INVESTIGATIONAL PLAN

A prospective, single arm, multi-center study evaluating the short-term clinical outcomes of ventral hernias treated with OviTex® reinforced bioscaffold

Protocol No:	TB2016.01.01
Type and Phase:	Post-market prospective study
Test Product:	OviTex® Permanent 1S Reinforced Bioscaffold
Sponsor:	TELA Bio Inc.
Address:	1 Great Valley Parkway, Suite 24 Malvern, PA 19355
Study Manager:	Jennifer Dugan
Telephone No:	610-454-7200
E-mail:	jenniferdugan@emergentclinical.com
Sponsor's Representative:	Maarten Persenaire, MD TELA Bio Inc.
Telephone No:	610-457-5275
E-mail:	mpersenaire@telabio.com
Principal Investigator:	George DeNoto, MD
Version and Date:	**Version 2.0** **15-June-2017**
Revision History:	Revision 2

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PROTOCOL SIGNATURE PAGE

The signature below constitutes the approval of this protocol entitled **A prospective, single arm, multi-center study evaluating the short-term clinical outcomes of ventral hernias treated with OviTex® reinforced bioscaffold**, and provides the necessary assurances that this trial will be conducted in compliance of all stipulations of the protocol, including all statements regarding confidentiality, and according to local legal and regulatory requirements, the Food and Drug Administration, International Conference on Harmonization Good Clinical Practice E6 (ICH-GCP), and applicable US regulatory requirements.

_____

Investigator's Printed Name

_____ _____

Investigator's Signature ***Date***

STUDY SYNOPSIS

Title	A prospective, single arm, multi-center study evaluating the clinical outcomes of ventral hernias treated with OviTex® Permanent 1S reinforced bioscaffold.
Investigational Product	OviTex® Permanent 1S reinforced bioscaffold
Protocol Number	TB2016.01.01
Study Design	A prospective, single arm, multi-center study
Number of Study Sites	Up to 7
Number of Subjects	100
Study Population	Male and female subjects at least 18 years of age presenting with ventral hernia
Study Treatment	OviTex Permanent 1S reinforced bioscaffold in hernia repair
Study Objective	The study evaluates the post-operative complications and re-herniations following the use of OviTex® Permanent 1S reinforced bioscaffold in subjects with ventral hernias.
Study Endpoints	Primary endpoints: 1. Incidence of early post-operative surgical site occurrences or wound related events (e.g. - ileus, deep or superficial wound infection, seroma, hematoma, wound dehiscence, skin necrosis, fistulae) noted at the hernia repair site and occurring within the first three months of the ventral hernia repair. 2. Incidence of other early post-operative complications (e.g. ileus, bowel obstruction, fistula) occurring within the first three months of the ventral hernia repair. Secondary endpoints:

	1. Incidence of late post-operative surgical site occurrences or wound related events (e.g. ileus, deep or superficial wound infection, seroma, hematoma, wound dehiscence, skin necrosis, fistulae, bulging) noted at the hernia repair site and occurring > 3 months after index surgery. 2. Incidence of other late post-operative complications (e.g. ileus, bowel obstruction, fistula) occurring > 3 months after index surgery. 3. Patient Reported Outcomes (QoL and pain assessments). 4. True hernia recurrence at the site of surgery at post-operative day 90 and months 12 and 24 months.
Clinic Visits	Baseline, hospital stay (admission, day of surgery, day of discharge), 30 days, 90 days, 12 months, 24 months.

Time and Events Schedule

Assessments	**Baseline Visit (BV)**	**Hospital Stay**			**Post-operative Visits**			
		Admission	Day of Surgery (DOS)	Day of Discharge (DOD)	Day 30 (±2wks)	Day 90 (±2wks)	Month 12 (±4wks)	Month 24 (±4wks)
Informed Consent	X							
I/E Criteria	X		X					
Medical History	X		X					
Physical Exam	X		X					
Hospitalization & Perioperative Information		X	X	X				
Surgeon Assessment of Mesh			X					
Surgical Site Assessment *				X	X	X	X	X
Ventral Hernia Assessment	X**				X	X	X	X
Pain Visual Analogue Scale					X	X	X	X
QOL scales	X				X	X	X	X
Subject/Surgeon Satisfaction					X	X	X	X
Adverse Events			X	X	X	X	X	X

*** Surgical site assessment is intended to document any surgical site occurrences of wound related events noted at the hernia repair site.**

**** Baseline ventral hernia assessment is intended to estimate the actual hernia defect size.**

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Glossary of Terms and Abbreviations

AE	Adverse Event
ASA	American Society of Anesthesiologists
BV	Baseline Visit
BMI	Body Mass Index
CFR	Code of Federal Regulation
Cm	Centimeter
COPD	Congestive Obstructive Pulmonary Disorder CO_2 Carbon Dioxide
CRF	Case Report Form
CT	Computerized Tomography
CV	Curriculum Vitae
DOS	Day of Surgery
EBL	Estimated Blood Loss
ECM	Extracellular Matrix
EQ-5D	EuroQol 5 Dimension
FDA	U.S. Food and Drug Administration
GAGs	Glycosaminoglycans
GCP	Good Clinical Practice
HerQLes	Hernia-Related Quality-of-Life Survey to Assess Abdominal Wall Function
ICH	International Conference on Harmonization
I/E	Inclusion/Exclusion
IRB	Institutional Review Board
ISO	International Organization for Standardization
MEC	Medical Events Committee
Mm	Millimeter
OTC	Over the Counter
OTM	Ovine Tissue Matrix
OR	Operating Room

PE	Physical Exam
POD	Post Operative Day(s)
PTFE	Polytetrafluoroethylene
QoL	Quality of Life
RBS	Reinforced BioScaffold
SAE	Serious Adverse Event
SSI	Surgical Site Infection
UADE	Unanticipated Adverse Device Effect
VAS	Visual Analogue Scale
WKS	Weeks

STUDY OVERVIEW

A baseline visit will be performed prior to the ventral hernia repair and will include assessment of the subject's medical history, physical exam and pre-operative instructions. The subjects will also complete baseline Quality of Life (QOL) Surveys, one of which will be a disease specific assessment (HerQLes) and the other a standard measure of health outcomes (EQ-5D)

On the day of surgery, repair of the ventral hernia will occur using OviTex® Permanent 1S reinforced bioscaffold to reinforce the repaired hernia site. Perioperative data will be collected, including the anatomical placement of the mesh and fixation methods. During the course of hospitalization the patient will be assessed for incidence of early post-operative surgical site wound events and complications including the nature and severity of the complications, all necessary medical interventions and/or re-operations.

On the day of hospital discharge, surgical site occurrences or wound related events (e.g. infections, hematomas, seromas, wound dehiscence) noted at the hernia repair site and the occurrence of other early post-operative complications (e.g. ileus, bowel obstruction, fistulae) will be assessed.

At post-operative days 30 and 90, surgical site occurrences or wound related events (e.g. infections, hematomas, seromas, wound dehiscence) noted at the hernia repair site will be assessed. If a clinically significant hernia is suspected e.g. bulging noted at the hernia site, it will be confirmed via diagnostic imaging with a CT scan. The occurrence of other post-operative complications (e.g. ileus, bowel obstruction, fistulae) will be also assessed. Disease specific and general Quality of Life (QoL) surveys (HerQLes and EQ-5D), a pain scale and a subject/surgeon satisfaction assessment will also be administered.

At post-operative months 12 and 24, late surgical site occurrences or wound related events (e.g. infections, hematomas, seromas, wound dehiscence, bulging) noted at the hernia repair site will be assessed. If a clinically significant hernia is suspected e.g. bulging noted at the hernia site, it will be confirmed via diagnostic imaging with a CT scan. The occurrence of other late post-operative complications (e.g. ileus, bowel obstruction, fistulae) will also be assessed. Disease specific and general Quality of Life (QoL) surveys (HerQLes and EQ-5D), a pain scale and a subject/surgeon satisfaction assessment will also be administered.

Concomitant treatments, surgeries and Adverse Events (AEs) will be collected throughout the study period. Subject safety will be monitored throughout the study period; from the Day of Surgery through the Month 24 visit. All AEs, UADEs and SAEs that occur from the day of surgery through the Month 24 visit will be reported in the CRF. In addition to notation in the CRF, all SAEs will also require completion of a separate reporting form for submission to the Sponsor through Day 90. Following the Day 90 visit, only SAEs considered by the investigator to be "Related or "Possibly Related" to the study product will require completion of the additional reporting form for submission to the Sponsor. Conversely, following the Day 90 visit, it will no longer be necessary to complete the separate reporting form for those SAEs that the investigator determines to be "Unrelated" to the OviTex mesh.

1 INTRODUCTION

1.1 BACKGROUND

Meshes are indicated to reinforce absent or weakened soft tissue. Their main clinical application is found in hernias and abdominal wall defects. [1-3] In these diagnoses, the fascia underlying the abdominal muscles (rectus abdominus, transverse, internal and external obliques) exhibits a defect. The fascia is a layer of dense organized connective tissue that resists tension forces. It is comprised of closely packed bundles of organized collagen fibers, produced by the resident fibroblasts. [4, 5]

A defect in the fascia allows abdominal contents, e.g. the viscera, to migrate or 'herniate' to a position outside the abdominal cavity, under the skin. Ventral hernias are common and are often the result of previous abdominal surgeries where the sutured fascia ultimately fails (incisional hernia). [6, 7] The term 'abdominal wall defect' is reserved for situations where a substantial section of the fascia is missing, and surgical repair is challenging. This can be caused by failed previous surgeries, infections, trauma and other causes. Many subjects with ventral hernias or abdominal wall defects suffer from co-morbid conditions that can have a negative impact on healing, such as obesity, diabetes, COPD, steroid use, or the presence of a stoma, [8] which may add to the complexity of the surgical repair and recovery. Reported recurrence rates after ventral hernia repair range from 2.7% to 62%. [2] [9-13]

The goal for surgical repair of these ventral hernias is to obtain a tension-free primary closure of the defect in [1-3] the fascia, although this is not always possible. Techniques used to create more 'real estate' to achieve this goal, such as component separation, result in an increased surface area, but an overall thinner, and thus potentially weaker, abdominal wall. [1, 14] To reinforce the abdominal wall, many hernia surgeries include the use of a mesh. In cases where primary closure has been achieved, the mesh is used to reinforce the fascia and is placed either on top or below the newly constructed abdominal wall. e.g. 'onlay' or 'underlay'.[15] In cases

where primary closure cannot be achieved meshes are used to bridge the remaining defect, e.g. 'inlay'.[16]

There exist two main classes of meshes, synthetics made of materials such as polyester, polypropylene, polytetrafluoroethylene (PTFE); and biologic ones that consist of decellularized extracellular matrix from different organs and species. Within these classes many different implants exist. [17, 18] Some synthetic meshes include a resorbable coating on one or both sides to prevent or reduce the incidence and severity of adhesions. The advantages of synthetic meshes are that they are strong, provide a permanent repair without developing laxity, can be designed in different shapes and are relatively low cost. [19] Disadvantages of synthetics include that they may need to be removed in the presence of infection, are prone to adhesions, promote scar formation instead of de novo fascia, become brittle over time, shrink, and can cause 'meshomas' or migrate and erode through organs. [20-22]

Biological meshes are made from connective tissue known as 'extracellular matrix'. These meshes are made from dermis, small intestine, bladder, pericardium and other organs rich in connective tissue. In the manufacturing process the extracellular matrix is separated from associated layers and decellularized via mechanical and chemical processes. The structure of the matrix is preserved as much as possible. The composition of the extracellular matrix is virtually identical among all mammals. Its main constituent is fibrillar type I and III collagen; it also contains adhesion molecules such as proteoglycans, glycosaminoglycans (GAGs), and other glycoproteins. These molecules play numerous structural and functional roles, including binding and presenting growth factors to cell surface receptors, interacting directly with cells via specific receptors including integrins, and forming complex extracellular structures. Many of these functions are crucial to remodeling the implanted matrix into functional native tissue. [23]

The collagenous matrix however is sensitive to damage caused by manufacturing processes, including terminal sterilization. The damage inflicted can take the form of fragmentation, cross-linking, or denaturation. The resulting matrix may no longer be completely natural and may be

perceived as a foreign body by the host, and cause inflammation or become encapsulated. Each manufacturer uses different source materials and proprietary protocols to decellularize and sterilize their product, leading to marked differences in their mechanical and biological performance. [24, 25]

The advantages of effective biologic meshes include that they recreate a natural fascia, allow the surgeon to treat local infections while leaving the implant in-situ, cause minimal or no adhesions to the viscera and other tissues, do not shrink and do not lead to long-term complications such as 'meshomas' or erosion of organs.

