

An evaluation of *Aloe vera* leaves gel with polypropylene mesh to repair of ventrolateral abdominal hernia in rams

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Abstract

The presented article was designed to evaluate using polypropylene mesh alone and using *Aloe vera* gel for hernioplasty in rams. Under the protocol of sedations, local anesthesia, and strict surgical preparations, the 10 cm of experimental ventrolateral abdominal hernias were surgically induced in twenty-four rams. The animals were divided into two equal groups. Hernioplasty was done with polypropylene mesh in both groups. The first group remained without treatment and was considered the control group. In the second group, after hernioplasty the *Aloe vera* leaf gel spread equally along the repaired area, then the skin and subcutaneous tissues closed routinely. Clinical, Ultrasonographic, and Laparoscopic examinations were done. Clinically, all operative animals completely subsided the hernia ring. Laparoscopically, the results indicated less degree of adhesion and inflammatory reaction were occurs in the treated group at 45 days post-surgery. Ultrasonographic investigation in the control group at 30 days post-surgery exhibited Wavy echogenic representing inflammatory effusion. It represented Hypoechoic at muscle mass and mesh at 45 days, whereas in the treated group, the subcutaneous tissue appeared normal echotexture with a clear mesh at 45 days post-treatment. In conclusion, compatibility occurs between the implant and the edges of the hernia ring without signs of rejection, less degree of adhesion, and the hernia opening completely closed. The *Aloe vera* gel had a beneficial effect during hernioplasty in the ram.

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Introduction

A hernia defines as a protrusion of internal organs or tissues through a natural or acquired opening resulting in swelling of this area, the organ or tissues such as intestine, or other abdominal cavity content (1). Repairing massive abdominal wall hernias is still a real problem and a challenge to workers in surgery fields due to inadequate autogenously tissue for adequate abdominal wall closure with the highest incidence of recurrence being a common outcome. Hence, it is inevitable to avoid the use of prosthetic material in various species of animals such as biomaterials and these materials

must provide perfect strength without sensitivity reactions or immune rejection (2,3). The use of some prosthetic biomaterial for reconstruction of abdominal wall defects is gaining increasing recognition to achieve a tension-free repair. It has resulted in a significant reduction in postoperative pain, duration of the recovery period and the repetition of recurrence (4). A hernia could be repaired in different methods according to the size and location of the hernia. Firstly, a hernia reconstructs by primary closure by approximation the edge of hernia ring (herniorrhaphy) this method has some drawbacks as delay or non-healing as well as the incidence of recurrence (5). Various synthetic

materials such as carbon mesh, carbon fiber, nylon mesh and polypropylene and Marine Fish Acellular Dermal Matrices have been used for the reconstruction of hernias in ruminants in the clinical applications (6,7). Using polypropylene mesh may lead to various postoperative complications such as, adhesion, seroma, infection mesh extrusion, recurrence to reduce the occurrence of such potential complications, many biological materials are suggested and used to aid in the management of the reconstruction of abdominal defects (8,9). The *Aloe vera* plant was commonly used for the treatment of wounds, burnings, and infections. Many people in the world have used this plant for different purposes (10). It plays an important role in improving healing because it increases transversal connections among these bands rather than the creation of change in collagen structure and as a result accelerates wound improvement (11). Hernias were diagnosed perfectly by using different methods and techniques such as ultrasonography according to alteration in echogenicity which provides beneficial data about the nature of these swellings by differentiating solid from the architecture of cystic structures giving greater details that are not investigated in radiological and clinical evaluation (12,13).

The object of this study is to evaluate the role of *Aloe vera* in improving tensile strength and fibroplasia and reducing the incidence of adhesion and infection at the site of hernioplasty with polypropylene mesh in rams.

Materials and methods

Twenty-four healthy rams were included in the current study. The experimental animals were allocated into two equal groups. All sheep underwent strict preoperative preparation for inducing ventrolateral hernia under protocol of sedation with 0.01mg/ kg/B.W. 2% Xylazine (Alfasan, Holland), and local infiltration of lidocaine 3.4mg/ kg/B.W. (14).

