

## Original Research Article

# Dynamic ultrasound in evaluating the spectrum of anterior abdominal wall lesions

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### ABSTRACT

**Background:** Lesions in anterior abdominal wall are evident early and their clinical detection is easy. Ultrasonography is the first investigation for the patient clinically suspected to have an anterior abdominal wall lesion. This study evaluated the anterior abdominal wall pathologies using Dynamic ultrasound (USG) and compared the findings with surgical operative findings.

**Methods:** There were 100 consecutive patients of all age groups with clinically suspected anterior abdominal wall pathologies referred for USG of the abdomen were selected for this study.

**Results:** Our study showed a higher incidence of anterior abdominal wall pathologies in male patients (77 %) with an incidence of 41 % in the age group of >60 years. Hernias had an incidence of 93 % followed by undescended testis: 4 %, Divarication of recti: 2% and Rectus sheath hematoma: 1%. Inguinal hernia was the most common hernia with an incidence of 58%. The findings correlated with surgery and gave a sensitivity of 100 %.

**Conclusions:** Ultrasonography including Dynamic USG is a safe, quick, cost-effective, accurate and non-invasive modality for assessing the anterior abdominal wall lesions with a high sensitivity. Dynamic USG also helped to accurately measure the diameter of the neck and content of the sac which aided the surgeon in managing the repair of the hernia.

**Keywords:** Abdominal wall hernia, Anterior abdomen wall, Dynamic USG, Hernia, Ultrasonography

### INTRODUCTION

Lesions in the abdominal wall are evident early, and their clinical detection is easy.<sup>1</sup> However the abdominal wall being a laminated structure the exact anatomical location of the lesion and its extent requires further imaging for precise management.<sup>2</sup> Ultrasonography is the investigation choice for clinically suspected abdominal wall lesions.<sup>3</sup> Advantages of ultrasound are easy availability, portability, cost effectiveness, no known side effects, and real time capability. Interaction with patients and eliciting probe tenderness can further accentuate diagnostic accuracy. Dynamic ultrasound using Valsalva

and compression techniques further helps detect occult hernias, their contents, evaluate the neck and determine reducibility thus aiding in surgical management. This study described the various anterior abdominal wall pathologies using Dynamic ultrasound (USG) and compared the findings with surgical operative findings.

### METHODS

This was a prospective cross sectional study, performed over a period of 15 months (from August 2016 to October 2017) in Department of Radiology, Bharati Hospital, Pune, Maharashtra on 100 consecutive patients (23

women, 77 men, mean age 49.7 years, age range: 1 day-88 years) who complained of swelling and pain over abdomen wall. Most patients were able to perform daily activities. Pregnant female were excluded from the study. A written informed consent was taken from the patient. The patients underwent USG, followed by Dynamic sonography. Color Doppler was also performed.

**Sonography technique**

A Philips Affiniti 50 and 70 ultrasound machines (Philips, Amsterdam, Netherlands) with (5-12) MHz linear array transducer and curvilinear probes were used. The ultrasound assessment was performed in supine or standing position depending on the location of the symptoms. All the layers of abdominal wall scanned. Images were routinely obtained during a particular position or maneuver that patients associated with their condition, e.g. Hernias. The Valsalva maneuver was used liberally as a pro-vocative test during real-time evaluation. Frame captured from a cine clip also make sonographic findings more conspicuous and were preferred over static images. Care was taken not to apply too much compression with the probe as it could prevent herniation from occurring.

**Statistical analysis**

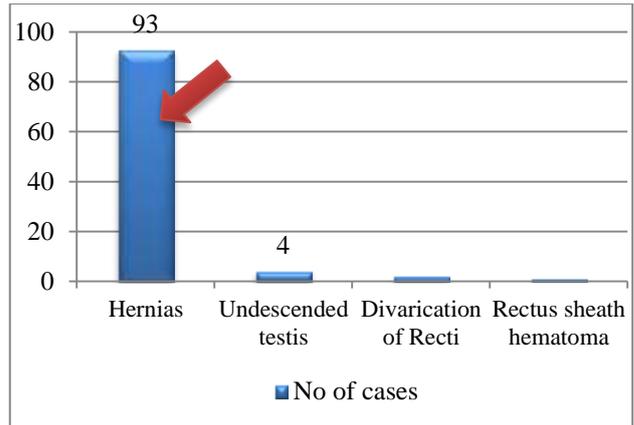
The collected data was coded and entered in Microsoft Excel sheet. The sensitivity, specificity, positive predictive value, negative predictive value and diagnostic accuracy were determined using statistic formulae. Ethical clearance was given by the Ethical committee, Bharati Vidyapeeth University (Deemed to be University), Pune-411043, Maharashtra.

