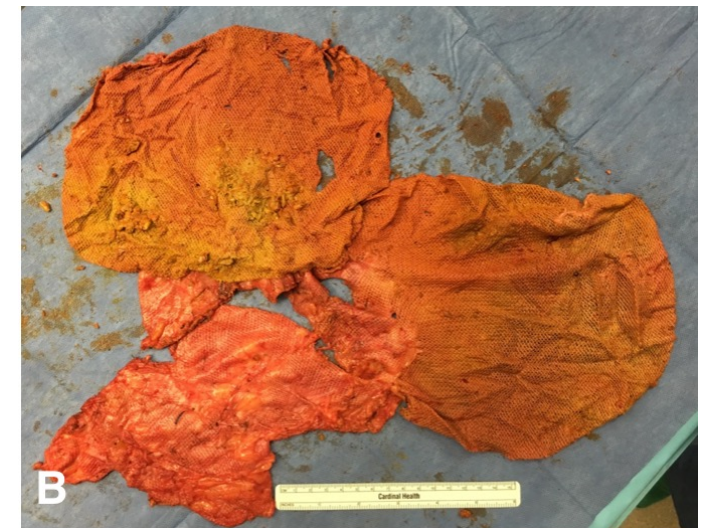
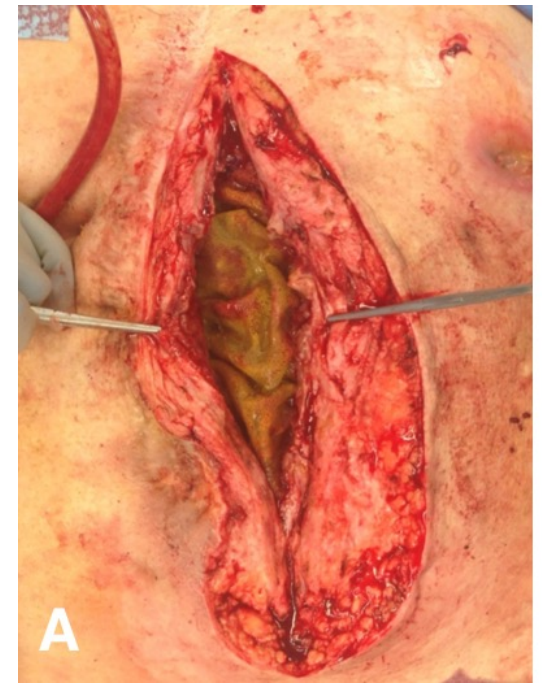
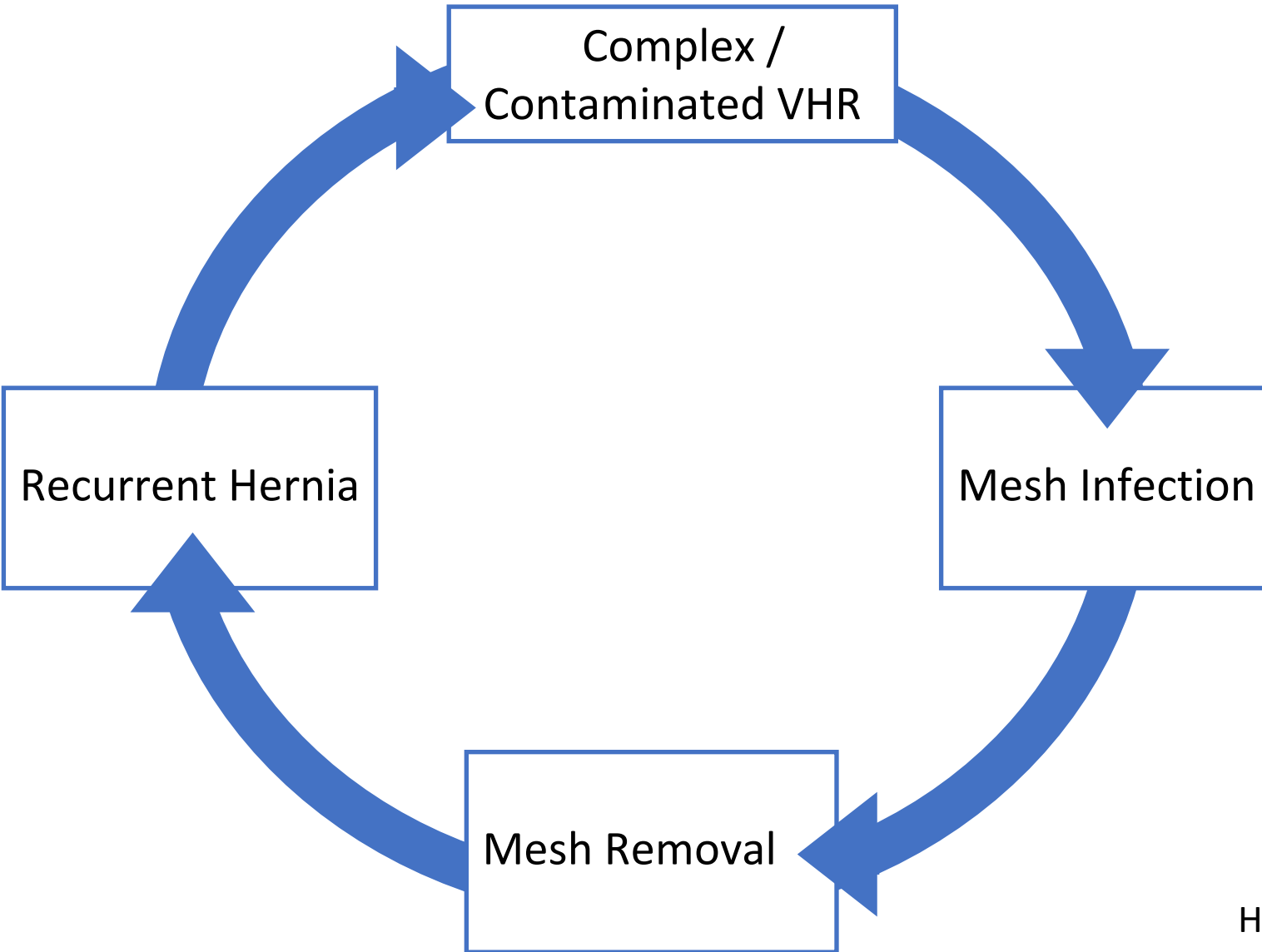