Twelve cm incision vertically approached via skin reach to the underline subcutaneous structure and muscular layers, 10 cm diameter with circular resection of the muscular layer in ventrolateral of abdomen without opening the peritoneum layer, the edge of experimental defect sutured with simple continuous technique then the subcutaneous structure sutured with nonabsorbable suture material. The induced defect left for a month to accomplish the hernia process and establish its components. The hernia was repaired using polypropylene mesh 30*30 cm (Betatech®)-Turkey, with modified sub-layer technique, the margin mesh interposed between the peritoneum layer and transverse muscle in first group (control group). In the second group (treated group), after hernioplasty with polypropylene mesh the *Aloe vera* leaf gel spread completely along the repaired area then the skin and subcutaneous tissues closed routinely. The *Aloe vera* gel was prepared immediately at the time of

operation as fresh gel. Clinical, Ultrasonographic during the period 7-, 15-, 30- and 45-days post-surgery and Laparoscopic evaluation were done 45 days post-surgery.

Ethical approve

The Research was approved by Ethics Committee of Faculty of the College of Veterinary Medicine Medicine/ Mosul University No UM.VET.2021.055.

Results

The hernia was successfully induced in all operative rams without apparent complications, only mild seroma and edema which subsided gradually during a few days post operation. Clinically there were signs of redness, and mild swelling at the site of operation, all of these signs subsided during 3-4 days post-surgery. Directly post-surgery the clear swelling developed just at the ventro lateral abdomen in all operated animals which represented ventro- lateral hernia (Figure 1). The signs of hernia as swelling, during the palpation their hernia ring these signs which disappeared after thirty days post hernioplasty with polypropylene mesh (Figure 2).



Figure 1: induced ventro-lateral abdomen hernia one month later.



Figure 2: 30 days post hernioplasty with polypropylene mesh.

Laparoscopically shows less degree of adhesion was detected around the implant and the underlying tissues in the treated group at 45 days post-surgery (Figure 3). The compatibility occurs between the implant and the edges of the hernia ring without signs of rejection and the hernia opening completely closed. Whereas laparoscopic investigation 45 days post-surgery in the control group show a moderate degree of adhesion between repaired hernia area and internal organ (Figure 4).

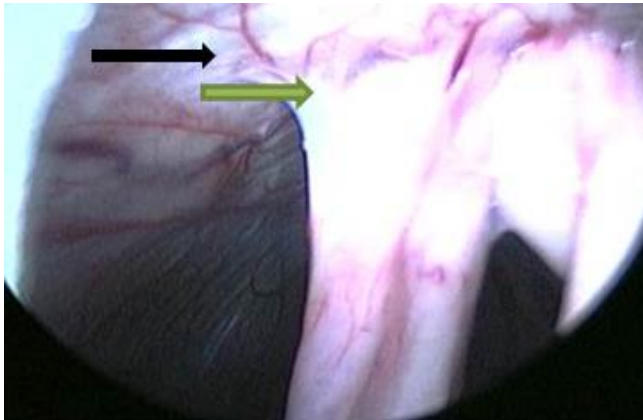


Figure 3: Laparoscopic investigation 45 days post-surgery in the treated group show less degree of adhesion (green arrow) between repaired hernia area and internal organ, black arrow.

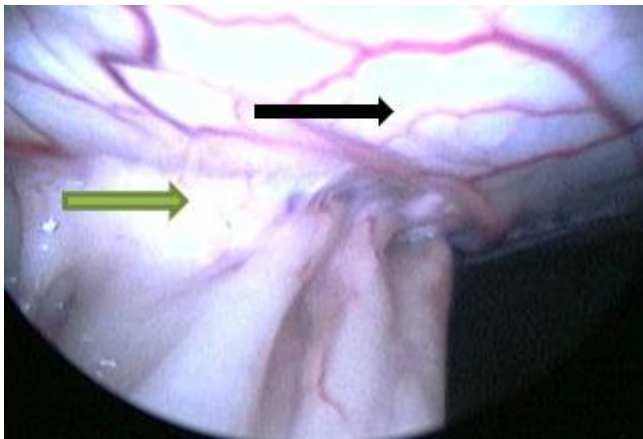


Figure 4: Laparoscopic investigation 45 days post-surgery in control group show a moderate degree of adhesion (green arrow) between repaired hernia area and internal organ black arrows.

Ultrasonographic examination at zero-time pre operation show Normal echo texture of the muscle's fiber (white arrow), Mesh (black arrows) without any inflammatory reactions and exudate (Figure 5). In control group with only polypropylene mesh 7 days post hernioplasty exhibited

accumulation of inflammatory exudate this appears as Hypoechoic echo texture above (white arrow) and under mesh (black arrow) which appear as an echogenic line, increases the thickness of subcutaneous and muscle mass (Figure 6).

