

# Evaluation High-Resolution Sonography and Colour Doppler in assessment of Complicated Anterior Abdominal Wall Hernia

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## ABSTRACT

*Background: There are wide range of pathology affecting the anterior abdominal wall which range from simple fluid collection to hernias to complex neoplasms. Anterior abdominal wall hernias are the most common lesion of anterior abdominal lesions. The aim of the present study was to evaluate high-resolution sonography and colour Doppler in assessment of complicated anterior abdominal wall hernia. Patients and methods: This study includes (48) patients were referred for sonography due to vomiting and abdominal pain of unobvious cause. Patients were subjected to full clinical examination and high-resolution Ultrasound and Doppler examination and X-Ray for intestinal obstruction if needed. Results: Mean defect size of hernia associated with bowel ischemia was  $1.3 \pm 0.85$  cm while the bowel wall thickness mean was  $4.1 \pm 0.3$  mm, in contrary, the mean defect size of hernia with non-ischemic bowel was  $2.9 \pm 0.65$  cm and the bowel wall thickness mean was  $2.2 \pm 0.89$  mm. Among the studied group, Reduction of viable loops and herniorrhaphy were done in 45.8 % of patients, Reduction of viable loops and hernioplasty in 22.9% of cases, while resection and primary anastomosis were done in (14.6) of cases. The ultrasound finding comparing with the operative data revealed that ultrasound had 100% sensitivity, while accuracy in diagnosis of peristalsis, bowel irreducibility, bowel thickness was ranged from 93.4% to 98.8%. Also Doppler accuracy was 100% Conclusion: High-resolution ultrasonography (US) is non-invasive, safe and effective and simple diagnostic tool for detecting the presence of abdominal wall hernias and accurately detecting the content and the possible associated complications.*

*Keywords: Ultrasonography; Doppler; anterior abdominal wall hernia*

## Introduction:

Abdominal wall lesions often mimic intra-abdominal conditions and frequently present as palpable masses this is more common with patients who have a thick abdominal wall with a large layer of fat (1).

There are wide range of pathology affecting the anterior abdominal wall which range from simple fluid collection to hernias to complex neoplasms of the abdominal wall hence early detection of these pathology with use of high resolution USG and other cross sectional imaging have revolutionized the treatment options for the

surgeons. Anterior abdominal wall hernias are the most common lesion of anterior abdominal lesions (2).

The anterolateral abdominal wall encompasses two groups of paired muscles, those are the vertical recti abdominis muscles as a medial group and the flat (sheet) like muscles of the flanks including from exterior to interior, the external oblique, the internal oblique, and the transversus abdominis muscles (3).

Femoral hernia is a rare hernia that is more common in women, possibly because of pregnancy (4).

Umbilical and paraumbilical hernias involve protrusion of intraabdominal contents through a weakness at the site of passage of the umbilical cord through the abdominal wall (5).

Epigastric hernia occurs in the midline above the umbilicus till the xiphisternum. Diastasis of the rectus abdominis muscle often predisposes to epigastric hernias and fatty hernia of the linea alba (6).

Incisional hernia is an important type of hernia that is located at the scar from previous surgery as a delayed complication of abdominal surgery (4). The most common complications of abdominal wall hernias are bowel obstruction secondary to the hernia, incarceration, and strangulation. These complications can often be detected at clinical evaluation. Presenting symptoms may include abdominal pain, vomiting, and distention. Physical examination may reveal a firm, tender abdominal wall mass (7).

With the introduction of high-frequency, high-resolution probes, detailed examination and recognition of different layers of the abdominal wall are now possible on USG examinations. A high-resolution examination is capable of deciding whether an abnormality is in the abdominal wall or inside the abdominal cavity. Physical findings in abdominal wall pathologies have low specificity and often a clinically suspected intra-abdominal lump proves to be in the abdominal wall (8).

Doppler signals in the hernial contents and the presence or absence of peristalsis in the herniated bowel loop may be detected (9).

The aim of the present study was to evaluate high-resolution sonography and colour doppler in assessment of complicated anterior abdominal wall hernia.

### **Patients and Method:**

This study includes (48) patients were referred for sonographic evaluation of the abdominal wall and the abdomen of any age or sex when their clinical presentations were suggestive of abdominal wall hernia obstruction either progressed or not progressed to bowel obstruction, when their physical examinations were inconclusive. Also this study included a patient clinically presented with acute inguinal lump with suspected obstructed abdominal wall inguinal hernia, some cases were referred for sonography due to vomiting and abdominal pain of unobvious cause.

