

Sonographic evaluation of spleen size and prevalence of accessory spleen in a healthy male Turkish population

Sağlıklı Türk erkeklerinde dalak boyutu ve aksesuar dalak prevalansının ultrasonografi ile değerlendirilmesi

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Abstract

Objective: It is known that the measurement of splenic length in routine clinical practice is a very good indicator of actual splenic size. Knowledge of the normal range of spleen size in the population being examined is a prerequisite. Racial differences in splenic length could result in incorrect interpretation of splenic measurements. The purpose of this study was to establish the range of spleen length in a young male Turkish population.

Material and Methods: A total of 2179 volunteers, healthy men aged 17-42 years, from the annual Army Reserve Officer Training Corps training camp at Manisa were included in the study. Sonographic measurements of spleen length were performed on 2179 military personnel. Presence of accessory spleen was also determined. In addition, the height, weight, and age of each volunteer were recorded. Using linear regression analysis, the relation of spleen length and body height, weight and body mass index (BMI) was evaluated. Additionally, the prevalence of accessory spleen detected on ultrasound was calculated.

Results: The mean±SD height was 173,1±6,5 cm, mean weight 69,1±9,7 kg, and mean BMI 22,62±2,87. Mean spleen length was 10,76±1,8 cm. The length of the spleen was below 12,80 cm in 95% of the subjects. No statistically significant correlation ($p<0.01$) between spleen length and body height, weight and BMI was found. The prevalence of accessory spleen was determined as 2.5% on ultrasound screening.

Conclusion: It was found that in healthy Turkish men, mean spleen length was 10,76±1,8 cm. This data should be taken into consideration when the diagnosis of splenomegaly is established in Turkish males.

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Key words: Splenomegaly, ultrasonography, prevalence of accessory spleen

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Özet

Amaç: Dalak boyutu hematolojik hastalıklarda önemli bir parametredir. Rutin klinik pratikte dalak uzunluğu gerçek dalak boyutunun en iyi göstergesidir. Dalak boyutlarındaki bölgesel farklılıklar doğru olmayan dalak ölçümü değerlendirmelerine ve en sık karşılaşılan dalak patolojisi olan splenomegalinin yanlış yorumlanmasına neden olabilir. Dalak boyutunun normal aralığının bilinmesi bu durumda önemlidir. Prospektif çalışmamızın amacı sağlıklı genç erişkin Türk erkeklerinde ortalama dalak uzunluğunun belirlenmesidir.

Yöntem ve Gereçler: Yaşları 17-42 arasında 2179 sağlıklı genç erişkin asker (Manisa er eğitim merkezi) tarama ultrasonografisi ile incelendi. Olguların yaş, boy, kiloları, dalak uzunluğu ve aksesuar dalak varlığı kaydedildi. Lineer regresyon analizi ile olguların dalak boyutu ile kilo, boy ve BMI (vücut kitle indeksi)'leri ilişkisi değerlendirildi.

Bulgular: Olgularda ortalama boy 173,1 cm±(SD) 6,5 cm, ortalama ağırlıklı 69,0 kg±(SD) 9,7 kg, ortalama BMI 22,62±(SD) 2,8. ortalama dalak boyu 10,76 cm±(SD) 1,84 cm bulundu. Dalak uzunluğu ile boy, ağırlıklı ve BMI arasında istatistiki anlamlı bir ilişki saptanmadı. (p < 0.01). Çalışma grubumuzdaki olguların % 2.5'inde ultrasonografi ile aksesuar dalak saptandı.

