numbers and percentages in Table 1.

Table 1: Preferences of the students regarding teaching Radiological Anatomy and Radiology Questionnaire Booklet Abbreviations in the Table: SA - Strongly agreed, A - Agree, UC - Uncertain, DA - Disagree, SDA - Strongly disagreed

Sr. no.	Did the Questionnaire help to	Options				
		SA No. %	A No. %	UC No. %	DA No. %	SDA No. %
1	Understand the radiographs	84 53.16%	67 -42.40%	6 -3.79%	-	1 -0.63%
2	Understand the Gross Anatomy	36 -22.78%	98 -62.02%	20 -12.65%	2 -1.26%	2 -1.26%
3	Make learning radiological anatomy more interesting	60 -37.97%	81 -51.26%	14 -8.86%	1 -0.63%	2 -1.26%
4	Improved the thinking ability	58 -36.70%	82 -51.89%	16 -10.12%	1 -0.63%	1 -0.63%
5	Improved the answering ability	77 -48.73%	66 -41.77%	13 -8.22%	1 -0.63%	1 -0.63%
6	Develop presentation (answering) skills during evaluation	69 -43.67%	75 -47.46%	11 -6.96%	1 -0.63%	2 -1.26%
7	Build confidence during evaluation	69 -43.67%	74 -46.83%	13 -8.22%	-	2 -1.26%
8	Does a questionnaire booklet be made of all the topics in Anatomy to assist teaching and learning Anatomy?		Yes- 146 -92.40%		No-12 -7.59%	
9	Weather the conventional method of teaching without a questionnaire was better?		Yes- 17 -10.75%		No- 141 -89.24%	

DISCUSSION

Radiology as a method of diagnosis is essentially Applied Anatomy. The medical student learns Anatomy by various modalities doing dissections, studying hard parts, soft parts, micro anatomy and radiographs in DOAP sessions and in lectures. Dissection helps to train the hand and eye, but it does not of itself show how the body works. To think of structure in terms of function the student must compare the structures revealed in the dead body with such data as he may obtain of the form and the action of these structures in the living body. The radiographs help the student to think of the structures found in the cadaver as in place in the living body.²

The progress made by Radiology in the examination of the human body has led to its increasing use in the diagnosis of disease, so that every general practitioner must have some knowledge of the normal radiographic appearances of the body if he is to understand the meaning of

the radiologist's report. It is plain that any attempt to teach students the meaning of radiographs showing abnormal conditions without first teaching them to interpret radiographs of the normal is like trying to teach morbid histology without having first a knowledge of normal histology. The teaching of normal radiology in the anatomy department, as well as making the subsequent teaching of radiographs of pathological conditions easier, also exerts a favorable influence on the student's approach to his anatomical studies.⁴

A study was done by C Chew, et al³ to directly link Radiology teaching with improved Anatomy examination result. They have concluded in their study that radiology small group teaching significantly improved anatomy scores of medical students in the summative end of year examination, compared to the years when it was not taught.

Utilising postgraduate trainees to deliver undergraduate teaching is a logical and well established practice encouraging multimodality

input and promoting symbiotic learning.⁶ In this study an Applied Anatomy class was introduced at the completion of each anatomical module for the academic year of 2011/2012 (first and second year students). The format contained two hour class, involved dividing the students into 7 to 8 groups and rotating them around a matching number of stations at 8 minute intervals. The stations were taught by first year Radiology Registrars each addressing different imaging modalities with anatomical regions. The author concluded that the study was beneficial for both the teachers and the students.

The review article by N B Heptonstall et al⁷ presents the importance of integrating Radiology and Anatomy teaching. They stated that on an average only 5% of total teaching time in medical education is dedicated to radiology. Often, radiology teaching does not adequately fulfill students learning needs and potentially leaves them underprepared for medical practice. Benefits of integrating radiology and anatomy include improved clinical application of anatomy, an increase in student's interest in anatomy, and ultimately improved radiological interpretation. They have concluded that combining radiological resources with traditional anatomy teaching methodology in a blended approach is most beneficial.

Anatomy and Radiology are usually taught separately with a considerable time lag. A study was done by S Dettmer et al⁸ on interdisciplinary course. The integrative course "Radiological Anatomy" was established in the second year of medical education, combining these two closely related subjects. This interdisciplinary course was retrospectively evaluated by consideration of a student questionnaire and staff observations. They concluded in their study that integrative teaching of anatomy and radiology was well received by the students and both anatomical and radiological comprehension and motivation to learn were improved.

Kishore D. Khushale et al⁵ in their study prepared charts of histology diagrams to assist the first year MBBS students to draw diagrams in their Histology Journals. They wanted to augment the students ability for drawing good histology diagrams, to enhance the performance of the students in evaluation of Histology. They concluded that histology charts must be developed by each department of anatomy for enhancing the drawing skills of the students, improving understanding of

the subject, thinking ability and reducing mistakes committed the students.

Similar to the studies mentioned above³⁻⁸ in this present study an attempt is made to enhance the understanding of Radiological Anatomy of the first year MBBS students and thereby their performance in examinations. By analysing the response of the students for the questionnaire booklet of radiology it is evident that majority of the students are in favour of the questionnaire booklet.

The radiology questionnaire booklet assisted to understand the radiographs was strongly agreed by 53.16% and agreed by 42.40%. Similarly booklet helped to understand the Gross Anatomy was agreed by 62.02% and strongly agreed by 22.78%. Learning Radiological Anatomy by using the booklet was more interesting was agreed by 51.26% and strongly agreed by 37.97%, also 51.89% agreed and 36.70% strongly agreed that their thinking ability improved. Significant percentage of students have approved that the booklet has improved their answering ability (48.73% strongly agree, 41.77% agree), help develop presentation skills (47.46% agree, 43.67% strongly agree) and build confidence during evaluation (46.83% agree, 43.67% strongly agree). Majority of the students 92.40% are in favor of a questionnaire booklet made for all the topics in Anatomy to assist teaching and learning Anatomy. 89.24% are not in favor of the conventional method of teaching without a questionnaire booklet. Refer Table 1.

CONCLUSION

Questionnaire booklet of Radiology was well received by the students. Both, radiological and anatomical comprehension and the motivation to learn were improved. The teaching of normal Radiology in the Anatomy Department, exerts a favorable influence on the student's approach to his anatomical studies. It appears that combining radiological resources in terms of booklet with traditional anatomy teaching methodology in a blended approach is most beneficial. Questionnaires should be incorporated in those subdivisions of anatomy which are neglected by the students.

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A Quest into the Morphology of Cadaveric Livers: An Analytical Study

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How to cite this article:

Rani Nallathamby, Boban Babu/A Quest into the Morphology of Cadaveric Livers: An Analytical Study/Indian J Anat. 2022;11(4):113-119.

Abstract

Background: Abnormalities of liver are rarely reported. Even though they are present in society, most of them are asymptomatic and remain undetected. The morphological abnormalities of liver can cause diagnostic confusion for physicians, surgeons, radiologist and anatomists. A sound knowledge of the normal and variant liver anatomy is a prerequisite for a favorable surgical outcome. Eventhough the segmental anatomy of the liver has been a field of extensive research, there are very few studies regarding the surface variations of the liver.

Materials and Methods: Observational study on 60 cadaveric livers ranging from 40-60 years undertaken.

Results: 35 livers showed various types of morphological variations.

Conclusion: This study highlights patterns of variations in the lobes and fissures of the liver and useful for the radiologists and surgeons to ward off the possibility of misdiagnosis and also in planning surgical procedures related to Liver and Gallbladder.

Keywords: Liver; Morphological variations; Cadaveric Livers; Surgeons; Radiologist.

INTRODUCTION

Liver is the largest gland in the body mainly situated in the right upper quadrant of the abdomen. It occupies a major part of the right hypochondrium, upper epigastrium and extends into the left hypochondrium. Diaphragmatic surface is smooth, dome shaped and

covered with visceral peritoneum, except posteriorly in the bare area of the liver. Anteriorly left lobe and right lobe are separated by falciform ligament which extends from liver to anterior abdominal wall. Abnormalities of liver are very rare despite its complex development in the ventral mesogastrum. (1) Externally liver is divided into two anatomical lobes and two accessory lobes by the reflections of peritoneum. Internally on the basis of the blood supply Knowledge of commonly occurring variations in Liver assumes more significance in the era of diagnostic imaging and minimally invasive surgical approaches. Accessory lobe may be confused with tumor. Accessory fissure may mimic internal trauma at the time of the autopsy. In any operative procedure involving the liver, a surgeon's knowledge of hepatic anatomy is vital in determining

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Received on: 02.08.2022 **Accepted on:** 05.09.2022

the outcome. (3) Hence to alert clinicians, surgeons and radiologists and to add information to the data base of anatomists, this study is undertaken.

OBJECTIVE

Although segmental anatomy of liver has been extensively researched, very few studies have dealt with the surface variations of liver. Aim of present study is to find out the morphological variation of Liver. A multidimensional knowledge of the normal and variant anatomical possibilities of Liver is essential for a successful surgical outcome. This knowledge is of high significance in the present era of diagnostic imaging and minimally invasive surgical procedures.

