Polypropylene Mesh in Vaginal Surgery
Risk Analysis & Alternatives

Michael T Margolis, MD, FACS, FACOG
Assistant Clinical Professor
Department of Ob/Gyn, UCLA
Conflicts of Interest

- Cook Biomedical
- Boston Scientific
- Wyeth Ayerst
- TAP Pharmaceuticals
DEMOGRAPHICS

- Average age of menopause US is 50 yrs. & life expectancy of women is 80 yrs thus,
- Women live greater than 1/3 of their lives in the postmenopausal years

- U.S. Census Data 2006
  - 300 million people in the US
    - 152 million women
      - 60 million women 45 yrs old and greater
        - 20% of the population
NET GROWTH IN NUMBER OF WOMEN 45 Y/O & OVER (1995-2020)

*US Bureau of the Census 1994
Since the majority of incontinence & prolapse occurs in the late & post-reproductive age group, pelvic floor defects will continue to affect large numbers of women well into the future.
LIFETIME RISK OF UNDERGOING A SINGLE OPERATION FOR PROLAPSE OR URINARY INCONTINENCE

- Olsen et al *Obstet Gynecol* 1997;89:501-6
- Reviewed literature
  - 50% of parous women have prolapse
- Studied women age 20 & up
  - lifetime risk of single operation by 80 yrs. 11.1%
  - risk of reoperation = 29.2%
SURGERIES FOR SUI
Almost 200 procedures have been described

- Kelly plication
- Needle suspension procedures
- Retropubic urethropexy:
  - Open, scope & robotic
- Sling operations:
  - Old & new
- Periurethral injections
- Artificial sphincter
- Urinary diversion
10 YEAR CURE RATES FOR VARIOUS PROCEDURES (%)
SOME GENERAL COMMENTS
ON SLING PROCEDURES
GOEBELL-FRANKENHEIM-STOECKEL FASCIA LATA SLING PROCEDURE

- First described in 1907
- Indicated for type III SUI (aka ISD)
  - Characterized by:
    - Absence of urethral hypermobility
    - Low UPP (<20 cm H2O)
    - Valsalva leak point pressure <60 cm H2O
    - Often seen in pts. with hx previous surgery
SOME GENERAL COMMENTS ON SLING PROCEDURES

- Slings are:
  - by definition obstructive procedures
  - always done blindly, thus risk of injury to adjacent organs is high
  - overall, have higher complication rates than RPU’s
GOEBELL-FRANKENHEIM-STOECKEL FASCIA LATA SLING PROCEDURE

- Pros:
  - >90% success rate

- Cons:
  - Bladder/urethral injuries
  - Urethral obstruction (5-15%)
  - DI
The Fascia Lata Sling Procedure for Treating Recurrent Genuine Stress Incontinence of Urine

- Twenty two year experience with fascial lata sling
- 170 patients
- Cure rate 92.4%
Indications for slings liberalized because:

- Of the increase in # of baby boomers reaching menopause w/ SUI
- Inexpensive petroleum derived materials are readily available and cheap
- Ins companies pushing OP procedures over IP
- Slings are easy to teach, easy to perform & fast
- Slings bill out at a high reimbursement rate
Polypropylene
What is Polypropylene?

- Thermoplastic synthetic polymer made from the monomer propylene
Polypropylene

Applications:
- Packaging
- Textiles
- Plastic parts
- Reusable containers
- Indoor/outdoor carpeting

- Laboratory equipment
- Loudspeakers
- Automotive components
- Medical
What is Propylene?*

*Dow Product Safety Assessment

- Hydrocarbon monomer produced from fossil fuels (petroleum, natural gas and coal)
- A colorless, highly flammable gas produced as a byproduct of oil refining & natural gas processing
- During oil refining, propylene is produced as a result of the cracking of hydrocarbon molecules
- A major industrial chemical intermediate that serves as a building block for an array of chemical and plastic products including polypropylene
TENSION FREE VAGINAL TAPE

TVT

The most popular of the current sling procedures because:

- Outpatient procedure
- Easy to do & short procedure
- Tolerable success rate
- Aggressive marketing by industry

