

EVALUATION OF LIVER VOLUME OF CADAVERIC SPECIMEN AMONG BANGLADESHIS BELONGING TO DIFFERENT AGE GROUPS

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ABSTRACT

Background: Liver size is related to body surface area. The liver volume has been proven to correlate with liver function and it is a morphological index that is widely used in patients undergoing liver transplantation. The accurate estimation of liver volume is very important during pre-transplantation assessment. **Aim:** The present study has attempted to assess the normal volume of the liver in Bangladeshi population. It was a cross sectional study carried out in the Department of Anatomy in Mymensingh Medical College, Mymensingh. Study of morphology of liver can help the clinician with diagnosis as well as treatment of liver diseases and also may help the surgeons during the resection of the liver. Standard liver volume is important in risk assessment for major hepatectomy. **Materials and Method:** Apparently normal liver specimens were obtained from 60 cadavers aged 1 day to 75 years. The volume of the liver was measured using the water displacement method in a bucket with an attached draining tube. The volume of the displaced water was measured with a graduated cylinder marked in milliliter (ml). Collected data were calculated and liver lengths were co-related with different age groups. **Results:** The mean volume was maximum in Group C (1700 ml), and was minimum in Group A (65ml). The mean difference of the liver volume was statistically significant between Group A and B, A and C, A and D and statistically not significant between Group B and C, B and D, C and D. **Conclusion:** From the present study it was concluded that all the measurements were increased with the increase of age up to 45 years. Then it slightly decreased in late age.

Keywords: Liver, Volume, Measurement, Water displacement method.

Cite this article: Sultana ZR, Rahman MM, Hossain SR, Perven HA, Rashid S, Akter S. Evaluation of liver volume of cadaveric specimen among Bangladeshis belonging to different age groups. J Med Coll Women Hosp. 2025; 21(1): 38-43. <https://doi.org/10.3329/jmcwh.v21i1.81069>

INTRODUCTION

Liver is the heaviest organ and the largest gland of the body and consist of both exocrine and endocrine parts which is concerned with the various metabolic, storage and synthetic function of the body and helps in growth and development of the human¹⁻⁴. It is located in the right upper part of abdomen. Upper border is usually at the fifth intercostal space and

lower border at or close to the left costal margin. Enlargement of liver with protrusion below the costal margin is often a signal of hepatic disease. Occasionally in normal individuals and particularly in those with some intrathoracic disorder such as pleural effusion or emphysema, the lower border of the normal liver may protrude one to several centimeters below the costal margin⁵.

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The liver is important in the removal and breakdown of toxic or potentially toxic materials from the blood. In fetal life, it is an important site of hemopoiesis⁶. It is one of the very few organs that can regenerate. Surgical resection of the liver for primary and secondary neoplasia is now routine and there is very low morbidity and mortality. As much as 80% of the liver mass can be removed safely and will regrow to its original size some 6-12 months after resection.

Liver transplantation nowadays is a well-accepted treatment option for end stage liver disease and acute liver failure. Liver transplantation or hepatic transplantation is the replacement of a diseased liver with a healthy liver allograft⁷. Cirrhosis of the liver is one of the common diseases in the hepatobiliary system. Diagnosis is made from clinical features and investigations. Its diagnosis has improved significantly with the availability of ultrasound in combination with clinical and serological criteria. Right upper quadrant pain, fever and tender hepatomegaly are the predominant clinical features⁸.

Many diseases affecting the liver are associated with its enlargement and require medical and surgical intervention. For this reason, it is essential to have knowledge of the normal size and appreciation of variational anatomy of liver which is clinically important in the evaluation and management of hepatic disorders. Treatment of liver disease is a complex issue and depends on the type of disease, underlying cause and the duration of the disease. The study of the anatomy of human liver is an undebatable requirement for successful diagnosis and treatment of liver disease. Detailed studies of the macroscopic anatomy of the cadaveric livers can still contribute to the identification of important anatomical variations. With this background in mind the present study was carried out on

cadaveric liver to study the morphology and its variation.