None of the biological meshes on the market today meet all the criteria of an ideal implant. [26] The degree to which they fall short of the mark varies; disadvantages that are mentioned frequently are the development of laxity ('bulging') over time, true recurrences and the costs of the implants. [27, 28]

1.2 RATIONALE FOR VENTRAL HERNIA STUDY

In today's surgical practice, synthetic meshes are typically indicated for patients with low to moderate risk of post-operative complications, with expectations that the mesh will become integrated into a fascia like layer. Biologic meshes, on the other hand, tend to be reserved for use in patients with a high risk of post-operative complications, with the expectation that the product will remodel into de-novo native fascia. [8] In reality, neither product fully succeeds in achieving either of these goals. Poor outcomes associated with use of both types of product have prompted the development of a unique new product category of Reinforced BioScaffolds (RBS). It is hypothesized that RBS have all the characteristics and benefits of a biologic, e.g. avoiding complications of fibrosis, bowel erosion and infection, while retaining the strength of a synthetic material and providing adequate reinforcement to a poor/damaged fascia and as such are not prone to bulging and form an improved alternative in the repair of ventral hernias.

OviTex® Permanent 1S reinforced bioscaffold consists of an extracellular matrix with a light internal polymer skeleton. The biologic component of OviTex® Permanent 1S reinforced bioscaffold is derived from ovine rumen and available in several thicknesses (strengths) and reinforced using a monofilament polypropylene thread. The processing has been optimized to ensure preservation of the natural characteristics of the matrix, after which the material is freeze dried. Layers are subsequently sewn together and sterilized. The sewing pattern yields a 6 x 6 mm square open pattern. OviTex Permanent 1S includes one outer layer with a reduced 25 x 25 mm pattern on one side to reduce the risk of adhesions when placed in contact with the viscera.

It is hypothesized that the use of OviTex® Permanent 1S reinforced bioscaffold in abdominal hernia repair (in comparable subjects) will result in less seroma formation, the same percentage or fewer infections and fewer surgical repair related secondary procedures such as fluid aspirations or wound debridement. In addition, the use of OviTex® Permanent 1S reinforced bioscaffold is expected to result in a similar or lower rate of true recurrent herniations as reported for comparable prospectively studied subjects in the literature treated with other implants. [30-33] Surgical procedure related outcomes tend to occur within the first three months after surgery, and the recurrence of a hernia may occur at any point in time after treatment. This study focuses on the surgical outcomes over the first 3 months and continues for a total of 24 months to capture the longer-term incidence of hernia recurrences.

1.3 PREVIOUS EXPERIENCE (PRE-CLINICAL AND CLINICAL)

OviTex® Permanent 1S reinforced bioscaffold has been (and is being) evaluated in several animal models. A rat study comparing a previous version of the OviTex reinforced bioscaffold to Surgisis, a porcine small intestine derived biologic, has been completed. A non-human primate study was performed and the results were compared to other mesh products used in ventral hernia repair, both synthetics and biologics studied in the same model. The results of the primate studies show OviTex® Permanent 1S reinforced bioscaffold to perform equivalent or superior to the most widely biologic and synthetic meshes used in this field with regards to inflammation,

kinetics of cell repopulation, absence of seroma formation and handling. The study reports are currently being prepared.

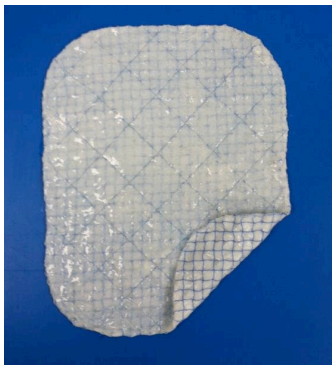
A study in rabbits evaluating the formation of adhesions was recently completed, initial results show that Ovitex Permanent 1S implants are less prone to adhesion formation than the positive control (Prolene).

A previous embodiment of the Reinforced BioScaffold also constructed from layers of ovine rumen and monofilament polypropylene has been implanted in 19 patients. Seventeen were treated for inguinal hernia and two for ventral hernia. To date, no adverse events or recurrences have been reported in these patients.

1.4 DEVICE DESCRIPTION AND INTENDED USE

OviTex® Permanent 1S reinforced bioscaffold is a six-layer construct of ovine derived extracellular matrix (ECM) and are assembled by stitching together multiple sheets of ECM with monofilament polypropylene. An example of an OviTex device is shown in Figure 1 below. The device is individually packaged and supplied sterile in various sizes up to 400 cm^2. The device is supplied freeze dried and sterile in a "ready to use" in a peel pouch, and requires up to 5 minutes of rehydration time prior to implantation.

Figure 1: Image of OviTex 1S Permanent RBS



OviTex® Permanent 1S reinforced bioscaffold is 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.

2 OBJECTIVES, HYPOTHESES, PRIMARY AND SECONDARY ENDPOINTS

2.1 OBJECTIVES

The study is designed to demonstrate that, in subjects with comparable characteristics, the use of OviTex® Permanent 1S reinforced bioscaffold in ventral hernias leads to the same or lower percentage of early post-operative complications and true hernia occurrences as compared to prospective reports in the literature for either synthetic or biological meshes.

2.2 PRIMARY AND SECONDARY ENDPOINTS

2.2.1 Primary Endpoints

1. Incidence of early post-operative surgical site occurrences or wound related events (e.g. - ileus, deep or superficial wound infection, seroma, hematoma, wound dehiscence, skin necrosis, fistulae) noted at the hernia repair site and occurring within the first three months

of the ventral hernia repair.

2. Incidence of other early post-operative complications (e.g. ileus, bowel obstruction, fistula) occurring within the first three months of the ventral hernia repair.

2.2.2 Secondary Endpoints

1. Incidence of late post-operative surgical site occurrences or wound related events (e.g. ileus, deep or superficial wound infection, seroma, hematoma, wound dehiscence, skin necrosis, fistulae, bulging) noted at the hernia repair site and occurring > 3 months after index surgery.
2. Incidence of other late post-operative complications (e.g. ileus, bowel obstruction, fistula) occurring > 3 months after index surgery.
3. Patient Reported Outcomes (QoL and pain assessments).
4. True hernia recurrence at the site of surgery at post-operative day 90 and 12 and 24 months.

2.3 STUDY DESIGN

This is a prospective, single arm, multi center, study evaluating the early post-operative clinical course and the true hernia recurrence rate of ventral hernias treated with the OviTex® Permanent 1S reinforced bioscaffold device. The study will be conducted at up to 7 sites and uses a prospective, observational design. Refer to Section 5 below for the Statistical Considerations of the study.

2.3.1 Rationale for the OviTex® Permanent 1S reinforced bioscaffold study

The purpose of the OviTex® Permanent 1S reinforced bioscaffold Study is to provide prospective data on the early post- operative clinical course and the true hernia recurrence rates in the repair of ventral hernias. Data relating to subjects with similar baseline characteristics will be correlated and compared to (prospective) published data where applicable.

2.4 NUMBER OF SITES/INVESTIGATORS

This study will be conducted at up to 7 investigational sites with George DeNoto, M.D. serving as the Lead Principal Investigator.

2.5 NUMBER OF SUBJECTS

The study will enroll at least 100 subjects who complete the screening visit (see Section 5). Interim analyses will be performed to assess whether sufficient subjects exhibiting similar baseline characteristic have been included to allow statistical comparison to the literature. Based on the interim analyses enrollment may continue beyond 100 subjects.

2.6 STUDY ARMS

The study will include a single arm design with all subjects receiving the OviTex® Permanent 1S reinforced bioscaffold device.

2.7 INCLUSION CRITERIA

2.7.1 Inclusion Criteria at Screening: Visit 1

1. Subject suffers from an uncomplicated ventral hernia that requires surgical repair (open, laparoscopic or robotic) with the use of an implant to reinforce or replace weakened or missing tissue.
2. The size of the implant needed for repair is expected to be 18 x 22 cm, 20 x 20 cm or less.
3. Subject meets CDC/SSI Wound Classification Class I (Clean), Class II (Clean-Contaminated) or Class III (Contaminated) criteria.
4. Subject is willing and able to sign an informed consent for the study and has signed the IRB approved Informed Consent form for this study.

5. Subject is able to complete Quality of Life (QoL) and pain Questionnaires.
6. Subject is at least 18 years old, (or considered an adult per state law).
7. Subject is able to participate fully in, and for the full duration of, the study.

2.8 EXCLUSION CRITERIA

2.8.1 Exclusion Criteria at Screening: Visit 1

1. Subject has a BMI of > 40
2. Subject meets CDC/SSI Wound Classification Class IV (Dirty-Infected) criteria
3. Subject is female and is pregnant.
4. Subject has a life expectancy of < 2 years making it unlikely that the subject will successfully achieve two-year follow-up.
5. Subject has recent history of drug or alcohol abuse (in last 3 years).
6. Subject has an allergy to ovine-derived products.
7. Subject has participated in another clinical trial within the past 30 days or is currently involved in another clinical trial.
8. Subject unable to receive OviTex® Permanent 1S reinforced bioscaffold at time of surgery

2.8.2 Exclusion Criteria Intraoperative: Visit 2

1. Subject requires implant that exceeds 18 x 22 cm or 20 x 20 cm.
2. Subject unable to receive OviTex® Permanent 1S reinforced bioscaffold at time of surgery.

3 STUDY PROCEDURES

3.1 BASELINE VISIT

The baseline visit will be performed in the 30 days prior to, including the day of, ventral hernia repair. Subjects will provide written consent, using the Institutional Review Board (IRB) approved informed consent form, before any study procedures are performed. After informed consent is obtained screening on all potential subjects will consist of the following:

- Assessment of subject's study eligibility according to study inclusion/exclusion criteria. Subjects who meet all of the inclusion and none of the exclusion criteria will be assigned a sequential subject number.
- A relevant physical examination including review of systems and collection of height, weight, BMI, blood pressure, temperature, as well as an abdominal examination to evaluate the ventral hernia and to estimate the defect size, (length, width, area cm^2).
- A review of relevant medical history, including previous abdominal surgeries and any co-morbidities. A review of subject demographics including age, gender, race and ethnicity.
- Assessment of disease specific and general Quality of Life (QoL) surveys (HerQLes and EQ-5D), (See Appendix 1).
- A clinical evaluation to determine surgical approach (open, laparoscopic or robotic), a brief review of the surgical procedure and device to be used, in addition to pre-operative instructions.

3.1.1 Surgical Date

Sites will notify TELA Bio of scheduled surgeries within 5 days of the actual surgery date to ensure that study product is on-site for the day of surgery.