Problem

- TVT is a sling & thus has a higher complication rate than MMK/Burch
- It carries the risks of polypropylene mesh
PUBLISHED TVT COMPLICATIONS

- Deaths
- Major vascular injury w/ hemorrhage
- Visceral injuries-bladder/bowel
- Urethral obstruction
- Detrusor instability
- Pain/dyspareunia
- Permanent irreversible synthetic material related
  - Infection, erosion, fistula
Grafting in Gyn Surgery - General Theory

- Why use graft?
  - Ostensibly
    - Strengthen surgical repair
    - Improve success rate
    - Improve function, anatomy & symptoms of repaired organ
  - Requirements
    - Has to be safe
    - Has to be inert
    - Has to be effective
    - Complications have to be low
    - Should be quick
    - Should be inexpensive
    - SHOULD HAVE AN ADEQUATE EXIT STRATEGY - Should be removable

- THE BENEFITS HAVE TO OUTWEIGH THE RISKS
Grafts

- Biologic
  - Autologous-self
  - Allograft-same species
  - Xenograft-different species

- Synthetic
  - Permanent v. absorbable
  - Material-polypropylene, gortex, etc.
  - Braided or monofilament
  - Architecture (woven or knitted)
  - Pore size
  - Density
  - Stiffness
Biology of Prosthetic Implant

- **Day 3**
  - Inflammation
    - Exudative, then cellular

- **Day 10**
  - Fibroblastic ingrowth

- **Week 6**
  - Complete ingrowth

- Prosthetic strength doubles from week 3 to 12

- Ongoing remodeling of implant persists beyond 12 months

* Petit J, J Chir, 1974
* Adloff M, Chirugie 1976
Emphasis
Transvaginal Polypropylene

- The most common mesh used today
- Amid classification type I
  - Macroporous
    - Pore size > 75 microns allows for
      - High collagen deposition
      - High capillary penetration
      - High attachment strength
  - Theoretically resistant to infection
    - Macrophages enter larger pores
Known Issues to Date Regarding Polypropylene Mesh

- Mesh shrinkage
- Mesh Erosion
  - Early vs Late
- Mesh Infection
- Dyspareunia
- Chronic Pelvic Pain
- Mesh Degradation
Mesh Shrinkage

- Polypropylene “cross-hatched” mesh
  - 2D sheets shrink 20% in surface area*
  - 3D plugs shrink 75% in total volume

- Shrinkage caused by fibroblast contraction of scar plate around mesh

- Results in more contraction on adjacent tissue than desired

*Amid PK, Hernia 1997
Differences in polypropylene shrinkage depending on mesh position in an experimental study

  - Polypropylene mesh (5x3.5 cm) implanted into 15 rabbits
  - 5 animals each were euthanized at days 30, 60 and 90
  - Mesh areas calculated
  - Mesh areas reduced by 25.92%, 28.67% and 29.02% respectively
- “These observations support the theory of PP mesh shrinkage as a consequence of the incorporation of the biomaterial to the scarring tissue”
Retraction of tissues surrounding the mesh is usual with a reduction in the size of the mesh.

Average shrinkage is 25-30%.

Shrinkage may reach 40% of the initial surface of the implant after surgery.

- **30-50%** shrinkage rate with polypropylene mesh
Effects of Mesh Weight

- Heavier (g/m²) mesh associated with
  - Greater and more prolonged inflammation
  - Greater scar plating
  - Less elasticity
  - Ongoing inflammation & remodeling at 1 year

- Some suggestion that surface area, not just density, is responsible.
  - This is why POP kits are more problematic than slings, there’s more mesh
Mesh Erosion
Risk Factors for Mesh Erosion

- Age > 70
- Smoking
- Concomittent hysterectomy
- Stage of prolapse > 2
- Estrogen deficiency
- Dosage of mesh
- Infection
RCT’s Mesh Cure & Erosions for Anterior POP

- Iglesia 2010  Mesh Cure 40.6%  Erosion 15.6%
- Withagen 2011  Mesh Cure 90.4%  Erosion 16.9%
- Nieminen 2010  Mesh Cure 87%  Erosion 19%
Incidence of mesh erosion including exposure, extrusion and perforation initially described in the literature varies widely from 0-33%
Mesh Erosion From ASCP/TAH

- Abdominal Sacral Hysteropexy: a pilot study comparing sacral hysteropexy to sacral colpopexy with hysterectomy.