# **Algorithms in VHR: *Contaminated Field***

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University of South Carolina School of Medicine Greenville  
Prisma Health - Upstate

# Background



Holihan JL. JACS (2015); 221(2):478

# Key Considerations

- Primary indication / purpose of the operation
- Impact of mesh material / location
- Degree / cause of contamination
- Quality of the tissue

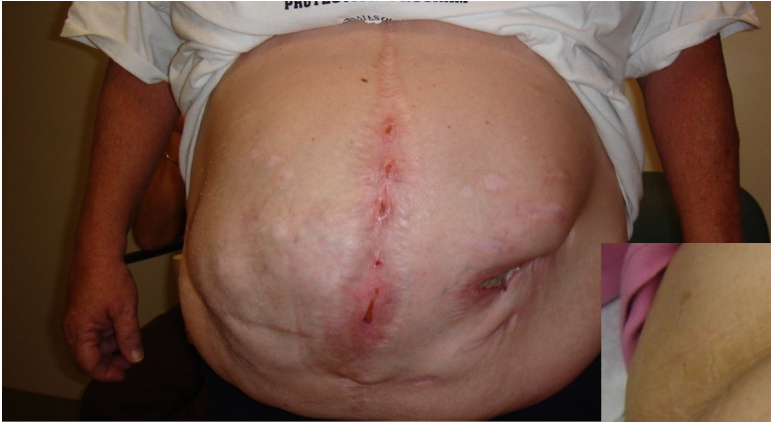
# What is the primary indication for surgery?

- *Hernia repair?*
- *Enterocutaneous fistula takedown?*
- *Cancer resection?*
- *Ostomy reversal?*