MATERIALS AND METHODS

The materials used for present study comprises 60 adult livers with age ranging from 40 to 75 years which were harvested during routine dissection classes for medical undergraduate students over a period of 12 years in Department of Anatomy, Yenepoya Medical College, Mangalore and Believers Church Medical College, Thiruvalla. The Formalin fixed livers were carefully studied for the presence morphological variations such as presence of accessory lobes, accessory fissures, atrophy of lobes, elongated lobes, presence of Hartmann's pouch, absence of cystic notch, accessory processes etc. Livers with features of cirrhosis or any damage or diseases were excluded

from this study. This was an observational study with no usage of any experimental instruments. Appropriate measurements were taken by calipers and measuring tape. The specimens were photographed and the findings were appropriately documented.

RESULTS

In our study out of 60 livers studied, we found morphological variations in 35 livers; 58.3%. We found Accessory liver lobes in 20 cases i.e. 33.3%. Atrophy of left lobe of liver in 2 cases i.e. 3.3%, Accessory fissures (ranging from 1-5) in 23 cases i.e. 38.3%. Elongated right lobe in 2 cases i.e. 3.3%, interconnected left lobe and Quadrate lobe with absence of fissure for ligamentum teres in 1 case i.e. 1.6% and 1 case (1.6%) showed fissure for ligamentum teres not extending into the inferior border. In 13 cases ligamentum teres is found to run in a tunnel. (21.6%). 2 cases (3.3%) showed up with additional quadrate lobe and 7 cases (11.6%) showed accessory process from quadrate lobe. One liver (1.6%) showed additional caudate lobe and one liver (1.6%) had an unusually prominent caudate process. 2 cases (3.3%) showed an exaggerated cystic notch whereas 2 livers (3.3%) had no cystic notches in their inferior borders with Gallbladder not extending into the inferior border. One case also showed the presence of Hartmann's pouch. (table:1)

Table.1: Percentage incidence of morphological variations of liver lobes

Serial Number	Type of Variation	No: of Livers Showing the Variation	Percentage of Variation (%)
1	Accessory Fissures	23	38.3
2	Accessory Lobes	20	33.3
3	Absence of Fissure for Ligamentum Teres	1	1.6
4	Tunnel for Ligamentum Teres	13	21.6
5	Left Lobe Atrophy	2	3.3
6	Additional Quadrate Lobe	2	3.3
7	Accessory Process from Quadrate Lobe	7	11.6
8	Additional Caudate Lobe	1	1.6
9	Unusually Prominent Caudate Process	1	1.6
10	Absent Cystic Notch	2	3.3
11	Exaggerated Cystic Notch	2	3.3
12	Elongated Right Lobe	2	3.3

Fig.s- liver



Fig. 1: Atrophy of left lobe

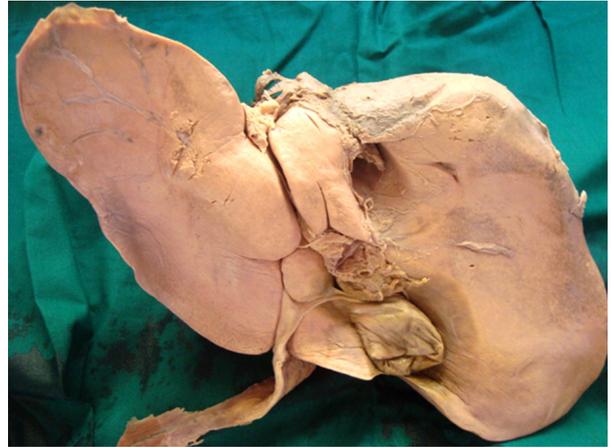


Fig. 2: Additional quadrate lobe



Fig. 3: Tunnel for ligamentum teres



Fig. 4: Gall bladder showing Hartmann's pouch



Fig. 5: Accessory sulci and fissure



Fig. 6: Accessory process on quadrate lobe



Fig. 7a: Absence of fissure for ligamentum teres



Fig. 7b: Ligamentum teres coming out through anterior aspect



Fig. 8: Unusual fissure on superior surface of liver



Fig. 9: Liver showing multiple fissures



Fig. 10: Elongated right lobe



Fig. 11: Accentuated cystic notch



Fig. 12: Prominent caudate process



Fig. 13: Presence of accessory lobe on right inferior aspect of caudate lobe



Fig. 14: Presence of additional lobe on fissure for ligamentum venosum



Fig. 15: Short gallbladder with absence of cystic notch



Fig. 16: Fissure on ligamentum teres not extending to inferior border

DISCUSSION

According to Champetier J. et al² hepatic anomalies can be divided into two categories, i.e. anomalies due to defective development and anomalies due to excessive development of the liver. The liver tissue in the communicating with the main mass of liver is termed as accessory lobe while the liver tissue lying in the vicinity of the liver termed as ectopic liver. Accessory lobe of the liver is very rare variation which may remain silent in many subjects. Accessory lobes, if present, are usually seen on the inferior surface of the liver, but also reported to be seen on the gall bladder surface and hepatogastric ligament.³ In our study we found accessory lobes in 33.3% of livers. (Fig. 13,14)⁸ cases showed its presence in Right lobe, 3 cases in left lobe,⁴ in quadrate and 5 in caudate lobes respectively. This study showed presence of accessory fissures in 23 cases i.e; 38.3% of livers. (fig. 5,8,9) of which inferior surface showed their presence in 7 cases, superior surface 4 cases, caudate lobe 4 cases, anterior surface and posterior surface showed fissures in 1 case each. Multiple accessory fissures may mimic pathologic liver nodules on CT and may be associated with diaphragmatic scalloping or eventration on the chest film. When only parts of these fissures are seen sonographically, they may be mistaken for echogenic liver lesions. Usually the diaphragm which is related to the superior surface may exert costal pressure to give rise to diaphragmatic fissures.⁴ Any collection of fluid in these fissures may be mistaken for a liver cyst, intrahepatic hematoma or liver abscess. Implantation of peritoneal disseminated tumor cells into these spaces may mimic intrahepatic focal lesions.³ Shailaja et al⁵ in her study revealed the presence of accessory lobes (6%) and accessory fissures (24%). Hussein Muktyaz et al found accessory liver lobes in 6 cadavers 14.6%, atrophy of left lobe in 2 cadavers 4.8%, accessory fissures in 5 cases 12.1%.⁶ In this study we got 3.3% of cases with atrophy of left lobe.(fig. 1) Lobar atrophy of the liver due to causes other than liver tumor or liver cirrhosis is a relatively rare pathological condition, and there are only a few reports in the literature.⁶ Hepatic lobar atrophy usually occurs in the setting of combined biliary and portal vein obstruction. A significant correlation exists between hepatic lobar atrophy and ipsilateral portal vein obstruction.⁷ liver showed complete absence of fissure for ligamentum teres with hepatic tissue bridging where the ligamentum teres come out through the anterior surface (fig. 7a,7b) and in 1 liver the fissure was not extending up to the inferior border (fig. 16). In 13 cases, (21.6%) ligamentum teres is found to run in a

tunnel (fig. 3). Ebby et al. reports a case of liver with the presence of complete tunnel instead of fissure for ligamentum teres.¹¹ During development, the liver is separated into 2 lobes by the falciform and round ligaments by the second month of gestation, failure of which may cause the fusion of lobes to variable extent resulting in formation of a tunnel for ligamentum teres. When the patient lie in supine position, the fissure for ligamentum teres contains some air in case of pneumoperitoneum. This air is visible in radiographs as a vertically directed area of hyperlucency which may be masked by the presence of hepatic tissue in case of a tunnel.^{12,13} One liver (1.6%) showed additional caudate lobe and one liver (1.6%) had an unusually prominent caudate process (fig. 12) During the formation of caudate lobe, a small portion of caudate lobe may have become separated from it and included in mesentery of ductus venosus to form the accessory lobe (15). 2 cases (3.3%) showed up with additional quadrate lobe (fig. 2) and 7 cases (11.6%) showed accessory process from quadrate lobe (fig. 6). Joshi SD et al studied 90 livers where quadrate lobe was absent in 2 cases. (10) 2 cases (3.3%) showed an exaggerated cystic notch (fig. 11) whereas 2 livers (3.3%) had no cystic notches in their inferior borders with Gallbladder not extending into the inferior border (fig. 15). One case also showed the presence of Hartmann's pouch (fig. 4). The observations are tabulated in table 1. (table. 1) The gall bladder is situated in the fossa for gall bladder on the inferior surface of Liver. Its fundus produces a cystic notch on the inferior border of the liver and projects beyond the inferior border and may touch the anterior abdominal wall near the tip of right ninth costal cartilage causing infective pathologies to spread easily into parietal peritoneum. Short gall bladders hiding in their fossa, may lead to confusions in imaging and also in laparoscopic approaches.¹⁴

CONCLUSION

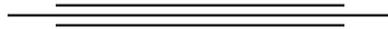
In this study we have described morphological variations of the liver lobes. Atrophy, presence of accessory fissure or lobe, can cause diagnostic confusion for surgeons during surgery and for physicians, radiologist and anatomist. Presence of variations in the liver may cause complications during transplantation surgeries and may present as incidental findings at autopsy creating confusions. This variations may complicate a liver transplantation surgery.