**RESULTS**

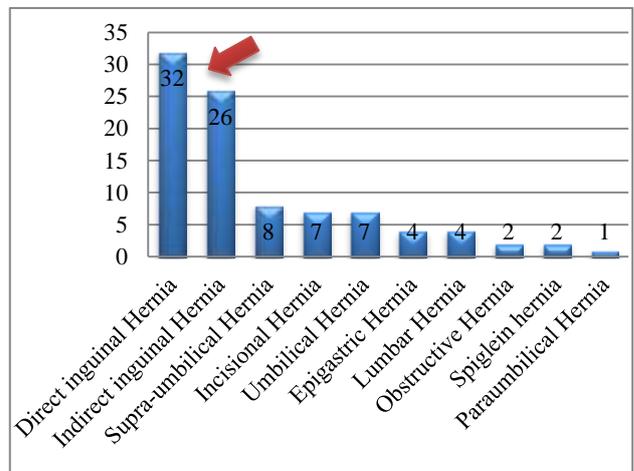
Our study showed high incidence of anterior abdominal wall pathologies in male patients (77%) with a high prevalence of anterior abdominal wall lesions in the age group of > 60 years of age with 41 patients (41%).

**Table 1: Demographics of the study.**

Variables	Total number of cases (n=100)
Mean age (years)	49.7
Sex	Males: 77%, Females: 23%
Commonest lesion	Inguinal hernia: 58% Direct: 32%, Indirect: 26%
Common symptom	Swelling
Most common content of the lesions	Fat
USG correlation with postoperative findings	Sensitivity: 100%



**Figure 1: Distribution of the pathologies involved.**



**Figure 2: Distribution of types of hernias.**

The various pathologies seen in the 100 cases of the study Hernias (all types): 93 %, Undescended testis: 4%,- Divarication of recti: 2 %, Rectus sheath haematoma: 1%. Inguinal hernia - direct and indirect was the most common anterior abdominal wall lesion seen in 58 (58%) out of 100 cases (Figure 1, 2). These findings were correlated with operative findings and gave a sensitivity of 100%.

**DISCUSSION**

Ultrasound is a highly accurate imaging modality for diagnosing anterior abdominal wall pathologies. Dynamic USG further augments diagnostic accuracy and management strategies. The use of this modality has increased exponentially. Lesions which were diagnosed on USG were correlated with surgical findings with a sensitivity of 100 %.

**Age**

Our study showed a high prevalence of anterior abdominal wall lesions in the age group of > 60 years of

age with 41 patients (41 %) belonging to this group. The mean age was 49.7 years (Table 1).

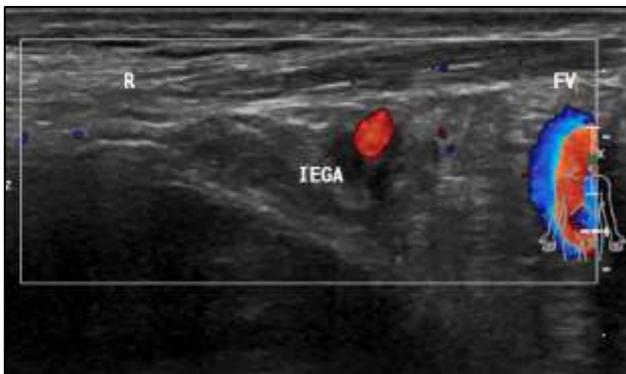
The higher prevalence of anterior abdominal wall lesions in this age group is that patients seek medical/surgical attention more frequently than other age groups. Rettenbacher et al, in a prospective study on 236 patients having anterior abdominal wall hernias showed that most of the patients belong to age group 50 to 60 years which is similar to our study.<sup>4</sup>

**Sex**

Gender wise prevalence of the anterior abdominal wall lesions showed that there was a high incidence of anterior abdominal wall lesions in males 77 out of 100 (77 %), majority being direct inguinal hernia, which is in consistent with study done by Edward et al, where there was a male predominance and inguinal hernias were one of the most common reasons a primary care patient needed referral for surgery due to the loss of abdominal muscular tone in the aging patient (Table 1).<sup>5</sup>

**Direct hernia**

Direct hernias occur due to weakening of the muscles and transversalis fascia in the Hesselbach triangle (Figure 3). Therefore, they are seen in the elderly with chronic conditions viz. COPD, chronic constipation increasing the incidence.



