ORIGINAL RESEARCH PAPER

Volume-7 | Issue-10 | October-2018 | PRINT ISSN No 2277 - 8179

INTERNATIONAL JOURNAL OF SCIENTIFIC RESEARCH

ROLE OF HIGH RESOLUTION SONOGRAPHY IN EVALUATION OF ANTERIOR ABDOMINAL WALL LESIONS

Radiology

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ABSTRACT

INTRODUCTION: High resolution ultrasonography due to its cost effectiveness, easy availability, without ionizing radiation and accuracy makes it as supreme imaging modality in the evaluation of abdominal wall pathologies. Abdominal wall lesions mimic intra-abdominal conditions and frequently present as palpable masses. This is more common with patients who have a thick abdominal wall. There are wide range of pathologies affecting the anterior abdominal wall which ranges from simple fluid collections to complex neoplasms. Early detection of these pathology using high resolution USG and other imaging modalities has revolutionized the treatment options.

METHOD: A 100 sample was randomly selected irrespective of age and sex either attending the O.P.D. or admitted in the various wards of tertiary care hospital having abdominal wall lesion and positive ultrasonographic findings.

RESULTS: In our study incisional hernia was the most common anterior abdominal wall lesion followed by ventral hernias. The most common benign neoplasm was lipoma and the malignant tumour was metastatic nodule and abdominal wall sarcoma. Miscellaneous lesions were dermatomyositis and anterior abdominal wall haemangiomas etc.

CONCLUSION: USG is a sensitive diagnostic modality for making the diagnosis of anterior abdominal wall masses and this modality provides valuable guidance for diagnosis and follow-up.

KEYWORDS

High resolution sonography, anterior abdominal wall, abdominal wall hernia and tumour

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. Pathologic processes that may involve the abdominal wall occasionally raise diagnostic challenges because of the low specificity of physical findings. The most common situation when a sonographic examination of the abdominal wall is needed is when there is a doubt about a palpable abdominal mass to decide whether it is in the abdominal wall or inside the abdomen. Sometimes clinically suspected intra-abdominal mass proves to be in the wall, and sometimes an abdominal wall lesion is seen as an incidental finding on abdominal sonography performed for some other reason.

Often patients with chronic abdominal pain need an examination of the abdominal wall, especially when a positive Carnett sign suggests the cause of pain to be in the abdominal wall[1,2].

Carnett's sign is an eponymous finding on clinical examination in which acute abdominal pain remains unchanged or increases when the muscles of the abdominal wall are tensed. A positive test increases the likelihood that the abdominal wall and not the abdominal cavity is the source of the pain. A negative Carnett's sign is said to occur when the abdominal pain decreases when the patient is asked to lift the head; this points to an intra-abdominal cause.

With the introduction of high-frequency, high-resolution probes, detailed examination and recognition of different layers of the abdominal wall are now possible on high resolution sonography examinations. A high-resolution examination is capable of deciding whether an abnormality is in the abdominal wall or inside the abdominal cavity.

There are wide ranges of pathologies affecting the anterior abdominal wall which ranges from simple fluid collection to hernias to complex neoplasms of the abdominal wall, hence early detection of this pathology with use of high resolution sonography and other cross sectional imaging has revolutionized the treatment options for the surgeon.

High resolution sonography is cost effective, easily available and without ionizing radiation making it a supreme imaging modality in the evaluation of abdominal wall pathology.

METHODOLOGY

Total 100 cases of anterior abdominal wall lesions that were examined in the department of radiology during period of 18 month. These cases were evaluated using high resolution ultrasonography with high frequency linear array probe (3-12 MHZ). Convex probe (3-5MHZ) was used for bigger lesion.

SOURCE OF DATA: The sources of data for the study were patients from our tertiary care hospital.

INCLUSION CRITERIAS: Patients irrespective of age or sex either attending the O.P.D. or admitted in our tertiary care hospital, who were having abdominal wall lesion and positive ultrasonographic findings were included in our study.

EXCLUSION CRITERIAS

1. Patients unwilling to give consent.
2. Patients who are not having positive findings on ultrasonography.
3. Patients having groin masses were excluded from our study.

MACHINES: - Our study was undertaken using the following high end resolution machine –

1. PHILIPS HD11 XE USG MACHINE with Linear probe (3-12Hz) for superficial structures, Convex probe (2-5Hz) for obese patients and larger lesions.