3.1.2 Shipment of Study Device

The study will be performed using product that is provided at no cost by the Sponsor to all sites participating in the study.

3.2 SURGICAL VISIT

The surgical visit is split into three phases: admission, intraoperative and discharge.

3.2.1 Admission

During the admission visit, the following components will be collected/reviewed:

- A brief review of inclusion/exclusion criteria.
- An abbreviated review of subject's medical history to document any changes since the baseline visit.
- An abbreviated physical examination to evaluate hernia and document any changes since the baseline visit.
- Assessment of Surgical Site Infection (SSI) classification (See Appendix 2)
- For female subjects, a pregnancy test will be performed

3.2.2 Intraoperative

On the day of surgery, definitive repair of the ventral hernia site will be performed with an OviTex® Permanent 1S reinforced bioscaffold implant. The Investigator will use the study product on a first-to-expire basis. Investigators will follow their individual Institutional guidelines for their standard surgical preparation regimen. During the index surgery, the following perioperative components will be collected:

- Type of approach (Laparoscopic versus Open)
- Actual size of defect (length, width, cm^2)
- Product item and lot-serial number used

- Size of implant used in surgery (final mesh dimensions after any trimming)
- Location of implant (onlay, retrorectus, extraperitoneal, intraperitoneal or inlay/bridging)
- Operative data
    - Component separation (anterior or posterior)
    - Fixation method (suture type and size)
    - Number of drain(s) placed, drain volume and duration
    - Rectus muscle condition
    - Presence or absence of adhesions
    - Any concomitant procedures
    - Iatrogenic injury
    - Blood loss
    - Skin closure (complete restoration of abdominal wall and primary skin closure)
    - Operative time (time of first cut to last suture)
- All subjects will be assessed for intraoperative complications.
- Using a Likert scale, surgeons will be asked to provide their subjective assessment on the mesh handling characteristics as defined by ease of placement and ease of securing OviTex® Permanent 1S reinforced bioscaffold implant (See Appendix 3).

3.2.3 Discharge

On the day of hospital discharge, the following will be collected:

- Length of Stay, including number of days hospitalized prior to repair and following surgery, the number of days in ICU, step down and regular ward.
- Number of drains still in place, drain volume and duration.
- Any early surgical site occurrences (infections, seroma, hematoma, wound dehiscence) or wound related events noted at the hernia repair site.
- Any other early post-operative complications (ileus, fistulae).

3.3 POST-OPERATIVE DAYS 30 AND 90

At post-operative days 30 and 90, the following procedures will be completed:

- Number of drains still in place, drain volume and duration.
- Assessment of any surgical site occurrences or wound related events (infections, seromas, hematoma, wound dehiscence) noted at the hernia repair site.
- A relevant physical examination to evaluate hernia repair. If there is any suspicion of a recurrent hernia e.g. bulging noted at the repair site, an abdominal CT scan will be performed to confirm the clinical diagnosis. If it is determined that it is clinically necessary to repair the hernia recurrence during the study period, those subjects will complete their participation in the study at the time of that repair
- Assessment of any other post-operative complications (ileus, fistulae).
- Assessment of disease specific and general Quality of Life (QoL) surveys e.g. EQ-5D and HerQLes, (See Appendix 1).
- Subject and Surgeon satisfaction assessment of hernia repair (See Appendix 5).
- Subject assessment of post-operative pain as measured by the Pain Visual Analog Scale ((VAS) See Appendix 5).

3.4 POST-OPERATIVE MONTHS 12 AND 24

The following activities will be performed at months 12 and 24 of Study period visit:

- Assessment of any late surgical site occurrences or wound related events (e.g. infections, seromas, hematoma, wound dehiscence, bulging) noted at the hernia repair site.
- A relevant physical examination to evaluate hernia repair. If there is any suspicion of a recurrent hernia e.g. bulging noted at the repair site, an abdominal CT scan will be performed to confirm the clinical diagnosis. If it is determined that it is clinically necessary to repair the hernia recurrence during the study period, those subjects will complete their participation in the study at the time of that repair.

- Assessment of any other late post-operative complications (e.g. ileus, fistulae). Assessment of disease specific and general Quality of Life (QoL) surveys e.g. EQ-5D and HerQLes, (See Appendix 1).
- Subject and Surgeon satisfaction assessment of hernia repair (See Appendix 4).
- Subject assessment of post-operative pain as measured by the Pain Visual Analog Scale ((VAS) See Appendix 5).

4 CONCOMITANT PROCEDURES/TREATMENTS AND ADVERSE EVENTS

All treatments, surgeries, procedures and Adverse Events will be recorded for the duration of the study. All AEs, UADEs and SAEs that occur from the day of surgery through the Month 24 visit will be reported in the CRF. In addition to notation in the CRF, all SAEs will also require completion of a separate reporting form for submission to the Sponsor through Day 90. Any Serious Adverse Events (SAEs) or Unanticipated Adverse Device Effects (UADEs) will be reported to TELA Bio (or their designee) within 24 hours of the investigator's first awareness of their occurrence. Following the Day 90 visit, only SAEs considered by the investigator to be "Related or "Possibly Related" to the study product will require completion of the additional reporting form for submission to the Sponsor. Conversely, following the Day 90 visit, it will no longer be necessary to complete the separate reporting form for those SAEs that the investigator determines to be "Unrelated" to the OviTex mesh.

5 PATIENT WITHDRAWAL AND LOST TO FOLLOW-UP

Subjects have the right to withdraw from the study at any time for any reason. Subjects who wish to withdraw from the study should be instructed to notify the investigator in writing. The Investigator, acting in the best interests of the patient, also has the right to withdraw subjects from the study.

If the reason for removal of a subject from the study is an adverse event, the event will be recorded on the Adverse Event Case Report Form. In the case of any Serious Adverse Event (SAE) or Unanticipated Device Effect (UADE) the Investigator is also required to report the event using the required reporting forms. All efforts will be made to follow-up the patient until the condition resolves or Investigator determines that the patient's health has returned to an acceptable state.

In the event that a patient is lost to follow-up (LTFU), the Investigators should document due diligence efforts to maintain contact with any subjects with at least 3 attempts by email or telephone with the final attempt being made by certified mail.

6 ADVERSE EVENTS

An adverse event is any unfavorable, unintended sign, symptom, condition or disease in a study subject, where the experience occurs during the course of the study, regardless of its relationship to the test product or surgical procedure. Follow-up of an AE, even after the completion of the study is required until the event or its sequelae resolve or stabilize at a level acceptable to the Investigator and TELA Bio.

All AEs will be recorded in the Electronic Case Report Form and source documents. The Investigator will assess each event in terms of severity and relationship to study product, as follows:

TABLE 1

Intensity	Definition
Mild	Experiences that are transient, requiring no special treatment, or do not interfere with the subject's daily activities
Moderate	Experiences that introduce some level of inconvenience or concern to the subject and may somewhat interfere with daily activities but are usually ameliorated by simple therapeutic measures, such as over the counter (OTC) medications.

Severe	Experiences that are unacceptable or intolerable, significantly interrupt the subject's usual daily activity, and/or require systemic drug therapy or other treatment, including other medical or surgical intervention or hospitalization.

6.1 RELATIONSHIP

The relationship or association of the AE to study product will be characterized by the following categories:

Not related:

- There is no temporal relationship between the study product/treatment and the event, which makes a causal relationship clearly and incontrovertibly due to extraneous causes, e.g. not related to study product.
- Other factors, such as concurrent illness, progression or expression of a disease, or a reaction to a concomitant medication are a more likely the cause of the event. It is improbable that the study product caused the AE.

Possibly related:

- The AE cannot be fully explained by other causes, and it is possible that the study product caused the event.

Related:

- A reasonable temporal association exists between the AE and the study product, and based upon the investigators clinical experience, the association of the AE with the study product treatment seems probable.
- A definite or certain temporal association exists between the AE and study product, and based upon the Investigator's clinical experience, the association of the AE with study product seems definite or certain.

6.2 SERIOUS ADVERSE EVENTS

Serious Adverse Events are those Adverse Events that are:

- Are life-threatening,
- Are fatal,
- Result in inpatient hospitalization or prolongation of a hospitalization,
- Result in persistent or significant disability/incapacity, or
- Result in congenital anomaly or birth defect.

6.3 ANTICIPATED AND UNANTICIPATED ADVERSE DEVICE EFFECTS

6.3.1 Anticipated Adverse Events

Anticipated adverse events related to ventral hernia repair include post- operative surgical site events such as ileus, deep or superficial wound infection, seroma, hematoma, wound dehiscence, skin necrosis, fistulae and recurrent hernia. A comprehensive list of these events can be found in a patient information brochure at the American College of surgery website; (http://www.facs.org/public_info/operation/brochures/ventral_hernia.pdf), see Appendix 7). Although anticipated, should these events occur in subjects enrolled in this study, they are considered Adverse Events and should be noted in the eCRF.

In addition to those events listed above, there are other anticipated adverse device effects that include failure of the product to incorporate, rupture of the OviTex® Permanent 1S reinforced bioscaffold sheet or dehiscence of the product, mesh infection, bowel obstructions from adhesions or other mesh complications. These events, although possible and therefore defined as anticipated, are considered to be rare occurrences.

6.3.2 Unanticipated Adverse Device Effects (UADEs)

As per 21 CFR 812.3, Unanticipated adverse device effects are those effects, which have a serious adverse effect on health or safety or any life-threatening problem or death caused by, or associated with a device, if that effect, problem or death was not previously identified in nature, severity, or degree of incidence.

In this study all SAEs as defined in Section 6.2 above and adverse events which occur that are not identified will be considered Unanticipated Device Effects and will be reported to the Sponsor as described in Section 6.4.

6.4 INVESTIGATOR REPORTING REQUIREMENTS

6.4.1 Reporting Serious Adverse Events

In addition to notation in the CRF, all SAEs will also require completion of a separate reporting form for submission to the Sponsor through Day 90. All Serious Adverse Events will be reported to TELA Bio within 24 hours of the Investigator's first awareness of their occurrence. Following the Day 90 visit, only SAEs considered by the Investigator to be "Related or "Possibly Related" to the study product will require completion of the additional reporting form for submission to the Sponsor. Conversely, following the Day 90 visit, it will no longer be necessary to complete the separate reporting form for those SAEs that the Investigator determines to be "Unrelated" to the OviTex mesh.

6.4.2 Reporting Unanticipated Adverse Device Effects (UADEs)

Unanticipated adverse device effects (UADEs) are those that in nature, severity or degree of incidence differ from the list of anticipated adverse events above. UADEs will be reported to the Sponsor within 24 hours of the Investigator's first awareness of their occurrence.

6.5 SERIOUS ADVERSE EVENT AND UADE REVIEW

Reported SAEs and UADEs will be reviewed and investigated per TELA Bio Operating Procedures. When considered appropriate, TELA Bio will notify pertinent regulatory bodies and all Investigators within 10 working days of TELA Bio's receipt of notification of the event. It is the Investigators responsibility to notify their respective IRBs.

6.6 COMPLAINTS

Any deficiencies related to the identity, quality, durability, reliability, safety, effectiveness or performance of OviTex® Permanent 1S reinforced bioscaffold, but which are not Adverse Events, will be promptly reported to the Sponsor's Customer Service Department.

7 STATISTICAL CONSIDERATIONS AND DATA MANAGEMENT

7.1 SAMPLE SIZE

A sample size of up to 100 subjects is planned for this study. This is a sample of convenience and is estimated to be sufficient to allow assessment of clinical performance in this patient population.