Patients with infected skin at site of hernia were excluded. There is no other exclusion to any patient as the Doppler US examination is totally safe. It is based on non-ionizing radiation, so it does not have the same risks as X-rays or other types of imaging systems that use ionizing radiation.

Patients were subjected to full clinical examination and high-resolution Ultrasound and Doppler examination and X-Ray for intestinal obstruction if needed. Ultrasound equipment included an LOGIC V5 unit with 2- to 4-MHz curved array and 7- to 11-MHz linear array transducers. Color Doppler sonography was performed using the previously mentioned linear array transducer.

A manual reduction of a hernia was done by asking the patient himself to reduce it if he could do this, but if he could not, the examiner asked the patient to lay down, then the hernia could be reduced spontaneously or by simple manipulations. Most of the examined hernias were totally or partially reducible; irreducibility is a sign of complication, either strangulation or incarceration, and this was only seen in one patient in our study.

Extended or panoramic views were occasionally taken to demonstrate the relationship between the lesion and the nearby structures in the abdominal wall. There were no needs for any abdominal preparation. Any abdominal wounds were cleaned and, if possible, covered by a thin, sterile, plastic adhesive membrane, or, more simply, the probe was covered by a sterile glove. The patients lied supine while their lower extremities were extended.

Color-Doppler analysis was done to increase diagnostic power of the method detecting circulatory alterations.

### Statistical analysis

The collected data were analyzed by computer using Statistical Package of Social Services version 24 (SPSS), Data were represented in tables and graphs, Continuous Quantitative variables e.g. age were expressed as the mean  $\pm$  SD & median (range), and categorical qualitative variables were expressed as absolute frequencies (number) & relative frequencies (percentage).

### Results:

According to demographic data, the mean age of the studied patients was  $47.5 \pm 21.88$  years old ranged from 3 months to 66 years old, (41.7%) of the studied patients were male and 58.3 % were females. The most frequent complaint in all of the studied sample was lump, about 1/3 of patients complaining of vomiting (31.3%), abdominal pain and constipation were found in 22.9% and 20.8% of the studied patients respectively (**Fig.1**)

Third of the studied cases were inguinal hernia (35.4%), (20.8%) Umbilical hernia, the incisional hernia either (Right lower Quadrant or Right Upper Quadrant or paraumbilical) were founded in (16.7%) of the studied patients, either paraumbilical hernia or femoral hernia were found in (10.4%) of the studied patients (**Fig. 2**)

When ultrasound was performed, 100% of the studied hernias were irreducible containing omentum, while hernias were containing bowel in 95.8% of cases, 41.7 % of cases contain free fluid in hernia sac, 47.8% of the studied patients had absent bowel peristalsis (**Fig.3**)

The Mean defect size of hernia associated with bowel ischemia was  $1.3 \pm 0.85$  cm while the bowel wall thickness mean was  $4.1 \pm 0.3$  mm, in contrary, the mean

defect size of hernia with non-ischemic bowel was  $2.9 \pm 0.65$  cm and the bowel wall thickness mean was  $2.2 \pm 0.89$  mm. Among the studied group, Reduction of viable loops and herniorrhaphy were done in 45.8 % of patients, Reduction of viable loops and hernioplasty in 22.9% of cases, while resection and primary anastomosis were done in (14.6) of cases (Fig.4).

Comparing the ultrasound finding with the operative data revealed that ultrasound had 100% sensitivity, while accuracy in diagnosis of peristalsis, bowel irreducibility, bowel thickness was ranged from 93.4% to 98.8%.Also Doppler accuracy was 100% (Fig.5).

A case of child 3 months, male patient, presented with irreducible right inguinal hernia. Ultrasound revealed a day before- us showed reducible hernia not reach scrotum, B, C & D at time of presentation, thick walled bowl loops (3.5 mm), free fluid within the hernia sac, hernia neck measuring 0.89 cm, arterial a and venous flow seen within the bowl wall. Diagnosis was incarcerated right inguinal hernia and the patient underwent reduction of viable loops then hernioraphy (Fig.6).