***The primary indication should take precedence.  
Staged approach is appropriate!***

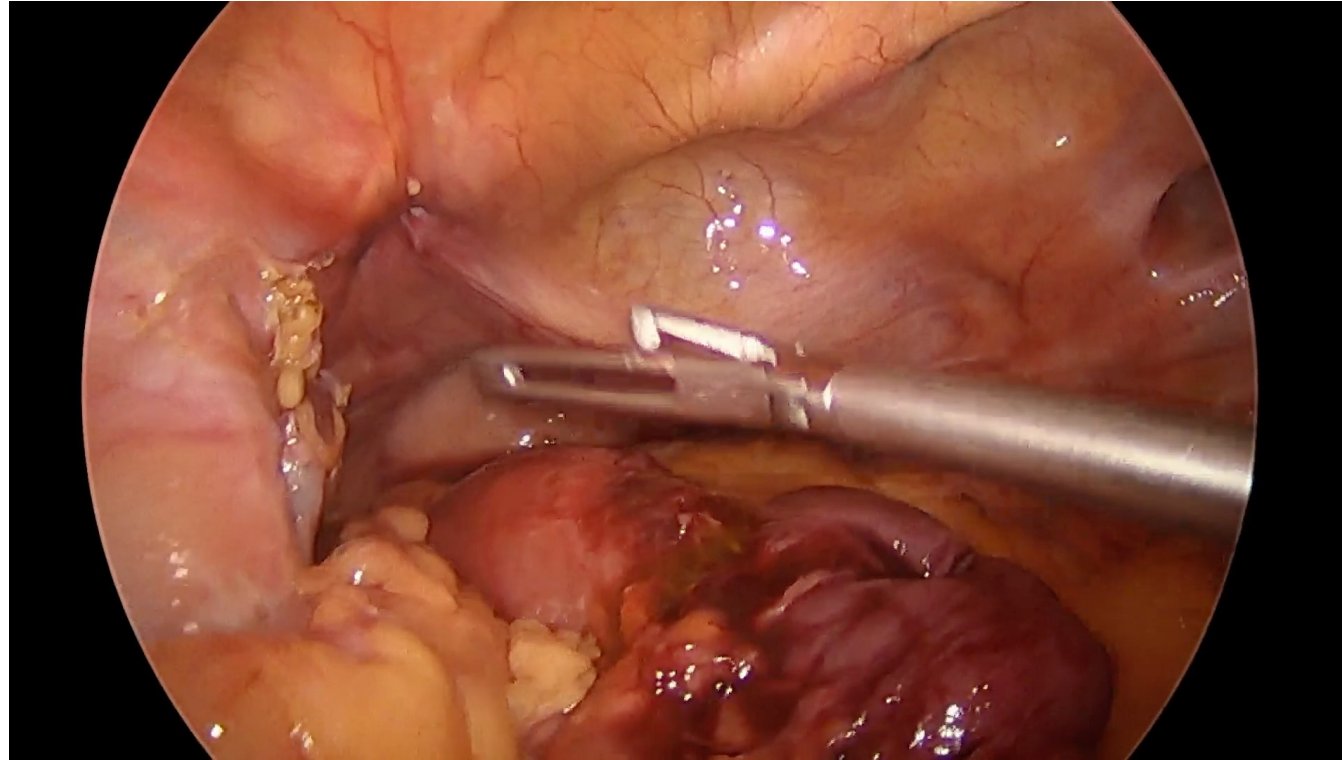
# Defining Contamination

- *Preexisting* source of contamination

