

Use of ultrasound in medicine I. and II.

I: Measure the blood flow velocity

The short test (at the start exercise) will be from Medical Biophysics, Practical Exercises, and Measurement of blood flow speed: ultrasound Doppler device (p.108 – 113) + Instruction for use of equipment for ultrasonic diagnosis ALOKA ProSound SSD-350.

II: Calculate the volume of selected organs

Instructions for use of equipment for ultrasonic diagnosis ALOKA ProSound SSD-350

I. Switch on the device ALOKA ProSound SSD-350

1. Connect the device to the source.
2. Switch on the USG device using POWER.

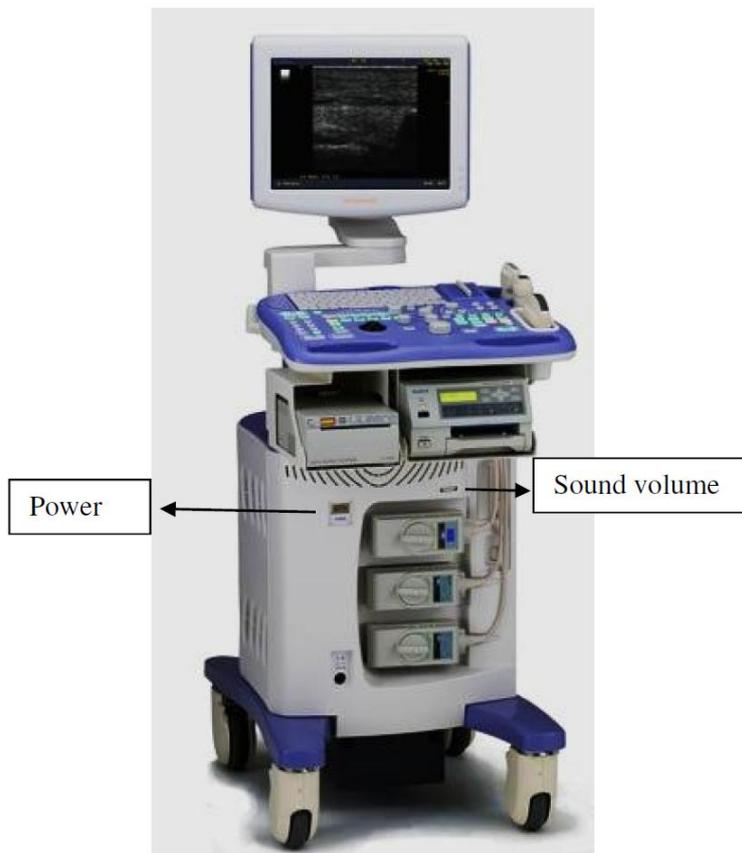


Figure 1. USG device ALOKA ProSound SSD-350.

