Original paper

Early Post-Operative Ultrasonographic Appearance of Implanted Mesh for Abdominal Wall Hernia Repair

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Abstract

Background: Mesh herniorrhaphy (open method or through laparoscopic approach) is a common surgical procedure. Identification of the mesh is necessary when abdominal ultrasound is performed. Scanty studies had been involved in the Ultrasonographic appearance of mesh in the early post-operative period.
Aim: to assess the ultrasonographic appearance of polypropylene meshes used for anterior abdominal wall hernia repair.
Patients and methods: Sixty five patients with different types of anterior abdominal wall hernias (epigastric, umbilical, inguinal and incisional) treated with mesh herniorrhaphy, were examined with ultrasound in the early post-operative period. Ultrasonographic appearance of the mesh including visibility of the mesh, regularity, twinkling and posterior acoustic shadowing were assessed.
Results: Sixty five patients were examined and most of them were males. All meshes were visible. Most meshes were wavy and showed posterior acoustic shadowing. Twinkling was rare.
Conclusion: Ultrasound is very useful in identification of the meshes implanted for hernia repair within the early post-operative period and can identify all implanted meshes.
Key words: ultrasonography, hernia, mesh.

Introduction

Ventral abdominal wall hernia repair is one of the most commonly performed surgical procedures through open or laparoscopic approach [1, 2]. Synthetic meshes are frequently used in these procedures [3, 4]. Assessment of the surgical site during the early post-operative period may be requested by the surgeon and so the identification of the mesh will be necessary. Identification of these meshes by different imaging modalities including US is inconsistent [5, 6] although US is better than CT in identifying polypropylene mesh [3, 7]. Studies discussing the early post-operative ultrasonographic appearances of the meshes are few.

Aim of the study: To characterize the US characteristics of the meshes used for anterior abdominal wall hernia repair.

Patients and Methods

This is a case series study of sixty five patients with different types of anterior abdominal wall hernias treated with mesh herniorraphy conducted in Safeer Al-Hussain surgical hospital, Kerbala, Iraq. All patients were examined, after explanation of the methods and individual consent, with ultrasound on the 7-10th post-operative day to look for and assess the visibility, regularity, twinkling and posterior acoustic shadowing of the mesh. All operations were done using polypropylene mesh. Operations were done by open surgery or

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by laparoscopic approach (trans-abdominal pre-peritoneal laparoscopy). Ultrasound examination was done by using GE US machine (Voluson 730). The examination was performed using two probes, a curved array probe (2-7 MHz) and linear array probe (6-12 MHz). Both probes were used for examination of all meshes and the appearance by one probe was regarded enough for recognition.

Results

Sixty five patients underwent surgical repair of abdominal wall hernias with mesh. Thirty three patients treated through laparoscopic approach and thirty two patients through open surgery. Most patients were male (80 %). Only one female had inguinal hernia, left sided, and was treated by laparoscopic approach while all other females had other types of hernias which were managed by open surgical approach (fig.1).

In the present study although all meshes are visible but some are ill defined, 2 (7%) meshes are ill defined with laparoscopic approach and 12 (38%) with open surgery.

All meshes done with laparoscopic approach were wavy while 12 (65%) of meshes with open surgery showed wavy appearance and the others were regular. Only 1 (3%) mesh showed twinkling in each group.

Shadowing behind the mesh seen in 28 (84.8%) of meshes in laparoscopic approach and in 24 (75 %) of open surgical repair cases (Fig. 2).

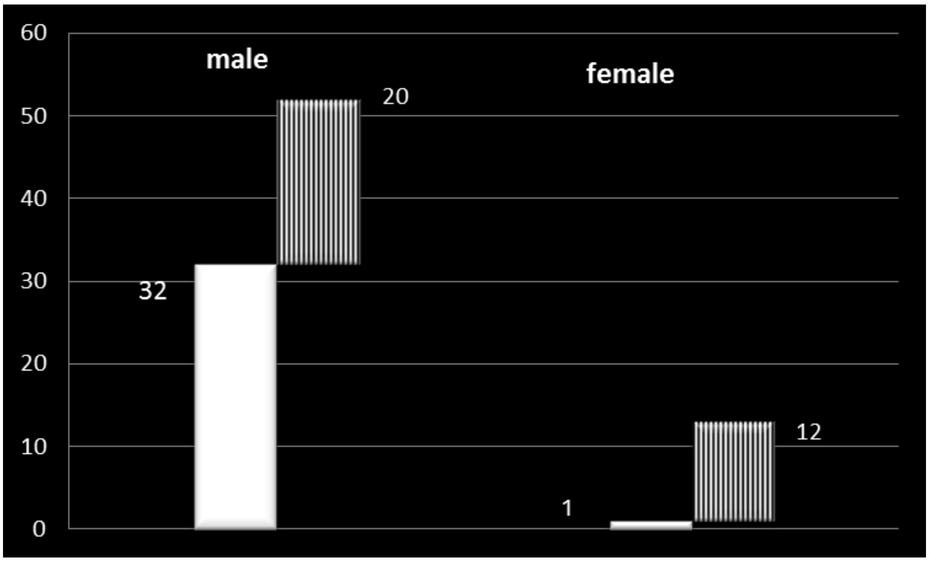

Fig. 1. Number of patients and sex distribution of patients

(Solid column represent patients with laparoscopic approach and shaded columns represent patients with open surgery approach)

The mean age for all patients was 43 years.