The findings of study may be helpful to radiologists and surgeons respectively, to avoid

possible errors in interpretations and subsequent misdiagnosis, and for planning appropriate surgical approaches.

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A Study Coracoid Process of Scapula and its Clinical Significance

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How to cite this article:

Viren Sharadkumar Sawant, Sharadkumar Pralhad Sawant et. al./A Study Coracoid Process of Scapula and its Clinical Significance/Indian J Anat. 2022;11(4):121-127.

Abstract

The coracoid process is aptly defined as the “light house of the shoulder” since an important principle of shoulder surgery is to board an approach which is lateral to the coracoid process. This is done to evade the neurovascular structures passing medially; besides, many important tendinous and ligamentous attachments are anchored here. Loss or damage of any of the structures could lead to alterations in the structure of coracoid process. Therefore, a more comprehensive study of the morphology of coracoid process is needed.

Aim: To study the coracoid process of scapula and its clinical significance.

Material and Methods: The present study was conducted on 100 dry human scapulae. Coracoglenoid shape was examined and classified into Type I - round bracket, Type II - square bracket and Type III fish hook. Morphometric parameters such as length, breadth, thickness and height, acromiocracoid and coracoglenoid distance were measured and statistical analysis was carried out.

Results: Type I Coracoglenoid shape was observed in maximum number of specimens. Differences observed in the morphometric parameters observed on right and left side were statistically insignificant.

Clinical Significance: The coracoid is involved in many surgical interventions on the glenohumeral joint, hence variant dimensions of the coracoid process are of importance for Radiologists and Orthopaedic surgeons for planning reparative procedures on the shoulder and is also useful in Forensics for gender determination.

Conclusion: The outcomes of the present study establish the proportions of the coracoid process which can aid in finding the suitable approaches for repair of a coracoid fracture.

Keywords: Coracoid Process; Scapula; Coracoglenoid Shape; Glenohumeral Joint; Radiologists; Orthopedic Surgeons; Forensics; Gender Determination; Coracoid Fracture.

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Received on: 22.06.2022 **Accepted on:** 25.07.2022

INTRODUCTION

The shoulder blade is called scapula but the name scapula is limited to the dorsal aspect of the bone. The ventral part of the shoulder blade is called the coracoid bone. The scapula and the coracoid bone join at the epiphyses lying superior to the glenoid fossa. The scapula proper and coracoid correspond to the ilium and ischium of the pelvic girdle while pubis corresponds a tiny bone called precoracoid which ossifies separately at the

tip of the coracoid process; it takes no part in the formation of shoulder joint. The coracoid process is a hook shaped structure project forwards and slightly laterally from the superior part of the neck of the scapula. It is often denoted as the 'lighthouse of the shoulder' by orthopaedic surgeons as many tendinous and ligamentous attachments are anchored here. The coracoacromial anatomy includes acromion, coracoacromial ligament and tip of coracoid process. The glenohumeral joint is the most mobile and unstable joint in the human body and hence the most commonly dislocated joint.¹ Patients with a significant glenoid bone loss remain to have a high failure rate after Bankart repair for shoulder dislocation.² A number of investigations have described glenoid reconstruction procedures using the coracoid process out of which Latarjet procedure (Coracoid transfer to the anterior glenoid) is the most common reconstruction procedure used for anteroinferior shoulder instability.³ The coracoid increases the surface area of the glenoid but is inadequate in patients with bone loss of >33% of the glenoid width.⁴ A complete morphometry is valuable in traumatic cases, surgical interventions and replacement surgeries in the shoulder region and is also useful in Forensics for gender determination. Not many studies have been conducted to record various morphometric parameters of the coracoid process.

Aim: To study the coracoid process of scapula and its clinical significance.

MATERIAL AND METHODS

The present study was conducted on 100 dry human scapulae. 55 pairs belonged to male and 45 pairs belonged to female. The scapulae included in this study were free from damage and scapulae with broken edges and degenerative changes of coracoid process were excluded from the study. Coraco-glenoid space was examined and classified according to its shape into - Type I (round bracket), II (square bracket) and III (fish hook) as advocated by Gallino et al.⁵ A digital vernier calipers with accuracy up to 0.01 mm was used to measure other morphometric parameters such as length, breadth, thickness and height, acromio coracoid and coracoglenoid distance.

The distance from anterolateral end to posteromedial end of coracoid process was taken as the maximum length.

The distance from lateral border to medial border of coracoid process was taken as the maximum breadth.

The Maximum thickness was measured in the supero-inferior direction 1cm posterior to tip of coracoid process.

The distance between supraglenoid tubercle to undersurface of coracoid process was taken as the maximum height.

The distance between supraglenoid tubercle to top of ascending portion of coracoid process was taken as the Coracoglenoid distance.

The distance between tip of the acromion process and tip of the coracoid process was taken as the Acromiocracoid distance.

Data obtained was analysed using SPSS 20 software. The Independent t-test was employed in the assessment of size and gender differences. p-value ≤ 0.05 was considered significant.

RESULTS

Coraco-glenoid space observed were as follows

- Type I-round bracket was seen in 47specimens.
- Type II- square bracket was 33 specimens.
- Type III- fish hook was 20 specimens.

Type I was observed in maximum number of specimens followed by Type II and Type III comprised the least number

DISCUSSION

The coracoid process is aptly defined by Matsen et al as the "lighthouse of the shoulder" since an important principle of shoulder surgery is to board an approach which is lateral to the coracoid



Fig. 1: showing photographic presentation of Type I - round bracket Coraco-glenoid space seen in 47specimens.

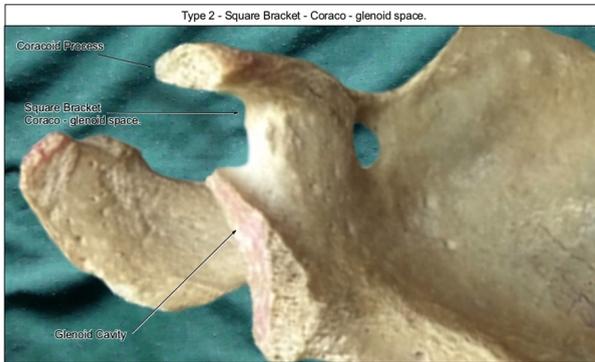


Fig. 2: showing photographic presentation of Type II - square bracket Coraco-glenoid space seen in 33specimens.

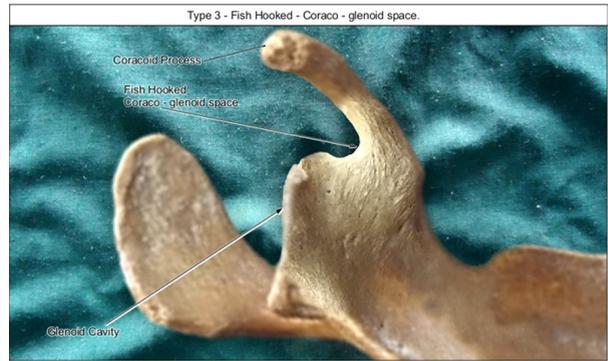


Fig. 3: showing photographic presentation of Type III - fish hook Coraco-glenoid space seen in 20 specimens.

Table 1: Comparison of Shape of Coraco-glenoid space between right and left sides.

Shape of Coraco-glenoid space	Right	Left
round bracket (n=47)	25	23
square bracket (n=33)	16	17
fish hook (n=20)	10	10

Table 2: Comparison of all the parameters between right and left sides in both males and females.

Parameter	Mean ± S. D		p-value
	Right (mm)	Left (mm)	
Length	41.21± 3.57	40.01± 3.75	0.209
Breadth	15.34 ± 1.52	14.90 ± 1.25	0.992
Thickness	8.35 ± 1.35	8.12 ± 0.87	0.506
Height	13.27±1.53	13.65±1.31	0.923
Acromiocracoid distance	28.85± 4.70	28.46± 3.62	0.872
Coracoglenoid distance	26.55 ± 3.24	24.35± 3.20	0.255

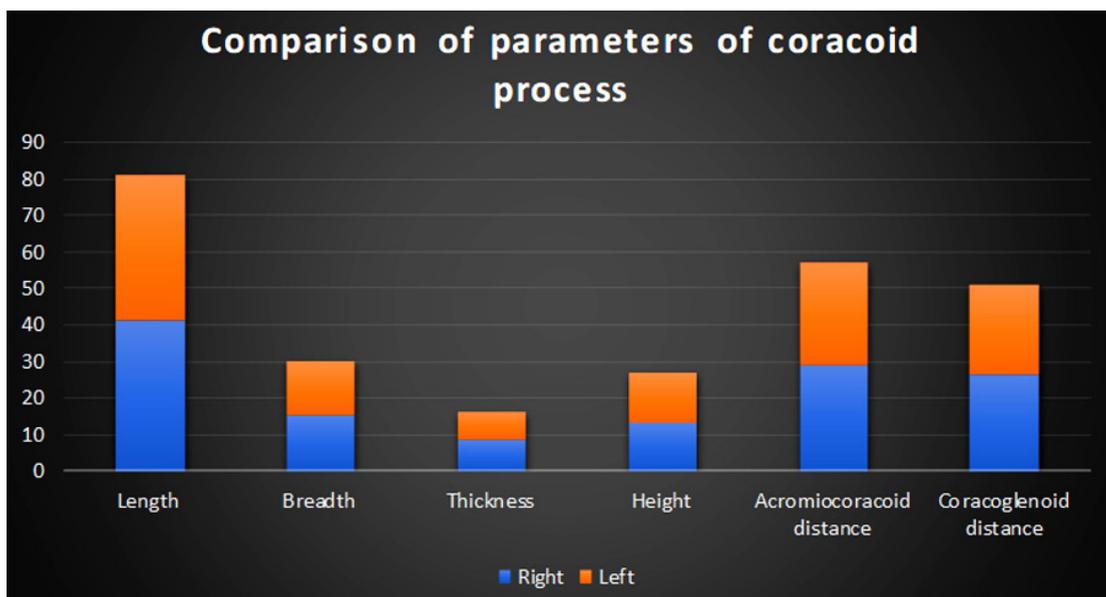




Fig. 4: showing photographic presentation of measurement of length of coracoid process.



