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## THE ACCURACY OF ULTRASOUND IN DETECTING OCCULT INGUINAL HERNIA IN PATIENTS WITH INCONCLUSIVE CLINICAL FINDINGS, COMPARED WITH SURGICAL RESULTS

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### Abstract

**Objective:** The aim of this study was to evaluate the accuracy of ultrasound in detecting inguinal hernia in patients with symptoms suggestive of inguinal hernia but inconclusive physical examination.

**Materials and Methods:** A total of 86 patients were referred for ultrasound exam with clinically suspected inguinal hernia. All patients had a history suggestive of inguinal hernia with normal or equivocal physical examination. Patients with positive ultrasound exams underwent surgery, and those with negative ultrasound findings, were followed up. Patients with remained symptoms underwent surgery. Surgical findings were compared with ultrasound results.

**Results:** Ultrasound diagnosed inguinal hernia in 48 patients and surgical findings were positive in 47 of them. Ultrasound sensitivity and specificity were 87%, and 86.8%, respectively. Ultrasound identified 43 of 47 indirect hernias (sensitivity: 91.1% and specificity: 0%) and 2 direct inguinal hernias were not detected.

**Keywords:** Inguinal hernia, Occult, Ultrasound

### Introduction:

Hernia includes a protrusion of part of body building that there is a normal tissue inside it (1). Inguinal hernia or inguinal hernia refers to hernia in the area of inguinal canal (1). Inguinal area has been formed from the muscular layers and buildings that pass from potential weak layers (2). Common causes of hernia includes acquired factors: Aging, the existence of femoral hernia which causes inguinal hernia the existence of diseases such as asthma (severe cough), debilitating diseases and pressure on the body so that the individual to lift heavy object also leads to the development of inguinal hernia. In children also occurs inguinal hernia after premature born of baby. It also causes such as hereditary or being familial and congenital dislocation of the femoral head is a predisposing factor (3). In

embryonic period the testicles engenders into the abdominal cavity and before birth through the inguinal canal is driven into the scrotum. Then the hatch between these two cavities is closed. If this hatch not be closed or when due to a defect of closure or with weakness of the hatch along with a large increase in intra-abdominal pressure, for example due to heavy work, cause the opening a window between the abdominal cavity and scrotum and the abdominal organs into the driven scrotum cavity. The most common of organ is the intestine although rarely the bladder may also include organs that find way to the scrotal cavity in inguinal hernia. Vast majority of inguinal hernias occur in the men (4). The type of III hernia is more common in men, while the type of I and II of it (hidden hernia) is more common in women. The type of I and II hernia usually refers to secret inguinal hernia and inguinal pain in women, men and athletes associated (4).

Inguinal hernia can be direct or indirect depending on anatomically of it. Inguinal hernia that find protrusion in lateral side of inferior epigastria artery and pass through a ring of deep are called as indirect inguinal hernia while the direct hernia instead of inward of inferior epigastria artery have protrusion (10). The main symptom of hernia is pain. However, depending on the severity of hernia is observed other symptoms such as swelling of the groin area (11, 12). Number of conditions can be faced with ambiguity the straightforward diagnosis of inguinal hernia. These include obese patients (which the hernia cannot be found based on physical examination) and inguinal hernias are recurrent. In these event from a radiologic investigation may be used as an auxiliary method of biography and physical examination (11, 13). Sonography can well be used for evaluation and differentiation of inguinal hernia (14). Sonography is a cost-effective and high-resolution technique which allow direct scan and dynamic evaluation of the patient's pain (13-15).

Larmark et al (16) showed that sonography is useful in evaluating complications after hernia repair. Given that the inguinal hernia is common, being high of diagnostic accuracy of ultrasound in correct diagnosis of this disorder can alter treatment plans, and to prevent of surgery that is an invasive method. This method was used in infants to prove the inguinal hernia clinical evidence but the different accuracy has been reported to assessment of bilateral inguinal canal (12, 14, 17, 18).

