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Reinforced Biologic reduces risk of recurrence in ventral hernia (VH) patients: One-year data from the BRAVO Ventral Hernia Study

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PURPOSE:

To report the one year results in the first 32 patients enrolled in the BRAVO clinical trial ("Bioscaffold Reconstruction of Abdominal wall and Ventral hernia defects with Open or laparoscopic repair"). This prospective single-arm study evaluates the clinical performance of a Reinforced Biologic (RB) to reinforce repairs in 100 patients with a variety of ventral hernias.

BACKGROUND:

The primary goal of using mesh in ventral hernia surgery is to reinforce the repair which should lead to a reduction in recurrences. Ideally, this should be achieved without increasing complications. The typical construct consists of a primary closure of the fascia which then is supported by a mesh that protects the closure from peak loads while allowing the physiological tension necessary for effective healing. The final repair should be both durable and as much as possible mimic the anatomical and biomechanical characteristics of the native abdominal wall. The value of mesh reinforcement over suture repair alone was proven in the landmark study performed in 200 patients in the early 2000s in The Netherlands [1 2]. Around the same time, the benefits of component separation to help achieve a primary closure of the defect became widely recognized and accepted to assist in achieving primary fascial closure [3 4 5]. As a result, the percentage of ventral hernias in which a bridging repair is performed has decreased. The majority of meshes are placed in either the sublay or underlay position. In ventral hernia surgeries that achieve primary fascial closure, the use of mesh protects the repair against sudden increases in intra-abdominal pressure and provides an overall strengthening of the repaired defect.

Use of synthetic meshes dates back to the late 1950s[6]. The basic technology of these has not changed much over the decades beyond developing lighter weight meshes, adding non-adhesive layers for intra-peritoneal applications and creating meshes with certain three-dimensional shapes. In the early 2000s, biological meshes, first in the form of dermal allografts, and subsequently also in the form of different xenografts, were introduced as an alternative to synthetic materials. The main application of the biologic meshes was found in patients with moderate to high risk of infection. During this same era, resorbable synthetics were developed as well. The main drawback of synthetic meshes is the dose-dependent chronic foreign body response they illicit and the induction of scar tissue formation. [7-9] Data from the Danish registry show that seven (7) years after surgery for a primary incisional hernia repair almost one in five patients have undergone a subsequent surgery for either recurrence or a mesh-related complication. [10] In addition, synthetic meshes risk becoming infected following implantation and in that situation usually require explantation, while under the same circumstances, a non-crosslinked biologic mesh could be left in place. Biologic meshes are collagen matrices that are remodeled by the patient over time. A potential drawback of the remodeling process is that the implant, and thus the repairs, may develop laxity over time. In addition, the use of a biologic implant is associated with a higher cost. [11,12] To address the shortcomings of laxity and recurrence with biologic mesh, OviTex Reinforced Biologics (RB) were developed and introduced for clinical use in 2016. Their design combines the benefits of both synthetics and biologics while eliminating or mitigating their shortcomings. A recently published article describing the mechanical properties of the abdominal wall, as well as those of the biomaterials used to repair it, provides a comprehensive classification of all available hernia meshes. OviTex RBs are different in their construction and are in a separate category from other meshes. [13] OviTex® 1S Permanent RB (OviTex) consists of a layered extracellular matrix with a light, 11 grams per cm^2,

internal interwoven polypropylene reinforcing grid. OviTex 1S Permanent includes four layers of biologic tissue sewn together with a 6 x 6 mm square open pattern and adds two additional layers with a reduced 25 x 25 mm pattern on one side. Animal studies have shown this surface minimizes tissue attachment when placed in contact with the viscera, thus allowing it to be placed intraperitoneally. The purposeful design of OviTex ensures that the tensile loads in ventral applications are shared by both the biological and synthetic components simultaneously; in addition, the biological component mitigates the mild inflammatory response invoked by the low dose polymer presence. OviTex performed well in a full thickness abdominal wall defect model in non-human primates and compared favorably to the most commonly used implants today in this same model. [14,15] Based on these positive results, OviTex was made available for clinical use and a prospective human clinical study initiated. The BRAVO study (registry number: NCT03074474) was developed to address the paucity of prospective evaluations of specific meshes in the surgical repair of ventral hernias in everyday clinical practice. The study evaluates the incidence of surgical site occurrences (SSOs), including recurrences, in patients treated with OviTex.