- Graft erosion occurred in 33% of patients undergoing TAH with concurrent ASCP

- Thus proving that the problem arises from the implantation of synthetic mesh through or next to a contaminated wound
  - Biologically plausible-It makes sense
Mesh Complications-2012

<table>
<thead>
<tr>
<th>Reported Complication</th>
<th>Range Based on Case Series (%)</th>
<th>Range Based on Randomized Controlled Trials (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mesh erosion (exposure)</td>
<td>1–18.8</td>
<td>5–19</td>
</tr>
<tr>
<td>Buttock, groin, or pelvic pain</td>
<td>2.9–18.3</td>
<td>0–10</td>
</tr>
<tr>
<td>De novo dyspareunia</td>
<td>2.2–15</td>
<td>8–27.8</td>
</tr>
<tr>
<td>Reoperation*</td>
<td>1.3–7.6</td>
<td>3.2–22</td>
</tr>
</tbody>
</table>

*Does not include reoperation for stress urinary incontinence.

- **Vaginal Placement of Synthetic Mesh for Pelvic Organ Prolapse**
- **Committee on Gynecologic Practice**
- **Female Pelvic Medicine & Reconstructive Surgery. 18(1):5-9, January/February 2012.**
Adverse Events over Two Years after Retropubic or Transobturator Midurethral Sling Surgery: Findings from the Trial of Midurethral Sling (TOMUS) Study

4.7% erosion rate with TVT

As an aside, TOMUS also noted:

- 42% adverse event rate
- 20% serious adverse event rate
Randomized comparison of the suprapubic arc sling procedure vs TVT for SUI

- 19.4% erosion rate with TVT
  - “Rejection of tape”
  - “Protrusion of tape edge”

- 29.1% erosion rate with TVT
  - “Defective vaginal wound healing”
Pathologic evaluation of explanted vaginal mesh: interdisciplinary experience from a referral center

- Review of 1 institution’s experience with path findings of explanted vaginal mesh over a 2 year period
- 102 explants reviewed
- Indications for removal
  - 42% for erosion
  - 28% for pain
  - Urinary retention 6%
  - Infection 3%
  - No history provided 25%
Pathologic evaluation of explanted vaginal mesh: interdisciplinary experience from a referral center

What conclusions can be drawn?

Mesh/sling complications are common
- 102 removal in 2 years at one institution

Erosion is common
- 42% of all explants
Graft-related complications and biaxial tensiometry following experimental vaginal implantation of flat mesh of variable dimensions
Manodoro, S et al  BJOG. 2013 Jan;120(2):244-50

- Gynemesh M implanted into vagina of 20 ewes and sacrificed at 60 & 90 days
- 5 x 5 cm mesh implants led to exposures in 30% of cases
- Average contraction rate was 52% +/- 14%
- 3.5 x 3.5 cm mesh implants did not erode but contraction rate was 25% +/-26.3%
Comparison of polypropylene mesh and porcine-derived, cross-linked urinary bladder matrix materials implanted in the rabbit vagina and abdomen

- Forty rabbits implanted with PP mesh (n = 20) or cUBM (n = 20) in the vagina & abdomen. Grafts harvested 12 weeks later & processed for histology & biomechanical testing.
- Vaginal PP erosion rate was 67 %, whereas abdominal PP and cUBM showed no erosion.
- All patches adhered to vaginal mucosa and shrank to varying degrees, especially PP grafts.
Overall Reported Sling Erosion Rates In Humans

4.7% - 19.4% (29.1%)
Mesh Infection
NORMAL SKIN FLORA

- Staphylococcus epidermidis
- Staphylococcus aureus
- Other Staphylococcus species
- Streptococcus species
NORMAL VAGINAL FLORA

Lactobacillus
Bacteroides
Peptococcus
Peptostreptococcus
Gardnerella
E. coli
Streptococcal
Staphylococcus
Mycoplasmas
Ureaplasma
Enterobacteriaceae
Candida
Mobiluncus
Acinetobacter
Classification of operative wounds based on degree of microbial contamination (Adapted from Berard F, Gandon J, Ann Surg 1964)

- **Clean** - Elective, not emergency, non-traumatic, primarily closed; no acute inflammation; no break in technique; respiratory, gastrointestinal, biliary and genitourinary tracts not entered.