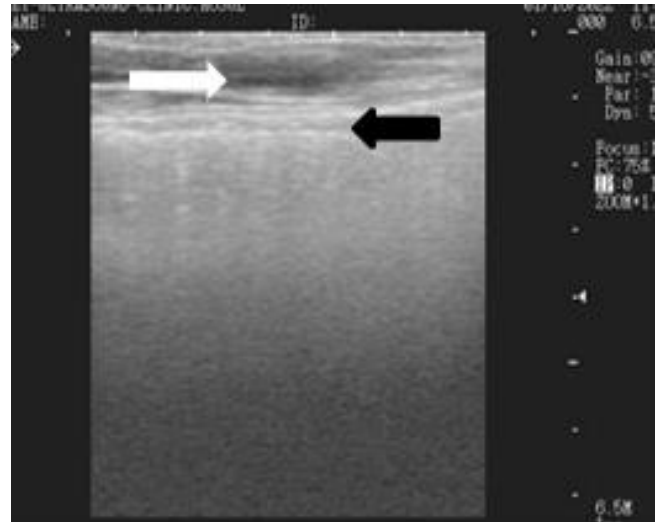


Figure 5: 0 day time, represented Normal echotexture of the muscle (white arrow), Mesh (black arrow).

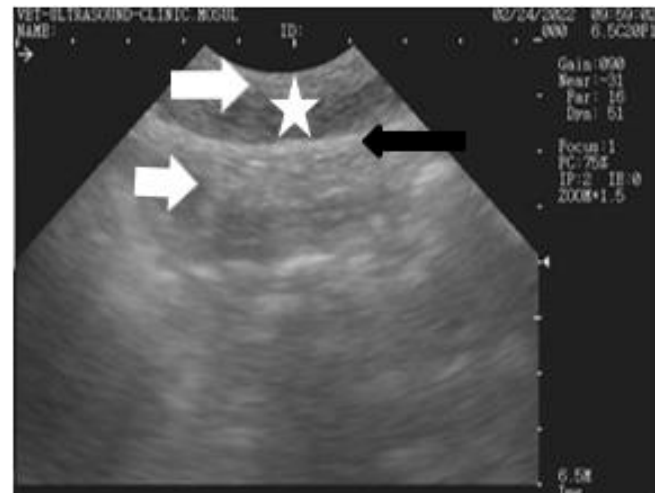


Figure 6: 7 days post implantation in control Hypoechoic (inflammatory exudate) matter (white arrow) above and under mesh which appear as echogenic line (black arrow), increase the thickness of subcutaneous and muscle mass (white star).

At 15 days post operation in the control group the ultrasonographic image exhibited hypochoic areas of different shapes (white arrow) represents exudates spread in homogenous mid echogenicity tissue indicate increase

thickness of muscles tissue and mesh (Figure 7). In 30 days, post operation in the control group exhibited a Wavy echogenic line representing mesh (white arrow) float in the hypoechoic area (black arrow) representing inflammatory effusion (Figure 8). In 45 days, post operation in the control group imaging reveals Hypoechoic in muscles mass (white arrow) and mesh (black arrow) (Figure 9).

In the treated group, at 7 days post operation imaging a Hypoechoic area (white arrow) of exudates with echogenic areas of granulation tissue (thin white arrow), and Mesh (black arrow) (Figure 10), Whereas at 15 days post treatment there was Echogenic areas of fibrosis, granulation tissue (thin white arrows), Mesh (black arrow) (Figure 11). At 30 days post treatment subcutaneous tissue with Hypoechoic areas of exudates (white arrow) mash (black arrow) (Figure 12). At 45 days post treatment subcutaneous tissue appears normal echotexture (white arrows) with a clear mesh (black arrow) (Figure 13).