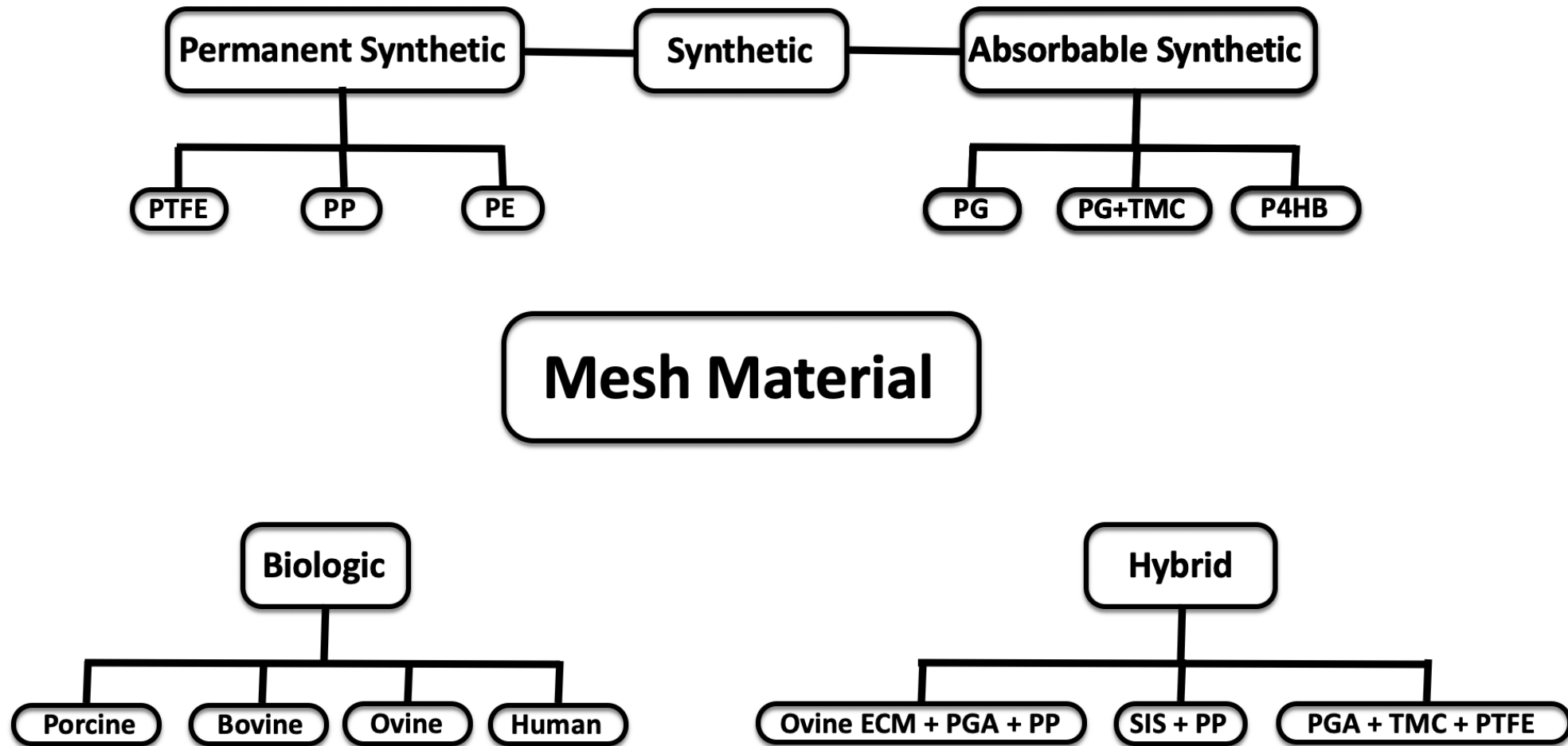


# Defining Contamination

- *Intraoperative* source of contamination

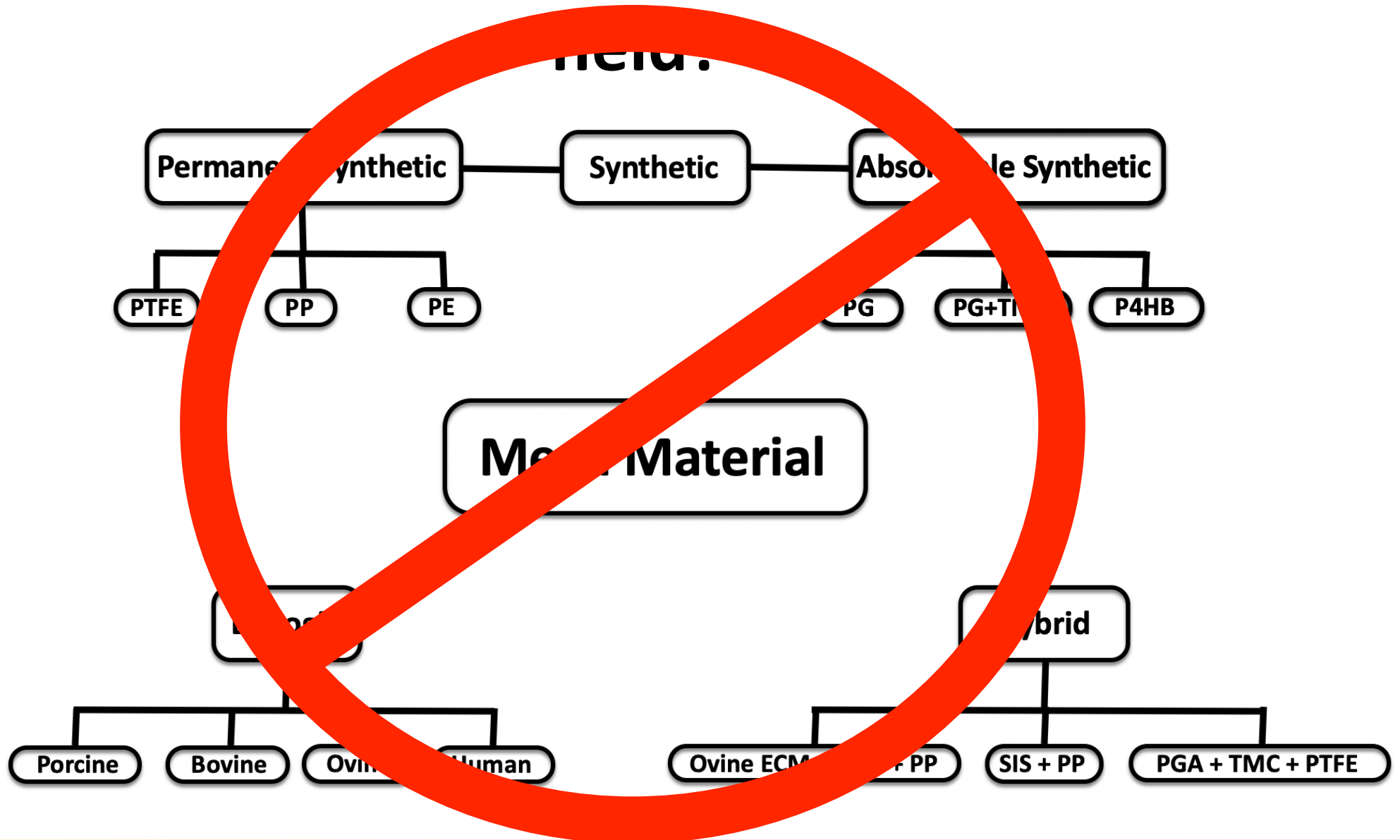


# Is there an appropriate mesh for use in contaminated field?

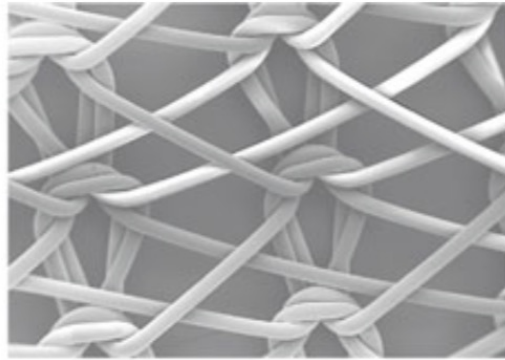