- **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.

- **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.

- **Dirty** - Purulent inflammation (e.g. abscess); preoperative perforation of respiratory, gastrointestinal, biliary or genitourinary tract; penetrating trauma >4 hours old.

**Rates of infection** (Cruse and Foord, 1980/1992) 1-2% or less for clean wounds, 6-9% for clean-contaminated wounds, 13-20% for contaminated wounds and about 40% for dirty wounds.
Mesh Infection
Mesh Complications: Review
Shah & Badlani IJU, 2012

- Incidence of infection 0-8%
- Clinical presentation
  - Non specific pelvic pain
  - Persistent vaginal discharge or bleeding
  - Dyspareunia
  - Urinary/fecal incontinence
  - Induration of vaginal incision
  - Vaginal granulation
  - Draining sinus tracts
  - Graft erosion
Bacterial Colonization of Polypropylene Vaginal Mesh
Vollebregt, et al Int Urogyn, 2009

- Culture swabs of core mesh taken during surgical implantation of vaginal mesh
- 67 implants cultured
- 56 (83.6%) implants cultured positive for vaginal bacteria
- Conclusions: “Colonization of vaginally implanted mesh occurs frequently”

- 16 mesh systems removed
  - 62% for erosion
- Cultures performed
- Bacterial contamination found in all meshes
Dyspareunia & Chronic Pelvic Pain In Patients Undergoing Sling and Mesh Surgery
Dyspareunia*

- Up to 24% incidence with TOT
- Pts. undergoing POP surgery 6.2%-24.4%

Causes:
- Mesh erosion
- Mesh infection
- Mesh shrinkage/contraction
- Extensive vaginal scarring & fibrosis

Comparison of Dyspareunia Between TVT v Burch Patients


- Evaluated sexual satisfaction rates following TVT and Burch
  - 23% of TVT group expressed neg. changes
    - (at 34 months)
  - 9% of Burch group expressed neg. changes
    - (at 89 months)
  - Majority suffered from dyspareunia
Urinary complications and sexual function after the TVT procedure


- 71 pts. Evaluated before and after TVT
- 20% reported impaired sexual function after surgery including:
  - 14.5% with dyspareunia
  - 5.4 % with loss of libido
Vaginal Contractility After Mesh


- Implanted Gynemesh PS (Ethicon), SmartMesh (Coloplast) & UltraPro (Ethicon) polypropylene mesh systems into vaginas of 45 rhesus monkeys

- Mesh & vagina excised & studied 3 months later

- Vaginal contractility decreased by 80% with Gynemesh PS, 48% after SmartMesh & 68% after UltraPro
Vaginal degeneration following implantation of synthetic mesh with increased stiffness
Liang, R et al  BJOG 2013 Jan;120(2):233-43

- 50 rhesus monkeys implanted with Gynemesh PS or UltraPro in vagina
- 12 control animals without mesh
- Magee-Womens Research Institute at U of Pitt
- Mesh-vagina complex removed and studied after 3 months
Vaginal degeneration following implantation of synthetic mesh with increased stiffness
Liang, R et al  BJOG 2013 Jan;120(2):233-43

- Results
  - Gynemesh PS caused
    - Substantial thinning of the vagina (p=0.02)
    - Increased apoptosis (process of programmed cell death) in the area of the mesh
    - 20% & 43% decreased collagen and elastin content (respectively)
    - Increased collagenase activity(135% p=0.01)
    - GAG (a marker of tissue injury) was highest w/ Gynemesh PS compared w/ control & other meshes

- Conclusion-Gynemesh PS induced a maladaptive response consistent with vaginal degeneration
Of the many studies reporting on suburethral slings:

