Abstract

Background Liver size is related to body surface area. The present study was conducted to assess liver size and to find its relationship with body parameters. Also, the external surface of liver was studied for presence of fissures, which may demarcate the vascular segments and the blood vessels beneath them and may help the surgeon for resection of liver segment.

Material and Methods Apparently normal liver specimens were obtained from 50 cadavers aged 19–65 years. Measurements of liver diameters were taken with the help of Vernier Calipers. Volume of liver was taken by water displacement method. Means and standard deviation of data were calculated and liver dimensions were co-related with body parameters.

Results The mean maximum transverse diameter was 199.4 + 24.5 mm and maximum vertical diameter was 149.5 + 18.7 mm. Significant correlations were observed between Maximum anteroposterior diameter and body mass index (p < 0.05); Vertical diameter at falciform ligament and body weight (p < 0.01); Highly significant correlation was seen between liver volume and body surface area (P < 0.001). The fissures showed underlying veins draining into the inferior vena cava in 40% cases.

Conclusions A significant increase in the body parameters with a corresponding increase in the liver dimensions was found. Study of morphology of liver can help the surgeons to dissect in proper planes to make the resection safe. The surface of liver showed 1–3 fissures distributed on all lobes in 70% specimens demarcating the vascular segments, which may help the surgeon during resection of liver.

Keywords Liver dimension · Fissure resection · Vascular segments

Introduction

The determination of liver size is important, which may be altered by various hepatic disorders. Clinical estimation of liver size has been attempted by radioactive rose Bengal scintiscans [1]. Methods like palpation, percussion, and inspection of conventional roentgenograms of abdomen, scintillography etc. give only an idea of the dimensions of liver and need for more exact methods were recognized. The hepatic size may be determined by palpating below coastal margin but it is an unsatisfactory method [2]. Liver span is also a prognostic marker of fulminant hepatic failure [3]. However, liver span measured by percussion underestimates liver size as compared to radiological methods [4, 5]. Liver volume also has been suggested to reflect liver atrophy [2].

The above studies are methodology oriented and gives data on liver size, volume and surface area in foreign
populations [1, 2, 6, 9, 10]. Data on liver span and its correlations have also been presented on Indian population [4, 5, 7, 11, 14] but none of these studies give the dimensions at various planes of the liver. The present study gives the liver size by physical measurements of liver diameters and its volume and correlates them with body parameters. The external surface of the liver was also studied for morphological features such as presence of fissures and vessels below them, boxing, humps and relations of gall bladder with liver.

**Material and methods**

The study was conducted on 50 normal liver specimens obtained from cadavers aged 19–65 years. Livers showing signs of any organic disease or of hard consistency were excluded. Body parameters viz. age, body height, and body weight of cadavers were noted. Body mass index was calculated: (weight (kg)/ height (m \(^2\))) and body surface area (BSA) was calculated from a nomogram [8]. Diameters (in mm) were taken on liver specimens with the help of Vernier Calipers (Mitotoyo, Japan) (Fig. 1):

- Maximum anteroposterior diameter
- Maximum transverse diameter
- Maximum vertical diameter
- Vertical diameter at fundus of gall bladder
- Vertical diameter at attachment of falciform ligament

Volume (ml) of liver was taken by water displacement method. The data was subjected to the statistical analysis, mean and standard deviations of liver diameters and volume were calculated and correlations between liver dimensions and body parameters were obtained. External surface of liver was observed for fissures, humps and boxes and relations of gall bladder. These fissures were slit open to observe the blood vessels beneath them. The incidence of presence of fissures on the lobes was noted.

**Results**

The mean body parameters of the present study cadavers showed mean age of 33.05 ± 11.51 years, mean of body mass index of 19.59 ± 3.32, (Table 1). The mean liver dimensions show the maximum transverse diameter to be greatest, 199.4 ± 24.5 mm and vertical diameter at falciform ligament to be smallest, 96.8 ± 13.9. Volume of liver was 1140.15 ± 244.68 ml, (Table 2).

Statistically significant correlations were observed between maximum anteroposterior diameter and BMI (P < 0.05); vertical diameter at falciform ligament and body weight (P < 0.01). Liver Volume correlated significantly with body height (P < 0.05), body weight (P < 0.001) and BSA (P < 0.001).

Morphological external features of the livers showed a partially embedded gall bladder with margins adherent