STASTICAL METHODS: Diagnostic accuracy and efficacy of anterior abdominal wall lesion using high resolution ultrasonography were determined by comparing with operative and histopathological findings, by performing diagnostic validity tests like sensitivity and predictive values.

STATISTICALANALYSIS:

Statistical analysis was done by using validity. The sensitivity, specificity, positive predictive value, negative predictive value and diagnostic accuracy were determined using the following formulae.

Sensitivity = A\A+C.
Specificity = D\B+D.
Positive predictive value = A\A+B.
Negative predictive value = D\C+D.
Accuracy = A+D\A+B+C+D.
Where, **A=true positives,**

B= false positives,
C= false negatives
D= true negatives.

RESULT

1) Total of 100 patients having positive findings on ultrasonography and with inclusion and exclusion criteria as described previously in methodology were studied. All patients were subjected to high resolution sonography examination aided with colour doppler examination.
2) The final diagnosis was established in 84 cases by surgery and/or histopathology.
3) Age of the patients ranged from 8-68 years. The maximum patients were in found between 31-40 years of life i.e. 44 cases (44%) out of 100.
4) Female preponderance was observed in our study as 67 were females and 33 were male.
5) Among 100 clinically suspected cases of anterior abdominal wall lesions, the most common indication for high resolution sonography was incisional hernia.
6) Second most common indication for high resolution sonography was palpable abdominal lump which was relatively a non-specific clinical diagnosis.
7) High resolution sonography helped to characterize these abdominal lumps.
8) In our study incisional hernia was the most frequently encountered abdominal wall lesion seen in 44 cases (44%) and was more common in female population.
9) Second most common lesion in our study was ventral hernia i.e. 14 cases (14%). The various ventral hernias in our study were 8 umbilical hernias, 2 paraumbilical hernias and 4 epigastric hernias.
10) In our study most common benign neoplasm was lipoma 10 cases (10%), the other benign tumour being desmoid tumour i.e. 4 cases (4%).
11) The malignant tumour encounter in our study was metastatic nodule in 2 cases (2%) and abdominal wall sarcoma in 2 cases (2%).
12) Anterior abdominal wall fluid collection in our study were, abdominal wall seroma in 2 cases (2%) , anterior abdominal wall hematoma in 8 cases (8%) and abdominal wall abscess in 2 cases (2%).
13) In our study we found 4 cases (4%) of sebaceous cyst and 2 cases (2%) of abdominal wall endometriosis and 2 cases (2%) of pyomyositis.
14) The others miscellaneous lesions in our study were one case of dermatomyositis, one case of anterior abdominal wall haemangiomas and inguinal hernia with herniation of ovary.
15) In our study design diagnostic accuracy and efficacy of sonography in evaluation of anterior abdominal wall lesions was 97.6%.

CHART 1:- BAR DIAGRAM SHOWING DIAGNOSIS OF ANTERIOR ABDOMINAL WALLLESIONS ON HIGH RESOLUTION SONOGRAPHY

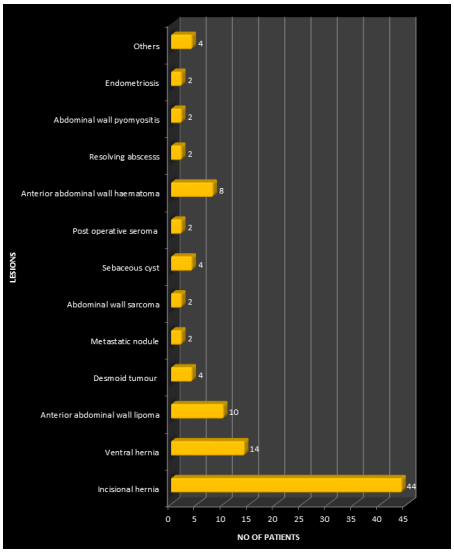

FIG 1: Transverse panoramic scan of normal anterior abdominal wall showing detailed anatomy. RA–rectus abdominis, EO–external oblique, IO–internal oblique, TA–transverse abdominis, LA-linea alba

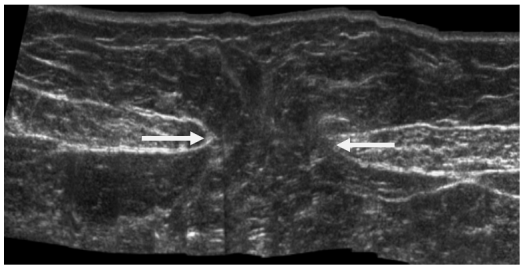

FIG 2:- Panoramic image of incisional hernia showing defect in the linea alba with lateral displacement of rectus muscle and herniation of omentum.