7.2 STATISTICAL METHODS

Statistical methods will be carried out in accordance with the Statistical Analysis Plan (SAP) developed for this study.

The majority of data will be expressed as descriptive statistics. A p-value of less than or equal to

0.05 will be considered statistically significant. Any confidence bounds will show two-sided 95% confidence interval limits. Categorical variables will be summarized by number and percent. Continuous variables will be summarized by total number (N), mean, standard deviation, median, min and max. It is anticipated that the data will be evaluated using standard parametric and non-parametric procedures. Analyses of particular interest will be:

1. Correlation of rate of surgical site wound infection to SSI wound classification, number of previous repairs and pre-morbid conditions.
2. Correlation of surgical site occurrences or wound related events to re-herniation, BMI, number of previous abdominal.
3. Correlation of number of previous repairs with true hernia recurrence
4. Correlation of a visible bulge at hernia repair site with true hernia recurrence
5. Correlation of subject abdominal wall function and QoL with bulging at the hernia repair site and hernia recurrence rates.

The primary and secondary endpoints of this study will be also be compared to the clinical outcomes reported for other prospective studies in the literature. The results will be compared for the group as a whole, and, if the numbers will allow this, for subgroups of subjects exhibiting similar baseline characteristics, such as size of the hernia, co-morbid conditions, number of previous abdominal procedures etc.

7.3 PLANNED ANALYSIS

Interim analyses will be performed to assess the short-term outcomes when the first 25, 50 and 75 active subjects reach 90 days. The final analysis for the primary endpoint will be performed when all active subjects have completed their 90-day follow-up, and when all subjects have completed their Month 12 visit. Additional analyses will be done when subjects have completed their 12 and 24 months visits.

7.4 RISK ANALYSIS

7.4.1 Potential Risks

Potential risks of surgery with the OviTex® Permanent 1S reinforced bioscaffold device are similar to those that are encountered with other surgical meshes used to reinforce and/or repair

soft tissue where weakness exists. The associated risks will also be noted in the Informed Consent Form that all study subjects are required to sign prior to participation in the investigation.

As per the patient information brochure of the American College of Surgery, the risks of ventral hernia repair include, but are not limited to:

- Recurrence
- Seroma
- Intestines / bowel injury or temporary decrease in motility
- Urinary retention
- Wound infection
- Pain
- Hernia at port site
- Hematoma or bleeding into the abdomen
- Heart and breathing problems
- Death

http://www.facs.org/public_info/operation/brochures/ventral_hernia.pdf (See Appendix 7)

7.4.2 Potential Benefits

Subjects receiving the OviTex® Permanent 1S reinforced bioscaffold device may not experience any direct benefit as a result of the study. However, there is the potential that the use of the product may lead to lower incidence of seroma, infection and re-herniations than reported in the literature for synthetic and biologic meshes, as well as an overall lower cost of treatment.

8 CLINICAL SUPPLIES

8.1 STORAGE

The OviTex® Permanent 1S reinforced bioscaffold device should be stored in a clean, dry location at room temperature (25°C). The device should not be frozen.

8.2 EXPIRATION

The expiry date is displayed in the product labeling as the year (4 digits) and month (2 digits) next to an hourglass symbol. The product expires after the last day of the month indicated on the labeling.

8.3 ACCOUNTABILITY

The study will be performed using commercially available product and will not be subject to investigational device regulations. However, the lot number of implants used in the study will be recorded in the subject medical records and also on a product accountability log. Accountability of product used in this study is the responsibility of the Investigator and appropriate records of receipt of the product and implantation should be maintained.

8.4 DATA COLLECTION

Data submitted in support of the safety and efficacy of the study must be accurate and complete. The most effective way to accomplish this is to have accurate completion of the electronic Case Report Forms (eCRFs) and appropriate supporting source documentation maintained at the site. For this study, electronic CRFs will be maintained. The system, iMedNet, is certified as 21 CFR Part 11 compliant. Instructions on the use of the system and on completion of the specific CRFs will be provided to the site and reviewed by the study monitor as part of the Site Initiation Visit. Instruction/training will be repeated as necessary throughout the duration of the study.

9 INVESTIGATOR SELECTION AND REGULATORY OBLIGATIONS

9.1 INVESTIGATOR SELECTION

Investigators will be identified based on their qualifications to conduct the investigation. TELA Bio or their designee will further assess the qualifications of each Investigator and their staff by

conducting a review of their CV, checking the status of the Investigator within the FDA Debarment List, discussing the availability of the correct patient population at the institution and through a review of the clinical space to ensure that the facility has adequate amenities to conduct the study according to the protocol. The final determination on an Investigator's participation will be made following review of the above criterion and completion of the Site Qualification/Pre-Study Visit.

9.2 INSTITUTIONAL REVIEW BOARD APPROVAL

Investigators will be responsible for obtaining the initial and continuing review approvals from the governing IRB for the institution at which the proposed clinical investigation is to be conducted. Written certification of approval, and any conditions of approval imposed by the IRB, will be submitted to TELA Bio or their designee prior to the site's participation in this investigation. Investigational supplies will not be shipped to participating sites until documentation of IRB approval has been provided to TELA Bio or their designee. The Investigator and/or his staff is responsible for knowing and complying with any reporting requirements stipulated by their governing IRB.

9.3 INVESTIGATOR'S AGREEMENT

Investigators will be advised of their responsibilities as Investigators in a clinical study. Investigators will also be advised regarding FDA regulations governing clinical studies, and must abide by record keeping and reporting requirements. This information will be provided to the Investigators via the Clinical Trial Agreement, which must be signed by the Investigator and returned to TELA Bio or their designee prior to study participation. The Investigator will also be required to read and sign a Statement of the Investigator (See Appendix 8) and Sub-Investigators will be required to read, understand and sign the Sub-Investigator agreement (See Appendix 9).

9.4 REGULATORY DOCUMENTATION AND ASSESSMENT OF SITE FACILITIES

As part of the study start-up process, the Investigator and his staff will be required to supply documentation of their qualifications to participate in the study as well as a Financial Disclosure Form. Prior to participation in the study, each Investigator is required to submit the following documentation to TELA Bio or their designee:

- A signed Clinical Trial Agreement
- A current signed and dated curriculum vitae (current within 2 years)
- A completed Financial Disclosure questionnaire
- Written approval of the study protocol and associated Informed Consent Form from their governing IRB, (This must be provided prior to Investigational product being sent to the site or any subjects being enrolled).

The Investigator/site is also required to submit any information required as part of the approval/renewal process for their governing IRB. Reports of any protocol deviations, AEs and Lost-to-Follow-Up subjects should also be provided to the IRB according to their stated requirements.

The Site Qualification Visit or Pre-Study Visit enables the Monitor to review the following with the Investigator and his staff: clinical protocol, Investigator responsibilities, data collection and reporting requirements.

Another purpose of this visit is for the Monitor to assure that the Investigator:

- Has appropriate training, facilities, patient load, staff, time and willingness to comply with study requirements;
- Understands the requirement to submit the clinical protocol to the IRB for review and approval;
- Understands the requirement to maintain all study correspondence, study binders, case

report forms and patient records on file; and

- Assumes responsibility for oversight of the investigation at his / her center

The Monitor will complete a Qualification Visit Report to document all activities and topics reviewed during the visit as well as the site personnel present for the meeting. The report will also document any open action items identified as a result of the visit.

9.5 INFORMED CONSENT

Subjects expressing an interest in participating in the study will be provided a copy of the IRB approved Informed Consent Form for review. The Investigator or a qualified member of his study staff should answer any study related questions posed by the potential subject.

Potential subjects willing to participate in the study will be required to sign and date the Informed Consent Form. Only those who meet all inclusion and exclusion criteria for the study may be enrolled. Execution of the Informed Consent Form must be completed prior to initiating any study specific procedures. The signed original informed consent is to be maintained in the site records and the subject should be provided with a copy for their records.

9.6 CONFIDENTIALITY OF DATA

Access to subject's records is restricted to the Investigators, site support staff, and to TELA Bio's (or their designee's) clinical research personnel. Investigators are to instruct their staff in the methods and importance of maintaining subject confidentiality. On all study related documents, paperwork and reporting forms, study subjects should be identified only by their assigned subject number and initials.

Study results reported by TELA Bio will be in aggregate form and individual identities will not be publicly disclosed. It is possible that regulatory authorities (e.g., FDA) may request detailed

clinical information regarding specific subjects. In these situations, information will be provided to regulatory authorities by the assigned subject number and subject initials.

The investigator agrees that complete source documents for this study will need to be available to appropriately qualified personnel from TELA Bio (or their designee) or to country specific health authority inspectors after appropriate notification. The verification of Electronic Case Report Form data will be done by direct inspection of source documents (where permitted by law). Record review will be done in adherence with HIPAA and in a manner that protects subject confidentiality.

During the conduct of the study, Investigators must agree not to publicly disclose any study related information including the study design, results or conclusions of the investigation without prior consent of TELA Bio.

9.7 PROTOCOL AMENDMENTS

While not expected, it is possible that TELA Bio may need to amend the clinical protocol (for example, at the request of the FDA, due to emergence of new information etc.). In the event that this is needed, the protocol amendment will be reviewed and approved internally by the appropriate TELA Bio staff. Once finalized, the amendment will be distributed to the participating Investigator sites. Protocol amendments must undergo IRB review and approval at each clinical site, but may undergo expedited review if minor changes are made in the protocol that does not alter subject risk. The written approval from the IRB for the amendment should specifically refer to the Investigator, the protocol number and title, and reference any amendment numbers that are applicable.

9.8 PROTOCOL ADHERENCE

It is the responsibility of each Investigator and TELA Bio to conduct this study in accordance with all aspects of the protocol, Institutional Review Board requirements, the Declaration of Helsinki, the Code of Federal Regulations 21 CFR Part 50- Protection of Human Subjects, 21 CFR Part 54- Financial Disclosure, and 21 CFR Part 56- Institutional Review Boards, International Organization for Standardization (ISO) 14155:2011 and general Good Clinical Practice (GCP).

In the event of protocol deviations, both TELA Bio and the IRB should be notified of the event via the Protocol Deviation Log as soon as possible. If necessary, corrective actions will be taken to ensure the patient's safety and the integrity of the clinical investigation including, but not limited to site or study termination.

9.9 CHANGE IN INVESTIGATOR

Should the Investigator, during the conduct of the study, resign, relocate or retire, he / she must immediately inform TELA Bio and provide an orderly process for study continuation. Should the Investigator, after completion of the study, resign, relocate or retire, he / she must immediately inform TELA Bio and provide an orderly process for record retention.

9.10 RECORDS RETENTION

The types of records to be created and maintained for the clinical trial are dictated by the study protocol, Institutional Review Boards, and Federal regulations. Maintenance of records of device disposition, signed consent forms, study data forms (CRFs), adverse event reports, all correspondence, dates of monitoring visits, and supporting information for a period of two years following the completion of the study. The Investigator has the responsibility to retain all study

records, including the protocol, case report forms, IRB correspondence, letters to and from TELA Bio and any other applicable study documentation for the applicable period.

At the completion of the required retention period, it is requested that the Investigator contact TELA Bio and allow TELA Bio the option of permanently retaining the Investigator's study records.

If the Investigator retires or relocates, he/she must identify an individual at their site who will hold responsibility for maintaining the study records. The name and title of this individual should be provided to TELA Bio. Under no circumstances will anyone remove study records from the original study site without prior notification of, and approval by TELA Bio.

Investigators may release responsibility to maintain records and transfer custody to any other person who accepts such responsibility. A notice of transfer must be given to the sponsor no later than ten working days after the transfer occurs.