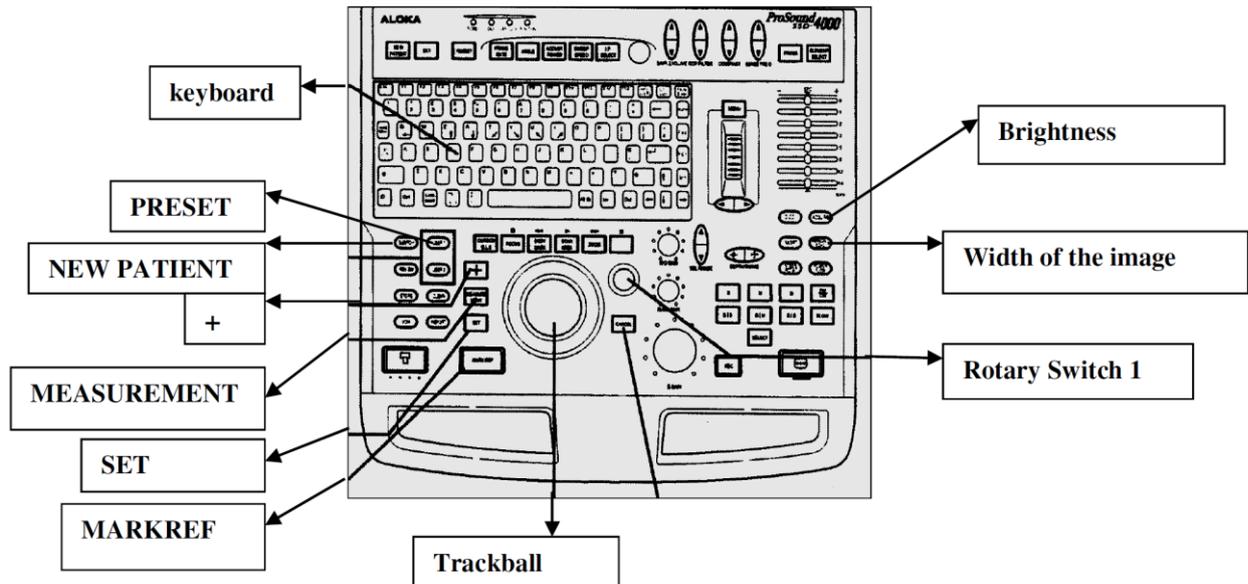


Figure 2. Control Panel

II. Register a new patient

- Using the button on panel **NEW PATIENT** we open a table.
- We see the table for patient registration. It is necessary to fill in the data: ID Input, Patient ID, Patient Name, Sex, Date of Birth, Age, Height, Weight and Occupation.

ID Input:

The function ID is intended for the award patient data (identification number ID, name, etc.)

Patient Information

*Patient ID: (for example: identification number) *Sex: (Male or Female)

*Date of birth: (day (06)-in month (JAN, FEB, MAR, APR, MAY, JUN, JUL, AUG, SEP, OCT, NOV, DEC)-in year (1988)

If you enter the date of birth then the system automatically calculates the patient's age.

*Age: (D-days, W-weeks, M-Months, Y-years), *Height: (cm), *Weight: (kg), *Occupation: (student)

Study Information (Not filled).

OK (The entered information is saved and the page closes).

Cancel (The page where are the identification data will be closed without saving the data).

Series/Image Information (Not filled)_

<Making>

Before the examination you need to enter information about patient and information about his examination. The Name and patient's ID patient you can see over the ultrasound image.

1. Switch on NEW PATIENT → write ID using the keyboard.
2. ENTER → write NAME → ENTER
3. Enter the remaining information about the patient know the same way as the information listed above.
4. During the announcement of sex, you must use the *trackball* (black ball on the control panel). You must move the arrow over the mark ▼ Sex → **SET** select the correct one → **SET**.
5. If you enter all the information about the patient, use OK → **SET** → This page is closed. You can see image from ultrasound section with the patient data (patient's name and ID).

Note: If you use button Cancel, all data will be lost.

III. Selecting profile for ultrasound diagnosis

Switch on the button on panel **PRESET**. You can see the table, where are different profiles (to eliminate the complicated configuration of all parameters).

<Making>

By trackball move the arrow on the selected profile → **SET**. You can work in the selected profile now.

IV. Deleting patient data

Press **NEW PATIENT** → **Data Management** → **SET** → **Search** File Name → Here is the table with all patient names → you choose the name → press **SET** → **Delete** → **OK** → **SET**.

V. Turn off the device ALOKA ProSound SSD-350

1. Press POWER
2. Wait until the screen turns off. Disconnect the device from sources.

I: Measure the blood flow velocity

Exercise 1: Measure the blood flow velocity in the human artery (Artery carotis).

Determine:

v_1 –the systolic velocity, v_2 –the diastolic velocity, Δv –velocity between the points of measurement, **PI**–the pulsatility index, **RI**–the resistative index, **PSV**–the threshold value of systolic velocity, **EDV**–the velocity at the end of diastolic, **MnV**–the mean velocity, **FlowT**–the flow time.

Then determine their average.

Exercise 2: Listen to the Artery carotis and Vena carotis and differentiate their sounds.

Procedure:

1. Switch on the USG device ALOKA ProSound SSD-350.
2. Register a new patient.
3. You choose the profile for diagnosis (5 carotid) → **SET**.