- “Most do not adequately evaluate dyspareunia”…..
- but, those that do inquire report denovo dyspareunia occurring in 8-69% of pts. (average 15-30%)
Chronic Pelvic Pain*

- Groin & thigh pain in 40% TOT pts.
- In POP surgery, the incidence of chronic pain published is 1.9%-24%
- Causes:
  - Mesh erosion
  - Mesh infection
  - Mesh shrinkage/contraction
  - Extensive vaginal scarring & fibrosis

Trocar Related Injuries

- Bladder
  - Urethra, bladder and ureter
- Bowel
  - Rectum and small bowel
- Blood vessel
  - Iliac, obturator, inferior epigastric and pudendal
- Nerve
  - Obturator, pudendal, iliohypogastric
Bladder Perforation Rate

- Bladder perforation rate 6.7%

- Bladder perforation 24% vs 23% (SPARC vs TVT)
Bladder Perforation

  - 100 pts. with SUI underwent TVT
  - Bladder penetration occurred in 24 (24%)
  - Conclusion “TVT is safe”
Overall Reported Bladder Perforation Rates

6.7% – 24%
Voiding Dysfunction & Urgency After Sling
Reviewed 31 articles re. TVT complications

Found:

- De novo urgency & voiding dysfunction 31.5%
- Urinary retention 19%
Urinary complications and sexual function after the TVT procedure


- 71 pts. evaluated (with urodynamics and questionnaire) before and after TVT
- Postop findings:
  - Voiding difficulty in 60%
  - Urinary urgency in 47%
  - Sig. outflow obstruction in 34.5%
  - Urinary frequency in 33%
Problems With Synthetic Slings

Urogynecology & Reconstructive Pelvic Surgery 3rd Ed.
Walters & Karram, 2007

- Foreign body inflammatory reaction resulting in higher risk of erosion & fistula compared with autologous material
- Incidence of voiding disorders 2%-37%
- Incidence of DI 3%-30%
- Erosion 5%
- Sling revision or removal 1.8%-35%
Underreporting of Complications After Sling
Physicians who perform mesh procedures may not be aware of the complications their patients experience and these providers may be responsible for future mesh-related complications with no awareness of the existing magnitude of the issue.
Most of the women who seek management of synthetic mesh complication after POP or SUI surgery have severe complications that require surgical intervention & a significant proportion require >1 surgical procedure.
Effect of the Material

- Is polypropylene truly inert?
  - No-If it were, the immune system would not mount a foreign body rxn to it!
  - “Chronic foreign body giant cell rxn”

- Inflammation, oxidation and degradation occurs with polypropylene implants

- What are the effects of the degradation products........? *Unknown, nobody ever studied it before taking it to market!*

Polypropylene as a reinforcement in pelvic surgery is not inert: Comparative analysis of 100 explants

Clave, et al Int Urogynecol J 2010

- Contrary to the prevailing understanding of polypropylene as an inert material when used in vaginal surgeries, Clave, et al in their study of 100 explants noted that all showed evidence of degradation on SEM after 3 months
Mesh damage included

- Superficial degradation with peeling of the fiber surface, transverse cracks in the implant threads, significant cracks with disintegrated surfaces & partially detached material & superficial & deep flaking
- Polypropylene implants degraded more in the presence of infection or inflammation (common in vaginal implants)
MARLEX POLYPROPYLENES (ALL GRADES)

MEDICAL APPLICATION CAUTION: Do not use this Chevron Phillips Chemical Company LP material in medical applications involving permanent implantation in the human body or permanent contact with internal body fluids or tissues.
Material Safety Data Sheet

SECTION 1: PRODUCT AND COMPANY IDENTIFICATION

MARLEX® POLYPROPYLENES (ALL GRADES)

Product Use: Coatings
Synonyms: PLASTIC
Product Cas No.: MIXTURE

Company Identification:
Chevron Phillips Chemical Company LP
10001 Six Pines Drive
The Woodlands, TX 77380

Product Information:
MSDS Requests: (800) 852-5530
Technical Information: (800) 852-5531

