J Neurol Orthop Med Surg (1995) 16:41–43
Editorial Office: 880 East 9400 South, Suite 110,
Salt Lake City, UT 84094, USA

Fallacies of Ultrasound

S.N. Asfar, M.Sc. and A.B. Shindi, M.Sc.

University of Basrah, College of Medicine, Basrah, Iraq

Introduction

Routine ultrasonography is frequently used now to complete the physical examination and investigation of almost all parts of the body. The accuracy of ultrasound seems to be influenced by many factors including: proper preparation of the patient (fasting for upper abdominal exam and full bladder for pelvic exam), age, sex, and weight of the patient, the observer, and the sonographic transducer quality [1,2]. Although ultrasound gives a high accuracy rate, fallacies still occur which may lead to unnecessary operation or even fatality.

Errors of ultrasound fall into four groups: Display of echoes which do not correspond to real structures, omission of genuine echoes from the display, displacement of echoes, and distortion of echo characteristics [3].

The aims of this study are to find the relation of the observation quality to age, weight, sex and different organs examined, and to find the most common types of observation errors demonstrated during operations.

Patients and Methods

Ultrasonographic reports of 95 patients were collected from four investigators, and were checked during surgery for the following parameters: size, number, position, shape, consistency, and the presence of lesions. The operative findings were assigned three grades: excellent, fair, and poor according to how accurate the report was. The relation of age, weight, gender, and the observer were also evaluated. Data were analyzed statistically using Student's t-test to demonstrate the significance of differences between the groups.

Results

Ninety-five patients were included in this study, their age range 3–75 years, weight range 15–85 kg, and the female/male ratio was 2:1.

Figure 1 shows the age distribution of the cases in which significant excellent results were obtained between 30 and 50 years, and poor results were demonstrated in the age extremes.

Weight showed significant excellent results in the range of 50-80 kg and poor results out of this range as demonstrated in Figure 2.

Gender relation is demonstrated in Figure 3. It shows that males had higher percentage in grades excellent and fair while females had a higher percentage in grade poor.

Figure 4 shows that observer A had higher excellent results while observer C had the higher poor results.

Observation quality in different organs is demonstrated in Figure 5 showing that spleen and thyroid have the highest excellent results while the pelvis, right kidney, and general peritoneal cavity have the poorest results. Only 22% of the ultrasound reports had no errors as checked intraoperatively. The highest type of observation errors was in the size and number of the lesion and the lowest observation error was in the shape of the lesion as shown in Figure 6.

Discussion

The scope of ultrasound continued to increase rapidly as it is a very beneficial tool of diagnosis, but it should be used carefully and interpreted in a meticulous way to obtain good results.

We found in this study that many factors may influence the accuracy of ultrasound. Excellent results were obtained at 30–50 years of *age,* probably because a younger age group has poor cooperation especially for fasting or for full bladder, while an older age group may have scaphoid abdomen, which is technically difficult [4], or they are improperly prepared. We found that the best *weight* was 50–80 kg, as it is well-known that leanness is a favorable condition for ultrasound because adipose tissue can distort and attenuate the ultrasound waves, so that the clarity of the image will be suboptimal in obese patients [1]. In relation to *gender* this study showed that females had poor results due to obesity or poor cooperation. Also this study showed significant between-*observer* errors, confirming the concept that ultrasound is an operator-dependent technique and machines should

Correspondence to: Dr. Salam Najib Asfar, Department of Surgery, College of Medicine, University of Basrah, Basrah, Iraq
ISSN 0890-6599

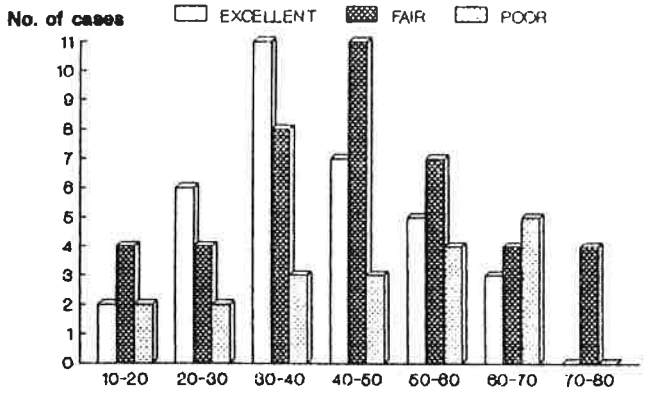

Fig. 1. Age distribution of the cases.

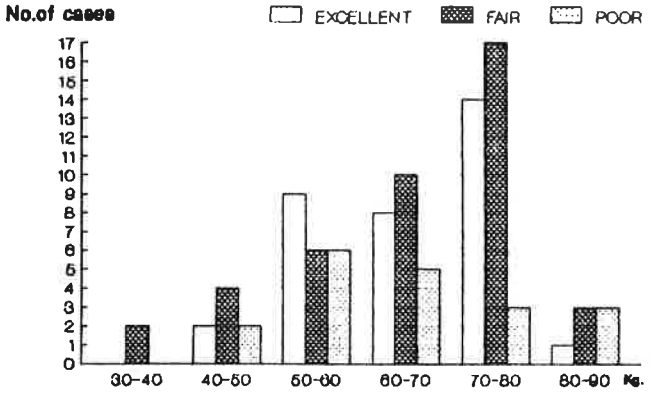

Fig. 2. Weight distribution of the cases.