10 REFERENCES

1. Luijendijk RW, Hop WC, van den Tol MP, et al. (2000) A comparison of suture repair with mesh repair for incisional hernia. N Engl J Med 343:392–398. doi: 10.1056/NEJM200008103430603

2. Burger JWA, Luijendijk RW, Hop WCJ, et al. (2004) Long-term Follow-up of a Randomized Controlled Trial of Suture Versus Mesh Repair of Incisional Hernia. Transactions of the Meeting of the American Surgical Association CXXII:176–183. doi: 10.1097/01.sla.0000141193.08524.e7

3. Butler CE, Baumann DP, Janis JE, Rosen MJ (2013) Abdominal wall reconstruction. Curr Probl Surg 50:557–586. doi: 10.1067/j.cpsurg.2013.08.003

4. Peeters E, Hertogh G, Junge K, et al. (2013) Skin as marker for collagen type I/III ratio in abdominal wall fascia. Hernia. doi: 10.1007/s10029-013-1128-1

5. Franz MG (2006) The biology of hernias and the abdominal wall. Hernia 10:462–471. doi: 10.1007/s10029-006- 0144-9

6. Poulose BK, Shelton J, Phillips S, et al. (2011) Epidemiology and cost of ventral hernia repair: making the case for hernia research. Hernia 16:179–183. doi: 10.1007/s10029-011-0879-9

7. Muysoms FE, Miserez M, Berrevoet F, et al. (2009) Classification of primary and incisional abdominal wall hernias. Hernia 13:407–414. doi: 10.1007/s10029-009-0518-x

8. Breuing, K, Butler, CE, Ferzoco, S, Franz, M, et al. (2010) Incisional ventral hernias: review of the literature and recommendations regarding the grading and technique of repair. Surgery 148:544–558. doi: 10.1016/j.surg.2010.01.008

9. Nockolds CL, Hodde JP, Rooney PS (2014) Abdominal wall reconstruction with components separation and mesh reinforcement in complex hernia repair. BMC Surgery 14:1–7. doi: 10.1186/1471-2482-14-25

10. Petro CC, Nahabet EH, Criss CN, et al. (2014) Central failures of lightweight monofilament polyester mesh causing hernia recurrence: a cautionary note. Hernia. doi: 10.1007/s10029-014-1237-5

11. Nguyen MT, Berger RL, Hicks SC, et al. (2014) Comparison of Outcomes of Synthetic Mesh vs Suture Repair of Elective Primary Ventral Herniorrhaphy: A Systematic Review and Meta-analysis. JAMA Surg 149:415. doi: 10.1001/jamasurg.2013.5014

12. Carter SA, Hicks SC, Brahmbhatt R, Liang MK (2014) Recurrence and pseudorecurrence after laparoscopic ventral hernia repair: predictors and patient-focused outcomes. Am Surg 80:138–148.

13. Liang MK, Berger RL, Li LT, et al. (2013) Outcomes of laparoscopic vs open repair of primary ventral hernias. JAMA Surg 148:1043–1048. doi: 10.1001/jamasurg.2013.3587

14. Lipman J, Medalie D, Rosen MJ (2008) Staged repair of massive incisional hernias with loss of abdominal domain: a novel approach. Am J Surg 195:84–88. doi: 10.1016/j.amjsurg.2007.02.017

15. Hawn MT, Snyder CW, Graham LA, et al. (2010) Long-term follow-up of technical outcomes for incisional hernia repair. ACS 210:648–55– 655–7. doi: 10.1016/j.jamcollsurg.2009.12.038

16. Jin J, Rosen MJ, Blatnik J, et al. (2007) Use of acellular dermal matrix for complicated ventral hernia repair: does technique affect outcomes? J Am Coll Surg 205:654–660. doi: 10.1016/j.jamcollsurg.2007.06.012

17. Bringman S, Conze J, Cuccurullo D, et al. (2009) Hernia repair: the search for ideal meshes. Hernia 14:81–87. doi: 10.1007/s10029-009-0587-x

18. Brown CN, Finch JG (2010) Which mesh for hernia repair? Ann R Coll Surg Engl 92:272–278. doi: 10.1308/003588410X12664192076296

19. Pott PP, Schwarz MLR, Gundling R, et al. (2012) Mechanical properties of mesh materials used for hernia repair and soft tissue augmentation. PLoS ONE 7:e46978. doi: 10.1371/journal.pone.0046978.t005

20. Klosterhalfen B, Junge K, Klinge U (2005) The lightweight and large porous mesh concept for hernia repair. Expert Rev Med Devices 2:103–117. doi: 10.1586/17434440.2.1.103

21. Amid PK (2004) Radiologic images of meshoma: a new phenomenon causing chronic pain after prosthetic repair of abdominal wall hernias. Arch Surg 139:1297–1298. doi: 10.1001/archsurg.139.12.1297

22. Millas SG, Mesar T, Patel RJ (2013) Chronic abdominal pain after ventral hernia due to mesh migration and erosion into the sigmoid colon from a distant site: a case report and review of literature. Hernia. doi: 10.1007/s10029-013-1182-8

23. Badylak SF, Freytes DO, Gilbert TW (2009) Extracellular matrix as a biological scaffold material: Structure and function. Acta biomaterialia 5:1–13. doi: 10.1016/j.actbio.2008.09.013

24. Zhang J, Wang GY, Xiao YP, et al. (2011) The biomechanical behavior and host response to porcine-derived small intestine submucosa, pericardium and dermal matrix acellular grafts in a rat abdominal defect model. Biomaterials 32:7086–7095. doi: 10.1016/j.biomaterials.2011.06.016

25. Kulig KM, Luo X, Finkelstein EB, et al. (2013) Biologic properties of surgical scaffold materials derived from dermal ECM. Biomaterials 34:5776–5784. doi: 10.1016/j.biomaterials.2013.02.055

26. Shankaran V, Weber DJ, Reed RL II, Luchette FA (2011) A Review of Available Prosthetics for Ventral Hernia Repair. Ann Surg 253:16–26. doi: 10.1097/SLA.0b013e3181f9b6e6

27. Patel KM, Bhanot P (2012) Complications of Acellular Dermal Matrices in Abdominal Wall Reconstruction. Plastic and Reconstructive Surgery 130:216S–224S. doi: 10.1097/PRS.0b013e318262e186

28. Bower, C and Roth, J Scott (2013) Economics of Abdominal Wall Reconstruction. Surgical Clinics of NA 93:1241– 1253. doi: 10.1016/j.suc.2013.06.007

29. White A, Burns D, Christensen TW (2006) Effective terminal sterilization using supercritical carbon dioxide. Journal of Biotechnology 123:504–515. doi: 10.1016/j.jbiotec.2005.12.033

30. Bellows CF, Shadduck P, Helton WS, et al. (2013) Early report of a randomized comparative clinical trial of Strattice™ reconstructive tissue matrix to lightweight synthetic mesh in the repair of inguinal hernias. Hernia. doi: 10.1007/s10029-013-1076-9

31. Ruiz-Jasbon F, Norrby J, Ivarsson ML, Björck S (2014) Inguinal hernia repair using a synthetic long-term

resorbable mesh: results from a 3-year prospective safety and performance study. Hernia. doi: 10.1007/s10029-014-1249-1

32. Itani KMF, MD et al. (2012) Prospective study of single-stage repair of contaminated hernias using a biologic porcine tissue matrix: the RICH Study. Surgery 152:498–505. doi: 10.1016/j.surg.2012.04.008

33. Zerbib P, Caiazzo R, Piessen G, et al. (2013) Outcome in porcine acellular dermal matrix reinforcement of infected abdominal wall defects: a prospective study. Hernia. doi: 10.1007/s10029-013-1153-0

11 APPENDICES

APPENDIX 1: Quality of Life Surveys:

HerQLes Questionnaire

For the following statements, please circle the number that is most appropriate for you.	Strongly Disagree	Moderately Disagree	Slightly Disagree	Slightly Agree	Moderately Agree	Strongly Agree
1. My **abdominal wall** has a huge impact on my health	1	2	3	4	5	6
2. My **abdominal wall** causes me physical pain	1	2	3	4	5	6
3. My **abdominal wall** interferes when I perform strenuous activities, e.g. heavy lifting	1	2	3	4	5	6
4. My **abdominal wall** interferes when I perform moderate activities, e.g. bowling, bending over	1	2	3	4	5	6
5. My **abdominal wall** interferes when I walk or climb stairs	1	2	3	4	5	6
6. My **abdominal wall** interferes when I dress myself, take showers and cook	1	2	3	4	5	6
7. My **abdominal wall** interferes with my sexual activity	1	2	3	4	5	6
8. I often stay at home because of my **abdominal wall**	1	2	3	4	5	6
9. I accomplish less at home because of my **abdominal wall**	1	2	3	4	5	6
10. I accomplish less at work because of my **abdominal wall**	1	2	3	4	5	6
11. My **abdominal wall** affects how I feel every day	1	2	3	4	5	6
12. I often feel blue because of my **abdominal wall**	1	2	3	4	5	6

Reference: Krpata DM1, Schmotzer BJ, Flocke S, Jin J, Blatnik JA, Ermlich B, Novitsky YW., Rosen MJ. Design and initial implementation of HerQLes: a hernia-related quality-of-life survey to assess abdominal wall function. J Am Coll Surg. 2012 Nov;215(5):635-42. doi: 10.1016/j.jamcollsurg.2012.06.412. Epub 2012 Aug 4.

EQ-5D

Under each heading, please tick the ONE box that best describes your health TODAY

MOBILITY
I have no problems in walking about □
I have slight problems in walking about □
I have moderate problems in walking about □
I have severe problems in walking about □
I am unable to walk about □

SELF-CARE
I have no problems washing or dressing myself□
I have slight problems washing or dressing myself □
I have moderate problems washing or dressing myself □
I have severe problems washing or dressing myself □
I am unable to wash or dress myself □

USUAL ACTIVITIES
(e.g. work, study, housework, family or leisure activities)
I have no problems doing my usual activities □
I have slight problems doing my usual activities □
I have moderate problems doing my usual activities □
I have severe problems doing my usual activities □
I am unable to do my usual activities □

PAIN / DISCOMFORT
I have no pain or discomfort □
I have slight pain or discomfort □
I have moderate pain or discomfort□
I have severe pain or discomfort□
I have extreme pain or discomfort □

ANXIETY / DEPRESSION
I am not anxious or depressed □
I am slightly anxious or depressed □
I am moderately anxious or depressed □
I am severely anxious or depressed □
I am extremely anxious or depressed □

We would like to know how good or bad your health is today. This scale is numbered from 0 to 100:

- 100 means the best health you can imagine.
- 0 means the worst health you can imagine.
- Mark an X on the scale to indicate how your health is TODAY.

Now, please write the number you marked on the scale in the box below.
YOUR HEALTH TODAY = □

APPENDIX 2: SSI Wound Classification:

Classification	Criteria
Class I Clean	Elective, not emergency, non-traumatic, primarily closed; no acute inflammation, no break in technique; respiratory, gastrointestinal, biliary and genitourinary tracts not entered.
Class II Clean-contaminated	Urgent or emergency case that is otherwise clean; elective opening of respiratory, gastrointestinal, biliary or genitourinary tract with minimal spillage (e.g. appendectomy) not encountering infected urine or bile; minor technique break.
Class III Contaminated	Non-purulent inflammation; gross spillage from gastrointestinal tract; entry into biliary or genitourinary tract in the presence of infected bile or urine; major break in technique; penetrating trauma <4 hours old; chronic open wounds to be grafted or covered.
Class IV Dirty	Purulent inflammation (e.g. abscess); preoperative perforation of respiratory, gastrointestinal, biliary, or genitourinary tract; penetrating trauma >4 hours

APPENDIX 3: Surgeon Assessment of Mesh

	Very Easy	Easy	OK	A little difficult	Very difficult
Rate the ease of placement					
Rate ease of securing mesh					

APPENDIX 4: Surgeon and Subject Satisfaction Assessment:

1. Subject Satisfaction with ventral hernia repair:

Worst _____OK _____Best

1	2	3	4	5	6	7	8	9	10

Mark an "x" at the number that corresponds with the subject's assessment.