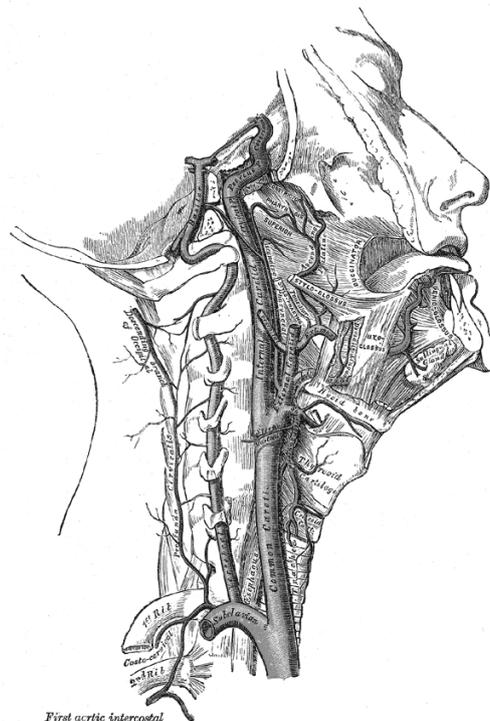


Figure 3. Artery carotis communis

4. Switch on the button on panel **B-mod** → using the small probe you must find *Artery carotis* (the probe must be in a horizontal position) (Figure 4.) → you will find carotid artery. The probes slowly turn on a vertical position. (The ball on the probe must be up) → from **B-mode** go to **B/D-mode** (Figure 5.).
5. Checking the position of carotid artery in the left picture. On the right picture you can see the blood flow in the carotid artery. → the probe set to a position about 60 degrees, so that blood flow was observed only in the positive plane (the x axis). Images are frozen, press >|< (FREEZE mode). The probe is now inactive.
6. Measurement: press the button +. In the middle of the screen you will see brand calliper „+“, which means trackball move to the starting point of measurement ($v_{1, \max}$ - cm/s, systole) in the interval 1.
7. You press **MARK REF.** → Your starting point is fixed. Use the trackball to move the brand calliper to end measuring point ($v_{2, \min}$ - cm/s, diastole).
8. Use the button **SET.** → The measurement is completed. Numerical results from interval 1 ($v_1, v_2, \Delta v, v_1/v_2$) are shown in the table in the lower left corner of the screen.
9. Under the table in the lower left corner of the screen you can see NEXT. Confirm by pressing **SET.** The next table for the interval 2 is opening. You choose the interval 2 in a left picture, next to the interval 1 (Figure 5.). Follow the same procedure (6-8) as for the interval 1. Numerical results from interval 2 ($v_1, v_2, \Delta v, v_1/v_2$) are shown in the table too.
10. Use the button +. **A rotary control (switch) 1** adjusts to the position **PI.** → Use the trackball to adjust the vertical green line on the starting point of measurement and confirm by pressing **MARK REF.** → Similarly, using the trackball to move the vertical green line on the end point measurement and confirm by pressing **SET.** In the table is automatically displayed PI, RI values, the threshold values of PSV- systolic velocity (cm/s) and EDV-end - diastolic velocity (cm/s), MnV – the mean velocity and FlowT – the flow time for the interval 1.
11. Under the table in the lower left corner of the screen you can see NEXT. Confirm by pressing **SET.** The next table for the interval 2 is opening. You choose the interval 2 in a left picture, next to the interval 1. (They must be the same as we used in determining the velocity.) Follow the same procedure (10) as for the interval 1.

12. You are listening to result: „pulsating sound” – **Arteria carotid**

„river flow“ – **Vena carotid**

13. After completion of measurement, use **CLEAR** button →All results will be deleted.

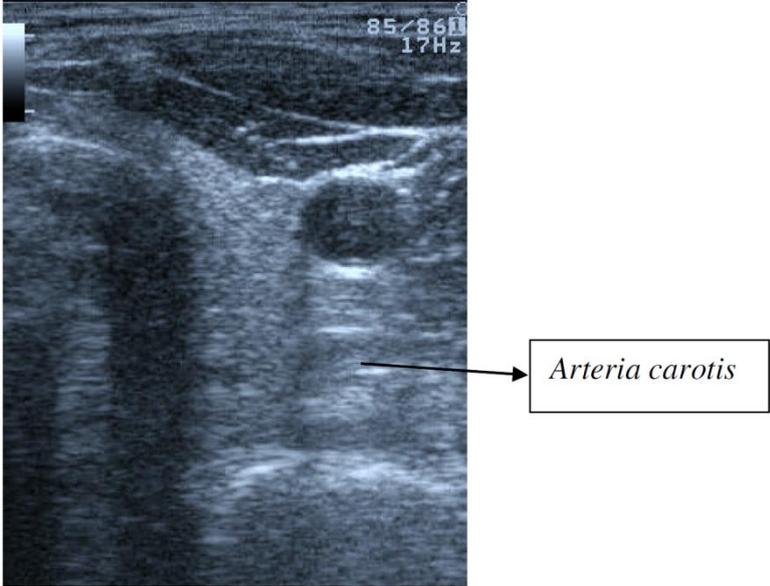


Figure 4. Arteria carotid in the B- mode (the probe is in a horizontal position)