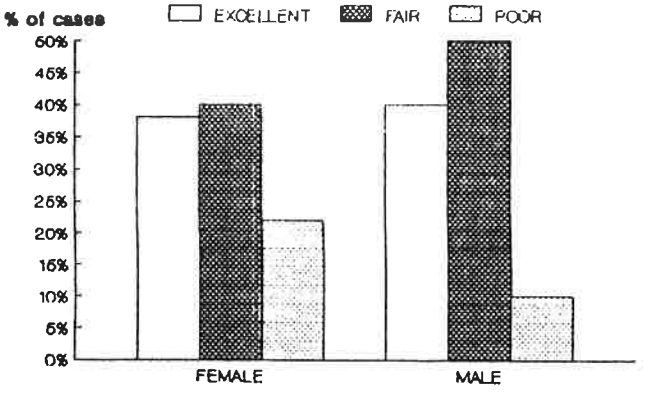

Fig. 3. The relationship of gender to grading.

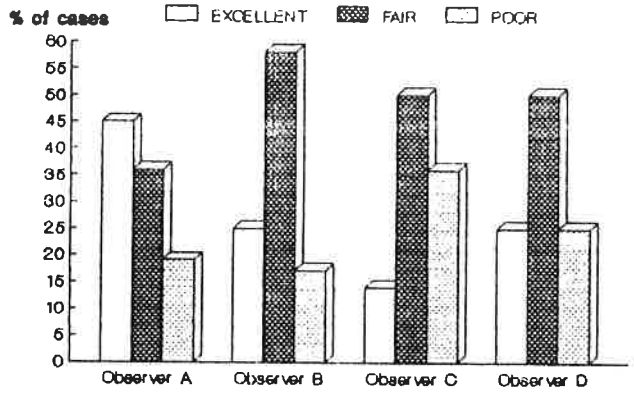

Fig. 4. Differences between observers.

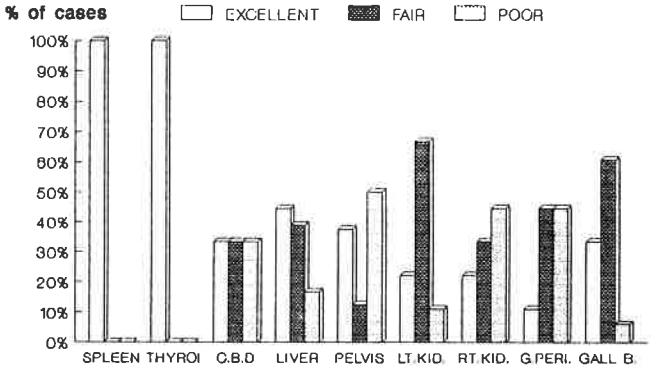

Fig. 5. Observation quality in imaging different organs.

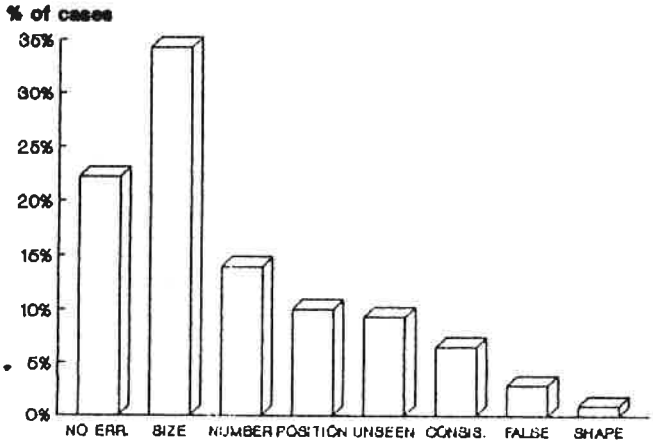

Fig. 6. Types of observation errors.

have regular testing and calibration [3]. The type of *organ* examined was another factor that may affect the accuracy of ultrasound as observation quality was high in organs like the spleen, thyroid, liver and gall bladder while it was very poor in the pelvis, general peritoneal cavity, and right kidney, with the worst results in the pancreas, as there were two missed cases of pancreatic cyst and tumor which could not be recognized by ultrasound. This can be explained by the fact that deeper structures and amount of fat layers affect the image quality [5]. We found that only 22% of the reports were 100% accurate, while the others showed errors in the size, number, position, consistency, and shape, in that order, with some missed pathologies and some false positive results. Ultrasound failed to diagnose pathologies in the ureter and gastrointestinal tract.

In conclusion, ultrasound is a very helpful device, yet surgeons should not depend solely on it, and we feel that only a qualified well-trained ultrasonographist should practice ultrasonography to minimize fallacies of ultrasound.

Summary

Ultrasonography is a useful tool in diagnosing many surgical conditions, yet surgeons should not depend solely on it. Further investigations should be requested for achieving diagnosis, as errors have occurred that can lead to unnecessary surgery or even fatality as happened on the table in one of our cases with an abdominal aortic aneurysm, which was diagnosed by ultrasound as a hydatid cyst.

This study showed that error of ultrasound depend on the age, weight, gender, the observer and his machine, and the organ examined. We found that the best results were obtained in the ranges 30–50 years of age and 50–80 kg of weight, and that there was more accuracy in males. The most accurate results were found in organs like the spleen and thyroid. Ultrasound was more accurate in determining the shape of the lesion rather than the size, number, position, and consistency.

References

1. Windler ET, Lempp FL. US of the upper abdomen: factors influencing image quality. Radiology 1985; 157:513–515
2. Gaffe CC, Harris DJ, Taylor KJ. Sonographic transducer performance cannot be evaluated with clinical images. A.J.R. 1981; 137:1239-1243
3. Shirley I, Blackwell F. A user's guide to diagnostic ultrasound Baltimore: University Park Press, 1978
4. Mittlestaedt CA. Abdominal ultrasound, first edition Churchill Livingstone. 1987
5. Laing FO. Diagnostic evaluation of patients with suspected acute cholecystitis. Radiol Clin North Am 1983; 21:477-491