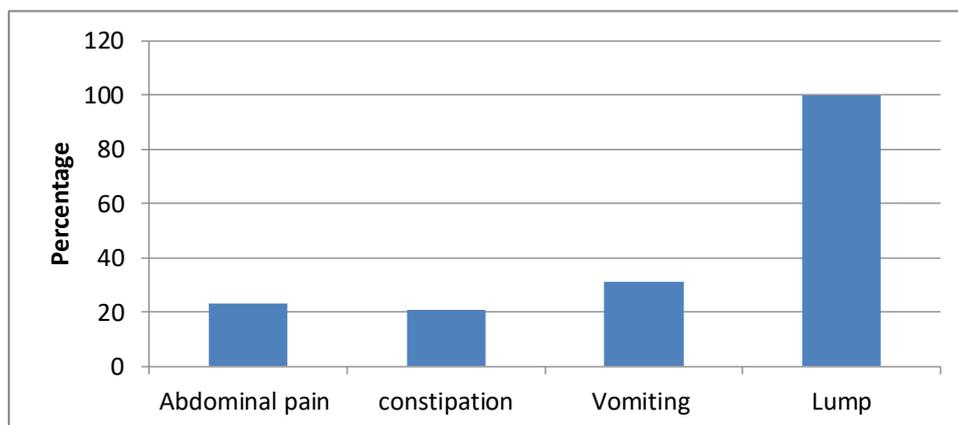


Fig. (1): Complain among the studied patients:

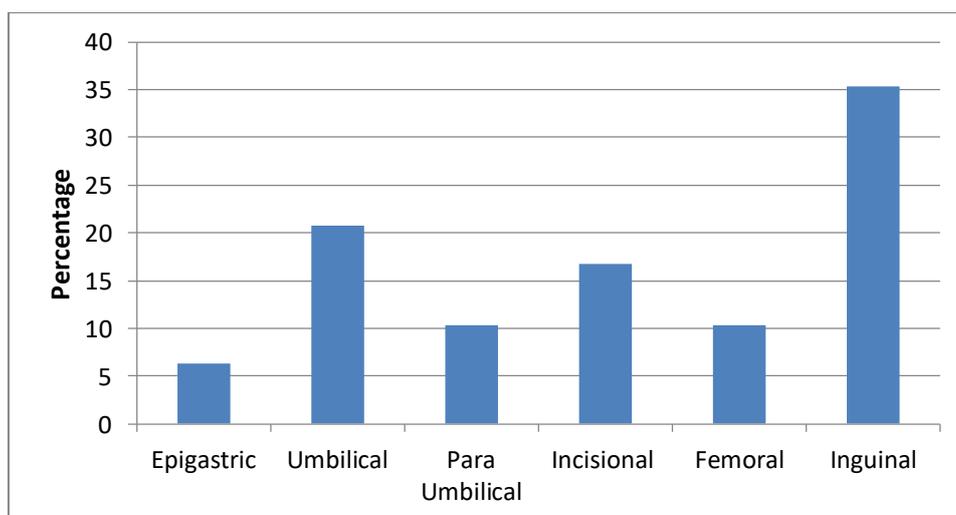
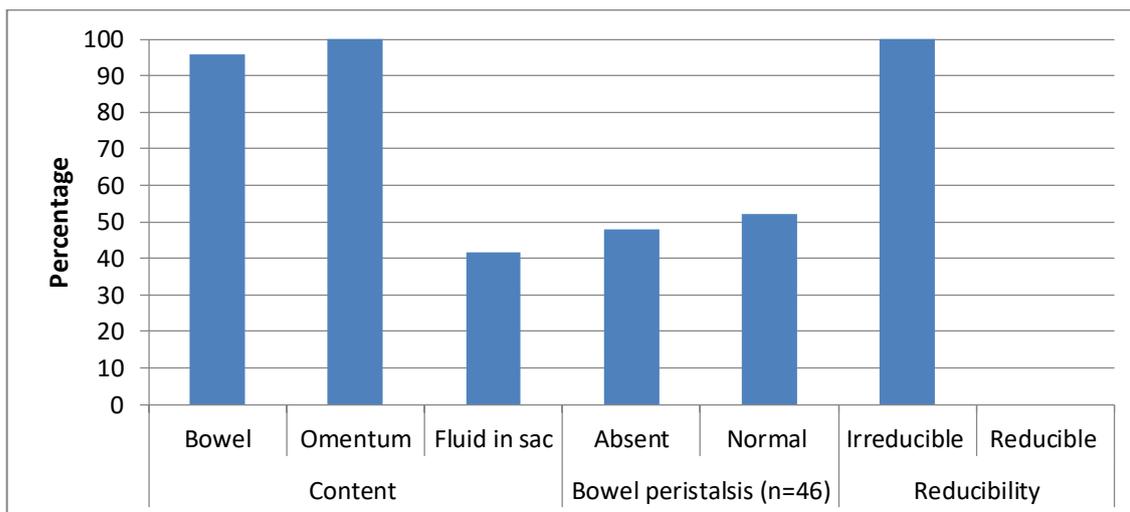
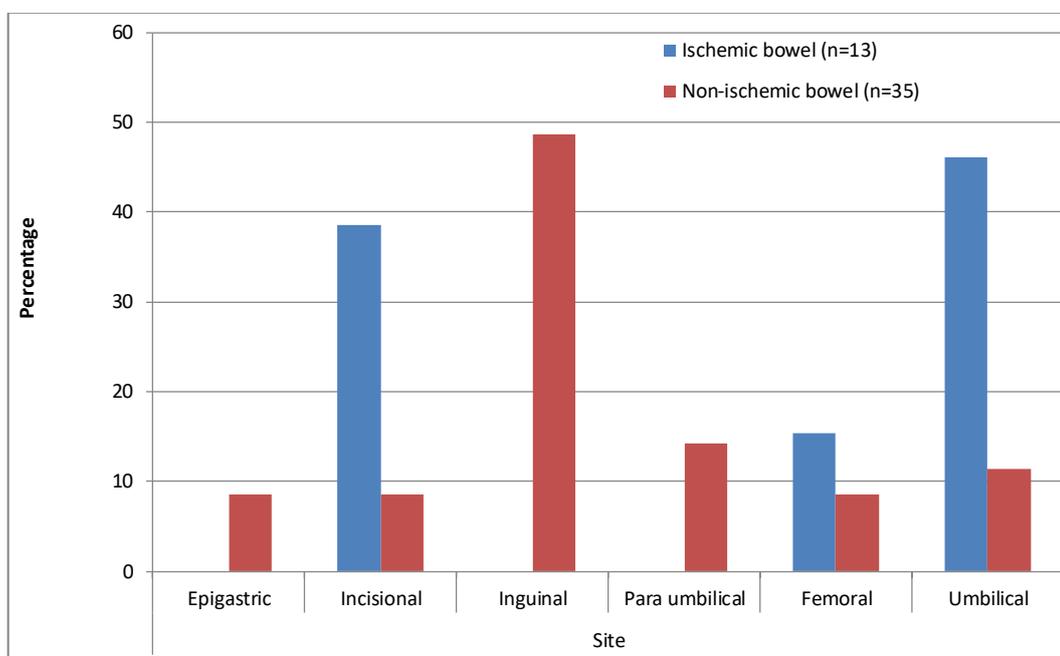