IEGA-Inferior epigastric vessels, FV-Femoral vessels. H-Hernia

**Figure 3: Direct inguinal hernia.**

In our study 32 (32 %) out of 100 patients were diagnosed to have direct inguinal hernia with male predominance (96%). These results are similar to that of Vasileff et al, whose study had 41 (87%) out of 47 cases being direct inguinal hernia.<sup>6</sup>

**Indirect hernia**

Indirect inguinal was the second most common groin hernia. The hernia arises lateral to the inferior epigastric vessels, lateral to the Hesselbach triangle, enters the inguinal canal then protrudes out of the external inguinal

ring and can extend through the external inguinal ring into the scrotum.

Our study showed 26 (26%) out of 100 cases of indirect inguinal hernia. Most of the patients belong to the adult age group 20 to 40 years of age. Shelley HJ, found indirect inguinal hernia in 50 % cases and most of the patients belonged to 20 to 40 years age group. The increased incidence is probably due to the increased muscular activity in this age group.<sup>7</sup>

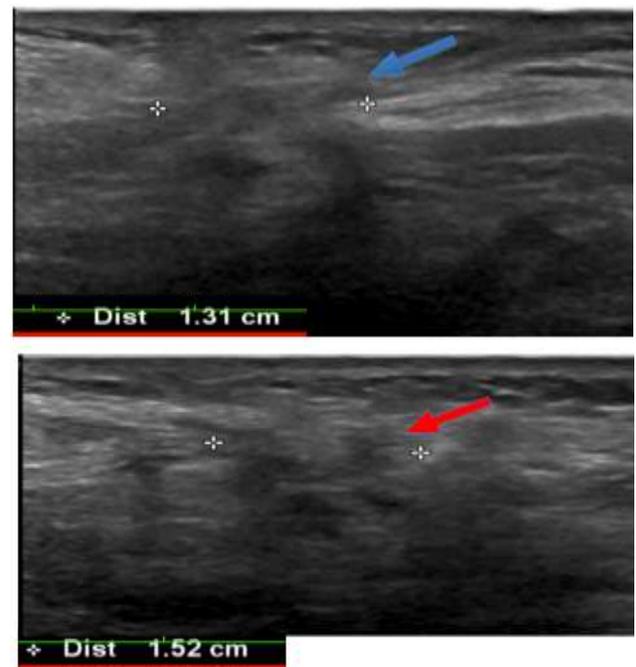
Out of 100 cases 60 % hernias were in the inguinal canal. 10 % extended beyond the external inguinal canal and 2 cases (2%) extended upto the scrotum.

**Role of dynamic ultrasound**

A dynamic scan was useful in determining the extent of the hernia and also gave an accurate measurement of the neck of the hernia. 2 cases of obstructive hernia were also seen. The neck was the obstructing area and Dynamic USG played a pivotal role in the diagnosis.

**Incisional hernia**

Incisional hernias are a common complication occurring after abdominal surgeries. In our study incisional hernia was seen in 7 cases and had a female preponderance (Figure 4). Kopperunde V et al, also found the same in 34 out of 35 (97%) patients.<sup>8</sup> The incidence is more in females due to the larger number of surgeries on the female genitourinary tract as compared to males.



**Figure 4: (A) USG at rest (Figure 2 A, Blue arrow demonstrate hernia) and on Valsalva (Figure 2 B, Red arrow demonstrate hernia), B) USG at dynamic.**

Gynecological procedures were the major contributing procedure for incisional hernia in our study almost 70 % followed by appendectomy (10%) cases. This concurs well with the study done by Clement et al, who had an incidence of 17 (70%) out of 24 cases of incisional hernia.<sup>9</sup> In our study, the most common site was lower midline (lower abdominal incision), which was involved in 90 % cases of incisional hernia.