Fig. 5: showing photographic presentation of measurement of breadth of coracoid process.

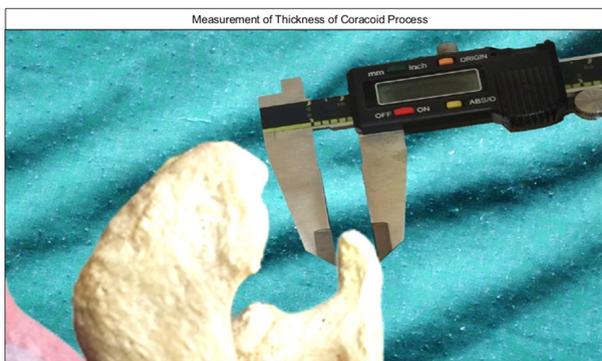


Fig. 6: showing photographic presentation of measurement of thickness of coracoid process.



Fig. 7: showing photographic presentation of measurement of height of coracoid process.

Table 3: Comparison of parameters of coracoid process in various studies⁵⁻¹⁷

Authors	Length (mm)	Breadth (mm)	Thickness (mm)	Height (mm)
Gallino et al 1998 ^[5]	41.10	-	-	-
Gumina et al 1999 ^[6]	38.15	-	-	-
Piyawinijwong et al 2004 ^[7]	37.50	13.50	6.6	-
Kavita et al 2013 ^[8]	40.9	14.1	-	-
Pahuja and Singh 2014 ^[9]	41.00	-	7.40	-
Rajan et al 2014 ^[10]	40.43	13.77	7.03	-
Karla et al 2016 ^[11]	40.4	-	-	-
Fathi et al 2017 ^[12]	43.44	13.68	-	15.94
Verma U et al 2017 ^[13]	35.54	14.5	7.95	20.10
Kumar V et al 2018 ^[14]	40.94	13.59	8.3	-
Das SR et al 2020 ^[15]	39.91	14.8	8.32	22.87
Khan R et al 2020 ^[16]	40.94	13.59	8.3	-
Raviprasanna et al.2022 ^[17]	39.47	13.9	8.24	19.13
Present study	39.35	14.0	7.95	13.27

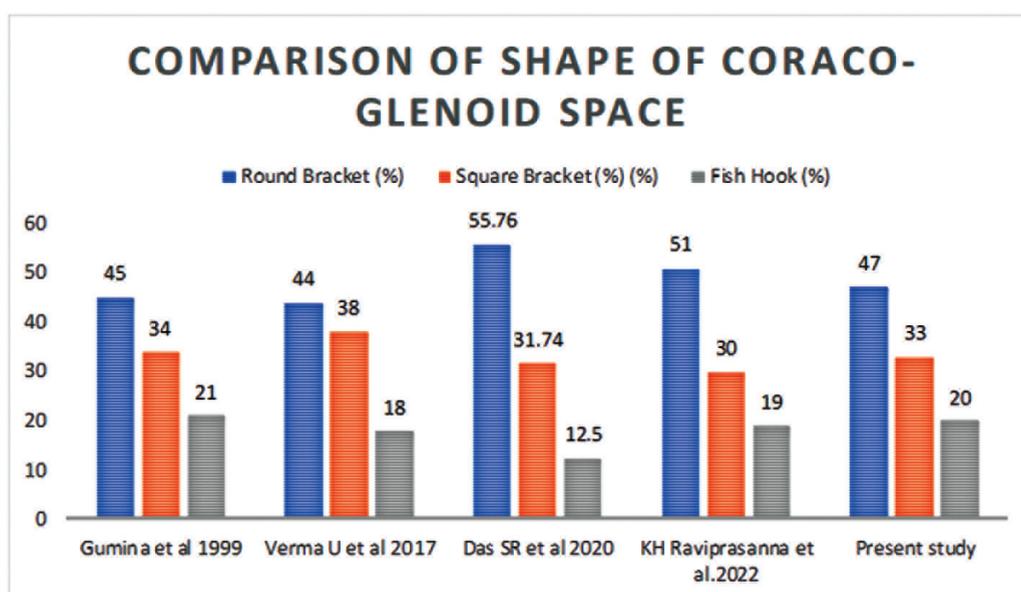
Table 3: Comparison of Coracoglenoid distance and Acromiocracoid distance in various Studies

Authors	Coracoglenoid distance (mm)	Acromiocracoid distance (mm)
Kavita et al 2013 ^[8]	23.3	23.3
Rajan et al 2014 ^[10]	22.9	27.53
El din et al 2015 ^[18]	31.3	-

Gosavi et al 2015 ^[19]	-	26.9
Kumar V et al 2018 ^[14]	26.23	-
Raviprasanna et al.2022 ^[17]	27.19	
Present study	25.34	28.65

Table 4: Comparison of shape of Coraco-glenoid space as seen documented in literature^{6,13,15,17}

Author	Round Bracket (%)	Square Bracket (%)	Fish Hook (%)
Gumina et al 1999 ^[6]	45	34	21
Verma U et al 2017 ^[13]	44	38	18
Das SR et al 2020 ^[15]	55.76	31.74	12.5
Raviprasanna et al.2022 ^[17]	51	30	19
Present study	47	33	20



process. This is done to evade the neurovascular structures passing medially, such as the brachial plexus and axillary vessels. Besides, many important tendinous and ligamentous attachments are anchored here like tendons of the pectoralis minor, coracobrachialis, and short head of the biceps brachii muscles, and the coracoclavicular, coracohumeral, coracoacromial, and transverse scapular ligaments. Loss or damage of any of the above structures could lead to alterations in the structure of coracoid process.²⁰ Therefore, a more comprehensive study of the morphology of coracoid process is needed. Coracoid process is vital for functioning of scapula. It is like a control through which the muscles like biceps, coracobrachialis, and pectoralis minor employ a force over the glenoid. Although glenohumeral joint has the highest incidence of dislocation, injury of the coracoid process is quite infrequent. Hence

such injuries present a challenge for restoration by orthopaedic surgeons.²¹ The incidence of coracoid process fracture is between 3% and 13% among all scapular fractures. The base of the coracoid is most commonly fractured. Arthroscopy of the shoulder or open surgery of the shoulder region involves the coracoid process. So, its morphometry is of pivotal importance in surgeries of the shoulder joint.²² The outcomes of the present study establish the proportions of the coracoid process which can aid in finding the suitable approaches for repair of a coracoid fracture. The present morphometric study was carried out to assess the measurements of the coracoid process as well as Coracoglenoid distance and Acromiocracoid distance (Table 2). The difference in data between the right and left side was also documented so as to supplement as an anatomical reference for radiologists, orthopaedic surgeons, clinicians and researchers. The parameters

were also compared to that of other researchers (Table 3). The present study was consistent with previous data. The few discrepancies observed could be due to regional and racial differences. Although all parameters observed were higher on the right side compared to the left side, the differences were statistically insignificant. The length of the coracoid process ranged between 37 to 44 mm while the breadth ranged from 13.5 mm to 15.5 mm which was consistent with that observed in literature. The coracoglenoid distance in the present study ranged between 23 to 27.5 mm, although the maximum Coracoglenoid distance has been observed to be 31.3 by El din et al. The acromiocracoid distance ranged between 25.5 mm to 31.3 mm which was slightly higher than that seen in literature. Thus, it is apparent that the dimensions of the coracoid process in the present study show similarities with the earlier studies. As observed in literature and collaborated with our studies as well, shape of Coraco-glenoid space was found to be Type I - Round bracket in maximum cases followed by type II - Square bracket and low incidence of Type III - Fish hook (Table 1 & 4). The data will help the orthopaedic surgeons to comprehend aetiopathogenesis of subcoracoid impingement syndrome and its management. It will also be useful in medicolegal, anthropological and archaeological studies.²³

Clinical Significance

The coracoid process is an important element of the scapular glenoid construct. Variations in height and length of the coracoid process are assumed to be accountable for modification in the shape of the space between coracoacromial arch and rotator cuff. Knowledge of dimensions of the coracoid process is vital in cases of trauma, surgical interventions, replacement surgeries well as for diagnosis of various pathological conditions in the shoulder region.^{24,25} The coracoid is involved in many surgical interventions on the glenohumeral joint, hence variant dimensions of the coracoid process are of importance for Radiologists and Orthopaedic surgeons for planning reparative procedures on the shoulder. The coracoacromial, coracoglenoid and acromioglenoid distances when precisely measured with palpable osseous landmarks become useful for portal placement during shoulder arthroscopic procedures.²⁶ While considering a etiology of shoulder pain, it is vital to bear in mind the Coracoacromial distance. A narrow gap is a risk factor for rotator cuff rupture.