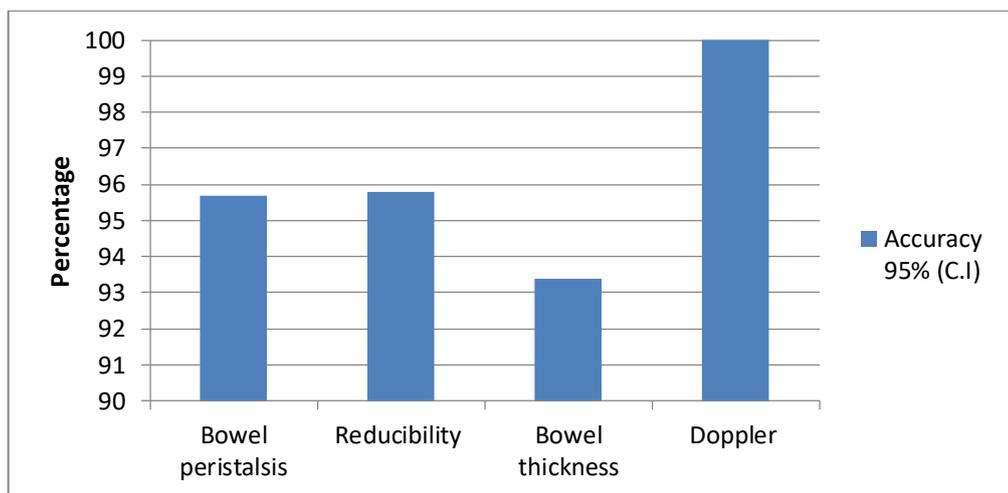
Fig. (2): Bar chart showing site of hernias among the studied cases.