It has also been shown that sonography is an accurate technique to proven inguinal hernia in adults (11, 15, 19-24). Since the sonography method is a noninvasive, the aim of this study is to evaluate the sensitivity, specificity and diagnostic accuracy of sonography method in determining inguinal hernia and comparison it with the findings during surgery by surgeon (11, 15, 19-24).

## **Materials and Methods:**

This was an epidemiological study conducted on 86 patients of different age groups who were suspected of inguinal hernia and have been referred to the surgery clinic in Ahvaz Imam Hospital 2011. They underwent sonography to reach a definitive diagnostic.

The relevant surgeon of all patients with positive clinical symptoms such as pain sensation or lump in the inguinal area examined carefully and in a standing position and during the Valsalva maneuver and patients with negative examination or questionable be referred for sonography. During the sonography also by placing a 5 MHz, linear probe for adults and 8-10 MHz for children in the longitudinal section for inguinal canal at the level of the symphysis pubis, patient were examined in standing and lying position at rest and during Valsalva maneuver. In an indirect longitudinal hernia scan as motion the hernia sac is seen beneath external oblique aponeurosis of level of internal inguinal ring to appearing in outer ring level. Direct hernia sac has a direct movement to probe from side of dorsal to ventral. Furthermore, if possible, position of placing the contents of the hernia is determined to inferior epigastria artery. Means that the direct hernia of medial is to inferior epigastria artery and lateral indirect hernia is to it.

In positive cases, often hypoechoic masses are seen that is suggestive of the omentum. In addition, sometimes part of the small intestine loop as well as mobile or fixed was seen that has peristalsis and gas. A hernia sac contained the ovary. All patients undergoing sonography are referred to the surgery clinic if being positive of sonography in terms of inguinal hernia.

Sonography findings in positive patients after surgery with intraoperative findings were compared for the presence or absence of defect. Patients, who were negative on sonography, were treated for 2 months and after 2 months in the case on behalf of symptoms, were considered as negative. Otherwise underwent surgery and were studied. Comparing the two ratio formula was used to calculate the sample size, The minimum sample size for the survey with 95% Confidence and considering that the positive cases is 70% of the total number. The 86 dubious cases were evaluated in clinical symptoms. Because the sonography is safe for patients and is part of the fallow of the patients, this plan seems perfect morally. However, after patient selection the process for the doing project is explained for them and was taken written consent form.

## **Results:**

In this study, 86 patients (15 (17%) female and 71 (83%) men) were selected with the age range of 2 months to 84 years old and average age of 33 years old (SD: 21 years), with complaint and suspected to inguinal hernia. in physical

examination of these patients was not proved compliance with inguinal hernia, so to the sonography section were referred for further investigation. The most frequent complaint was a mass in the inguinal area (63%) and the rarest of it was swelling in the inguinal area the complaint combination of mass and swelling of the inguinal area (both 1%) (Figure 1).

Physical examination findings in 64% of cases are ambiguous and the dubious and in 2.30% cases without finding was noteworthy and only 7.4% and 2.1%, respectively, included scrotum swelling and mass in the inguinal area (Figure 2). From the 86 patients under study, sonography findings announced the 48 patients with inguinal hernia, while from these number the 47 patients in surgery also had been diagnosed suffering from hernia and a patient was without hernia. Sonography raised another diagnosis in 14 patients, include 3 cases 3 spermatic cord cyst, 3 cases of lymphadenopathy, 3 cases of hydrocele, 2 cases of undescended testis, 1 case of abscess, inguinal, 1 case of fibrosis caused by previous surgery and 1 case of pelvic mass in inguinal area. Sonography was normal in another 24 patients. During follow-up the disease in people who their sonography was negative, 16 patients were relieved of their symptoms. The remaining 8 patients were operated that seven cases were hernia and a case was normal. According to the results of surgery and fallow of the patients and comparison it with the sonography findings, sensitivity, specificity, accuracy and positive and negative predictive value of sonography in the diagnosis of inguinal hernias is respectively 87%, 87%, 77%, 98% and 82%. (Tables 1 and 2). In addition, by comparison of surgery results and sonography in terms of hernia (direct and indirect), sensitivity, specificity, accuracy, positive and negative predictive value of sonography in the diagnosis the type of inguinal hernia (Namely ability to distinguish between direct and indirect hernia) by 94%, 0%, 6%, 94%, which means being invalid of the type of sonography findings in the diagnosis of inguinal hernia (table 3 and 4). The average size of a defect observed during the right side inguinal hernia surgery for 10.24mm with a standard deviation of 4.04mm that is significantly less than the average size of a defect seen with sonography ( $12.66 \text{ mm} \pm 5.04 \text{ mm}$ ) ( $P < 0.001$ ). The average size of a defect observed during left side inguinal hernia surgery 9.55 mm was with a standard deviation of 3.25 mm that is significantly less than the average observed by sonography ( $11.72 \text{ mm} \pm 4.44 \text{ mm}$ ) ( $P < 0.05$ ). Therefore, it can be concluded that sonography reports the size of defect in hernia inguinal area over the actual values (over estimate).