Congenital variations and iatrogenic causes increase susceptibility to subcoracoid dislocation.²⁷

CONCLUSION

The outcomes of the present study establish the proportions of the coracoid process which can aid in finding the suitable approaches for repair of a coracoid fracture. Knowledge of dimensions of the coracoid process is vital in cases of trauma, surgical interventions, replacement surgeries well as for diagnosis of various pathological conditions in the shoulder region.

Authors' contributions

VSS drafted the manuscript, SPS performed the literature review & SR assisted with writing the paper.

Disclosure Statement: There is no financial support for this research work from the funding agency.

Conflict of interest: None declared

Ethical approval: Not required

Data and materials availability: The data and materials used and analyzed during the current study are available from the corresponding author on reasonable request.

ACKNOWLEDGEMENT

Authors are thankful to Dean Dr. Varsha Phadke Madam and teaching and non-teaching staff for their support and encouragement. Authors acknowledge the immense help received from the scholars whose articles are cited and included in references of this manuscript. The authors are also grateful to authors/editors/publishers of all those articles, journals and books from where the literature for this article has been reviewed and discussed.

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Anatomical Study by Dissection of the Tricuspid Valve in Senegalese Melanoderma

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How to cite this article:

Mar Ndeye Bigue, Seck Iss Dior et. al./Anatomical Study by Dissection of the Tricuspid Valve in Senegalese Melanoderma./ Indian J Anat. 2022;11(4):129-136.

Abstract

The tricuspid valve is subject to multiple variations with respect to the modal variety, knowledge of these variations is essential to the practice of cardiac surgery. The objective of this work was to identify the anatomical variations of the tricuspid valve and to clarify their implications.

This was an anatomical study by dissection of 21 formalin hearts, taken from Senegalese melanoderms anatomical subjects. The morphometry of the cusps and the annulus was studied and analyzed statistically.

The ring shape was circular in 10 hearts and elliptical in 11 with an average diameter of 3.86 cm and an average circumference of 12.1 cm. Fifteen anatomical pieces contained 3 cusps; 2 had 2 and the rest had 4. Statistical analyzes revealed that as the number of cusps increases, the width of the anterior cusp decreases.

This work made it possible to highlight the anatomical variations of the tricuspid valve concerning the cusps and to establish averages concerning the morphometric values of the latter as well as their impact in its surgical management.

Keywords: Cusps; Human heart; Valvular apparatus.

INTRODUCTION

The tricuspid valve (TV) is a dynamic anatomical structure that is part of the valvular system of

the heart and helps establish unidirectional blood flow in the right heart chambers. TV is subject to multiple lesions that can be acquired or congenital (Ebstein disease). In Senegal, a study carried out on infective endocarditis of right heart showed that tricuspid valve is the most affected with a prevalence of 21.4%.¹ Tricuspid insufficiencies are much more common than tricuspid stenosis (respectively 75 and 25%).² Their surgical corrections involve valve replacement or reconstructive surgery. Surgery for acquired tricuspid lesions is dominated by conservative surgery for functional tricuspid insufficiency.^{3,4} According to data from the literature, there would be multiple variations of VT with respect to the modal variety.⁵⁻¹² It was thus about the existence of a muscular or membranous connection between the papillary muscle and the cusps, accessory cusps, and foramina within the valve leaflets. Knowledge of these variations is essential to the practice of cardiac surgery, which

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Received on: 08.06.2022 **Accepted on:** 09.07.2022

is intended to be precise and efficient. The aim of this work was to identify the anatomical variations of the tricuspid valve and to clarify their surgical implications.

MATERIAL AND METHOD

Material

We took 21 hearts from fresh cadavers of adults of both sexes in the anatomo-pathology departments of Aristide Le Dantec Hospital and Idrissa Pouye General Hospital. Cadavers whose circumstance of death was a natural death were not included in our series, as were those with macroscopically visible cardiac lesions.

The instruments used were: a double decimeter, a compass, an 8-megapixel digital camera, a computer, a magnifying glass ($\times 3$) with a diameter of 10 centimeters, formalin dosed at 10%.

METHOD

The removal of hearts was done in the autopsy's room and the dissection of tricuspid valves, in the laboratory of anatomy and organogenesis of *Dakar Cheikh Anta Diop University* following two stages: an atrial stage then a ventricular one.

The atrial approach was initially performed using *Rouviere's* technique¹³. We carried out on the external face of the right atrium, a "U" incision whose concavity was directed backwards and upwards towards the base of the heart, so as to be able to fold back a flap formed of all the external wall of the right atrium which was then resected. This incision went from the right edge of the superior vena cava to the tip of the right auricle perpendicular to the coronary sulcus, then it continued parallel to the coronary sulcus to the orifice of the mouth of the inferior vena cava. Finally, it was worn horizontally and parallel to the first segment, therefore also perpendicular to the coronary sulcus.

For 17 specimens, the approach was modified to better expose the TV with a "V" incision: this was performed vertically along the superior vena cava then along the atrioventricular sulcus, resulting in a "V" shape. "V" open top and back. The lateral wall of the right atrium was then resected.

The right ventricular approach was performed using *Rouviere's* technique¹³. It began with a vertical section of pulmonary artery's wall the passing between the right anterior and lateral pulmonary sigmoid valves. We extended the incision on the right ventricle along the interventricular septum.

The two lips of the incision were removed and part of the anterior wall of the right ventricle was resected. This resection was sometimes slightly modified to circumvent the anterior papillary muscle. Thus, care was taken to keep the anterior papillary muscle intact. Then we made another ventricular incision parallel to the atrioventricular (coronary) groove; from the pulmonary orifice to the left border of the heart.

In short, we first proceeded to an in situ inspection of the VT then secondarily to its removal from the heart after section of the tendinous chordae of the interventricular septum, of the papillary muscles at their base, and resection of the atrioventricular ring, at the level of its attachment zone on the orifice. During the morphological and morphometric analysis, we determined the number of cusps and the presence of accessory cusps, their dimensions (width, depth and calculated area) and the presence on their atrial side of foramina (true or false).

Thus, we used *Skwarek's* classification of TV¹⁴ to classify TV according to the number of cusps:

- Type 0: TV with 2 cusps;
- Type 1: TV with 3 cusps;
- Type 2: TV with 4 cusps including an accessory cusp;
- Under type 2A: the accessory cusp is located between the septal cusp and the posterior cusp.
- Subtype 2B: the accessory cusp is located between the anterior and septal cusps.
- Under type 2C: the accessory cusp is located between the posterior and anterior ones.
- Type 3: TV has 5 cusps including two accessory cusps.
- Type 4: TV has 6 cusps including three accessory cusps.
- Type 5: TV with 7 cusps including four accessory cusps.
- Next, we measured the width and depth (cm) for each cusp.
- The depth corresponds to the distance between the tricuspid ring and the apex of the cusps.
- The width is the greatest distance between two adjacent commissures.
- The area of the cusp was calculated according to the formula $S \text{ (cm}^2\text{)} = (\text{width (cm)} \times \text{depth (cm)}) \div 2$; in view of the cusps which appeared roughly triangular.

The large diameter of the ring was measured using a compass then this measurement was

reported to the graduated ruler and obtained in centimeters. Due to the shape of the tricuspid ring, roughly comparable to a circle, its circumference was calculated according to the formula: Circumference (cm) = $\pi \times$ large diameter (cm);

Finally, we took a photo of the specimen.

Statistical tests were carried out on the following different parameters:

- Age of the heart;
- Weight of the heart;
- Shape of the TV ring;
- Circumference of the TV ring;
- Number of TV cusps;
- Dimensions (width, depth) of the different particular cusps of the TV.

On these parameters, we performed bivariate statistical analyzes in order to better study the correlation or association between them, in particular:

- Age and shape of the tricuspid ring;
- Weight of the heart and the shape of the tricuspid ring on the one hand; and the circumference of the tricuspid ring, on the other hand;
- Circumference of the tricuspid ring and the depth of the cusps;
- Comparison of means between the dimensions of the cusps and the number of cusps categorized into two variables. A first group included specimens with valves

with 4 cusps (> 3) and a second, contained specimens with valves made with at most 3 cusps (≤ 3).

RESULTS

The ring had a circular shape for 10 hearts (47.6%) and elliptical for 11 hearts (52.4%). The average diameter of the tricuspid ring was 3.86 centimeters (cm) (± 0.59) with extremes of 3.3 and 4.4 cm. The average circumference was 12.1 cm (± 1.87) with extremes of 8.5 and 15.4 cm, it was 15.5 cm in men and 11 cm in women.