**Fig (3):** Hernia U/S finding among the studied patients

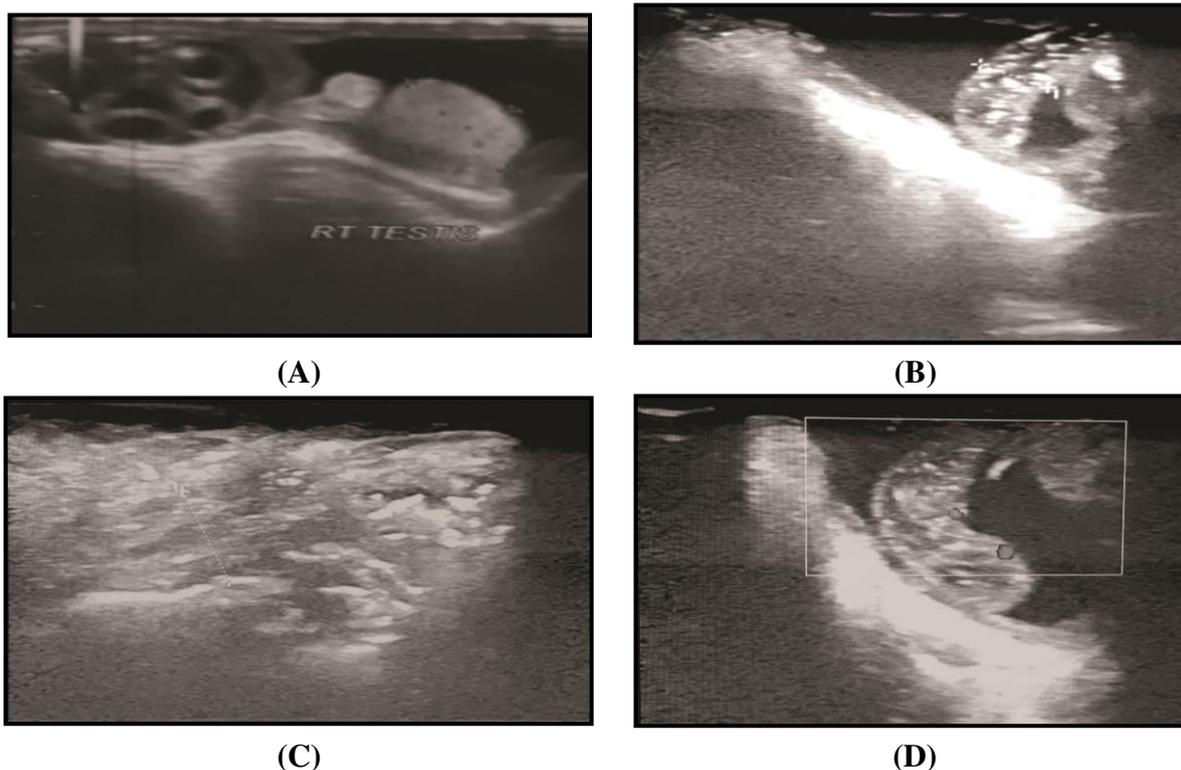


**Fig (4):** Percent of bowel ischemia among the studied cases



**Fig (5):** Accuracy of US diagnostic criteria in relation to operative finding among the studied patients

**Case (1)**



**Fig. 6:** Sonography evaluation of A child 3 months, male patient, presented with irreducible right inguinal hernia. Ultrasound revealed (A)- a day before- us showed reducible hernia not reach scrotum, B, C & D at time of presentation, (B) thick walled bowel loops (3.5 mm), free fluid within the hernia sac, (C) hernia neck measuring 0.89 cm (D) arterial a and venous flow seen within the bowl wall. Diagnosis was incarcerated right inguinal hernia and the patient underwent reduction of viable loops then herniorraphy.

**Discussion:**

Accurate clinical examination may be difficult or impossible in several situations due to pain, obesity or excessive scar formation, imaging studies become fundamental in these situations. (5)

In the present study, the main complaint was lump, 31.3% complain of lump plus vomiting, 20.8% complain of lump plus constipation, 22.9% complain of lump and abdominal pain. This agreed with result of **Baz et al., (10) and lee et al., 2013 (4)** who reported that the dominant presenting symptom was mass.

Regarding the type of a hernia, the current study showed that the predominant type of hernia was the inguinal hernia (35.4%) followed by the ventral hernia (31.2%), then the incisional hernia (16.7%) this was discordant with the results reported by **Baz et al., 2019(10)** who had documented that the ventral hernia was the frequent one (48.3%) followed by the inguinal type (38.7%). **Devareddy et al., 2016(11)** reported that incisional hernia (44%) was the frequent one followed by ventral hernias (14%) and this could be explained by the small sample size in both studies.