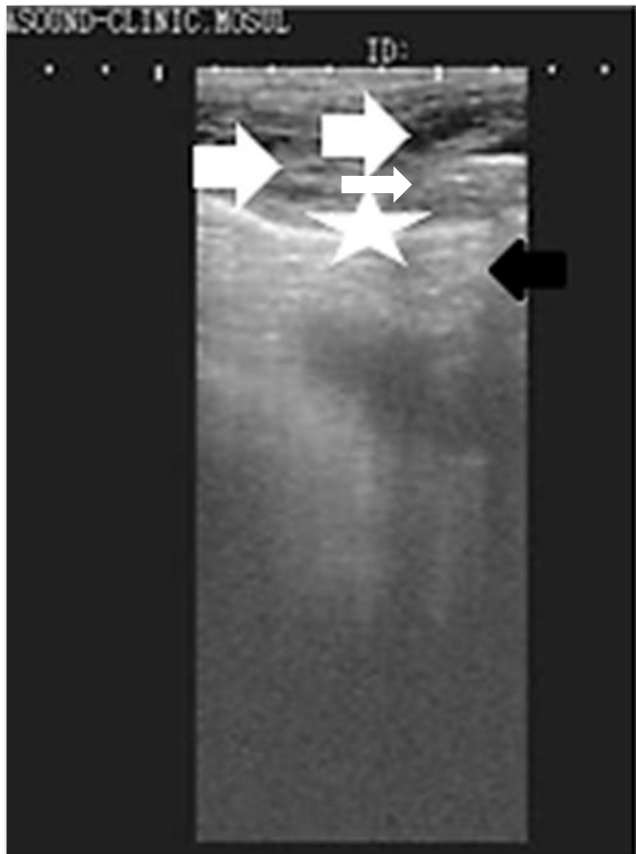


Figure 7: 15 days post operation - control Hypoechoic areas of different shapes (white arrow) represents exudates spread in homogenous mid echogenicity tissue (white star), increase thickness of muscles tissue, mesh (black arrow).

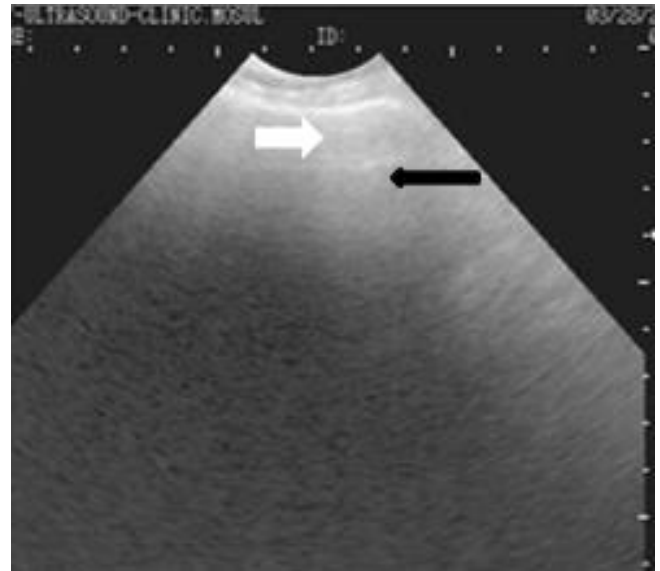


Figure 8: 30 days post operation control, Wavy echogenic line represents mesh (black arrow) float in the hypoechoic area (black arrow).

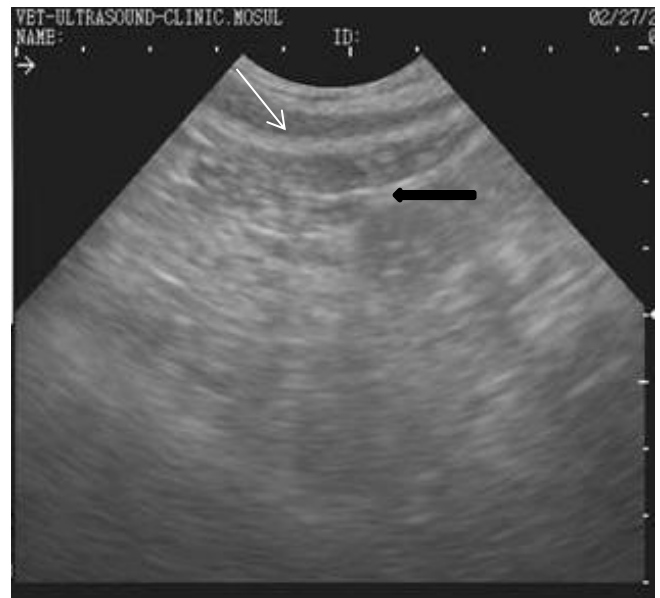


Figure 9: 45 days post operation in control group. Hypoechoic muscles mass (white arrow) with hypoechoic Mesh (black arrow).