MATERIALS AND METHOD

The present study was performed on 60 post mortem human livers collected from Bangladeshi cadavers age ranging from 1 day to 75 years. Specimens were collected from dead bodies autopsied on different dates under examination in the morgue of the Department of Forensic Medicine in Mymensingh Medical College, Mymensingh. The samples were collected from dead bodies as early as possible and all the collected specimens were from medico-legal cases.

To collect the livers, the selected dead body was placed on the examination table in supine position and then abdominal cavity was routinely exposed by giving classical midline incision from chin to symphysis pubis.

Then anterior abdominal wall was retracted laterally and the position of the liver and related structures were identified. After that, the liver was collected as block dissection along with associated structures. Liver of decomposed body, grossly injured livers and livers of cadavers who had undergone abdominal surgery were excluded. Each specimen was duly tagged by a piece of waxed cloth which bore an identifying number.

Then the specimen was fixed and preserved in 10% formol saline solution. All the specimens were studied by careful gross and fine dissection to observe the transverse length of liver. The collected specimens were divided into four groups; A, B, C and D according to the age for convenience of differentiating the changes of various features in relation to age. Table 1 conduct the grouping of the samples in relation to age for morphological study.

Table 1: Grouping of the samples in relation to age for morphological study

Group	Age (years)	Number of Specimen(n=60)
A	upto 15	14
B	16 to 30	15
C	31 to 45	15
D	46 to 75	16

The volume of the liver was measured using the water displacement method in a bucket with an attached draining tube. The volume of the displaced water was measured with a graduated cylinder marked in milliliter.

RESULTS

In the present study, 60 human livers were selected for measurement of volume of the liver. The maximum volume of the liver was 1050 ml, 1250 ml, 1700 ml, 1220 ml in Group A, B, C, and D respectively. The minimum volume of the liver was 65 ml, 700 ml, 710 ml, 645 ml in Group A, B, C and D respectively.

The mean volume was 544.5 ± 96.17 ml, 1007.33 ± 32.57 ml, 1063 ± 70.92 ml, 950 ± 47.02 ml in Group A, B, C and D respectively.

The mean volume was maximum in Group C (1700 ml), and was minimum in Group A (65ml).

It was shown in Table 2 and Figure 1 that the mean volume of the liver increased with age upto Group C then slightly decreased in late age (Group D).

The mean difference of the liver volume was statistically significant between Group A and B, A and C, A and D and statistically not significant between Group B and C, B and D, C and D (Table 3).

Table 2: Volume of the liver in different age groups

Age group	Number of specimens	Volume(ml)	Mean \pm SE (Minimum - Maximum)
A (Upto 15 Years)	14	(65 - 1040)	544.50 ± 96.17
B (16 to 30 Years)	15	(800 – 1350)	1006.00 ± 31.85
C (31 to 45 Years)	15	(710 – 1700)	1063 ± 70.92
D (46 to 75 Years)	16	(645 – 1220)	950.13 ± 47.02

Table 3: Comparison of the volume of the liver among groups

Relation between Variables	Mean Difference	Std. Error	p	Significance
A vs B	461.50000	92.68074	.000	Highly Significant
A vs C	518.50000	92.68074	.000	Highly Significant
A vs D	405.62500	91.27183	.000	Highly Significant
B vs C	57.00000	91.06878	.534	Not Significant
B vs D	55.87500	89.63453	.536	Not Significant
C vs D	112.87500	89.63453	.213	Not Significant