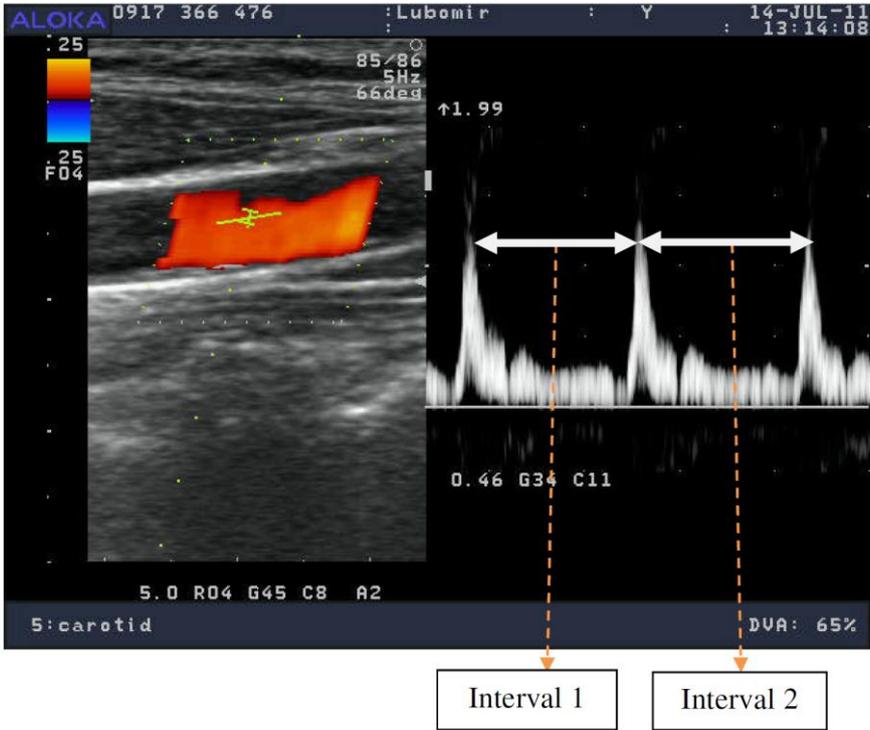


Figure 5. Arteria carotid in B/D - mode (the probe is in a vertical position)

II: Calculate the volume of selected organs

Exercise 1: Calculate the volume of Glandula thyroidea

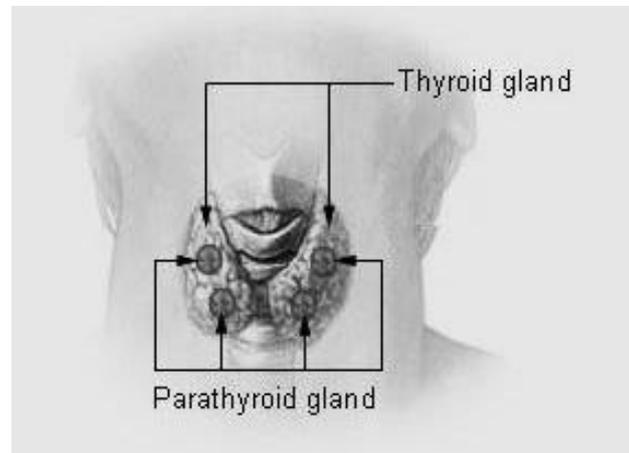


Figure 6. Glandula thyroidea

The **thyroidea gland** or simply, the **thyroid**, in vertebrate anatomy, is one of the largest endocrine glands. The thyroid gland is found in the neck, below (inferior to) the thyroid cartilage (which forms the laryngeal prominence, or "Adam's apple"). The isthmus (the bridge between the two lobes of the thyroid) is located inferior to the cricoid cartilage.

The thyroid gland controls how quickly the body uses energy, makes proteins, and controls how sensitive the body is to other hormones. It participates in these processes by producing thyroid hormones, the principal ones being triiodothyronine (T_3) and thyroxine (T_4). These hormones regulate the rate of metabolism and affect the growth and rate of function of many other systems in the body. T_3 and T_4 are synthesized from both iodine and tyrosine. The thyroid also produces calcitonin, which plays a role in calcium homeostasis.

The thyroid gets its name from the Greek word for "shield", due to the shape of the related thyroid cartilage. The most common problems of the thyroid gland consist of an overactive thyroid gland, referred to as hyperthyroidism, and an underactive thyroid gland, referred to as hypothyroidism.

Under normal circumstances, the man has thyroid in the volume of 22 ml, for women up to 18 ml. Depending on race, sex and age.