Sonuç: US tarama ile sağlıklı genç erişkin Türk popülasyonu için dalak boyutu ortalama 10,76 cm bulundu. Türk toplumunda splenomegali değerlendirilirken bu değer göz önünde bulundurulmalıdır. (Turk J Hematol 2009; 27: 25-8)

Anahtar kelimeler: Splenomegali, ultrasonografi, aksesuar dalak sıklığı

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Introduction

The presence of splenomegaly is very significant in the diagnosis of several groups of diseases: immunological and inflammatory diseases, reticuloendothelial proliferations, storage disease, and portal hypertension. While the diagnosis of gross splenomegaly is both clinically and ultrasonographically obvious, the diagnosis and monitoring of clinically impalpable mild splenomegaly by ultrasound (US) is not well established. Several complicated measurements have been described, but a single, simple sonographic measurement gives a clinically useful indication of true splenic size (1-3). Since previous US data have suggested that there may be racial differences in splenic size (1,4,5), these differences in splenic length could result in incorrect interpretation of splenic measurements. Therefore, standards of normal spleen sizes have been developed for different areas, and knowledge of the normal range of spleen size in the population is a prerequisite. On the other hand, the failure of fusion of splenic tissue results in the formation of accessory spleens, and detection of an accessory spleen is important for hematological conditions. The purpose of this study was to establish the range of splenic length and to determine the prevalence of accessory spleens in a population of healthy Turkish men.

Materials and Methods

Between August 2002 and May 2003, 2179 volunteers from the Reserve Officer Training Corps annual training camp in Manisa, Turkey were included in the study. The study group consisted of men serving an obligatory military service, who were randomly selected from different regions of Turkey. The subjects did not have any conditions likely to be associated with splenic enlargement. None of the subjects had a hematologic, immunologic or any other pathology like malaria or schistosomiasis. A medical history and laboratory tests were obtained from all volunteers who also underwent physical examination. Informed consent was obtained from all participants. The study was approved by the institutional review board and met all guidelines of the institution. US examination

was performed using Siemens Sonoline US machine with a convex 3,5-5 MHz transducer. The subjects were placed in a supine or right posterior oblique position and scanned during suspended respiration. The spleen size was measured in the sagittal plane in the standard oblique coronal orientation to record the maximum length (in millimeters) of the spleen. During the examinations, the presence of accessory spleens was noted. All examinations were performed and interpreted by three experienced radiologists. Measurements were done with electronic calipers on the image monitor during the examination. In addition, height, weight and body mass index (BMI) of the subjects were recorded. Relationships between spleen length and body height, weight and BMI were evaluated using linear regression analysis. Additionally, the prevalence of accessory spleen detected by US was calculated.

Results

A total of 2179 white male subjects were evaluated by US. The mean age±standard deviation (SD) of subjects was 22,4±3,6 years (range: 17-42). There was no racial variation in our study cohort. The study cohort consisted of subjects from all regions of Turkey; however, our subjects are homogeneous racially because there are no different racial groups in the country. The mean body height was 173,1±6,5 cm, mean body weight 69,1±9,7 kg, and mean BMI 22,62±2,87. Mean spleen length was 10,76±1,84 cm. No statistically significant correlations (p< 0.01) between spleen length and body height, weight and BMI were found. Pearson correlation coefficients between spleen length and body height, body weight and BMI were 0,76, 0,73 and 0,34, respectively. The length of the spleen was below 12,80 cm in 95% of the subjects. The distributions of spleen length are shown in the Figure 1. Forty-nine accessory spleens were identified in 2179 US scans, giving a prevalence of 2,2% for accessory spleen in this asymptomatic population.

Discussion

Spleen size may give information about the diagnosis and course of gastrointestinal and hematologic diseases (1-3).

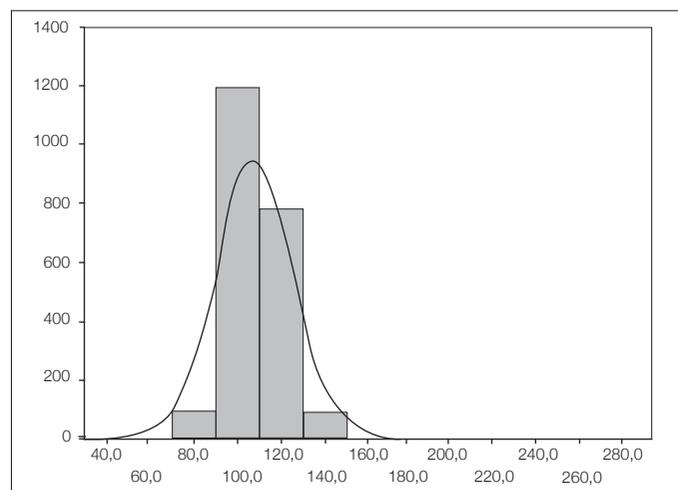


Figure 1. The distribution of spleen length (mm) in all participants
The x axis shows measurement of spleen length and the y axis shows number of subjects