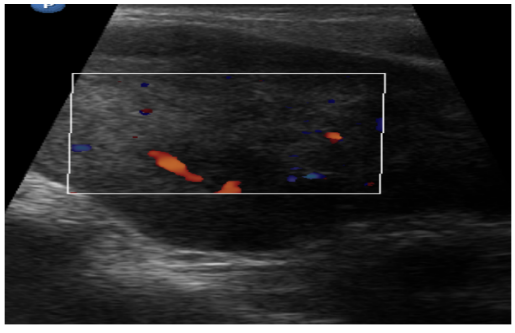

FIG 3: Desmoid : lobulated, hypoechoic solid mass lesion with mild vascularity on colour doppler study in the abdominal wall.

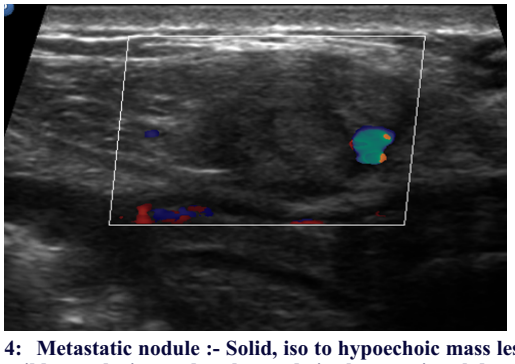

FIG 4: Metastatic nodule :- Solid, iso to hypoechoic mass lesion with mild vascularity on doppler study in the anterior abdominal wall region in a known case of carcinoma colon.

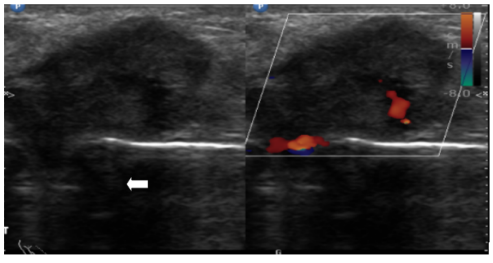

FIG 5(A, B): Sarcoma :- A) Irregular hypoechoic solid mass lesion involving rectus muscle in the paraumbilical region.

B) Lesion showing small breach in the posterior rectus sheath (marked with arrow).On colour doppler lesion shows mild vascularity

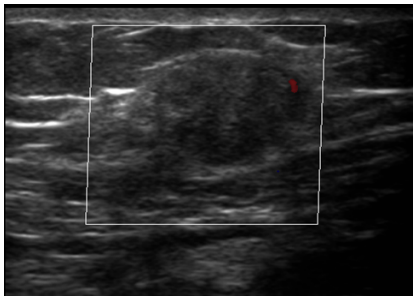

FIG6: Scar endometriosis: - Oval shaped, isoechoic solid mass lesion in a lower segment caesarean section scar in a patient with complaints of lump and pain at scar region during menses.

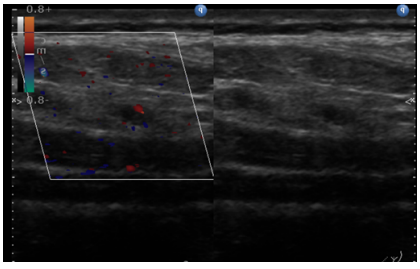

FIG 7 (A, B) Hemangioma: A) Ill-defined lesion involving the subcutaneous layer and external oblique muscle showing multiple anechoic cytsic areas in a patient having swelling over abdominal wall since birth. B) Colour doppler shows very minimal vascularity in some of these cystic areas

DISCUSSION

Anterior abdominal wall lesions often raise diagnostic challenge because of the low specificity of physical findings. High resolution sonography has lead to the better characterization and diagnosis of these lesions.We collected 100 cases of anterior abdominal wall lesions of various types over a period of 18 month. An operative and/or histopathological correlation was possible in 84 cases.

