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Physical and Clinical Sonography

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ABSTRACT

A study was on the physical concepts (transmission of sound waves among different parts of the body for medical diagnosis purposes) , methods of detection two dimensional 2D commonly used , modern methods as color Doppler (Duplex) , in addition new techniques that have developed and used together with the device , such as (contrast medium , catheters using techniques , guidance technique for therapeutic injections and a sample taking purposes (Biopsies) . The research included a study of a 50 clinical cases of different parts of the body, ages, gender over two months. After cases discussion showed that the device is useful as initial step and very sensitive tool in the medical clinical field, specifically if the new techniques are applied, in turn increase the benefits of the device, get good clinical results and finally minimize the ionizing radiation exposure of the other devices.

Keywords: Ultrasound; Sensitivity; Specificity.

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INTRODUCTION

Ultrasound is sound waves with frequencies higher than 20,000 Hz (or 20 kHz) . Ultrasound devices operate with frequencies from 1 MHz up to several gigahertz. [1]

The first Sonar device was invented in 1914 in the United States of America, where it was then used to identify marine navigation. The first ultrasound was introduced by a scientist in 1942 and was used to detect brain tumors. A doctor specializing in women and obstetric in the determination of some measurements within the womb of the mother, such as knowing the head of the fetus, watching the rest of its members, ensure the safety, and the development of the device very significantly in the 1970. In late 1955, scientists sought to develop a sonar to be smaller, more sensitive and easier in the way of the examination, where they were able to reach the mobile metal arm placed on the place assigned to the examination, and in the 1980 there was a huge revolution in the field of ultrasound, in the two-dimensional live imaging, where the device can identify the entire life of the fetus, of its kind, movements and actions, and was the first effective device in this field in Germany in 1985. [2] Techniques for ultrasound imaging:

A-mode: (amplitude mode) is the simplest type of ultrasound, this technique is rarely used today.

B-mode or 2D mode: two-dimensional image on screen, more commonly used today.

M mode or TM-mode (time motion) is used to analyze moving structures.

Doppler techniques were used to provide further information in various ways, they are especially important for examining blood flow.[3]

Duplex scanners were used to display both vessel anatomy and blood velocity waveform simultaneously.[4]

Advantages of the device

Safe from ionizing radiation, available, not expensive, portable, real-time nature of ultrasound imaging is useful for the evaluation of physiology as well as anatomy , ultrasound images may not be as adversely affected by metallic objects, an ultrasound exam can easily be extended to cover another organ system or evaluate the contralateral extremity, printing images.[5]

Disadvantages of the device

Bone blocks ultrasound waves, artifacts are common with bowel gases, and air in the lungs. Ultrasound device is a sensitive not a specific tool in most of diseased organs .Ultrasound techniques required improved anatomical knowledge and a formal educational program. [6]

New Techniques:

Panoramic Imaging:

High-performance image processors generate extensive ultrasound images from data acquired as the examiner moves the transducer slowly and continuously over the region of interest.

3D visualization:

Especially in obstetrics, the three-dimensional visualization of fetal facial features improves the diagnosis of malformations such as cleft lip and palate.

Contrast Enhancement:

Used to obtain a stronger signal from blood flows and detailed information about the static and especially the dynamic vascularity of tissues and tumors. [7]

Guided ultrasound technique: Ultrasound device detects joints alterations and to perform procedures such as aspiration of fluid as well as therapeutic injections; it helps in placing the needle correctly, greatly improving the outcome. Tissue biopsies can be performed with ultrasound guidance. [8]

MATERIALS AND METHOD

This study was carried out in radiology department in Al-Thawra hospital / Al-Bayda city. Libya. The subject of the study was about 50 cases of different ages and gender**.** The examination using ultrasound in general needs simple preparation, the patient is placed in the usual common position for the examination (supine) , take off clothes from area to be examined , jell in place , start the examination using the probe .

Statistical analysis

In general, most cases were Females, at a rate of 70% over two months period .Most cases were about gallbladder .The specific diagnosis was 48% .

RESULTS AND DISCUSSION

50 Cases libyan patients selected of different ages (young, middle, old) and gender . All these cases were taken during two months, from Al-Thawra hospital / Al-Bayda city. Libya . Ratio of females greater than as males for different cases as shown in table 1, and figure 1.

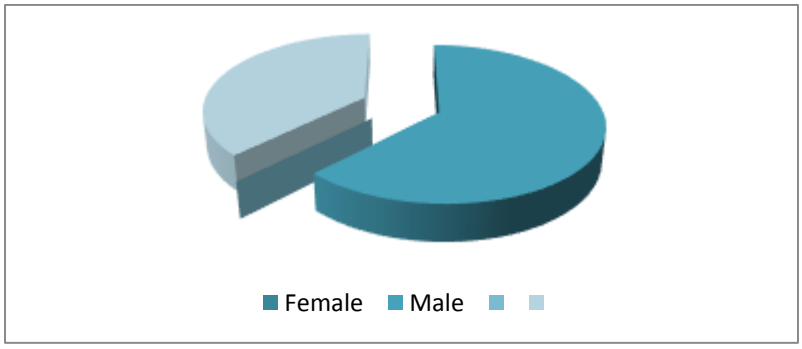

Figure 1: Comparison between male and female cases.

Table 1: **According to the most cases by gender.**

Gender	Child	Young	Teenager	Middle aged	old aged	Extreme old aged	Total
Female	0	8	1	14	7	6	36
Male	2	0	2	1	5	4	14

The most specific cases had been noticed was gall bladder, and the most non-specific was neck cases as shown in table 2, and figure 2.