Because of its diagnostic efficiency, US is suggested as the method of choice in the diagnosis and monitoring of splenomegaly. Thus determination of normal organ size can be significant. It is known that the measurement of splenic length in routine clinical practice is a very good indicator of actual splenic size. We have used only the splenic length measurement, since it has been shown in an autopsy series that sonographic measurements of splenic length correlate with actual spleen dimensions (3,6). A study by Loftus et al. (3) on 30 cadavers found a clear linear relationship between a sonographic measurement of splenic length and the actual length, volume, and weight as measured at autopsy. The Pearson's product moment correlation coefficient for maximum sonographic length and the actual length was 0.831 ($p < 0.001$). They suggested that a simple single sonographic measurement of length could be used for routine work, reserving the more complex volumetric measurement (splenic area or index) for problematic cases. This position is further bolstered by another study that showed good correlation between computerized tomography (CT) volume and splenic length measured on sonography ($r = 0.86$, $p < 0.001$) (7). The mean splenic length was 10,76 cm in our study group. The length of the spleen was below 12.80 cm in 95% of the subjects. This length differs from the western data. The measurements are higher than the literature measurement. Bezzeri et al. (7) found maximum spleen length of 9,7 cm as the upper limit of normality in United States volunteers. Accordingly, Niederau et al. (8) from Germany reported that in 95% of the normal subjects, the length of the spleen was less than 8.7 cm and mean spleen length was $5,5 \pm 1,4$ cm. Another article from Germany showed that in 95% of the normal subjects, the spleen length was less than 11 cm (9). Conversely, an article from Egypt demonstrated that Egyptian norms for US organometry of the spleen are different from those of other countries (4). The means, SD and 95th percentiles of all measurements were higher than those recorded in other studies. They suggested that Egyptian sonographers should use their own normograms in routine practice. An article from China recommends 12 cm as the

upper limit of normal in the Chinese population (5). We think that this can be attributed to the study cohort being comprised of young healthy male subjects. One of the possible reasons for the larger spleen size in our study group is the fact that a likely decrease in the size of the spleen caused by ageing (5) was not visible in our young case group. Moreover, Spielmann et al. (10) showed spleen length was greater than 12 cm in 31.7% of males (mean spleen length, $11,4 \pm 1,7$ cm) and in 12.8% of the females (mean spleen length, $10,3 \pm 1,3$ cm) among tall healthy athletes in the United States. Our results are less than the values reported in Spielmann's study population.

In children, there is an expected increase in splenic length with age and body weight and height (2). In adult populations, some reports demonstrate that splenic volume is not dependent on physical data, since it does not correlate with the patient's weight, height or BMI. In our study, splenic length and body height, weight and BMI showed no statistically significant correlation. This is in agreement with previous studies based on linear measurement of the spleen in ultrasonograms (7-9).

Accessory spleen is a common congenital anomaly. The failure of fusion of splenic tissue results in the formation of accessory spleens. The prevalence of accessory spleen detected by US was calculated as 2.2% in our study group. Mortelet et al. (11) reported that accessory spleens are present in 16% of patients undergoing contrast-enhanced abdominal CT. Chen et al. (12) found accessory spleens in 5% (5/103) of patients on US examinations. Gigot et al. (13) demonstrated that preoperative CT, scintigraphy and laparoscopic exploration detected accessory spleens in 25%, 25%, and 75% of patients with hematological disorders, respectively. The detection of accessory spleen is very important since the ultimate goal of surgery for hematological disorders is the complete removal of both the spleen and accessory spleens in order to avoid disease recurrence. It is known that preoperative investigations using CT and scintigraphy are indispensable for ruling out an accessory spleen in those patients for whom splenectomy needs to be done in order to alleviate hematologic disorders. Our study revealed a lower prevalence of accessory spleens in comparison to the literature. Since US is less sensitive in detection of accessory spleens, the lower prevalence can be explained partially by the imaging method.