A) AGE:

In our study, age of the patients ranged from 8-68 years. The maximum numbers of cases were of the age group 31-40 years (44%) and mean age of 32 years. The youngest patient was 8 years old and oldest was 68 years old. Age distribution of the present study is comparable to **El-Sayed El-Mekkawy El-Sayed et al** where higher incidence was found in age group of 30-50 years(54%).(El-Mekkawy El-Sayed, Abd-Ella, & Zaian, 2015)

B) SEX:

Our study showed a higher incidence of anterior abdominal wall lesions in females i.e. 67 cases (67%).

Vast majority of studies in the literature have shown higher incidence of anterior abdominal wall lesions in females, majority being various kinds of incisional hernias. This could be explained by the higher incidence of surgeries likes caesarean section, laparoscopy and tubal surgery in females.

H. Ishida et al also found high incidence of abdominal wall lesions in females as compare to male i.e. 19 females(51%) and 18 males(48%).(4)

ANTERIOR ABDOMINAL WALL LESIONS DIAGNOSED ON ULTRASOUND

1) INCISIONAL AND VENTRAL HERNIAS

Our study showed a high incidence of various types of incisional and ventral hernias i.e. 58 cases out of 100 cases (58%).

This was comparable with study by **Priti Prasad Shah et al.** They found the most common variety of anterior abdominal wall hernia was incisional hernia(41%).(Shah, Dubhashi, & Choudhary, 2014) **El-Sayed El-Mekkawy El-Sayed et al** found incisional and ventral hernia as most common type of anterior abdominal wall hernia i.e. 26 cases (52%).The incidence of hernia were higher in females as compare to males.(El-Mekkawy El-Sayed, Abd-Ella, & Zaian, 2015) This study also correlated with our study.

Incisional hernia were more common in females as compared to male i.e. 42 females and 2 males. This finding were comparable with study done by **Priti Prasad Shah et al** which showed high prevalence of incisional hernia in female with female to male ratio of (F:M-2.3:1).(Shah, Dubhashi, & Choudhary, 2014)

Second most common hernia in our study was ventral hernia. The various ventral hernias in our study were 8 umbilical hernias (13%), 2 paraumbilical hernias (3.4%) and 4 epigastric hernias (6.8%). This was comparable with study done by **Priti Prasad Shah et al** in which they found various ventral hernia in decreasing order of frequency were umbilical (32%), paraumbilical (17%) and epigastric (10%).(Shah et al., 2014) Out of 58 patients, 54 patients underwent surgery. Operative findings showed that 40 hernia contained bowel loops, 10 hernia contained bowel loops and omentum and 4 were linea alba defect with herniation of fat.

One patient showing ovary in inguinal hernia was included in this study as the patient presented with abdominal wall swelling in right iliac fossa region. **Kamran A Malik et al found** left ovary with hemorrhagic cyst, left fallopian tube and broad ligament in a herniated sac in left inguinal region in their study.(Malik, Al Shehhi, Al Qadhi, Al Kalbani, & Al Harthy, 2012)

2) ABDOMINAL WALL LIPOMA

In our study we found 10 patients (10%) of abdominal wall lipoma. Out of 10 cases 8 were male and 2 were female.. In 8 patients (80%) the lesions were well defined and in 2 patients (20%) lesion were ill-defined. This was comparable with study by **Bhawan K. Paunipagar et al** in which they found margin was well-defined in 50 cases (78%) and ill-defined 14cases (22%).(Paunipagar et al., 2010) This study is comparable with our study.

All patients underwent surgery followed by histopathology in which diagnosis of lipoma was confirmed.

3) DESMOID TUMOUR

In our study we found 4 cases (4%) of desmoid tumour. All cases were found in female patient. All cases were in reproductive age group i.e. between 20-40 year, with mean age of 28 years. **Lefevre JH, et al** found 19 cases of desmoid tumour in reproductive age women(15-45 years) mean age was 30 years.(Lefevre et al., 2008)

All the female patients (100%) had operative history in past. **Bertani et al** observed operative history in all their patients with desmoid tumour.(Bertani et al., 2009) This is comparable with our study. We found one patient (25%) has family history of desmoid tumour which was comparable with study by **Lefevre JH, et al** who found family history in 21% of patients.(Lefevre et al., 2008).

