ABSTRACT

Aim of the Study: Spleen is a clinically important organ because of its immunological and hematological role in the body. It can show a wide range of variation, the knowledge of which is important for physicians, surgeons and radiologists. The present study was done to perform a morphometric analysis of cadaveric spleens and compare the results with previous studies.

Materials and Methods: The present study was done on 53 cadaveric spleens. It can show a wide range of variation, the knowledge of which is important for physicians, surgeons and radiologists. The present study was done to perform a morphometric analysis of cadaveric spleens and compare the results with previous studies.

Results: Out of 53 spleens studied, a wedge shaped or triangular spleen was the most common shapes encountered (18 each) followed by 8 tetrahedral spleens and 5 oval spleens. The least common shapes were heart shaped, semi lunar shaped spleens (2 each). Weight of the spleen ranged from 53 to 444 g average weight being 145 g. Length of the spleen ranged from 50.5 to 144.3 mm average being 96.88. Breadth of the spleen ranged from 43.7 to 107.5 mm average being 68.4. Thickness of spleen ranged from 22.3 to 52.14 mm average being 36.12. Notches were only seen on the superior border of 44 spleens and most of these spleens had one or two notches. Three spleens showed the presence of multiple notches and in 5 spleens no notches were seen.

Conclusion: These findings will be helpful for operating surgeons and intervention radiologists and for objective determination of splenomegaly.

KEY WORDS: Accessory spleen, hematological, immunological, notches.

Introduction

Spleen consists of a large encapsulated mass of vascular and lymphoid tissue situated in the upper left quadrant between fundus of stomach and diaphragm. It is shape varies from a slightly curved wedge to a domed tetrahedron. The size and weight of the spleen varies with age and sex. It can also vary in the same individual under different conditions. On an average it is 12 cm long 7 cm broad and 4 cm thick in the adult. Weight of the spleen ranges from 80 to 300 g average being 150 g. Spleen assumes clinical importance due to hematological and immunological role. Surgeons also like to conserve splenic tissue during splenectomy due to the same reasons. The present study was undertaken to describe the morphometric variations in spleen and compare it with the available literature which would prove useful to both clinicians and academicians.

Materials and Methods

The present study was undertaken in the department of anatomy of MVJ Medical College and Research Hospital. A total of 53 human adult cadaveric spleen of both sexes were included. Spleen was removed from the abdominal cavity after ligating the splenic vessels. Fatty tissue was removed by dissection after the spleen was washed in tap water. All the spleens were studied for the following parameters. Spleens were studied for their shapes and percentage of different shapes were calculated. Weight of the spleen was measured by electronic weighing scale. Length of the spleen was recorded as the greatest distance between the two poles of the spleen. Greatest distance between two points at the same level on the superior and inferior borders was taken as its breadth and the maximum thickness of
all the spleens were noted. Notches on the superior and inferior borders were studied and the presence of multiple notches was also noted. Accessory splenic tissue was also looked for in the hilum of the spleen. The mean, standard deviation and range of parameters studied were tabulated and analyzed statistically.

**Results**

Out of 53 spleen studied 18 (34%) were wedge shaped (Figure 1), 18 (34%) were triangular (Figure 2), 5 (9.4%) were oval (Figure 3), 8 (15%) were tetrahedral (Figure 4) 2 (3.7%) were heart shaped (Figures 5 and 6), and 2 (3.7%) were semi lunar (Figures 7 and Table 1).

Weight of the spleen ranged from 53 to 444 g (Table 2). Out of the 53 spleen studied 31 spleens were in the weight range of 50-150 g. 13 spleens between 151 and 250 g, 3 spleens between 251 and 350 g, 5 spleens between 351 and 450 g and 1 spleen in the weight range of 451-550 g. Length of the spleen ranged from 50.5 to 144.3 mm average being 96.88. Breadth of the spleen ranged from 43.7 to 107.5 mm average being 68.4.

Thickness of spleen ranged from 22.3 to 52.14 mm average being 36.12.

Notches were only seen on the superior border of the spleen and 44 spleens had single notches. 3 spleens showed the presence of multiple notches of 2 or more and in 5 spleens no notches were seen.