## Discussion

Ahead findings showed that diagnostic accuracy of sonography in identifying inguinal hernia is very noticeable. In this study, the sensitivity of sonography in identifying hernias inguinal had been 87% that is similar by the results of

meta-analysis that was done in 2013 on nine study (which has determined the accuracy of sonography in identifying hernias inguinal areas) (23).

The sensitivity of sonography in identifying hernia of inguinal areas from the 92 to 100 percent (overall sensitivity of 96%) has been reported in the aforementioned study. Small difference between the results of this study and the study mentioned probably is due to differences in sample size of studies. In a study that conducted by the kraft and colleagues (23). Two-hundred-twenty patients admitted were to inguinal hernia surgery at beginning were under clinical examination and sonography that in terms of diagnosis amount the overall accuracy of physical examination and sonography, was 93% and 94%, respectively.

In leading study specificity of sonography in detection of inguinal hernia is 83 percent that is consistent by the mentioned results of the meta-analysis (84%). Positive and negative predictive value in this study, respectively had been 98 and 82 percent While in the meta-analysis tested on nine separate study the positive and negative predictive value has been reported (from the 83 to 100%) and (from the 40% to 100%) respectively.

In leading study the accuracy of sonography has been reported of 77 percent that is relatively high and has relatively consistent with the previous studies and meta-analyzes in 2013. In mentioned study the accuracy of sonography was 81%. In total the results of the upcoming study, alongside other studies indicate acceptable accuracy of sonography in identifying the inguinal areas hernia. The results of our study and other studies show that the use of sonography can help in the diagnosis of inguinal hernia area and to reduce the non-diagnose of this disease. Identify the type of hernia (indirect and direct) is less successful to detect the presence of hernia by sonography. In this study the sonography findings in identifying the type of hernia had been shown the low accuracy of this method in determining the type of hernia. The sensitivity of sonography and its characteristics in this regard had been 94 and zero percent respectively. In general, the accuracy of sonography in determining the type of inguinal hernia in different studies has been reported from the 45 percent to 86 percent for direct hernia and from 45 percent to 97 percent for indirect hernia (1, 12, 14, 19, 23, 25).

The main reason for mismatch of study findings with the other studies is different sample size compared to other studies that have evaluated the role of ultrasonography in determining the type of inguinal hernia. For this reason, it is suggested that further studies with larger sample size more suitable to be designed to investigate this matter. In this study the sonography be fulfilled the inguinal hernia size significantly to its actual size (during the operation) was achieved. 10.24 mm against 12.66 mm on the right and 5.9 mm against 11.72 mm on the left. However, in another

similar study sonography has estimated defect size of inguinal hernia less than the actual amount (during the operation). This difference can be attributed to different of experience and accuracy of sonographer.