Table 2: **According to the most cases by the specific diagnosis.**

Organ Diagnose	Specific diagnosis	Nonspecific diagnosis
Neck	4	7
Breast	2	2
Spleen	1	1
Liver	1	1
Gall bladder	10	2
Pancreas	-	1
Kidney	2	2
Pelvis and abdomen	-	3
Ovary	3	2
Uterus	1	2
Urinary bladder	-	3
Total	24	26

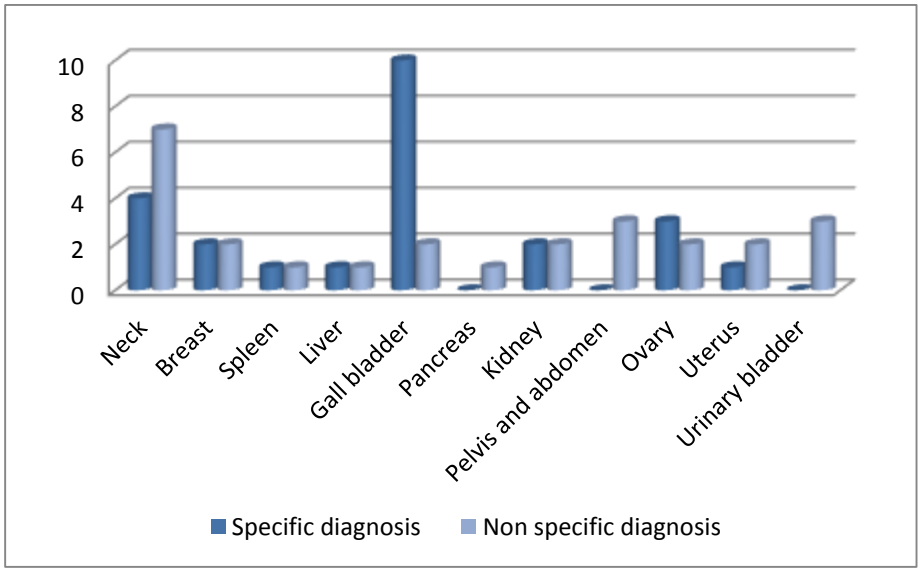

Figure 2: Comparison between specificity and non-specificity.

According to the most cases came to the department, the percentages have been shown that the most organ been diagnosed was gall bladder as great as 24% , neck 22%, and ovary 10% .

Table 3: According to the most cases came to the department.

Organ diagnose	Number of cases	Percentage
Neck	11	22%
Breast	4	8%

Spleen	2	4%
Liver	2	4%
Gall bladder	12	24%
Pancreas	1	2%
Kidney	4	8%
Pelvis and abdomen	3	6%
Ovary	5	10%
Uterus	3	6%
Urinary bladder	3	6%
All cases	50	100%

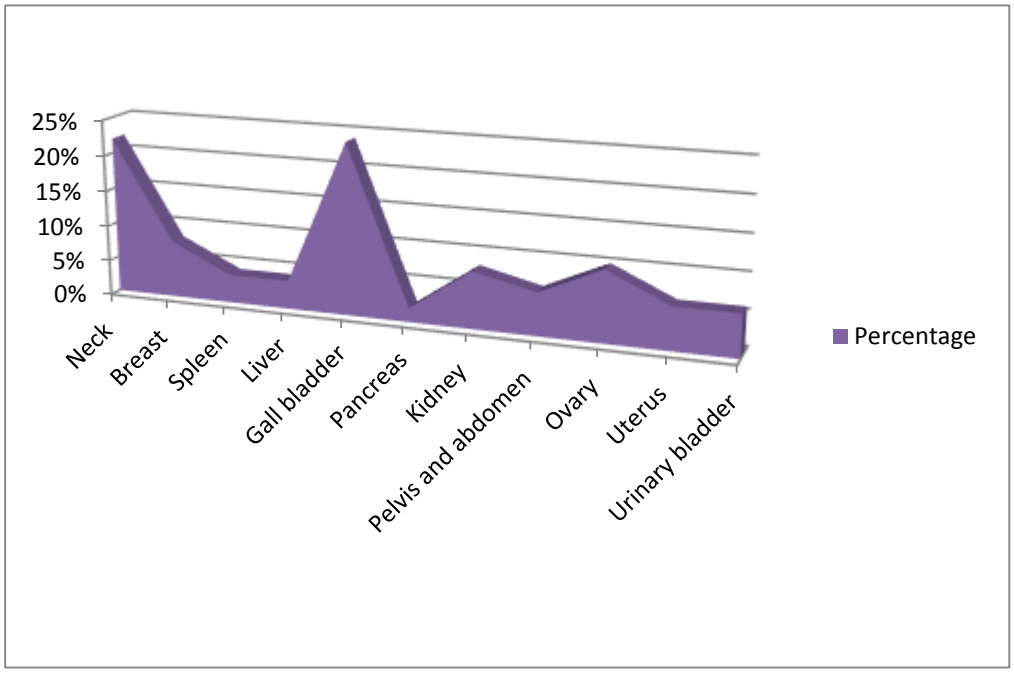

Figure 3: **The number of the cases percentages.**

CONCLUSION

This device is safe and can be used to identify all diseases if it was developed using all the above mentioned techniques and thus reduce the use of ionizing devices in diagnosis. The only disadvantage of the device is that, it is not used in the diagnosis of bones pathology at the present time. The diagnosis of the specific came by 48%, therefore, need to develop all the techniques mentioned earlier in the presentation of literature to increase the proportion of diagnosis specified by it.

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