METHODS:

BRAVO is a prospective, single arm, multicenter study designed to include 100 ventral hernia patients that were repaired with the 6 layered OviTex RB mesh (OviTex 1S), reinforced with permanent polymer. Patients presenting with a primary or recurrent ventral hernia are eligible, with the exception of those with a Body Mass Index (BMI) of over 40 kg/m^2, Center for Disease Control (CDC) wound class 4 (dirty/infected), or defects requiring implants larger than 20 x 20 cm or 18 x 22 cm. The primary endpoint is the incidence of early post-operative surgical site occurrences or wound-related events occurring at the hernia repair site. These include deep or superficial wound infection, seroma, hematoma, wound dehiscence, skin necrosis and fistulas. Early post-operative complications such as ileus are also recorded. Hernia recurrence is evaluated at each follow-up; in case of a clinical suspicion of a recurrence, imaging studies are performed. Patients are evaluated at 30 days, three months, one year, and two years. In addition to the binary patient-based outcomes, qualitative information regarding the results of treatment is collected. Patient reported outcomes include the HerQLes scale and a health status VAS (via the EQ-5D). Both patients and surgeons were asked how satisfied they were with the repair on a 10-point scale.

RESULTS:

The first 32 patients who underwent surgery and completed the one-year follow-up visit were evaluated. Excluded were two patients who withdrew from the study, one patient who is still active but has missed their one-year visit, and three subjects who expired within three weeks of surgery due to causes unrelated to the implant or the study procedure. The demographics of the 32 patients are presented in Table 1 (age, gender, smoking history, BMIs). The number of previous hernia repairs, history of surgical infection, wound status, ventral hernia working group (VHWG) classification and obesity classification are presented in Table 2.

Table 1. Demographic Data and Preoperative Symptoms

Sex	Female (n = 21 65.6%)	Male (n = 11 34.4%)	
Age	Mean 63.1 ± 11.3	Range 49 (36 - 85)	
BMI	Mean 31.0 ± 3.9	Range 14.9 (23.6 - 38.5)	
Comorbidities	DM (n = 6 18.8%) Obesity (n = 21 65.6%)	HTN (n = 16 50.0%) COPD / Asthma (n = 4 12.5%)	Previous VH Repair (n = 14 43.8%) Smoking History (n = 9 28.1%)

Table 2. Prior Surgical History and Hernia Grading

Prior Hernia Repairs	Yes (n = 14 43.8%) Mean number of prior hernia repairs = 2.4 ± 1.4	No (n = 18 56.3%)	Previous SSI (n = 1 3.1%)
History of Surgical Infection	Yes (n = 6 18.8%)	No (n = 26 81.3%)	
Wound Status	Class 1 (n = 27 84.4%)	Class 2 (n = 3 9.4%)	Class 3 (n = 2 6.3%)
VHWG Grade	Grade 1 (n = 5 15.6%)	Grade 2 (n = 21 65.6%)	Grade 3 (n = 6 18.8%)
Obesity Classification	Not Obese (n = 11 34.4%)	Obese (n = 15 46.9%)	Morbidly Obese (n = 6 18.8%)

Surgical information on the size and location of the hernia; open, laparoscopic or robotic approach; size and plane of placement of the mesh; blood loss; and drain volume are presented in Table 3, Figure 1 includes locations of hernias and Table 4 details Quality of Life and Satisfaction Assessments in.

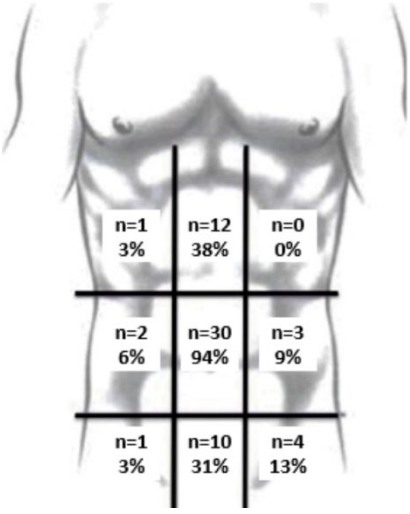
Table 3. Surgical Approach and Intraoperative Observations