**Discussion**

In the present study, the morphometry of spleen was compared with previous studies. The values for...
length, breadth and thickness were comparable with studies by Chaware et al.[2] and Chaudari et al.[3] but were less compared with studies by Michel[4] and Rao et al.[5] This could be attributed to the differing genetic factors, body built regional and socio economic backgrounds (Tables 2 and 3).

Comparison of the shape of spleen with previous studies (Table 4) showed that our findings correlated with the studies by Chaudari et al.[3] and Rao et al.[5] We also observed additional semilunar and heart shapes of spleen in two of the spleens studied in each.

Notches were observed only on the superior aspect of spleen. Presence of notches on the superior margin is useful for the physician to palpate the spleen during enlargement of spleen.[6] Previous studies regarding the site of notches on the spleen have revealed the presence of notches on the superior order in 98% Das et al.,[7] 78.6% by Skandalakis et al.,[8] 50% Sateesha et al.[9] Previous studies have shown the presence of notches on both superior and inferior aspects of spleen which was not found in our study.[3] Notched superior border results from improper fusion of the splenic nodules along the superior margin. Computed tomographic based study on the morphometry of spleen showed that all dimensions of spleen have significant positive correlation with height but length of the spleen has negative correlation with age.[10] This correlation could not be studied in this case, as we had measured the dimensions on spleens which had been previously dissected out.

Study of foetal spleen revealed that the ratio between foetal and splenic weight has no correlation with the gestational age.[11]

**Conclusion**

To conclude, knowledge of the anatomy and function of the spleen is essential for the assessment of its role in disease. The contribution of spleen to the immune function is critical in the maintenance of the immune system.

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**Table 1: Different shapes of spleen**

| Shape of spleen | N (%) |
|-----------------|-------|
| Wedge           | 18 (33.9) |
| Triangular      | 18 (33.9) |
| Tetrahedral     | 8 (15) |
| Oval            | 5 (9.4) |
| Semilunar       | 2 (3.7) |
| Heart shape     | 2 (3.7) |

**Table 2: Range of weight of spleen**

| Weight range (g) | N   |
|------------------|-----|
| 50-150           | 31  |
| 151-250          | 13  |
| 251-350          | 3   |
| 351-450          | 5   |
| 451-500          | 1   |

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**Figure 5**: Heart shaped spleen with multiple notches

**Figure 6**: Heart shape spleen

**Figure 7**: Semilunar shape spleen
response and defence against infections mandates the preservation of spleen by a conservative approach in the management of ruptured spleen. Studies on the morphometry of spleen will be of interest not only from academic point of view but also for operating surgeons and interventional radiologists. The detailed knowledge on spleen is important to avoid and prevent any complications and to obtain a good operative, as well as diagnostic intervention.

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Table 3: Comparison of the dimensions of spleen with previous studies

| Measurement | Michael | Rao et al. | Chaware et al. | Chaudhari et al. | Present study |
|-------------|---------|------------|----------------|-----------------|--------------|
| Length      | 11      | 10.5       | 9.66           | 9.59            | 9.68         |
| Breadth     | 7       | 8.3        | 6.22           | 6.59            | 6.84         |
| Thickness   | 3       | -          | 3.06           | 4.54            | 3.61         |

Table 4: Comparison of the shape of spleen with previous studies

| Shape       | Rao et al. (%) | Hollinshead (%) | Chaware et al. (%) | Chaudhari et al. (%) | Present study (%) |
|-------------|----------------|-----------------|--------------------|----------------------|--------------------|
| Wedge       | 40             | 44              | 61.26              | 33.87                | 33.9               |
| Triangular  | 32             | 42              | 12.61              | 19.35                | 33.9               |
| Tetrahedral | 20             | 14              | 21.62              | 32.25                | 15                 |
| Oval        | 8              | -               | 3.60               | 8.06                 | 9.4                |
| Heart       | -              | -               | 0.90               | 6.45                 | 3.7                |
| Semilunar   | -              | -               | -                  | -                    | 3.7                |