

Algorithm and software to determine an enlarged liver using reliable and valid measurements

Dear Editor,

Thank you very much for giving me the chance to present my point of view about the method of calculating liver size: Size of the liver is a significant indicator for recognition of illness in liver. Size of liver is also very important in planning surgery and treatments of liver. The liver has multiple functions, and many illnesses are caused by hepatomegaly. There are many methods to determine liver size; area. Liver volume is a better measure to represents the entire liver, rather than linear measurements in x, y plan. MRI and CT are both valid in the determination of liver volume; however, they are expensive to perform. CT scan has also x-ray which causes risk of cancer [1].

The liver can be easily measured using ultrasound; however, sonography measurement techniques provide X, Y measurement rather than volume measurements, There are many advances in 3D ultrasound imaging, but volume measurements of liver size using 3D ultrasound is very difficult and time consuming. A quantitative technique, for the measurement of hepatomegaly is much better than visual interpretation by physicians.

The aim of this study was to design a program using Matlab using the method introduced in reference, to calculate size of the liver and compare it with reference liver on the same sonography system [1].

The three linear measurements used to

determine liver volume done in the reference using the following equation:

$$\text{liver volume (cm}^3\text{)}=343.71+[0.84 \times \text{ABC}],$$

where ABC is the product of the three linear measurements in FIGURE 1.

Using designed software in Matlab user is able to introduce three mentioned lines on sonography image of reference and patient, interactively, the volume of liver in both cases is calculated by software and subtracted, to show if patient suffers from hepatomegaly. The program reads two images first being the reference image and second being the patient liver image, and takes the images to the same scale. Mouse is then activated on image and the coordinates of the points clicked are saved. The points should be clicked as indicated in the method on three images as they appeared, for both reference and patient images. The required values for A, B and C is then calculated and substituted in suggested formula by mentioned reference. The following is the mentioned program.

```
%read two images first for reference second for patient
```

```
A=imread('C:\Users\parsa\Downloads\thumb_4215717072.jpg');
```

```
B=imread('C:\Users\parsa\Downloads\thumb_4215717073.jpg');
```

```
J=imresize(A,[1024 1024]);
```

```
I=imresize(B,[1024 1024]);
```

```
figure;
```

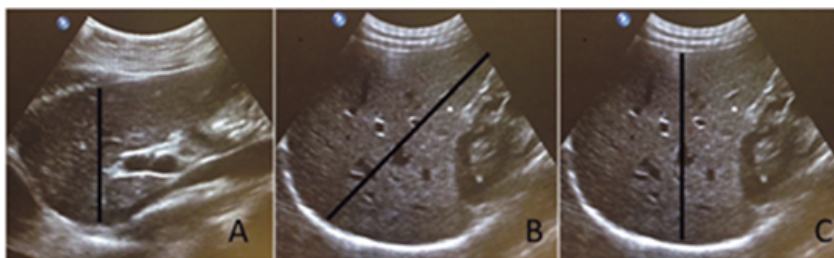


Figure 1. Three measures of liver for the given formula.

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%set first line for first image
h=imshow(J,'InitialMagnification','fit');
g=imdistline(gca);
[x1 y1]=ginput(1);
[x2 y2]=ginput(1);
d1=sqrt((x2-x1)^2+(y2-y1)^2)
figure;
%set second line for first image
h=imshow(J,'InitialMagnification','fit');
g=imdistline(gca);
[x3 y3]=ginput(1);
[x4 y4]=ginput(1);
d2=sqrt((x4-x3)^2+(y4-y3)^2)
figure;
%Set third line for first image
h=imshow(J,'InitialMagnification','fit');
g=imdistline(gca);
[x5 y5]=ginput(1);
[x6 y6]=ginput(1);
d3=sqrt((x6-x5)^2+(y6-y5)^2)
%calculating size of healthy person liver
D1=343.71+(0.84*d1*d2*d3)
figure;
%set first line for second image
h1=imshow(I,'InitialMagnification','fit');
g=imdistline(gca);
[x7 y7]=ginput(1);
[x8 y8]=ginput(1);

d4=sqrt((x8-x7)^2+(y8-y7)^2)
figure;
%set second line for second image
h1=imshow(I,'InitialMagnification','fit');
g=imdistline(gca);
[x9 y9]=ginput(1);
[x10 y10]=ginput(1);
d5=sqrt((x10-x9)^2+(y10-y9)^2)
figure;
%set third line for second image
h1=imshow(I,'InitialMagnification','fit');
g=imdistline(gca);
[x11 y11]=ginput(1);
[x12 y12]=ginput(1);
d6=sqrt((x12-x11)^2+(y12-y11)^2)
%calculating liver size patient from formula
D2=343.71+(0.84*d4*d5*d6)
%calculating the difference between
volume of patient and healthy person
D=D2-D1

I would like to thank my lecturers at L.S.E.
and North London Polytechnics for their help
and gaudiness, when I was their student.

I hope I could help some patients suffering
from liver diseases.

With great appreitiations,
Yours truly,
Saeid Parsa

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REFERENCE

1. Jessie TC, Adrian E, Kerry T *et al.* Ultrasound in the assessment of hepatomegaly: A simple technique to determine an enlarged liver using reliable and valid measurements. *Sonography* (2016).