Procedure:

1. Use the button **PRESET**.
2. You choose the profile for diagnosis (*4 Small Part*) → **SET**.
3. This will open the working window. With the small probe (the linear probe) you find *Glandula thyroidea*, on the left side of the neck. The probe is in a horizontal position and the small ball on the probe must be left.
4. Use the **B-mode** → find *Glandula thyroidea* (next *Arterii carotis*) → then choose B-mode to **B/B-mode** (press 2x) and the probe slowly flips into a vertical position → there will be a figure to measure the third dimension → images must be frozen (>|<) (Figure 7.).
5. Measurement: press the button +. **The rotary control 1** adjusts to the position **Volume 1** → **SET**.
6. In the middle of the screen you will see the calliper „+“, using the trackball move into the left image to determine the starting point of the first measurement (first dimension – the height).
7. Use the button **MARK REF.** → Your starting point will be fixed. Use the trackball to move the brand calliper to the target point for the first measurement (first dimension) → press +.
8. The brand calliper „+“, move to the starting point of the second measurement (2nd dimension – the width).
9. In determining the second dimension do the same: stay in the left image
10. Press **MARK REF.** → Your second starting point will be fixed. Use the trackball to move the brand calliper to the target point for the second measurement (2nd dimension) → press +.
11. 3rd dimension - thickness, doing as well as the first two dimensions (working in the right image on the screen).
12. Use **SET**. → The measurement is completed and we can see the numerical results in the table in the lower left corner of the screen.

13. In the table will automatically calculate the volume of thyroid in cm^3 .

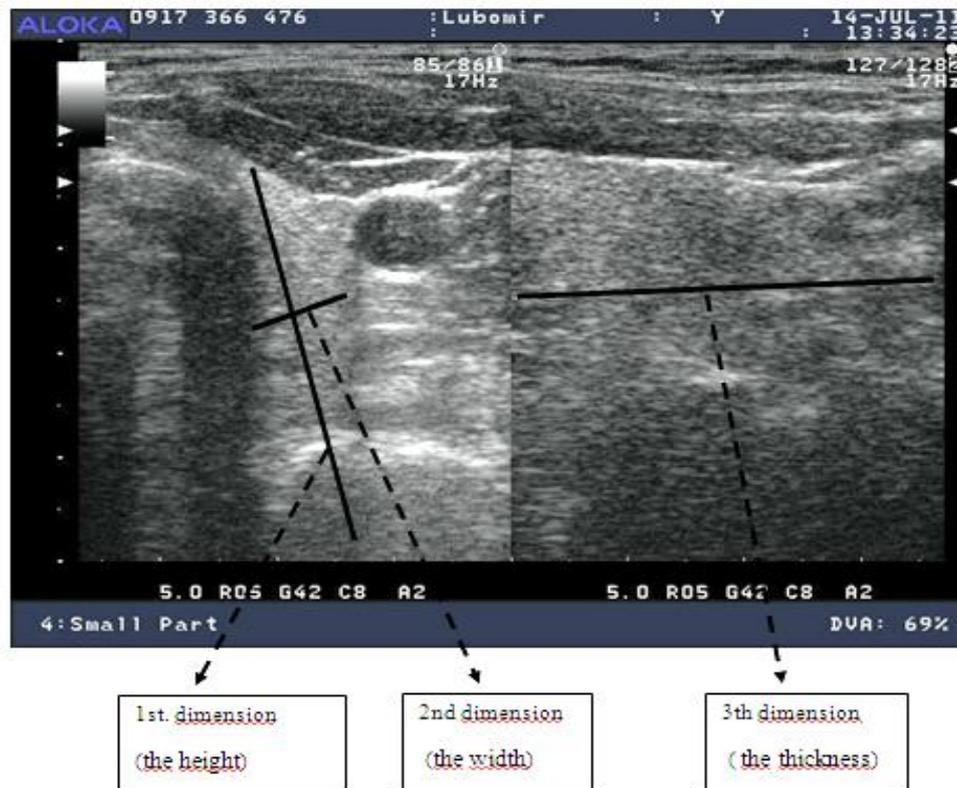


Figure 7. Glandula thyroidea in B/B – mode.