24-Hour Emergency Telephone Numbers
HEALTH: ICT Emergency Information Center (800) 231-0623 or (510) 231-0623
TRANSPORTATION: North America: CHEMTREC (800) 424-9300 or (703) 527-3887
ASIA: (800) ALERTS5S or (800) 2537874 or +6565429595
EUROPE: BIG +32+14+584546 (phone) or +32+14+583518 (telex)
SOUTH AMERICA SOS-Cotec inside Brazil: 0800+111+767
Outside Brazil: 55+19+3467+1600

MEDICAL APPLICATION CAUTION: Do not use this Chevron Phillips Chemical Company LP material in medical applications involving permanent implantation in the human body or permanent contact with internal body fluids or tissues.

Do not use this Chevron Phillips Chemical Company LP material in medical applications involving brief or temporary implantation in the human body or contact with internal body fluids or tissues unless the material has been provided directly from Chevron Phillips Chemical Company LP under an agreement which expressly acknowledges the contemplated use.

Chevron Phillips Chemical Company LP makes no representation, promise, express warranty or implied warranty concerning the suitability of this material for use in implantation in the human body or in contact with internal body fluids or tissues.

SECTION 2: COMPOSITION INFORMATION ON INGREDIENTS

Revision Number: 3
Revision Date: 01/28/2004

1 of 9

MARLEX® POLYPROPYLENES (ALL GRADES)
MSDS : 240590
Managers at Bard’s Davol unit used polypropylene made by Chevron Phillips Chemical Co. to produce vaginal-mesh products after Chevron officially registered a warning that it shouldn’t be permanently implanted in people, according to e-mails and documents in a lawsuit over Bard’s implants.

In 2004 and 2007 e-mails filed in federal court in West Virginia, a Davol executive warned colleagues not to tell Chevron Phillips or other resin makers that the company was using the material in medical devices placed in humans.
AR Without Synthetic Mesh

- Gandi 2005, AC success rate 71%
- Meschia 2007, AC success rate 81%
- Hviid 2010, AC success rate 85%
- Randomized trial of 3 techniques of AR (no polypropylene) Chmielewski, et al AJOG 2011
  - 88% success rate
AR vs Transvaginal Mesh
Altman et al. NEJM 2011

- Multi-center RCT
- AR vs Anterior Prolift
- Outcome at 12 mo. POPQ stage 0-1 and absence of bulge sx’s

**Good News for Mesh Proponents:**
- Mesh ↓ objective failure rate 14 v. 49%
- Mesh ↓ subjective failure rate 17 v 28%
AR vs Transvaginal Mesh
Altman et al. NEJM 2011

- **Bad News for Mesh Proponents**
- AR had less de novo apical & posterior prolapse than mesh 9.5% v. 17.7%
- Mesh had longer OR times & greater blood loss
- Mesh had greater cystotomy rate 3.5% v. 0.5%
- Mesh had more postop de novo SUI 12.3% v. 6.3%
Bad News for Mesh Proponents

- Mesh erosion rate 10.4%
- Mesh had higher reoperation rate 10.2% v. 5.8%

Quality of Life

- “The universally agreed upon most important outcome parameter defining success rate”
- NO DIFFERENCES BETWEEN MESH AND STANDARD AR

Conclusions - mesh should not be used
Regarding the Evidence for Use of Synthetic Mesh in the Anterior Compartment

Other studies have corroborated the Altman study and have concluded that there is no benefit of using polypropylene mesh in the anterior compartment.
Review of 56 published trials including 5954 women

ASCP better than SSLF

Transvaginal grafts (biologic and synthetic) reduce risk of prolapse when compared to native tissue repair

HOWEVER
Disadvantages of polypropylene mesh include:

- Longer operating time
- Greater blood loss
- Prolapse in other areas of the vagina
- New onset SUI
- Mesh erosion rate was 18%

“there is a lack of evidence to support transvaginal mesh operations used in apical or posterior compartment surgery”
Three-Year Outcomes of Vaginal Mesh for Prolapse-A RCT

- Planned 3 yr f/u of 65 women study that was halted because of 15.6% erosion rate
- “We found no significant differences in cure rates at 3 years between the mesh and no-mesh groups regardless of the definition used”
- Mesh group had a greater than 15% risk of mesh exposure
In October 2008, FDA issued a warning on higher-than-expected complications reported for use of mesh in transvaginal surgeries.