On sonography the lesion appeared as lobulated, hypoechoic, solid mass lesion in the anterior abdominal wall. The lesion showed minimal to mild vascularity on colour doppler study. All the lesions were in intramuscular plane. All patients underwent surgery followed by histopathology, which confirmed our diagnosis.

4) METASTATIC NODULE

In our study 2 cases (2%) of metastatic nodule were noted which were similar to study done by **El-Sayed El-Mekkawy El-Sayed et al** in which they found one case (2%) in 50 patients**.** (El-Mekkawy El-Sayed, Abd-Ella, & Zaian, 2015)

Both were female patients. One patient was operated case of carcinoma of colon and the other of uterine leiomyosarcoma.

GandolfoN, et al found that the most common primary tumour to cause metastatic nodules in abdominal wall was colonic carcinoma. (Gandolfo N, Pretolesi F, Martinoli C, Crespi G, n.d.) This was comparable with ours study.

Both the lesions were present in rectus muscle, showed minimal to mild vascularity on colour doppler study. Both patients underwent surgery with histopathology which confirmed our diagnosis.

5) ABDOMINAL WALL SARCOMA

In our study 2 cases of abdominal wall sarcoma were noted. Both

patients were female patients (100%). Median age of abdominal wall sarcoma was in our study was 55 year which correlated with study done by **S. Salas et al** in which they found median age was 55.5 years.(Salas et al., 2009)

On sonography both lesions were seen involving rectus muscle and appeared fairly well defined, irregular and hypoechoic. One of the lesions was causing breach in posterior rectus sheath.

6) SEBACEOUS / EPIDERMOID CYST

In our study 4 cases of sebaceous cyst were noted. Two were male and two were female patients. Age group was in the range of 30-40 year. All the four lesions were present in subcutaneous plane.

On sonography these lesions appeared well defined in 100% cases and oval shaped in 75%. **Kim HK et al** found similar finding in which 96% of sebaceous cyst were well circumscribed and 78% were ovoid-shaped.(Kim, Kim, Lee, Racadio, & Shin, 2011)

All four patients underwent surgery with histopathology which confirmed our diagnosis of sebaceous cyst.

7) SEROMA

2 cases (2%) of seroma were found in our study. One patient had history of laparotomy for bowel resection and other has history of splenectomy**. El-Sayed El-Mekkawy El-Sayed et al** also found postoperative seroma in 2% of their patients. (El-Mekkawy El-Sayed, Abd-Ella, & Zaian, 2015) Post operative seroma developed after 20 days in bowel resection patient and after 2 month in splenectomy patient.

8) ABDOMINAL WALL HEMATOMA

There were 8 cases of anterior abdominal wall haematoma in our study. Six patients were male (75%) and two patients (25%) were female. 6 patients (75%) had history of blunt abdominal trauma and 2 patients (25%) were on anticoagulation therapy. **Klingler PJ et al** found 13 cases (56.52%) of abdominal wall hematoma after local trauma(Klingler et al., 1999) which correlated with our study.

However our study was not comparable with study of **Cherry, W.et al** and **Neblett WW 3rd, et al** in which they found that 69% of patients were on some form of anticoagulation therapy(Cherry & Mueller, 2006; Neblett, Pietsch, & Holcomb, 1988).

On sonography 4 patient of blunt trauma to abdomen showed diffuse thickening involving the muscles with irregular hypoechoic collection while in rest of 4 patients well defined hypoechoic collection with mobile internal echoes were noted.

9) ABDOMINAL WALL ABSCESS

In our study 2 cases (2%) of abdominal wall suture abscess were noted. **El-Sayed El-Mekkawy El-Sayed et al** also found abdominal wall abscesses in 2% of cases.(El-Mekkawy El-Sayed, Abd-Ella, & Zaian, 2015)

One patient (50%) was operated for abdominal malignancy(rectal malignancy) and second patient(50%) was operated for appendectomy 20 days back. On sonography both patients showed irregular, hypoechoic fluid collection in anterior abdominal wall. Linear echogenic structure was present within this collection representing suture fragments. Both patients underwent surgical procedure which confirmed our findings.