Subject initials_____**Date** _____

2. Surgeon Satisfaction with ventral hernia repair:

Worst _____OK _____Best

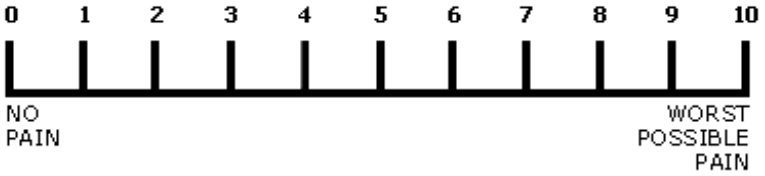
1	2	3	4	5	6	7	8	9	10

Mark an "x" at the number that corresponds with the surgeon's assessment.

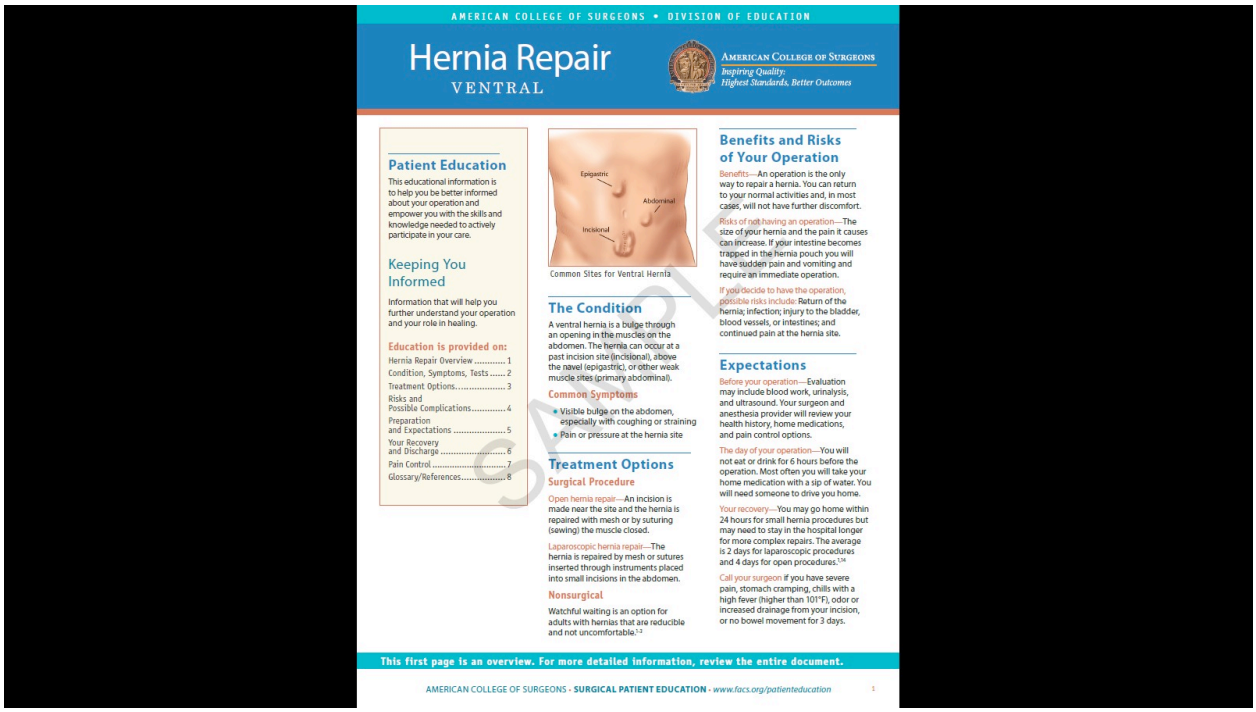
Surgeon initials_____**Date** _____

APPENDIX 5: Pain Visual Analog Scale

Please circle the number that most closely represents the level of pain you are experiencing at your ventral hernia repair site:



APPENDIX 6: American College of Surgery; Patient Information Brochure for ventral hernia repair



AMERICAN COLLEGE OF SURGEONS • DIVISION OF EDUCATION

Hernia Repair
VENTRAL

American College of Surgeons
Inspiring Quality: Highest Standards, Better Outcomes

Patient Education
This educational information is to help you be better informed about your operation and empower you with the skills and knowledge needed to actively participate in your care.

Keeping You Informed
Information that will help you further understand your operation and your role in healing.

Education is provided on:

Common Sites for Ventral Hernia

The Condition
A ventral hernia is a bulge through an opening in the muscles on the abdomen. The hernia can occur at a past incision site (incisional), above the navel (epigastric), or other weak muscle sites (primary abdominal).

Common Symptoms
- Visible bulge on the abdomen, especially with coughing or straining
- Pain or pressure at the hernia site

Treatment Options
Surgical Procedure

Open hernia repair—An incision is made near the site and the hernia is repaired with mesh or by suturing (sewing) the muscle closed.

Laparoscopic hernia repair—The hernia is repaired by mesh or sutures inserted through instruments placed into small incisions in the abdomen.

Nonsurgical

Watchful waiting is an option for adults with hernias that are reducible and not uncomfortable.[2,3]

Benefits and Risks of Your Operation
Benefits—An operation is the only way to repair a hernia. You can return to your normal activities and, in most cases, will not have further discomfort.

Risks of not having an operation—The size of your hernia and the pain it causes can increase. If your intestine becomes trapped in the hernia pouch you will have sudden pain and vomiting and require an immediate operation.

If you decide to have the operation, possible risks include: Return of the hernia; infection; injury to the bladder, blood vessels, or intestines; and continued pain at the hernia site.

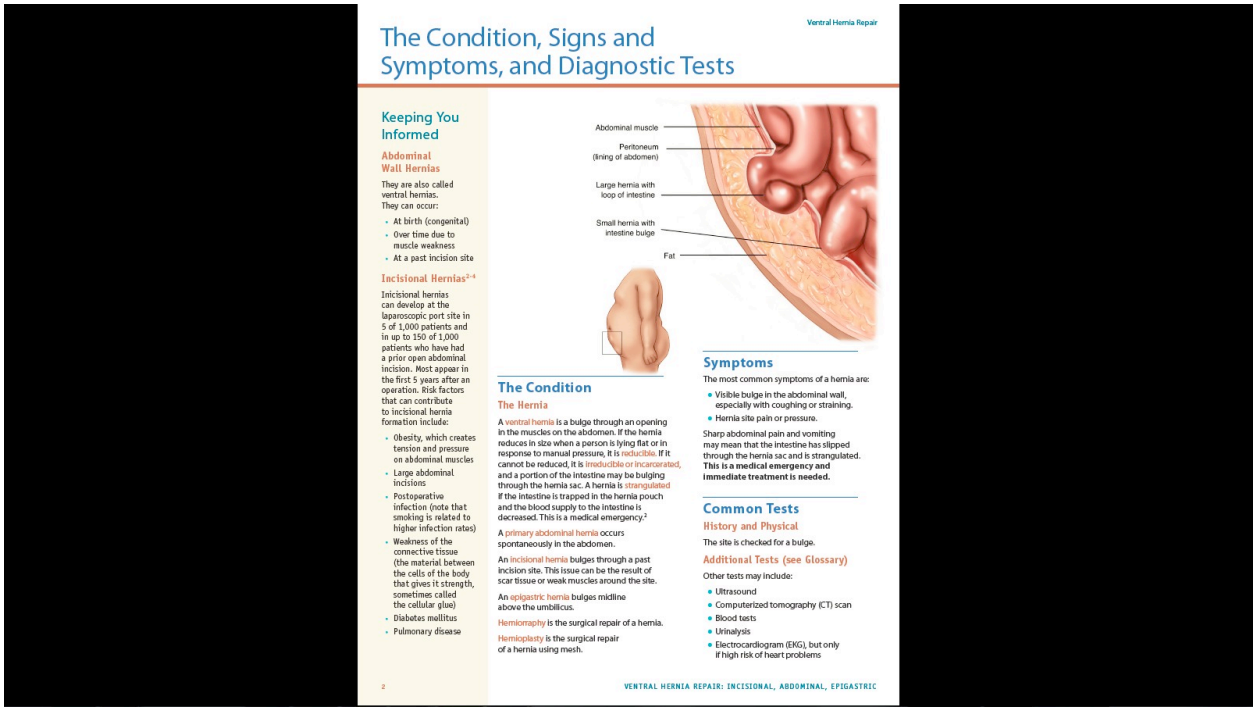
Expectations
Before your operation—Evaluation may include blood work, urinalysis, and ultrasound. Your surgeon and anesthesia provider will review your health history, home medications, and pain control options.

The day of your operation—You will not eat or drink for 6 hours before the operation. Most often you will take your home medication with a sip of water. You will need someone to drive you home.

Your recovery—You may go home within 24 hours for small hernia procedures but may need to stay in the hospital longer for more complex repairs. The average is 2 days for laparoscopic procedures and 4 days for open procedures.[1,14]

Call your surgeon if you have severe pain, stomach cramping, chills with a high fever (higher than 101°F), odor or increased drainage from your incision, or no bowel movement for 3 days.

This first page is an overview. For more detailed information, review the entire document.



The Condition, Signs and Symptoms, and Diagnostic Tests

Keeping You Informed
Abdominal Wall Hernias

They are also called ventral hernias. They can occur:
- At birth (congenital)
- Over time due to muscle weakness
- At a past incision site

Incisional Hernias[2-4]

Inicisional hernias can develop at the laparoscopic port site in 5 of 1,000 patients and in up to 150 of 1,000 patients who have had a prior open abdominal incision. Most appear in the first 5 years after an operation. Risk factors that can contribute to incisional hernia formation include:
- Obesity, which creates tension and pressure on abdominal muscles
- Large abdominal incisions
- Postoperative infection (note that smoking is related to higher infection rates)
- Weakness of the connective tissue (the material between the cells of the body that gives it strength, sometimes called the cellular glue)
- Diabetes mellitus
- Pulmonary disease

The Condition
The Hernia

A ventral hernia is a bulge through an opening in the muscles on the abdomen. If the hernia reduces in size when a person is lying flat or in response to manual pressure, it is reducible. If it cannot be reduced, it is irreducible or incarcerated, and a portion of the intestine may be bulging through the hernia sac. A hernia is strangulated if the intestine is trapped in the hernia pouch and the blood supply to the intestine is decreased. This is a medical emergency.[2]

A primary abdominal hernia occurs spontaneously in the abdomen.

An incisional hernia bulges through a past incision site. This issue can be the result of scar tissue or weak muscles around the site.

An epigastric hernia bulges midline above the umbilicus.

Herniorraphy is the surgical repair of a hernia.

Hernioplasty is the surgical repair of a hernia using mesh.

Symptoms
The most common symptoms of a hernia are:
- Visible bulge in the abdominal wall, especially with coughing or straining.
- Hernia site pain or pressure.