We found 3 commissures out of 15 hearts: these are the anteroposterior, posteroseptal and anteroseptal commissures. Two hearts presented 2 commissures and 4 other hearts, 4 commissures.

Fifteen (15) valves (71.4%) contained 3 cusps (Fig. 8); two (9.5%) had 2 cusps and finally 4 (19.1%) had 4 cusps. In these latter cases, the supernumerary or accessory cusp was located between the posterior and septal cusps. Thus, we noted that TV of type 0 were 9.5%, those of type 1 represented 71.4% and those of type 2 were at 19.1%. These corresponded to a 2A subtype.

The measurements of the anterior cusp were predominant over the others with a width of 3.34 cm, a depth of 2.12 cm and an average surface of 3.6 cm² as shown in table I.

The mean width of the anterior cusp was greater (4.7 cm) in the specimens with two cusps in contrast

Table I: Average measurements of TV's different cusps

Average measurements	Anterior cusp	Posterior cusp	Septal cusp	Accessory cusp
Average width (cm)	3.34(0.9)	2.92(1.04)	2.63(0.94)	0.39(0.84)
Average depth (cm)	2.12(0.54)	1.7(0.6)	1.8(0.83)	0.36(0.82)
Average area (cm ²)	3.6(1.47)	2.9(1.46)	2.5(1.47)	0.38(0.87)

to the mean width of the posterior cusps which was greater in the specimens with three cusps (3.2 cm) as illustrated in the table II.

Among the 21 pieces, 18 (85.71%) contained natural foramina. There were 52 natural foramina

including 11 true (Fig. 9) and 41 false (Fig. 10) as summarized in Table III.

Our bivariate static analyzes revealed that:

- The age of the heart has no influence on the

Table II: The relationship between cusp width and the number of cusps per specimen.

Number of cusps per specimen	2 cusps	3 cusps	4 cusps
Average anterior cusp width (cm)	4.7	3.3	2.6
Mean posterior cusp width (cm)	2.1	3.2	2.3
Mean septal cusp width (cm)	2.5	2.54	2.3

Table III : Number of natural foramina observed in our series.

Specimens	Number of natural foramina	
	true	False
18	11	41
3	0	0

shape of the tricuspid annulus ($p = 0.86$).

- There was no relationship between the weight of the heart and the shape of the tricuspid annulus ($p = 0.37$).
- The weight of the heart had no influence on the circumference of the tricuspid annulus ($p = 0.38$).
- There was no correlation between the annulus circumference and the depth of the anterior, posterior and septal major cusps ($p = 0.88$; $p = 0.64$; $p = 0.57$).
- The categorization of the number of cusps in relation to the respective mean widths of the anterior, posterior and septal cusps gave respective p-values of 0.0386, 0.096 and 0.18.

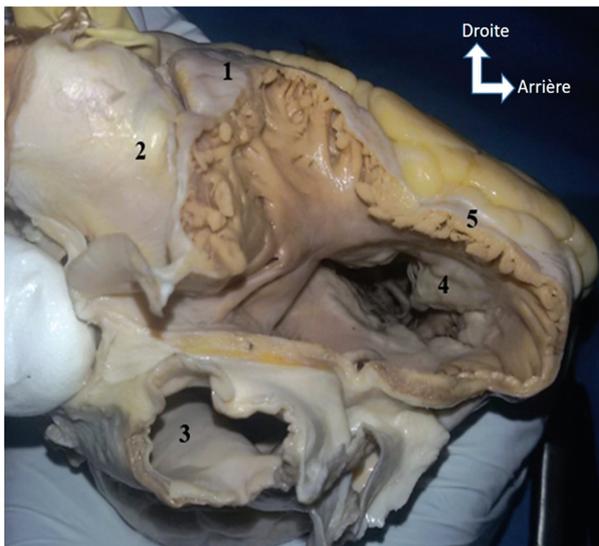


Fig. 1: Abord atrial de la valve tricuspide (atrium droit partiellement réséqué). 1. Auricule droit sectionné. 2. Aorte ascendante. 3. Atrium gauche. 4. Valve tricuspide. 5. Sillon atrio-ventriculaire (coronaire) droit

Therefore, as the number of cusps increased, the width of the anterior cusp decreased. For the other posterior and septal cusps, there was no influence between their respective width and the number of cusps.

- There was no relationship between the number of cusps and the depth of the anterior, posterior and septal cusps ($p = 0.62$; $p = 0.22$; $p = 0.81$).

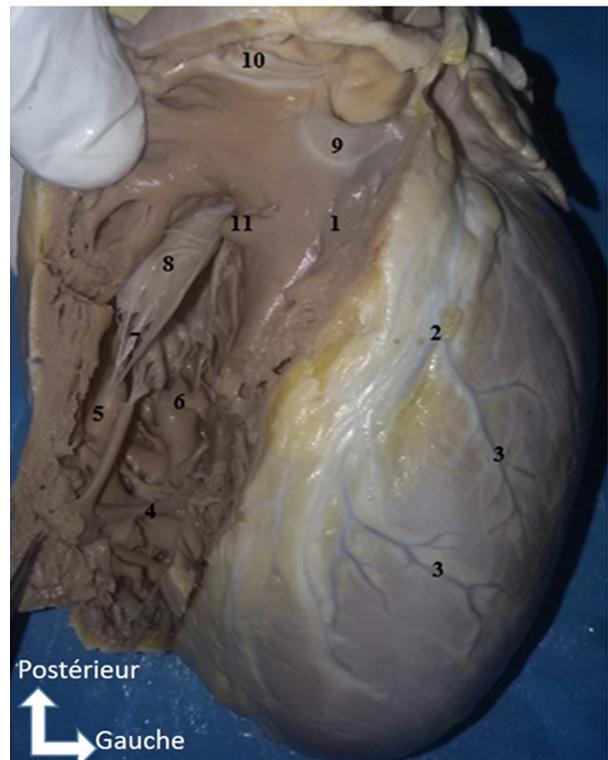


Fig. 2: Incision ventriculaire droite le long du sillon interventriculaire antérieur et résection de la paroi ventriculaire antérieure. 1. Septum interventriculaire. 2. AIVA. 3. Branches artérielles ventriculaires gauches. 3. Colonnes charnues de 2ème ordre. 4. Muscles papillaires antérieurs (piliers antérieurs) accolés. 5. Muscles papillaires antérieurs (piliers antérieurs) accolés. 6. Muscle papillaire postérieur (pilier postérieur). 7. Cordages tendineux. 8. Cuspide antérieure. 9. Sigmoide pulmonaire antérieure. 10 Sigmoide pulmonaire latérale gauche. 11. Muscle papillaire septal

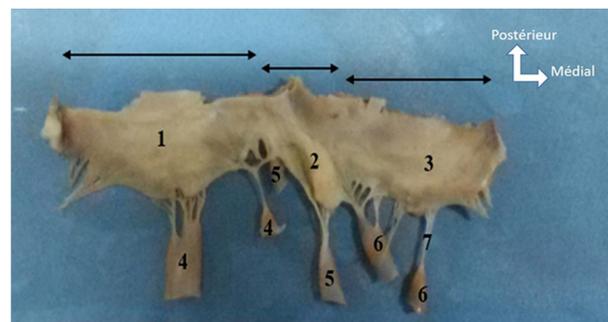


Fig. 3: Face atriale de la valve tricuspide prélevée après dissection et étalée. 1. Muscle papillaire antérieur. 2. Muscles papillaires septaux. 3. Muscle papillaire postérieur. 4. Cordages tendineux de deuxième ordre. 5. Cordages tendineux septaux sectionnés. 6. Commissure postéro-septale. 7. Commissure antéro-postérieure.

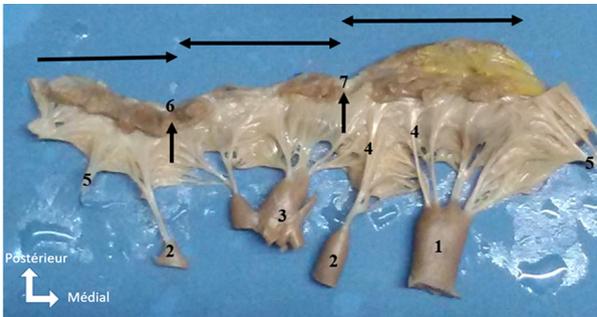


Fig. 4 : Face ventriculaire de la valve tricuspide prélevée après dissection et étalée. 1. Muscle papillaire antérieur. 2. Muscles papillaires septaux. 3. Muscle papillaire postérieur. 4. Cordages tendineux de 2ème ordre. 5. Cordages tendineux septaux sectionnés. 6. Commissure postéro-septale. 7. Commissure antéro-postérieure.



Fig. 5: Vrai foramen situé sur la cuspside postérieure d'une valve tricuspide réséquée. 1. Vrai foramen. 2. Voile tricuspide postérieure. 3. Cordages tendineux.



Fig. 6: face atriale d'un voile tricuspide mettant en évidence un faux foramen situé sur la cuspside postérieure d'une valve tricuspide réséquée. 1- Faux foramen sur la cuspside postérieure. 2- Cuspside antérieure.