10) ABDOMINAL WALL PYOMYOSITIS

There were 2 cases of abdominal wall pyomyositis in this study. Both were male patients. Median age was around 14 year. Both patients had painful abdominal swelling and fever. This was comparable with study by **Edwin N Elechi et al** in which they found 9 cases were males and 2 were females with mean age of 11 years. (Elechi, Anyomi, & Elechi, 1988).

On ultrasonography small ill defined, hypoechoic collection with echogenic, thickened and bulky abdominal wall muscles were noted. No significant vascularity was noted on colour doppler study.

11) ABDOMINAL WALL ENDOMETRIOSIS

2 cases (2%) out of 100 were diagnosed as abdominal wall endometriosis. One patient had past history of caesarean section and other patient had history of pelvic endometriosis. Both patients had cyclical abdominal pain at the site of swelling during menses. One lesion was noted at caesarean scar and other lesion was noted at umbilicus.

Hensen J et al found that all patients had a history of at least one prior caesarean section and all presented with focal pain near the surgical scar, which was cyclical in nature. (Hensen, Van Breda Vriesman, & Puylaert, 2006). On sonography these lesions appeared well defined, hypoechoic, solid mass lesion and showed minimal vascularity.

Both the patients underwent surgery and histopathology which confirmed our diagnosis of endometrioma.

12) ABDOMINAL WALL CYSTICERCOSIS

There was one case of abdominal wall cysticercosis in our study. The Patient was a female of age 40 years. On sonography the lesion appeared as well defined, cystic lesion in the muscle layer. An echogenic structure was noted along the cyst wall that representing the scolex.

Amit Mittal et al noted two patterns of sonographic findings of abdominal wall cysticercosis. First one revealed a well-defined cystic lesion with an echogenic nidus in the subcutaneous tissue in the area of the swelling. In the second one there was a small cyst, with a surrounding hypoechoic area.(Mittal, Gupta, Mehta, & Gupta, 2008). In our study first pattern was noted.

Patient did not undergo any operative procedure for it.

13) ABDOMINAL WALL DERMATOMYOSITIS

Our study included a female patient of 40 years with dermatomyositis. She had history of progressive lower limb weakness. She also had rash on her face and trunk region. On sonography sheet like dense echogenic calcifications with extensive posterior acoustic shadowing were noted.

In a case report by **Bradley C Presley et al found** that patient presented with progressive weakness in his lower extremities. Patient also had complaints of joint pain and rash on his face, arms, and legs. On imaging calcifications were noted in the both rectus abdominis muscle, both external oblique and in subcutaneous fat.(Presley, Bush, & Watson, 2012)

The patient did not undergo any surgery or histopathological examination.

14) ABDOMINAL WALL HAEMANGIOMA

In our study we found one case of anterior abdominal wall haemangioma. Patient was a male of age 20 years. Patient had swelling over left hypochondriac region which was present since birth. High resolution ultrasonography showed an ill-defined lesion involving the subcutaneous layer and external oblique muscle showing multiple anechoic cystic areas and without phleboliths. Very minimal vascularity was noted in some of these cystic areas.

D Sharma et al on sonography found a mass lesion with sinusoidal channels in the left rectus muscle and delineated the feeding vessel from the left inferior epigastric artery.(D Sharma, R Prasad, Puneet, R Shukla, M Kumar, n.d.)

The patient did not undergo any surgical procedure.

CONCLUSION

High resolution sonography is a non-invasive, easily available and cost effective modality. A high-resolution sonography examination is capable of deciding whether an abnormality is in the abdominal wall or inside the abdominal cavity. It is extremely helpful in patients with inconclusive clinical presentations such as anterior abdominal wall lump. On performing high resolution sonography of anterior abdominal wall lesions the site of lesion, its size, margins, contents, the internal echo texture, presence of calcification and relation to adjacent structures can be evaluated well. Colour doppler also helps in characterising the lesion based on vascularity

High resolution sonography in hernias plays a fundamental role in characterising them and evaluating the presence of complications such as strangulation, incarceration or obstruction. It is also useful in

postsurgical and posttraumatic cases of fluid collection in anterior abdominal wall. Most of these patients require follow up scan and sonography is easily repeatable. It is also helpful in characterisation of neoplastic lesions of anterior abdominal wall.

In conclusion, high resolution sonography is a sensitive diagnostic modality for making the diagnosis of anterior abdominal wall lesions.

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