Our data suggest that the absence of blood flow in the contents of a hernia is the most important sign of strangulation because almost all strangulated hernias in our series (27%) had no detectable blood flow on color Doppler sonography. The patients in whom color Doppler sonography did not detect blood flow in the incarcerated bowel loop are patients with incarcerated hernia and bowel necrosis confirmed by surgery. This agreed with a study by **Devareddy et al., 2016(11)** which also found that color Doppler sonography was effective in differentiation between strangulated and non-strangulated hernias

Wall thickening of herniated bowel is an important sonographic sign of incarceration in our patients, yet it does not help to distinguish obstructed from strangulated hernias. Wall thickening indicated incarceration of the hernias containing bowel with an excellent specificity but with limited sensitivity. A cutoff point of 3.2 mm for wall thickening in this study was obtained. Wall thickening of incarcerated bowel may be explained by blood congestion and edema. This agrees with study by **Rettenbacher et al., 2001(12)** which found bowel wall thickening in the hernia, which was detected in 88% of the incarcerated hernias and in none of the non-incarcerated hernias.

Our study results showed that the absence of peristalsis should be considered a sign of incarceration because strangulated herniated bowel did not show peristalsis during the sonographic investigation in a relatively high percentage of patients and if peristalsis is present in an incarcerated hernia on sonography, bowel resection at surgery is probably not necessary. This agreed with a study by **Rettenbacher et al., 2001(12)** which reported that the presence of peristalsis is a good sign, as bowel resection may not be necessary, and disagree with it in that the absence of peristalsis should not be considered a sign of incarceration.

Free fluid in the hernia sac was another important sign of incarceration in our study. Free fluid is an eye-catching finding on sonography as there is great difference in echogenicity between the usually anechoic fluid and the surrounding tissue. This sign was a highly indicator for presence of complication. Free fluid in an incarcerated

hernia may be explained by transudation into the hernial sac caused by the compromised blood supply of hernial contents. Our study revealed that fluid in the hernial sac may be clear or turbid and septated. **Rettenbacher et al., 2001(12)** reported free fluid in 91% of the studied incarcerated cases and agreed that free fluid in the hernia sac is an indicator for incarceration.

Our study found that the presence of dilated, fluid-filled bowel loops in the abdomen was an indirect sign of an incarcerated hernia. This sign indicated incarceration but not strangulation of the hernias containing bowel. Dilated, fluid-filled bowel loops may be the only suspicious finding in patients who clinically presented only with vomiting, diffuse abdominal pain, or both. We observed this scenario in two patients in our study. Almost all patients with an incarcerated hernia containing bowel can be expected to have complete bowel obstruction. For the absence of this sign in a relatively high percentage of patients, that may be due to incomplete incarceration, some chyme passed through, the time from the onset of incarceration to diagnostic imaging was too short to develop dilatation of bowel loops in the abdomen. This agreed with a study by **Rettenbacher et al., 2001 (12)** which also found that intestinal obstruction may be an indirect sign for hernias incarceration and vomite may be the only presenting symptom. And study by **Liang et al., 2006(13)** who reported that hernias must be included in the differential diagnosis of acute abdomen.

Gas in the bowel wall or free gas, either in the abdomen or the hernia sac, is considered a sign of a complicated hernia, but in our study, no patient had such an advanced stage of an incarcerated hernia.

Our study revealed that by early diagnosis serious complications of incarceration can be prevented; also reduce the risk of emergency hernioraphy. The viability was important in choosing the treatment plan for hernia. Bowel viability was the main determinant as it affects the safety and the effectiveness of manual or surgical reduction. Manual reduction of the incarcerated hernia may convert the treatment plan from emergency surgery to an elective operation thereby decrease the mortality risk. We observed this scenario in two patients in our study. When color Doppler us showed a visible flow, manual reduction was attempted but if it was unsuccessful surgical reduction and repair were done. When color Doppler show absent flow which mean ischemia and necrosis surgical bowel resection was done immediately to preserve viable bowel. Our finding match those of **Young et al., 2007(14)** study who stated that US is useful to check for hernias when planning abdominal hernia surgical procedures, particularly large or multiple recurrent hernias.

### **Conclusion:**

High-resolution ultrasonography (US) is non-invasive, safe and effective and simple diagnostic tool that may limit the patients' exposure to invasive biopsies and to the hazardous exposure to ionizing radiation and contrast media administration with high accuracy for detecting the presence of abdominal wall hernias and accurately detecting the content, and the possible associated complications.

**Conflict of Interest:** No conflict of interest.

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