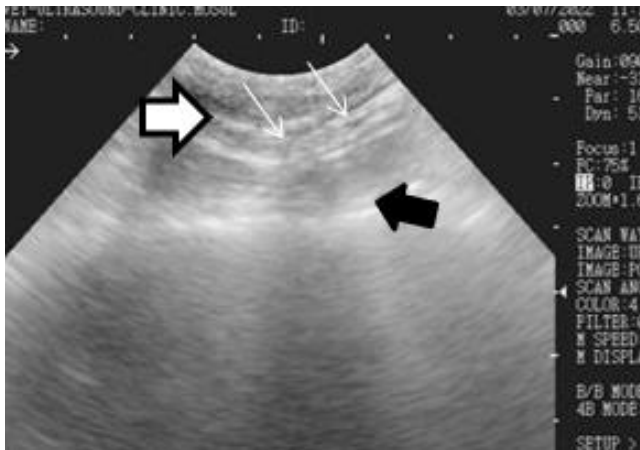


Figure 10: 7 days post operation in treated group hypoechoic area (white arrow) of exudates with echogenic areas of granulation tissue (thin white arrow), and Mesh (black arrow).

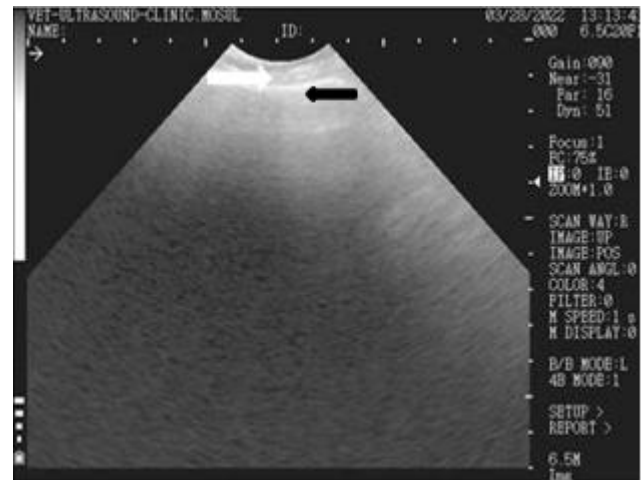


Figure 13: 45 days post treatment subcutaneous tissue (white arrows) mesh (black arrow).

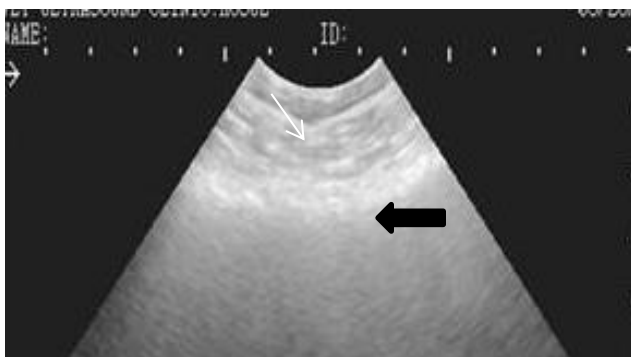


Figure 11: 15 days post operation Echogenic areas of granulation tissue (thin white arrows), Mesh (black arrow).

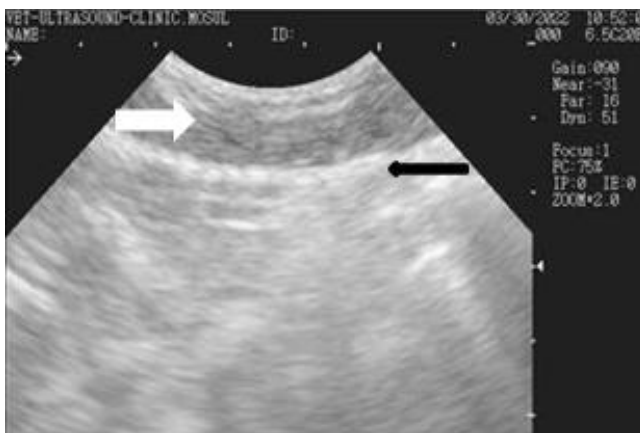


Figure 12: 30 days post treatment subcutaneous tissue with hypoechoic areas of exudates (white arrow) mesh (black arrow).

Discussion

A hernia may be acquired or congenital. In sheep acquired hernia occurs mainly abdominal hernias due to horning from another ram. In the current study, the control group clinically evidenced signs of pain, depression, dullness, swelling attributed to inflammatory reaction as a response to trauma and rough manipulations of the tissue these observations agree with Bauer, Al-Sobayil (15,16). Several biomaterials were developed to accelerate and improve the progression of the healing process in repairing hernia as the freshwater fish acellular dermal matrix for repairing hernia in buck (7). In both groups, the implanted tissue (polypropylene mesh) showed a very poor immune response in the host this may be due to the low antigenicity of this implant these results and also considered with Meade (17). In the current study, there aren't infection in the treated group this might be due to using the *Aloe vera* which help in infection tolerance and decrease the possibility of bacterial contamination at the surgical site and improve wound healing this coincided with Hekmatpou (18), who reported about using *Aloe vera* as antibacterial, anti-viral, anti-inflammatory (19).