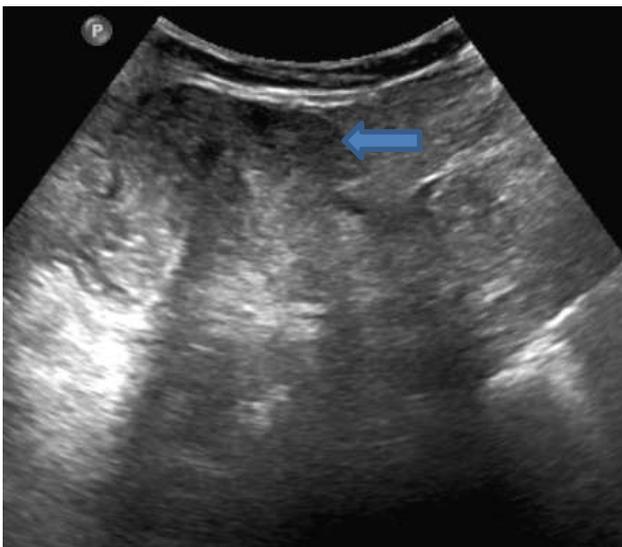
### **Lumbar hernia**

Lumbar hernia is a rare hernia. It involves postero-lateral wall of the abdomen. Our study had 4 cases (4%) of lumbar hernia with fat as its content. Pain was the most common non-specific presentation in these hernias and female predominance was seen our study. Surgery confirmed the diagnosis. USG gave 100% sensitivity in diagnosing the condition. This was in conformity with the study done by Mingolla et al, who found that lumbar hernia is rare but important to diagnose. Appropriate surgical treatment should be planned on the basis of etiology and hernia size.<sup>10</sup>

### **Other hernias**

We encountered 10 cases of supra umbilical, 7 cases of umbilical and 1 case of para-umbilical hernia Adult umbilical hernias are more common in women and in obese persons 10 (60%) out of 18 cases. 4 cases of epigastric hernia were detected in our study.

There were 2 cases of Spigelian hernia were also detected. Ultrasound with dynamic scanning was able to detect the mushroom like appearance of the hernia through the Spigelian fascia of the lateral abdominal wall the hernias were confirmed on surgery with 100% accuracy rate and further helped surgeon for management (Figure 5).



**Figure 5: USG image of Spigelian hernia (mushroom appearance at Spigelian fascia-blue arrow)**

### **Contents of hernial sac**

Fat, omentum or bowel was the most common content of hernia. In our study maximum hernias had fat as its content but in one pediatric case ovary was the content, which is a rare presentation. Ascitic fluid was also seen in the hernia sac.

### **Other conditions**

In our study 4 cases of undescended testis were found in inguinal canal and the testis were small in size (Figure 6). There was no change in the size of testis on dynamic USG. Further in our study, 2 cases of divarication of recti were evaluated. USG was able to give correct diagnosis which was confirmed postsurgery (100% accuracy). There was 1 case of rectus sheath hematoma. USG including dynamic maneuver was able identify and gave the exact location and nature of the hematoma. Surgery confirmed the diagnosis.



**Figure 6: USG image of undescended testis in inguinal region. No change in the size of testis on dynamic USG.**

### **Role of dynamic ultrasound**

Dynamic USG improved the morphological appearance of the lesion. In all cases it improved the visualization of the hernia and gave clarity of the content and as well as the blood supply, thereby aided in determining the viability. Dynamic USG also helped to accurately measuring the diameter of the neck of the sac, which aided the surgeon in his assessment during surgery especially while repairing the hernia.

### **CONCLUSION**

The study shows significant role of USG in diagnosis of lesions of abdominal wall. Ultrasonography including Dynamic USG is a safe, quick, cost-effective, accurate and non-invasive modality for assessing the anterior abdominal wall lesions. Dynamic studies helped to enhance diagnostic information especially in the

assessment of hernias in that it improved the visualization of the lesion, enhanced clarity of the contents and was able to determine the viability. Dynamic USG also helped to accurately measure the diameter of the neck of the sac which aided the surgeon in assessment during surgery and type of the repair of the hernia.

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