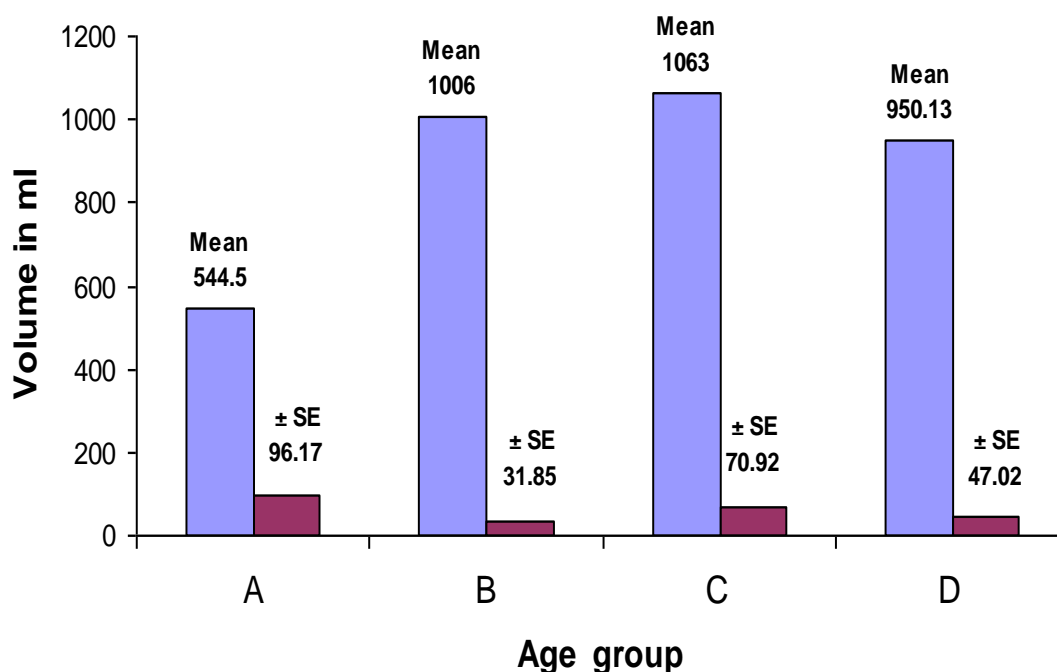


Figure 1 : Bar diagram showing the mean volume of the liver in different age groups

DISCUSSION

In the present study, it is found that the mean (\pm SE) volume of the liver in different age groups were 544.50 ± 96.17 , 1006 ± 31.85 , 1063 ± 70.92 and 950.13 ± 47.02 ml in group A (upto 15 years), group B (16 to 30 years), group C (31 to 45 years) and group D (46 to 75 years) respectively. The maximum value was found in group C (1063 ± 70.92). Izranov et al. studied liver volume on 34 cadavers age ranging from 28 to 96 years which correspond to age of group B, C and D of present study⁹. The average volume of the liver estimated using water displacement method was 1434 ± 503 ml. The volume of the liver described by Andersen et al. as 1602 ml (1350 ml-1854 ml) in men and 1341 ml (1233 ml - 1449 ml) in women⁶. The volume was measured by CT (Computed Tomography). Henderson mentioned the mean (\pm SE) volume of the liver as 1493 ± 230 ml⁹.

It was also measured by CT scan. However, they did not mention the age of study population. If it is taken as adult

value, the findings of present study of age group B and group C is conformed to their observation. Groshar et al. found the liver volume to be 1487 ± 397 (1350 ml -1585 ml) ml and mean age was 58.7 years⁷. In this study quantitative SPECT (Single Photon Emission Computerized Tomography) methodology was used to determine liver volume. Kardel et al. described the mean liver volume as 1611 ml, age range was 40 to 60 years⁵. This study was done by Ultrasonogram. Although the volume of the liver mentioned above was found in living body by various instrumental methods, the values lie within the range of the findings of present study on preserved or fixed post mortem specimen.

Here in present study the mean volume was less than the values mentioned above by the authors. These lowered values may be due to racial factor and also may be due to formalin fixed preserved specimen.

CONCLUSION

In this study, the maximum mean volume of liver was found in age group C. The mean differences of volume of liver between group C and group A were statistically significant and the mean differences between group C and the other groups were statistically not significant. From the present study it was concluded that all the measurements were increased with the increase of age up to 45 years. Then it was slightly decreased in late age. Estimation of liver volume is important for liver doner, liver transplant as well as extended liver resections.

It is expected that the findings of the present study will enrich the information pool on the gross morphology of liver in Bangladeshi people. To establish a standard, we need further studies adopting better techniques on larger samples from different parts of Bangladesh.

LIMITATIONS

The study was carried on a small number of cadavers due to time and financial constraint. The study was not carried out in multiple centers again due to limitation related to time and finance.

CONFLICT OF INTEREST

There is no conflict of interest.

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