Sharp abdominal pain and vomiting may mean that the intestine has slipped through the hernia sac and is strangulated. **This is a medical emergency and immediate treatment is needed.**

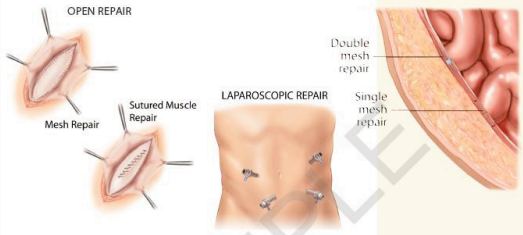
Common Tests
History and Physical

The site is checked for a bulge.

Additional Tests (see Glossary)

Other tests may include:
- Ultrasound
- Computerized tomography (CT) scan
- Blood tests
- Urinalysis
- Electrocardiogram (EKG), but only if high risk of heart problems

Surgical and Nonsurgical Treatment



Surgical Treatment

The type of operation depends on the hernia size, location, and if it is a repeat hernia. Your health, age, anesthesia risk, and the surgeon's expertise are also important. An operation is the only treatment for a hernia repair.

Your hernia can be repaired by:

- Suturing the muscle around the hernia site closed.
- Inserting a piece of mesh to reinforce the closed hernia site. Mesh is attached with sutures, tacks, or staples into the stronger tissue surrounding the hernia site. The mesh extends 3 to 4 centimeters larger than the size of the hernia.
- Use of a muscle or tissue flap directed over the hernia site.

Open Hernia Repair

The surgeon makes an incision near the hernia site. The bulging tissue is gently pushed back into the abdomen. Sutures, mesh, or a tissue flap is used to close the muscle. With complex or large hernias, small drains may be placed going from inside to the outside of the abdomen. The site is closed using sutures, staples, or surgical glue.

Laparoscopic Hernia Repair

The surgeon will make several small punctures or incisions in the abdomen. Ports or trocars (hollow tubes) are inserted into the openings. Surgical tools are placed into the ports. The abdomen is inflated with carbon dioxide gas to make it easier for the surgeon to see the hernia. Mesh is sutured, stapled, or clipped to the muscle around the hernia site. The hernia site can also be sewn directly together.

Nonsurgical Treatment

Watchful waiting is an option for a hernia without symptoms. All patients should get treatment if they have sudden, sharp abdominal pain and vomiting. These symptoms can indicate an incarcerated hernia and bowel obstruction.

Trusses or belts made to apply pressure on a hernia require correct fitting. When used correctly, part or complete control of the hernia was achieved in 31% of patients and 64% found the truss to be uncomfortable.[5]

Keeping You Informed

Open versus Laparoscopic Incisional Repair

There is no one type of repair that is good for all ventral hernias. Laparoscopic repairs are associated with lower infection rates and shorter hospital stays. There is no difference in recurrence rates, long-term pain, or quality of life. For patients with strangulated intestines and infections, the laparoscopic approach may not be an option.[1,6,14]

Will My Hernia Come Back?

Mesh reduces the risk that the hernia will return again. Mesh can be tacked, stapled, or sutured. All of these techniques have the same recurrence rate.[7]

Morbidly obese patients are prone to ventral hernias and can sometimes have the option of repair during gastric bypass surgery.

Risks of this Procedure

The Risk	What Can Happen	Keeping You Informed
Recurrence	Based on studies from the past 10 years, a hernia can come back for 41 of 1,000 mesh repair patients and 430 of 1,000 open, nonmesh repair patients.[1,6]	Recurrence is higher for a complex or infected hernia and previous hernia repair or abdominal surgery.
Seroma	On average, a seroma occurs in 137 of 1,000 patients for laparoscopic repair and 108 of 1,000 patients for open repair. Seromas are rare in infants/children.[1,6]	A seroma usually goes away on its own within 4 to 6 weeks. Wearing a binder around the abdomen may help decrease seroma formation. Rarely, the fluid is removed with a needle.[8]
Intestines/ bowel injury or temporary decrease in motility	On average, bowel injury occurs in 26 of 1,000 patients for laparoscopic and 7 of 1,000 patients for open mesh repairs. Ileus or the temporary stop of movement of fluid or food through the bowel can occur in 22 of 1,000 repairs.[1,9,10]	If injury occurs, repair is done at that time. If there is bowel leakage into the abdominal cavity, the hernia repair will be done after the bowel injury heals. If fluid is not moving through the bowel, a nasogastric tube may be placed to keep the stomach empty.
Urinary retention	Trouble urinating occurs in 210 of 1,000 patients following removal of a urinary catheter and 48 of 1,000 patients when no catheter was placed.[11,12]	General or regional anesthesia, older age, an enlarged prostate, and diabetes are associated with urinary retention. A temporary urinary catheter may be inserted or medication may be given.
Wound infection	On average, an infection is reported in 2 of 1,000 laparoscopic repairs and 91 of 1,000 open mesh procedures. Pediatric infection is less than 1 of 1,000.	Antibiotics and drainage of the wound may be needed. If the infection continues, the mesh may have to be removed. Smoking can increase the infection rate.
Pain	Pain scores are similar for laparoscopic and open procedures. Continued pain is reported in 10 to 30 of 1,000 patients.[1,6,9]	A nonsteroidal anti-inflammatory medication can help with pain while the patient is at home. Medication may be injected into the site for long-term pain.
Hernia at port site	Hernia at the site where the laparoscopic instruments were inserted occurs in fewer than 4 of 1,000 adults and fewer than 1 of 1,000 children.	This risk is reduced with the use of smaller ports and instruments. The most common location is the umbilical port site.[3]
Hematoma or bleeding into the abdomen	A hematoma (collection of blood at the wound site) is reported in 13 of 1,000 laparoscopic repairs and 53 of 1,000 open repairs.[1,6]	A blood transfusion may be needed. Repair of the bleeding site will be done.
Heart and breathing problems	Breathing problems/pneumonia are reported in 7 of 1,000 patients. Heart problems (chest pain/irregular heart rate) are reported in 4 of 1,000 patients.[6]	Other health problems increase the risk for heart and breathing complications. Deep breathing, walking, and good oral care can decrease your risk of pneumonia.
Pediatric risks	Risks are rare and include hematoma and wound infection.	Complex abdominal wall defects are often not repaired until age 1 to 2 years. They are sometimes repaired in a series of operations.
Elderly risks	The length of hospital stay increases with older age.	Risks may be higher because of other diseases/ health problems and may be related to the response to general anesthesia.
Obesity risks	Recurrence rates are higher and operating room time and length of stay are longer for obese patients.	Obesity increases the risk of infection and poor wound healing. Additional medical problems such as diabetes can also increase the risk of complications.
Death	Fewer than 1 in 1,000 patients die following a ventral hernia repair.	Perforated and large hernias and repair in patients with liver disease are at a higher risk of complications. Your surgical team is prepared for all emergency situations.

Expectations: Preparation for Your Operation

Preparing for Your Operation

Home Medication

Bring a list of all the medications and vitamins you are taking. Most often you will take your morning medication with a sip of water. If you are diabetic or taking blood thinners (Plavix, Coumadin, aspirin, nonsteroidal anti-inflammatory medication), your medication may have to be adjusted before your operation.

Home Preparation

The average length of stay is 1 to 2 days for laparoscopic repair and 3 to 4 days for an open procedure. Patients with a small hernia repair may go home the same day.

Anesthesia

Let your anesthesia provider know if you have allergies, neurologic disease (epilepsy, stroke), heart disease, stomach problems, lung disease (asthma, emphysema), endocrine disease (diabetes, thyroid conditions), loose teeth, or if you smoke, use alcohol or drugs, or take any herbs or vitamins.

If you have a history of nausea and vomiting with anesthesia, an anti-vomiting drug may be given.

About My Anesthesia

For laparoscopic and open repair, the most common option is general anesthesia.

The Day of Your Operation

Don't Eat or Drink

Not eating or drinking for at least 6 hours before the operation reduces your risk of complications from anesthesia.

What to Bring

- Insurance card and identification
- Advance directive
- List of medicines
- Loose-fitting, comfortable clothes
- Slip-on shoes that don't require you to bend over
- For children, their favorite toy or security blanket

Please leave jewelry and valuables at home.

What You Can Expect

An identification (ID) bracelet with your name and hospital/clinic number will be placed on your wrist. Your ID should be checked by all health team members before they provide any procedures or give you medication. If needed, you will also have an allergy alert bracelet.

An intravenous line (IV) will be started to give you fluids and medication.

For general anesthesia, a tube will be placed down your throat to help you breathe during the operation.

After your operation, you will be moved to a recovery room where your heart rate, breathing rate, oxygen saturation, blood pressure, and urine output will be closely watched.

Preventing Pneumonia

After your operation, moving around and taking deep breaths can help prevent complications such as blood clots, breathing problems, and pneumonia. Deep breathing can be done using an incentive spirometer or by taking 5 to 10 deep breaths and holding each breath for 3 to 5 seconds. Young children can do deep breathing by blowing bubbles.

Preventing Blood Clots

When you have an operation, you are at risk of getting blood clots because of not moving while under anesthesia. The longer and more complicated your operation, the greater the risk. This risk is decreased by taking a medication that thins your blood and by having support stockings or compression boots placed on your legs and walking 2 to 5 times per day.

Preventing Infection

Your surgical team will clip the hair near your surgical incision site. Do not shave the skin on your abdomen. Antibiotics are not routinely used for simple abdominal hernia repair. Be sure all visitors wash their hands.

Questions to Ask

About my home medications:

- What medications should I stop taking before my operation?
- Should I take any medicines on the day of my operation?

About my operation:

- What are the risks and side effects of anesthesia?
- What technique will be used to repair the hernia (laparoscopic or open; mesh or with sutures)?
- What are the risks of this procedure for me?
- Will you be performing the entire operation yourself?
- What level of pain should I expect and how will it be managed?
- How long will it be before I can return to my normal activities (work, driving, lifting)?

Your Recovery and Discharge

Keeping You Informed

High-Fiber Foods

Food high in fiber include beans, bran cereals and whole grain breads, peas, dried fruit (figs, apricots, and dates), raspberries, blackberries, strawberries, sweet corn, broccoli, baked potatoes with skin, plums, pears, apples, greens, and nuts.

Your Recovery and Discharge

Thinking Clearly

If general anesthesia is given, it may cause you to feel different for 2 or 3 days. Do not drive, drink alcohol, or make any big decisions for at least 2 days.

Nutrition

- When you wake up from the anesthesia, you will be able to drink small amounts of liquid. If you do not feel sick, you can begin eating regular foods.
- Continue to drink about 8 to 10 glasses of liquid per day.
- Eat a high-fiber diet to decrease your risk of constipation.

Activity

- Slowly increase your activity. Be sure to get up and walk every hour or so to prevent blood clot formation.
- The average length of hospital stay is 2 days for laparoscopic repair and 4 days for open repair. The length of time to resume full activities of daily living is reported as 4 to 5 days.
- Do not lift items heavier than 10 pounds or participate in strenuous activity until advised by your surgeon. Lifting limitations may last for 6 months following a complex repair.[16]

Work and Return to School

- You can go back to work when you feel well enough. The average time to return to work is 13 days for laparoscopic repair and 25 days for open repair.[3]

Wound Care

- Always wash your hands before and after touching near your incision site.
- Do not soak in a bathtub until your stitches, steri-strips, or staples are removed. You may take a shower after the second postoperative day unless you are told not to.
- Follow your surgeon's instructions on when to change your bandages.
- A small amount of drainage from the incision is normal. If the dressing is soaked with blood, call your surgeon.
- If you have steri-strips in place, they will fall off in 7 to 10 days.
- If you have a glue-like covering over the incision, allow the glue to flake off on its own.
- Avoid wearing tight or rough clothing. It may rub your incisions and make it harder for them to heal.
- Protect the new skin from the sun. The sun can burn and cause darker scarring.
- Your scar will heal in about 4 to 6 weeks and will become softer and continue to fade over the next year.