DISCUSSION

For Silver⁸ the tricuspid valve annulus is best appreciated on an atrial view which reveals a roughly triangular shape. However, SKWAREK¹² adds that the shape of the right atrioventricular ring evolves during life from a triangular shape to a more elliptical shape. In fact, he made cross-sections of the right atrium parallel to the plane of the atrioventricular orifice which show a circular or elliptical shape of the annulus. While right ventricular sections made from the apex show a triangular ring. He concludes that one of the two cavities exerts a great influence on the shape of the tricuspid valve. Our method which proceeds to the resection of the atrial wall, allowed us to observe an elliptical shape of the annulus in 52.4%. This elliptical shape was predominant over the circular one, contrary to the findings of SKWAREK.¹⁴

In the design of heart valve prostheses, there is a circular shape of the rings of mechanical prostheses or bioprostheses.¹⁵ The average circumference of the ring is evaluated at 9.7 cm (± 1.029) and 9.496 cm (± 1.059) respectively by KUJUR et al⁶ and Rohilla et al¹⁶ who worked on Indian populations. These values are lower than ours. This difference could be due to racial specificities. Also, our methods of determining the measurements are different, Kujur et al⁶ uses a malleable aluminum wire and Rohilla¹⁶ a surgical silk thread and both determined the circumference of the tricuspid valve annulus by direct affixing of the thread along the circumference of this ring. In our study, the use of the circle formula was used to determine the circumference, with a more frequent elliptical ring shape, which could be the cause of these differences in values. Similarly, calculating the perimeter of the ellipse is very complicated. This would explain the process used by some authors.^{6,16} Other authors have reported circumference values according to sex. In men, it is 11.4 cm (± 1.1) for SILVER et al⁸ and 10.7 cm to 12.1 cm for SKWAREK et al¹⁷ on the one hand and on the other hand in women respectively 10.8 cm (± 1.1) and 10.4 to 11.08 cm. In female specimens, our results are superimposable to those of the latter. As for the values for male specimens, they are lower than ours.

TEI CHUWA et al¹⁸ notes cyclical variations in the tricuspid annular circumference which depend on the cardiac cycle (systole/diastole). Thus, using two dimensional echocardiography in 16 normal subjects, he reports a maximum average value and a minimum average value of the annular circumference which are respectively 11.9 cm (± 0.9) and 9.6 cm (± 0.9). These echocardiographic values

obtained on living subjects are comparatively lower than ours obtained after dissection of anatomical specimens.

Concerning the commissures which are introduced by the clinicians as corresponding to the part of the valve contained between the fibrous annulus and the peak of the intercuspidal incision. The names of the commissures are compound words based on the adjoining cusps. We observed two commissures on a heart in two cases of bicuspid valve.

For Victor and Nayak¹⁹, bicuspid is the rule. He states that there is normally a septal cusp and a parietal cusp. The latter corresponded to the posterior and anterior cusps classically described in the literature. The commissures are therefore important landmarks when carrying out certain surgical techniques (such as the KAY technique, the commissural plication, the commissurotomy) hence the need to clearly identify them according to their situation in relation to the different cusps. Consequently, according to Chauvaud³, the following surgical techniques are noted.

The KAY technique: this involves performing bicuspidization by closing the posterior cusp. It is performed using the anteroposterior and postero-septal commissures. It is an annuloplasty technique aimed at reducing the annular circumference in the event of dilation. The stitches are passed through the tricuspid ring at the level of the commissures located on either side of the posterior cusp. It leads to total obliteration of the posterior cusp by tightening the points, thus reducing the annular perimeter;

- The commissural plication: we place plication points ("X" points) on the antero-posterior and postero-septal commissures. The wider the grip of the point, the greater the annular reduction. This is a complementary procedure used in tricuspid annuloplasty in the case of TI secondary to tricuspid endocarditis.²⁰
- In tricuspid stenosis (very often secondary to carcinoid syndrome or acute rheumatic fever), commissurotomy is a restorative technique used in surgical treatment. It is performed with a scalpel on the antero-septal and sometimes postero-septal commissure, sometimes the commissurotomy is limited to the septal commissure alone or is extended over the cords when these are fibrous or retracted.^{3,21}

The number of cusps and their configuration are still controversial. According to literature data, the

number of cusps varies, also accessory cusps can be found between the main cusps.^{5,6,11,17,23}

According to Kujur⁶, these accessory cusps consist of an endocardial fold reinforced by fibrous tissue and in reality, they simply allow a better coaptation of the valve.

Type 1 TV (with 3 cusps) is predominant in our series with a percentage of 71.4%. This is observed in other authors^{5,22} including KUJUR²³ in whom this percentage increases to 100. This would be explained by the fact that KUJUR worked on the Asian type on a sample of 42.

Type 2 TV is also present in 19.04% of our specimens. Its predominance is observed in a large number of authors.^{9,24}

The subtype is not specified by all the authors.²⁴ Skwarek and al report subtype 2A at a lower rate than ours. For GEROLA⁵, the subtype is 2C.

Type 0 VT was present in only 9.52% of the specimens in our series. This bicuspid type variation is rarely observed in the literature.^{5,22} Its value reaches 18% for GEROLA 5 and is lower (5.83%) for.²²

In most anatomy treatises, the tricuspid valve has 3 cusps. On the other hand, for Victor and Nayak¹⁹, the bicuspid is the rule, with a septal cusp and a parietal cusp. The presence of one or more clefts (related to its functional mobility) gives the appearance of 2 posterior and anterior cusps, or cusps called accessory cusps, on the latter. This would partly justify tricuspid valve replacement with a mitral homograft.

The other variations relating to the number of cusps (types 3, 4 and 5) are not observed in our series but are reported in the literature^{14, 22, 24}. Mishra and al²² report multiple variations in the dimensions of the TV cusps. Indeed, in his study, the anterior cusp is the widest followed by the septal cusp and finally the posterior cusp.

As for Kujur and al²³ also, our work reveals that the anterior cusp is the widest among the 3 cusps. As for, Rohilla and al¹⁶, in his study concerning 86 hearts, reports a greater width of the septal cusp with an average attachment zone of 2.874 cm.

Concerning the depth, that of the anterior cusp is the most important for all the authors.^{9,16,25}

It emerged from our study that the higher the number of cusps (3 or 4), the smaller the width of the anterior cusp; therefore, we believe that the accessory cusp would develop at the expense of the anterior cusp. This could be justified by the study

of Skwarek and al¹⁴ which reveals that the number of cusps of the tricuspid valve increases during evolution but the rules of this process are unknown. Based on his results, he advances the thesis that the accessory cusp had separated from the main cusp and that it is impossible to establish explicit links to the main cusps from which the accessory ones have separated. Thus, he asserts that the mechanism of accessory cusp separation is a complex process. Indeed, our statistical tests show that, the more the number of cusps increases, the more the width of the anterior cusp decreases. Rohilla and al¹⁶ agrees with us about his series of 86 Specimens. He also, contrary to us, found a statistically significant correlation between the number of cusps and the width of the posterior cusp, however, he agrees with the conclusions of Salomon and Nayak in relation to the bicuspid.

Total tricuspid valve replacement procedures, which are delicate, require respecting the septal cusp and the anteroseptal commissure in order to avoid trauma to the HIS beam.³ Indeed, the attachment zone of the septal cusp on the valvular annulus limits the triangle of KOCH, with the tendon of TODARO and the coronary sinus. Identifying this triangle helps to avoid lesion of the HIS bundle located at its apex during plastic surgery and replacement of the tricuspid valve.²⁶ Cusp variations are involved in certain malformations such as EBSTEIN disease, which combines a tricuspid anomaly on the one hand and a right ventricular anomaly on the other.²⁷ We thus note, an implantation of the septal cusp made on the interventricular septum (not on the tricuspid ring), a posterior cusp attached to the posterior wall of the RV, a normal implantation of the anterior cusp sometimes moved on the moderator band, an always dilated tricuspid ring, sometimes non-existent short tendon cords and an atrialized RV (intermediate chamber) due to displacement of the insertion of the cusps. It is a rare congenital anomaly (1 to 5 cases per 100,000 births), which most common expression is tricuspid insufficiency.²⁷

The natural foramina observed on the cusps are reported by Skwarek and al²⁸ with a percentage of 11.21%, much lower than ours which is 85.71%. These natural foramina may be responsible for the additional jets observed during echocardiography as well as the subclinical insufficiency of the tricuspid valve²⁹, especially since Gallet³⁰ reports that TI is physiological in 65 to 75% of normal subjects.

CONCLUSION

This work made it possible to highlight the anatomical variations of the TV concerning the cusps whose anatomy's knowledge coupled with morphometric data and the morphological variations, should allow a better approach of tricuspid pathology and surgical management.

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A Students perception of E-learning

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How to cite this article:

Viren Sharadkumar Sawant, Sharadkumar Pralhad Sawant, Shaheen Rizvi./A Students perception of E-learning./Indian J Anat. 2022;11(4):137-139.