Ultrasound is the method of choice in diagnosis and monitoring of splenomegaly because of its diagnostic efficiency. Standards for normal splenic size have been developed for different areas of the world. This first study designed to evaluate splenic size by US of healthy Turkish men found the average splenic length to be $10,76 \pm 1,84$ cm. The low prevalence of accessory spleens suggests that US does not allow adequate detection of accessory spleens.

In conclusion, this study provides normal standard splenometric data for a healthy Turkish adult male population. This data should be taken into consideration when the diagnosis of splenomegaly is established in Turkish males.

Conflict of interest

No author of this paper has a conflict of interest, including specific financial interests, relationships, and/or affiliations relevant to the subject matter or materials included in this manuscript.

References

1. Perlmutter GS. Ultrasound measurements of the spleen. In: Goldberg BB, Kurtz AB, editors. Atlas of Ultrasound Measurements. 1st ed. Chicago, IL: Yearbook Medical Publishers Inc, 1990: 126-38.
2. Rosenberg HK, Markowitz RI, Kolberg H, Park C, Hubbard A, Bellah RD. Normal spleen size in infants and children: sonographic measurements. *AJR Am J Roentgenol* 1991;157:119-21.
3. Loftus WK, Chow LT, Metreweli C. Sonographic measurement of splenic length: correlation with measurement at autopsy. *J Clin Ultrasound* 1999;27:71-4.
4. El Sharkawy E, Faris R, Grumbach K, Edelman R, Clemens J, Rao M, Darwish M. Ultrasonographic measurements of the normal liver and spleen among Egyptians 10-50 years old. *J Egypt Public Health Assoc* 1997;72:257-83.
5. Loftus WK, Metreweli C. Normal splenic size in a Chinese population. *J Ultrasound Med* 1997;16:345-7.
6. Lamb PM, Lund A, Kanagasabay RR, Martin A, Webb JA, Reznik RH. Spleen size: how well do linear ultrasound measurements correlate with three-dimensional CT volume assessments? *Br J Radiol* 2002;75:573-7.
7. Bezzera AS, D'Ippolito G, Faintuch S, Szejnfeld J, Ahmed M. Determination of splenomegaly by CT: Is there a place for a single measurement? *AJR* 2005;184:1510-3.
8. Niederau C, Sonnenberg A, Muller J, Eckenbrecht JA, Scholten T, Fritsch WP. Sonographic measurement of the normal liver, spleen, pancreas and portal vein. *Radiology* 1983;149:537-42.
9. Frank K, Linhart P, Kortsik C, Wohlenberg H. Sonographic determination of spleen size: normal dimensions in adults with healthy spleen. *Ultraschall Med* 1986;7:134-7.
10. Spielmann AL, DeLong DM, Kliewer MA. Sonographic evaluation of spleen size in tall healthy athletes. *AJR* 2005;184:45-9.
11. Mortelet KJ, Mortelet B, Silverman SG. CT features of accessory spleen. *AJR* 2004;183:1653-7.
12. Chen MJ, Huang MJ, Chang VH, Wang TE, Wang HY, Chu CH, SC Lin, SC Shih. Ultrasonography of splenic abnormalities. *World J Gastroenterol* 2005;11:4061-6.
13. Gigot JF, Jamar F, Ferrant A, van Beers BE, Lengele B, Pauwels S, Pringot J, Kestens BJ, Gianello P, Detry R. Inadequate detection of accessory spleens and splenosis with laparoscopic splenectomy. A shortcoming of the laparoscopic approach in hematologic diseases. *Surg Endosc* 1998;12:101-6.