Table 1- mean age (year)

Std. Deviation	N	Mean; year
14.22640	65	43.2154

The mean thickness of the meshes was (1.88 mm).

Table 2- mean mesh thickness (mm)

Std. Deviation	N	Mean; mm
.34152	65	1.8846

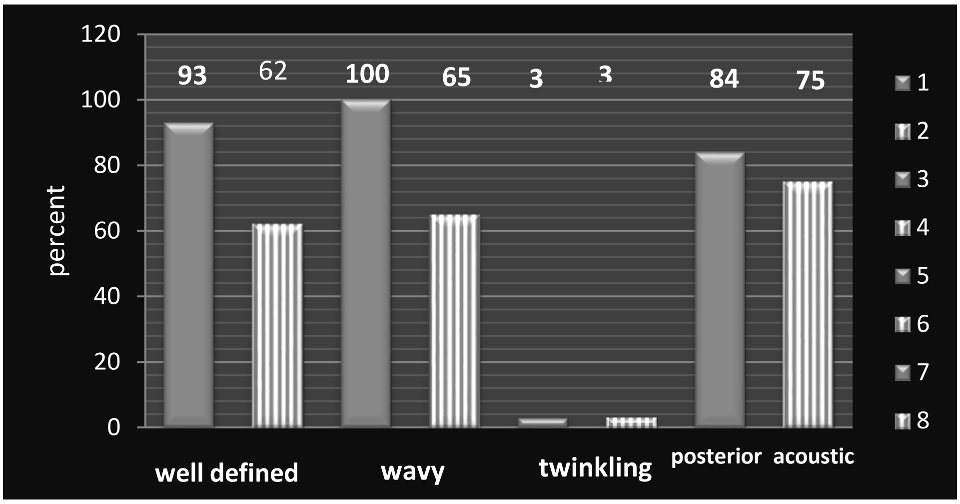

Fig. 2- Ultrasonographic characters of mesh. Solid columns represent laparoscopic repair while shaded columns represent open surgical approach

Discussion

Visibility of the mesh: All meshes were visible by at least one probe although some are ill defined. Other studies showed the mesh may be invisible due to the surrounding post-operative fibrosis which may have similar echogenicity to the mesh [8, 9] or due to native tissue incorporation within the mesh material [10]. Those studies include patients with long history of mesh implantation giving time for fibrosis and native tissue incorporation, while in our study all meshes were examined within the early post-operative period giving no time for fibrosis or tissue incorporation to develop. In the present study the previous knowledge of mesh implantation and surgical details make it easier and more confident to recognize the mesh.

In the present study although all meshes are visible but some are ill defined, (6%) with laparoscopic approach and (38%) with open surgery (Fig 2). This difference between the two surgical approaches regarding mesh ill definition may be explained by the fact that with open surgery there is more local inflammatory reaction and that meshes are surrounded by soft tissue on both sides making the visibility of mesh less well defined in open surgery approach

Thickness of the mesh: Actual thickness of the poplyproplene mesh is < 0.5 mm [11, 12]. The mean thickness of the meshes in our study is (1.88 mm) as shown in table 2. Mesh thickness (about 2 mm) was concluded by previous studies [13]. The increased thickness of the mesh seen on ultrasound is related to mesh shrinkage [14].

Echogenicity and Regularity of the mesh: In the present study meshes are echogenic, linear and most are wavy, 33 (100%) of meshes are wavy in laparoscopic surgery and 21 (65%) meshes in open surgical approach (Fig.3). Other studies showed similar findings regarding echogenicity of the mesh and wavy appearance [8, 11, 15]. The wavy appearance of the meshes may be due to mesh shrinkage as mesh material will undergo significant contraction after implantation particularly in the 1st three post-operative weeks[16, 17]. The difference in number of meshes that are wavy in both groups could not be explained. Although one study showed that mesh shrinkage was different between different surgical procedures [18]. One mesh showed acute angulation the pressing the anterior abdominal wall causing pain and tenderness on palpation (Fig.4).

Twinkling with Doppler examination: In one study [8] twinkling was seen in 79% of meshes. This study used different pulse repetition frequencies and different meshes with mean time of implantation (38 months), while in our study (only one PRF used) the twinkling was seen in only (3%)

of cases. This major difference seen in correlation with our study may be due to that in the early post-operative period the presence of inflammation may reduce the different tissue interfaces necessary for creating this artifact.