Abstract

During Covid 19 Pandemic, the field of medical education was severely affected. Faculty members and students alike felt the need for E-learning. In E-learning students can learn at their own convenience from remote locations and the matter can be repeated a number of times as and when required. In developing countries like India a lot of efforts were required to ensure that the transition to E-learning would be smooth. A good quality internet service is costly, technical problems and students unfamiliar with E-learning systems are some of the problems faced. The present paper expresses a student's perception of E-learning as a result of COVID-19 pandemic and the challenges faced. It is crucial that medical instructors communicate knowledge on effectiveness of E-learning and remove inhibitions among the students. Although E-learning is an effective tool which has come into a full-fledged existence after the COVID-19 pandemic, there are many challenges yet to be overcome in medical education.

Keywords: Covid 19 Pandemic; Medical Education; Faculty Members; Students; E-learning; Internet Service; Developing Countries.

INTRODUCTION

The in the year 2020, the world witnessed a COVID-19 pandemic which globally affected all activities including trade, businesses, education alike. Social distancing became the new normal. The field of medical education comprises of face to face lectures and tutorials, patient exposure, laboratory experiments observing surgeries etc. and thus was severely affected. Faculty members and students

alike felt the need for E-learning.¹

In E-learning students can learn at their own convenience from remote locations and the matter can be repeated a number of times as and when required. This ensures a very satisfactory method of gaining knowledge especially when blended with didactic teaching learning. If the student is an active participant it can have a constructive effect on the mind.²

The present paper expresses a student's perception of E-learning as a result of COVID-19 pandemic and the challenges faced.

Being Indians studying in a Russian Medical University, we realized that University closure is a critical step to control the spread of the pandemic but we expected that the pandemic would end soon and regular classes would start. Soon it dawned on us that E-learning is the best solution to this never ending and unpredictable pandemic situation.

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Received on: 00.00.2022 **Accepted on:** 00.00.2022

DISCUSSION

As the pandemic progressed, medical institutions globally adapted to the pandemic and began using E-learning. This was easy in developed countries but in developing countries like India a lot of efforts were required to ensure that the transition to E-learning would be smooth.³ Today E-learning has been found to be just as effective in improving knowledge as didactic teaching. It is also found to be associated with cost reduction compared to face to face learning.

E-learning has several advantages. Books are costly, or heavy to carry, research references can be accessed by E-learning at a lesser cost and time. Certain websites offer continuous medical education which can be of great help in later years. Learning occurs in a comfortable learning environment at a student's convenience with full control over the pace of learning. Updated material with latest evidence-based content is also available over the internet.⁴

None the less certain factors played a significant role against E-learning implementation. A good quality internet service is costly, and without a good quality connection it is tough to attend or download live lectures or files. There are few students who are unfamiliar with E-learning systems, have insufficient computer skills and have no idea how to tackle technical problems.⁵ A number of our E-learning sessions had to be cancelled due to technical issues. Moreover there being no interaction with the teachers made learning all the more difficult. Thus an understanding of the students' requirements will help to improve E-learning successfully. Only if students are committed to E-learning and accept it without any reservations, it will be highly successful.⁶

Although use of Information and Communication Technology in educational settings has grown immensely in developing countries since the onset of the pandemic, it still lags behind. Not only technical issues like connectivity and cost are hindering factors but also sufficient number of trained staff is an important factor in hampering E-learning. Problems are more accentuated for students in rural areas. Rural areas also face electricity challenges. Studies from developing countries have shown that even though 88.5% students had smartphones; only 32.1% of subjects have laptops, hence it is only smart phones which are used to access the internet. Studies have also shown that internet services are only 40.5% in rural areas of developing countries.⁷ Hence it is mainly smartphone E-learning applications which can be

used most effectually. E-learning software that is user-friendly and easy to function on a smartphone is needed in such settings. The main concern which arises here is that mobile devices are very slow especially in loading pages. They also need a large memory, which was deficient in phones owned by students. This was shown in studies carried out in a developing country like Africa.⁸

For students who are yet unfamiliar and thus against E-learning, it is crucial that medical instructors communicate knowledge on effectiveness of E-learning and remove inhibitions among the students. It should be in collaboration with the information technology staff to eliminate technical difficulties faced by the students. This will ensure increase students' engagement and better learning during online classes.

Studies are required to show how patient oriented studies, community based studies and other problem solving strategies can be accomplished with E-learning. Students are also apprehensive regarding online assessment and their evaluation. These can be effectively handled by faculty via good communication.

CONCLUSIONS

Although E-learning is an effective tool which has come into a full-fledged existence after the COVID-19 pandemic, there are many challenges yet to be overcome in medical education. These challenges should be analysed and evaluated and appropriate plans should be established to overcome them.

Authors' contributions: VSS drafted the manuscript, SPS performed the literature review & SR assisted with writing the paper.

Disclosure Statement: There is no financial support for this research work from the funding agency.

Conflict of interest: None declared

Ethical approval: Not required

Data and materials availability: The data and materials used and analyzed during the current study are available from the corresponding author on reasonable request.

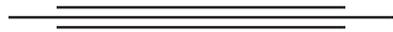
ACKNOWLEDGEMENT

Authors are thankful to the Dean of Volgograd State Medical University for the support and encouragement. Authors also acknowledge the immense help received from the scholars whose

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Sirenomelia: Mermaid Syndrome: A Case Report

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Abstract

Sirenomelia (mermaid syndrome) is a very rare congenital anomaly which results in fusion of two lower limbs along with many other visceral malformations. We report a case of mermaid syndrome in Maharashtra, India. An 18 – 20 weeks old abortus with lower limbs fused together like mermaid appearance. The abortus had fused lower extremities but bony structures for each leg were present on x-ray imaging. The umbilical cord consisted of a single artery and one vein. Multiple theories have been suggested for the pathogenesis of this condition, and despite recent progress in pathology, this condition remains debated.

Keywords: Mermaid syndrome; Sirenomelia; Single Lower Limb; Single umbilical artery.

INTRODUCTION

Sirenomelia or mermaid syndrome is an extremely rare and fatal congenital disorder with an incidence of 0.8 – 1 in 1,00,000 pregnancies. Male to female ratio being 3:1.¹ The sirenomelia reminds of the mermaid of Greek and Roman mythology, which was depicted as having the head and upper body of a human and the tail of a fish.²

The most common feature seen in sirenomelia is the complete or partial fusion of the lower limbs into a single lower limb, giving it a mermaid resemblance. There are usually multiple underlying visceral abnormalities that make it incompatible with life with a very few rare exceptions of infants surviving with this condition.

Here we have reported a case of an abortus with features of sirenomelia.

CASE REPORT

A 26 year old primigravida female came to hospital with severe lower abdominal pain and bleeding per vagina. She was immediately taken to the delivery room where she delivered an 18 – 20 weeks old fetus of weight 480 gms and length 21cm.

On physical examination, the baby had fused legs. The umbilical cord examination revealed single artery and one vein. The external genitalia were absent and an imperforate anus was observed. An X – ray done revealed poorly expanded lungs and two distinct sets of femur and tibia.

Once the mother was stable and shifted to general ward, detailed history was taken, which revealed history of consanguineous marriage and history of tobacco use before pregnancy. But mother said she had not consumed tobacco once she knew she is pregnant. No any antenatal check up or previous ultrasonography was done. The patient was from a very low socio economic status and both husband and wife work as labourer. She had pain in lower abdomen on and off since 3-4 days and leaking PV since 1-2 hrs, so came to hospital.

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Received on: 27.07.2022 **Accepted on:** 28.08.2022



DISCUSSION

Sirenomelia (Mermaid syndrome) anomalies are the most severe form of caudal regression syndrome.³ Caudal regression syndrome which is a rare congenital defect consists of a series of anomalies ranging from ectopic anus to sirenomelia, with a prevalence of 0.1- 0.2:10,000 in normal pregnancies in general population. But Prevalence is more (relative risk of 200 – 250) in diabetes.^{4,5}

Various theories have been suggested for the pathogenesis of this condition but none is proved conclusive. This pattern of anomaly can be probably due to a generalised alteration of mesodermal cell migration that occurs between 28 to 32 days of gestation.⁶ Altered oxidative metabolism may cause increase production of free oxygen radicals which may be teratogenic to the early stages of developing embryos. Mostly seen in uncontrolled diabetes in pregnancy.⁷

Another hypothesis of pathogenesis of mermaid syndrome in nondiabetic case has been proposed to be a vascular steal phenomenon with the single, aberrant, umbilical artery stealing blood supply from the lower torso and limbs. This leads to poorly perfused caudal region that undergoes partial or complete agenesis of caudal structures.^{8,9} A possible vertebral dysgenesis leading to lowerlimb atrophy and inconsistent lower limb fusion can also be present.¹⁰

A case of sirenomelia without any arterial steal was published by Jayessimi et.al. indicating that other factors may also be involved in the pathogenesis.¹¹ The teratogenic agents like retinoic acid, cyclophosphamide, cadmium has been reported in the genesis of sirenomelia in animal studies.^{12,13} Also there can be multifactor polygenetic transmission, dominant sex inked transmission and dominant autosomal transmission with a variable expression.¹⁴

CONCLUSION

Sirenomelia is a very rare and mostly fatal congenital anomaly. When diagnosed antenatally counselling and termination of pregnancy should be encouraged.

Regular antenatal checkup with optimum

maternal blood glucose level, if diagnosed with gestational diabetes, should be maintained.

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