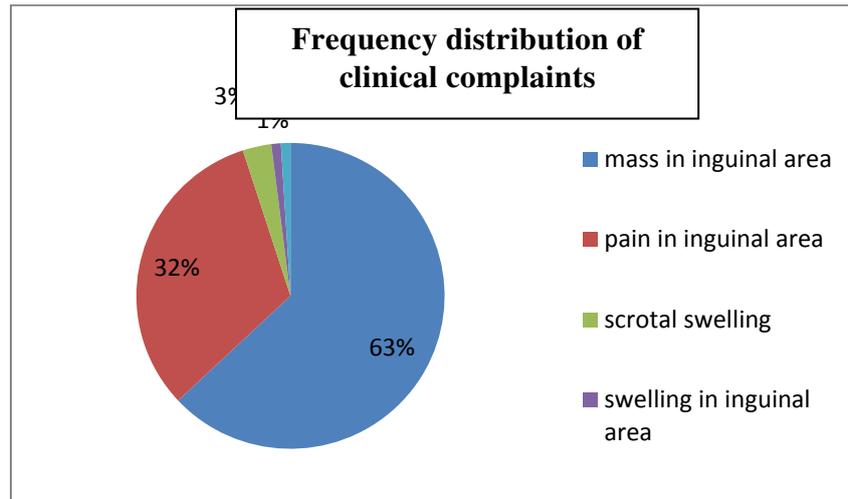


Figure1. Frequency distribution of clinical complaints.

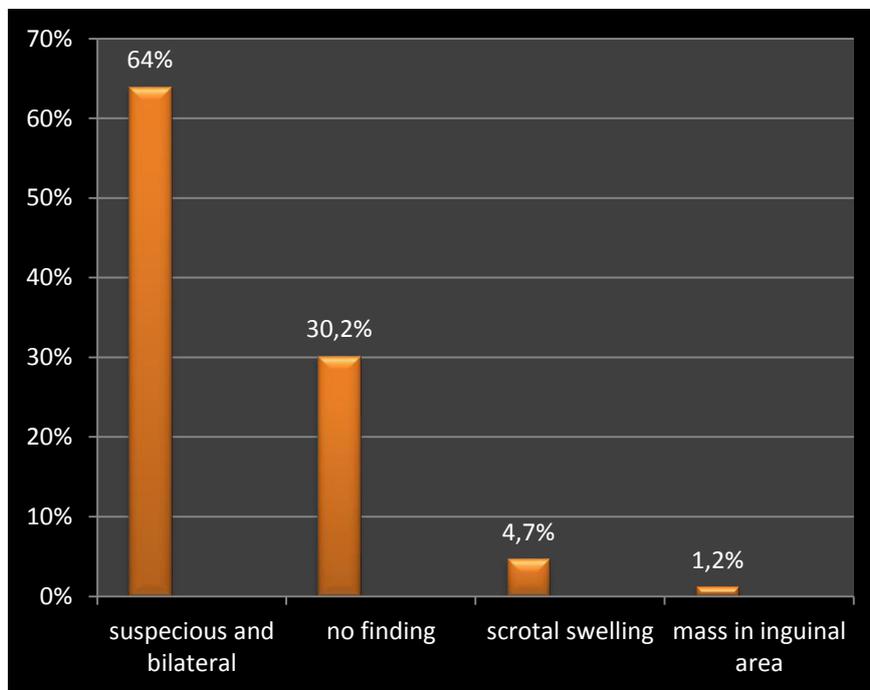


Figure 2. Frequency distribution of clinical findings.

Table-1: Results of sonography in the diagnosis of inguinal hernia of 86 patients under study.

Results	Number of cases
True positive	47
True negative	31
False positive	7
False negative	1

**Table-2: Sensitivity, specificity, accuracy, positive predictive value and negative predictive value of sonography in the diagnosis of inguinal hernia in 86 patients under study.**

indexes	%
Sensitivity	87
Specificity	78
Accuracy	77
PPV	98
NPV	82

**Table-3: Results of sonography in diagnosis of inguinal hernia (directly or indirectly).**

Results	Number of cases
True positive	35
True negative	0
False positive	2
False negative	2

**Table-4: Sensitivity, specificity, accuracy, positive and negative predictive value of sonography in the diagnosis of the type of inguinal hernia.**

indexes	%
Sensitivity	94
Specify	0
Accuracy	-6
PPV	94
NPV	0

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