Posterior acoustic shadowing: Ultrasound beam will be attenuated behind strongly reflecting beam structures [19, 20] and produces the posterior acoustic shadow appearing behind these structures. This artifact can be useful for more confident identification of meshes [13, 15]. This is similar to our finding since most meshes showing posterior acoustic shadowing (75-84%) enabling a more confident localization with easier visual identification (Fig.5).

Conclusion

Ultrasound is very useful in identification of the meshes implanted for hernia repair within the early post-operative period and can identify all implanted meshes.

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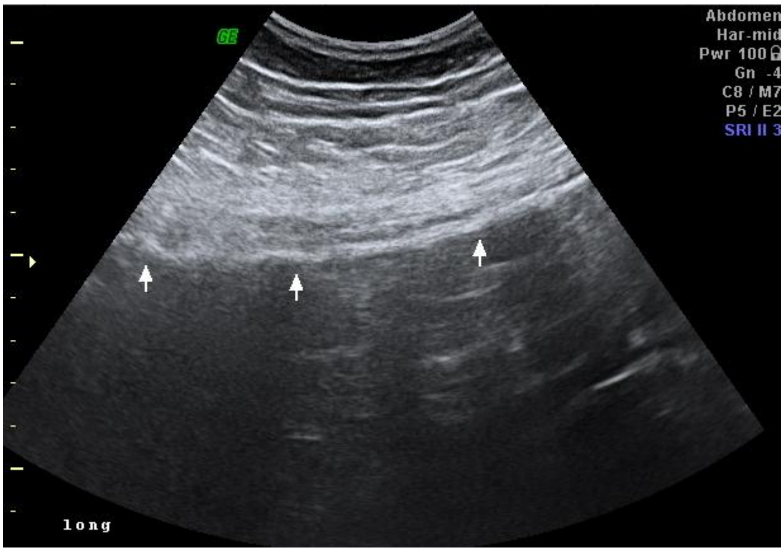

Fig.3- Mesh nearly regular

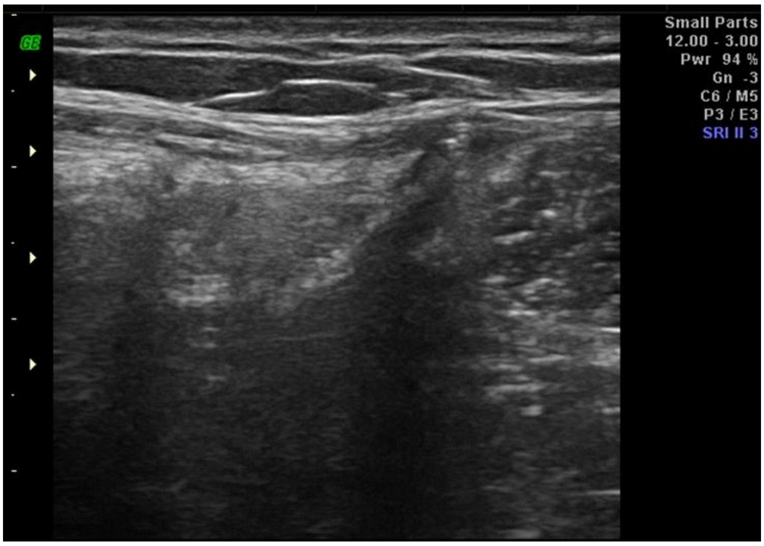

Fig.4- Mesh with acute angulation (spike like) causing pointing pain at the site of the angulation.

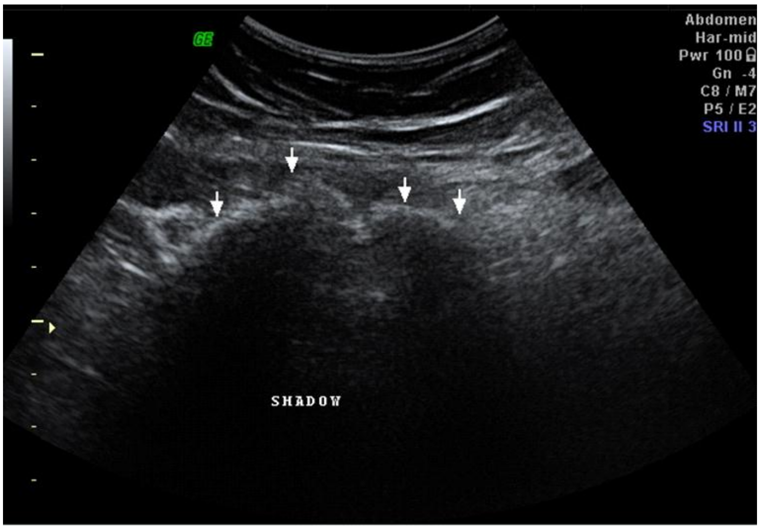

Fig. 5- Mesh with posterior acoustic shadow; wavy appearance

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