Laparoscopy now is the slandered devise for examination and treatment method which permits visualization, and reduce risk of bleeding less time consuming (20). In our study laparoscopic examination at 45 days post-surgery show degree of adhesion between omentum, repaired site and internal organ with less degree in treated group compare with control group this considers advantageous for sealing incision this played a role in preventing leakage and serous contamination in the treated group there were no complications and less adhesion this might be due to the role of *Aloe vera* as a bioactive material (10).

Ultrasound has the benefits of a noninvasive technique used for monitoring postoperative tissue healing (21) as investigation technique for repaired Achilles tendon rupture (22) and experimental cystotomy of urinary bladder in dogs (23). It plays an important role in the investigation and monitoring of operation along and post-surgical treatment, so this technique permits examining and identifying the status of mesh, diagnosis of complications such as post-operative seroma and wound dehiscence (24). In the treated group, the granulation tissue begins from the second week and fibrosis appear at 30 days which indicate the usefulness of *Aloe vera* in accelerating healing process due to the complete healing at 45 day the subcutaneous tissue appears normal echotexture with a clear mesh. From results of ultrasound at zero time the Mesh appear as thin echogenic white colored line inside the homogenous midechogenicity muscle mass, thereafter, re-examination with ultrasound of control group there were a hypoechogenic areas indicate inflammatory process with exudate accumulation around the Mesh, furthermore in treated group the hypoechoic areas appear early during the experiment then disappear and replaced by echogenic areas represents granulation tissue from the second week.

Conclusion

In conclusion, the compatibility occurs between the implant and the edges of the hernia ring without signs of rejection, less degree of adhesion and the hernia opening completely closed. The *Aloe vera* gel had beneficial effect during hernioplasty in ram.

Acknowledgments

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Conflict of interest

None.

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تأثير تقييم هلام أوراق الصبار وشبكة البولوي بروبيلين على إصلاح الفتوق البطنية الوحشية في الكباش

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الخلاصة

صممت الدراسة الحالية لتقييم استخدام شبكة البوليمر لوحدها أو مع استخدام مستخلص هلام الصبار لإصلاح الفتوق في الكباش. تحت التسدير العميق والتخدير الموضعي والتحصيرات الجراحية الشديدة تم إحداث فتق بطني (جانبي بطني) تجريبي بقطر ١٠ سم في ٢٤ كباش. قسمت الحيوانات الى مجموعتين متساويتين. تم رأب الفتق باستخدام شبكة البولوي بروبيلين في كلتا المجموعتين. في المجموعة الأولى فقط استخدمت شبكة البولوي بروبيلين واعتبرت مجموعه سيطرة. أما في المجموعة الثانية فبعد إجراء رأب الفتق باستخدام البولوي بروبيلين تم نشر هلام الصبار بشكل متساوي على الشبكة وحواف الشبكة وتم غلق الجلد والنسيج تحت الجلد بشكل روتيني. تم إجراء الفحص السريري وفحص الأمواج فوق الصوتية والفحص المنظاري. سريريا اختفت معالم وحلقة الفتق تماما. اثبت الفحص المنظاري وجود اقل درجة من الالتصاقات والالتهاب خاصة في المجموعة المعاملة بمستخلص هلام الصبار بعد ٤٥ يوما بعد العملية الجراحية. أظهر الفحص بالموجات فوق الصوتية في مجموعة السيطرة عند ٣٠ يوما بعد العملية الجراحية موجات صدى تمثلت بالانصباب الالتهابي حيث حصل نقص الصدى في كتلة العضلات والشبكة المستخدمة خلال ٤٥ يوما بعد المعالجة بينما في مجموعة المعالجة اظهر الفحص صدى طبيعي لنسيج تحت الجلد وظهور الشبكة بشكل واضح خلال ٤٥ يوما. خلاصة ذلك حصول توافق بين الشبكة المغروسة وحواف حلقة الفتق مع عدم حصول الرفض ودرجة التصاق اقل مع غلق تام لحلقة الفتق وان استخدام هلام الصبار له فائدة في رأب الفتوق في الكباش.