Approach	Open (n = 24 75.0%)	Robotic (n = 6 18.8%)	Laparoscopic (n = 2 6.3%)	
Size of hernia	135 cm^2 (4 cm^2 to 384 cm^2)			
Plane of placement	Retrorectus (n = 16 50.0%)	TAR (n = 7 21.9%)	Intraperitoneal (n = 8 25.0%)	Extraperitoneal/retro fascia (n = 1 3.1%)
Average blood loss	57.5 ml (1 to 250 ml)			
Average drain volume	845 ml (13 to 5,224 ml)	Patients with drains (n = 26 81.3%)	Avg. days with drains = 13.8 days (3 to 30 days)	

Table 4. Quality of Life and Satisfaction Assessments

HerQles	Baseline avg = 40.7 (n = 27)	Month 12 avg = 25.4 (n = 27)	Improvement = 15.4 (n = 27)
EQ-5D	Baseline avg = 7.8 (n = 27)	Month 12 avg = 7.1 (n = 27)	Improvement = 0.7 (n = 27)
VAS	Baseline avg = 78.4 (n = 25)	Month 12 avg = 83.6 (n = 25)	Improvement = 5.1 (n = 25)
Patient Satisfaction	Month 12 avg = 9.3 (n = 27)	Range 2 - 10	
Surgeon Satisfaction	Month 12 avg = 9.8 (n = 32)	Range 8 - 10	

Figure 1. Locations of hernias



Note: 19 of 32 hernias extended through multiple locations

Nine subjects experienced SSOs, of which five were considered possibly related to the device (5 of 32; 15.6%). These five SSOs were abdominal wall abscesses in four, and seromas in one. None of the SSOs required further surgery or removal of the implant, and all SSOs had resolved by the time of the 90 follow-up. All nine subjects had co-morbid conditions that are known to increase the risks of SSOs, including obesity in seven, diabetes in one, COPD in one, hypertension in five, one to five previous ventral hernia repairs in seven (average of 2.7 prior VH repairs) and previous surgical infections in three.

To date, no subject has experienced a recurrence (0 of 32; 0%).

Subject satisfaction for the completed subjects was 9.3 out 10 at 1-year; the surgeon satisfaction at that time was 9.8 out of 10. OviTex was considered easy or very easy to use in all cases.

CONCLUSION:

This poster presents the first set of prospective data reporting the one year outcomes and recurrence rates following ventral hernia repair with a novel Reinforced Biologic. Patient and surgeon satisfaction with the OviTex remains consistently high following the early reported outcomes, and there have been no mesh failures requiring explantation or reoperation or recurrences. The biomechanical optimization of the repair allowed by the reinforced biologic and its observed resilience against the effects of infection may both contribute to this observation. The recurrence result compares favorably to the reported 12-month recurrence rates for Phasix[16], Bio-A[17] and Strattice[18], which were 5.3%, 9%, and 19% respectively. The higher rate for Strattice may in part be due to the on average more complex patients included in their study. Longer follow-up in more subjects treated with OviTex is being pursued to confirm these initial findings.

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Important Safety Information

OviTex Reinforced BioScaffolds are intended for use as a surgical mesh to reinforce and/or repair soft tissue where weakness exists. Indications for use include the repair of hernias and/or abdominal wall defects that require the use of reinforcing or bridging material to obtain the desired surgical outcome.

Caution: Federal (US) law restricts this device to sale by or on order of a physician.

Do not use OviTex in patients known to be sensitive to materials of ovine (sheep) origin. For additional important safety information, please see the OviTex Reinforced BioScaffold Instructions for Use.

A surgeon must use his or her own clinical judgment when deciding which products are appropriate for treatment of a particular patient. Always refer to the package insert, product label, and/or instructions for use before using any TELA Bio product. Products may not be available in all markets because product availability is subject to the regulatory and/or medical practices in individual markets. Please contact your TELA Bio representative if you have questions about TELA Bio products. The results noted in this study were achieved in their specific setting. Due to variations in clinical experience and technique, there is no guarantee that these results are typical.


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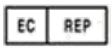

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