Pediatric Considerations—For infants, the hernia repair site may be covered with a waterproof dressing to protect the site from urine and stool.

Bowel Movements

Avoid straining with bowel movements by increasing the fiber in your diet with high-fiber foods or over-the-counter fiber medications such as Metamucil and Fibercon.

Pain

The amount of pain is different for each person. For adults, on average, narcotics were used for 3 days, and some patients needed no additional pain medication.[8] You can use throat lozenges if you have sore throat pain from the tube placed in your throat during your anesthesia.

Home Medications

The new medicine you will need after your operation is for pain control.

When to Contact Your Surgeon

Contact your surgeon if you have:

- Pain that will not go away
- Pain that gets worse
- A fever higher than 101°F
- Vomiting
- Swelling, redness, bleeding, or bad-smelling drainage from your wound site
- Strong or continuous abdominal pain or swelling of your abdomen
- No bowel movement 2 to 3 days after the operation.

Pain Control

Everyone reacts to pain in a different way. A scale from 0 to 10 is used to measure pain. At a "0," you do not feel any pain. A "10" is the worst pain you have ever felt. Following a laparoscopic procedure, pain is sometimes felt in the shoulder. This is due to the gas inserted into your abdomen during the procedure. Moving and walking helps to decrease the gas and the shoulder pain.

Extreme pain puts extra stress on your body at a time when your body needs to focus on healing. Do not wait until your pain has reached a "10" or is unbearable before telling your provider. It is much easier to control pain before it becomes severe.

Common Medicines to Control Pain

Narcotics or opioids are used for severe pain. Possible side effects of narcotics are sleepiness; lowered blood pressure, heart rate, and breathing rate; skin rash and itching; constipation; nausea; and difficulty urinating. Some examples of narcotics include morphine, oxycodone (Percocet/Percodan), and hydromorphone (Dilaudid). Medications can be given to control many of the side effects of narcotics.

Nonnarcotic Pain Medication

Most nonopioid analgesics are classified as nonsteroidal anti-inflammatory drugs (NSAIDs). They are used to treat mild pain and inflammation or combined with narcotics to treat severe pain. Possible side effects of NSAIDs are stomach upset, bleeding in the digestive tract, and fluid retention. These side effects usually are not seen with short-term use. An example of a NSAID is Ibuprofen.

Pain Control without Medicine

Distraction helps you focus on other activities instead of your pain. Music, games, or other engaging activities are especially helpful with children.

Splinting your stomach by placing a pillow over your abdomen with firm pressure before coughing or movement can help reduce the pain.

Guided imagery helps you direct and control your emotions. Close your eyes and gently inhale and exhale. Picture yourself in the center of somewhere beautiful. Feel the beauty surrounding you. Feel your emotions come back to your control. You should feel calmer.

Other Instructions:

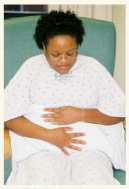
Follow-up Appointments		
Who	**Date**	**Phone**

Keeping You Informed

Pain after Ventral Hernia Repair

There was no difference in long-term pain or quality of life scores when comparing laparoscopic with open procedures. Pain that continued for more than 6 months is reported as 2.5% for laparoscopic procedures and 1.5% for open procedures. The cause of long-term pain will be assessed by your surgeon and is sometimes treated with local analgesia injections.[1]

Guided imagery



Splinting your stomach

More Information

For more information on tests and procedures, please go to the American College of Surgeons Patient Education website at *www.facs.org/patienteducation/*. For a complete review of hernia repair, consult *Selected Readings in General Surgery* "Hernia," Vol 37, No 8, at *www.facs.org/SRGS/*.

Glossary of Terms

Advance directives: Documents signed by a competent person giving direction to health care providers about treatment choices.

Blood tests: Tests usually include a Chem6 profile (sodium, potassium, chloride, carbon dioxide, blood urea nitrogen, and creatinine) and complete blood count (red blood cell and white blood cell count).

Computerized tomography (CT) scan: A diagnostic test using X ray and a computer to create a detailed, three-dimensional picture of your abdomen.

Electrocardiogram (ECG): Measures the rate and regularity of heartbeats, the size of the heart chambers, and any damage to the heart.

Hematoma: A localized collection of blood in the tissue or organ.

Nasogastric tube: A soft plastic tube inserted in the nose and down to the stomach; used to empty the stomach of contents and gases to rest the bowel.

Seroma: A collection of serous (clear/yellow) fluid.

Ultrasound: Sound waves are used to determine the location of deep structures in the body. A hand roller is placed on top of clear gel and rolled across the abdomen.

Urinalysis: A visual and chemical examination of the urine most often used to screen for urinary tract infections and kidney disease.

References

The information provided in this report is chosen from recent articles based on relevant clinical research or trends. The research below does not represent all that is available for your operation. Ask your doctor if he or she recommends that you read any additional research.

1. Saureland S, Wlagenbach M, Habermalz B, et al. Laparoscopic versus open surgical techniques for ventral or incisional hernia repair (Review). The Cochrane Collaboration. 2011.
2. Malangoni MA, Rosen MD. *Hernias.* In: CM Townsend, RD Beauchamp, et al. *Textbook of Surgery.* Philadelphia, PA: Saunders, 2008.
3. Helgstrand F, Rosenberg J, Bisgaard T. Trocar site hernia after laparoscopic surgery: A qualitative systematic review. *Hernia.* 2011;15:313–121.
4. Yahchouchy-Chouillard E, Aura T, Picone O, et al. Incisional hernia related risk factors. *Digestive Surgery.* 2003;20:3-9.
5. Cheek CM, Williams MH, Farndon JR. Trusses in the management of hernia today. *British Journal of Surgery.* 1995;82:1611-1613.
6. Forbes SS, Eskicioglu C, McLeod RS, et al. Meta-analysis of randomized controlled trials comparing open and laparoscopic ventral and incisional hernia repair with mesh.
7. Brill JB, Turner PL. Long-term outcomes with transfascial sutures versus tacks in laparoscopic ventral hernia repair: A review. *The American Surgeon.* 2011;77:458-465.
8. Eid GM, Mattar SG, et al. Repair of ventral hernias in morbidly obese patients undergoing laparoscopic gastric bypass should not be deferred. *Surgical Endoscopy.* 2004;18:207-210.
9. Turner PL, Park AE. Laparoscopic repair of ventral incisional hernias: Pros and cons. *Surgical Clinical of North America.* 2008;88:85-100.
10. Carlson MA, Trantzides CT, et al. Minimally invasive ventral herniorrhaphy: An analysis of 6266 published cases. *Hernia.* 2008;12:9-22.
11. Pierce RA, Spitler JA, et al. Pooled data analysis of laparoscopic vs open ventral hernia repair: 15 years of patient data accrual. *Surgical Endoscopy.* 2007;21:378-386.
12. Dreiser B, Moller MH, Bartholdy J. Post-operative urinary retention in a general surgical population. *European Society of Anaesthesiology.* 2011;28:190-194.
13. Mentler E, Mann K, et al. High incidence of acute urinary retention associated with immediate catheter removal after laparoscopic Nissen Fundoplication. *Surgical Endoscopy.* 2011;25:1611-1616.
14. Hwang CS, Wichterman KA, Alfrey EJ. Laparoscopic ventral hernia repair is safer than open repair: Analysis of the NSQIP data. *Journal of Surgical Research.* 2009;156:213-216.

Disclaimer

This information is published to educate you about your specific surgical procedures. It is not intended to take the place of a discussion with a qualified surgeon who is familiar with your situation. It is important to remember that each individual is different, and the reasons and outcomes of any operation depend upon the patient's individual condition.

The American College of Surgeons is a scientific and educational organization that is dedicated to the ethical and competent practice of surgery; it was founded to raise the standards of surgical practice and to improve the quality of care for the surgical patient. The ACS has endeavored to present information for prospective surgical patients based on current scientific information; there is no warranty on the timeliness, accuracy, or usefulness of this content.

Reviewed by: Mary Hawn, MD, FACS
Kathleen Heneghan, RN, MSN, PNC
David Feliciano, MD, FACS

Reviewed January 2012

We are grateful to Ethicon Endo-Surgery for the educational grant to the American College of Surgeons Foundation in support to the Division of Education Surgical Patient Education Program Hernia brochures.

APPENDIX 7: STATEMENT OF INVESTIGATOR

STUDY: TB2016.01.01

FORM: STATEMENT OF THE INVESTIGATOR

PROTOCOL TITLE: A prospective, single arm, multi-center study evaluating the short-term clinical outcomes of ventral hernias treated with OviTex® reinforced bioscaffold.

- I agree to conduct the study in accordance with this protocol and to make no changes except when necessary to protect the safety, rights or welfare of subjects. If such a change occurs, I will promptly inform the Sponsor of this event.

- I agree to personally conduct or supervise the study, and that all associates, colleagues and employees assisting me in the conduct of this study are informed of their obligations in meeting study commitments.

- I have read and understand the information in the Investigator's Brochure and/or the Instructions for Use, including the potential risks, expected adverse events and potential side effects of the study itself and the product being studied.

- I agree to protect the rights of my patients and obtain informed consent from those who may participate in this study, in accordance with 21CFR Part 56 and the requirements of my Institutional Review Board/Ethics Committee.

- I agree to report to the Sponsor adverse experiences that occur in the course of this study, in accordance with the study protocol requirements.

- I agree to maintain adequate and accurate records in accordance with study requirements and those records will be made available for inspection by the Sponsor, IRB or regulatory bodies such as the U.S. Food & Drug Administration.

- I agree to control the distribution of study product provided to me in the course of this study and provide accurate accounting of the disposition of those products.

- I agree to provide my Institutional Review Board/Ethics Committee with

all the information required to support both the initial and continuing review and approval of this study and I will not implement this study until such approval has been obtained. I agree to promptly report to the Institutional Review Board/Ethics Committee all changes in research activity and all unanticipated problems involving risk to subjects or others.

- Finally, I agree to comply with all other requirements regarding the obligations of clinical investigators, as outlined in 21 CFR Part 812.100-150. A copy of those regulations has been provided to me.

INVESTIGATOR NAME: _____

INVESTIGATOR SIGNATURE:_____

DATE: _____

INSTITUTION: _____

APPENDIX 8: SUB-INVESTIGATOR AGREEMENT

STUDY: TB2016.01.01

FORM: SUB-INVESTIGATOR AGREEMENT

PROTOCOL TITLE: A prospective, single arm, multi-center study evaluating the short-term clinical outcomes of ventral hernias treated with OviTex® reinforced bioscaffold.

Each of the undersigned collaborating physicians ("Sub-Investigators") shall be primarily responsible together with the Principal Investigator, for performing the obligations of the Principal Investigator in accordance with the Clinical Trial Agreement among TELA Bio, the Research Institution and Principal Investigator. Each Sub-Investigator certifies by signing below that he/she has all rights and privileges necessary to perform obligations of the Agreement under Protocol number TB2016.01.01 at the Research Institution. Each undersigned Sub-Investigator hereby expressly:

a. Acknowledges that he/she has received copies of, read and understands this Agreement and the TB2016.01.01 Protocol
b. Agrees to perform the obligations of the Investigator under the Agreement, and
c. Agrees that his/her participation in the study shall at all times be under the direct supervision of the Principal Investigator.

Principal Investigator Signature: _____

Printed Name: _____

Date: _____