The FDA warning states: "Over the past three years, the FDA has received over 1,000 reports from nine surgical mesh manufacturers of complications that were associated with surgical mesh devices used to repair POP and SUI..."
FDA

- Complications included:
  - erosions through vaginal epithelium
  - infection
  - pain
  - urinary problems
  - recurrence of prolapse and/or incontinence.
  - bowel, bladder, and blood vessel perforation during insertion
vaginal scarring and mesh erosion led to a significant decrease in patient quality of life due to discomfort and pain, including dyspareunia
On July 13, 2011, the FDA stated in a news release:

- "There are clear risks associated with the transvaginal placement of mesh to treat POP."
- "The FDA issued a safety communication in 2008 due to increasing concerns about adverse events associated with the transvaginal placement of mesh. Since then, the number of adverse events has continued to climb. From 2008 to 2010, the FDA received 1503 adverse event reports associated with mesh used for POP repair, five times as many as the agency received from 2005 to 2007."
Surgical mesh for POP was subsequently reclassified from Class II to Class III, requiring premarket and postmarket studies.
Regrettably, the instructions for use (IFU’s) and directions for use (DFU’s) published by the sling and mesh manufacturers superficially touch on only some (not all) of the complications described herein and even then in a wholly inadequate manner.
What about the argument that using polypropylene mesh in abdominal hernias is ok so therefore it must be ok to use it in the vagina?
The anatomy, mechanics and biology of implanting a piece of mesh in the abdominal wall...

1) the sheath of the rectus abdominis is formed by the aponeuroses of the external oblique and transversus abdominis muscles. The upper two-thirds of the sheath encloses the rectus muscle both anteriorly and posteriorly. To accomplish this, the internal oblique aponeurosis splits. Part of this aponeurosis joins the aponeurosis of the external oblique to form the anterior layer, while the other portion joins the aponeurosis of the transversus abdominis to form the posterior layer.

The lower one-third of the sheath (b), below the arcuate line, is deficient posteriorly, since the aponeuroses of all three muscles are separated by the rectus abdominis muscle.
...is fundamentally different than implanting the same mesh in the vagina
Is There A Conflict of Interest Regarding Mesh Use in The Medical Community?

- AUGS has been a vigorous champion of polypropylene mesh
  - describe mesh as the “gold standard”
- 2011 - AUGS received > $220,000 in industry support
- 2014 - 7 of the 14 AUGS BOD receive industry $$
- 2014 - AUGS BOD refused to acknowledge a conflict of interest in their public statements supporting mesh
- Key opinion leaders that promote mesh receive significant industry $$
Misuse Of The Phrase “Gold Standard”

  Jurgen AHR Claassen

- Between 1995 and 2005 over 10,000 publications have mentioned “gold standard”

- Medline Search 4/8/2014 for “gold standard” showed over 170,000 citations
What is the Gold Standard for SUI Surgery?

- Karram 2012 says it's the pubovaginal sling
- TeLinde’s Operative Gynecology 2014 says it's the Burch
- AUGS 2014 says it's the polypropylene sling

- So who’s right?
- Nobody, the term is 100% subjective and therefore meaningless
Putting It All Into Perspective

- 1907 Goebell Stoeckel fascia lata sling was introduced
- 1996 Ulmsten 1\textsuperscript{st} described TVT for SUI
- 2001 CPT panel of the AMA added 57287 (removal/revision of sling) to the codebook
- 2006 CPT panel of the AMA added 57295 (removal of mesh) to the codebook
1996 Ulmsten 1\textsuperscript{st} described the TVT for SUI. Subsequently, he was paid $400,000 by Ethicon to publish what would become the landmark study on TVT but payment was contingent on two required findings:

- The study had to show TVT was effective
- The study had to show TVT was safe
Conclusions

- The risks of polypropylene mesh in prolapse and SUI surgery clearly outweigh the benefits.
- There are several superb alternatives to mesh that have a 0% mesh complication rate.