Exercise 2: Calculate the volume of liver

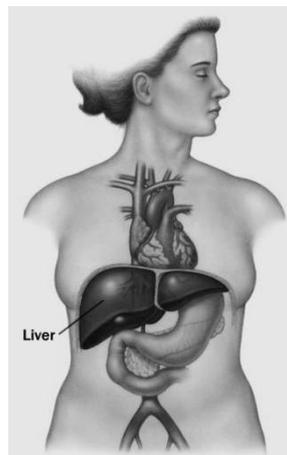


Figure 8. Liver

The liver, hepar, is a vital organ present in vertebrates and some other animals. It has a wide range of functions, including detoxification, protein synthesis, and production of biochemical necessary for digestion. The liver is necessary for survival; there is currently no way to compensate for the absence of liver function in the long term, although new liver dialysis techniques can be used in the short term. The liver lies to the right of the stomach and overlies the gallbladder. It is connected to two large blood vessels, one called the hepatic artery and second called the portal vein. The hepatic artery carries blood from the aorta, whereas the portal vein carries blood containing digested nutrients from the entire gastrointestinal tract and also from the spleen and pancreas.

Procedure:

1. Use the button **PRESET**.
2. You choose the profile for diagnosis (abdomen or abdomen chudy (for thin), abdomen corpus (with high weight) → **SET**.
3. This will open the working window. With the big probe (the convex probe) you find *liver*. The probe is in a horizontal position (perpendicular to the abdomen) and the small ball on the probe must be towards to the head. (You can regular the brightness and width of image with the buttons on control panel).
4. Use the **B-mode** → find *liver* → then choose B-mode to **B/B-mode** (press 2x) and the probe slowly flips into a vertical position → there will be a figure to measure the third dimension → images must be frozen (>|<).
5. Measurement: press the button +. **The rotary control 1** adjusts to the position **Volume 1** → **SET**.
6. In the middle of the screen you will see the calliper „+“, using the trackball moves into the left image to determine the starting point of the first measurement (first dimension – the height).
7. Use the button **MARK REF.** → Your starting point will be fixed. Use the trackball to move the brand calliper to the target point for the first measurement (first dimension) → press +.

8. The brand calliper „+“, moves to the starting point of the second measurement (2nd dimension – the width).
9. In determining the second dimension do the same: stay in the left image
10. Press **MARK REF.** → Your 2nd starting point will be fixed. Use the trackball to move the brand calliper to the target point for the 2nd measurement (2nd dimension) → press +.
11. 3rd dimension - thickness, doing as well as the first two dimensions (working in the right image on the screen).
12. Use **SET.** → The measurement is completed and we can see the numerical results in the table in the lower left corner of the screen.
13. In the table will automatically calculate the volume of liver in cm³.

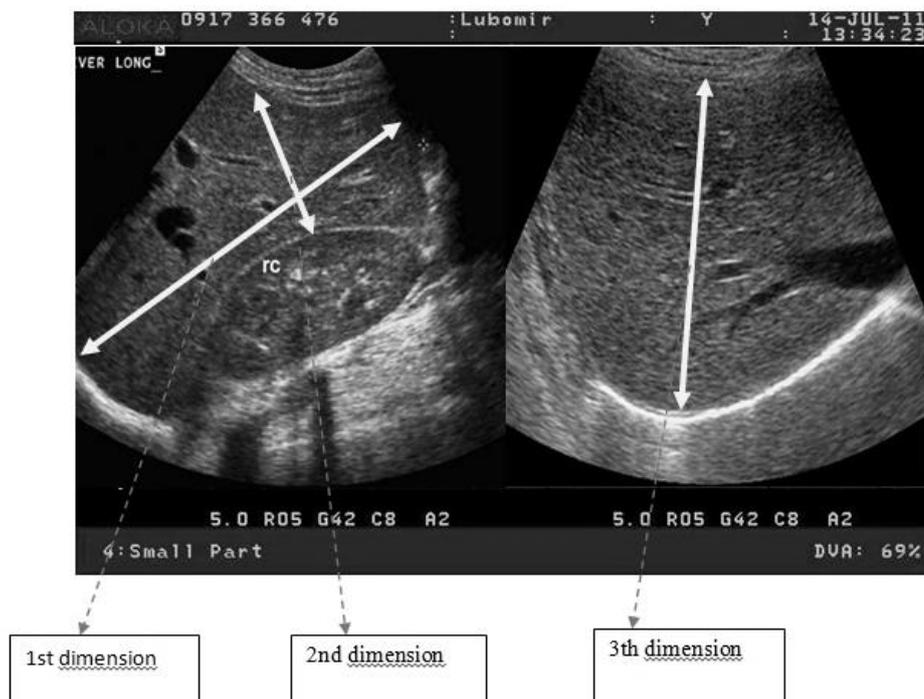


Figure 9. Liver in B/B mode