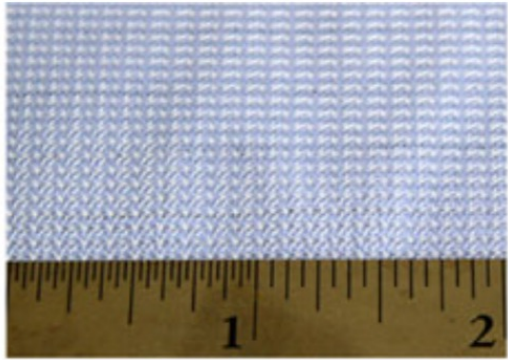


# Is there an appropriate mesh for use in contaminated

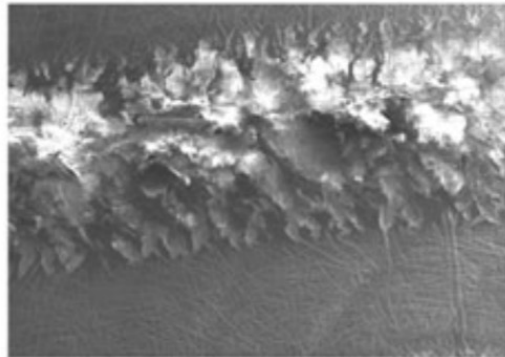
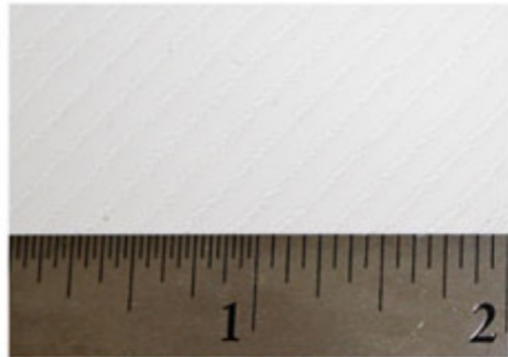
FDA



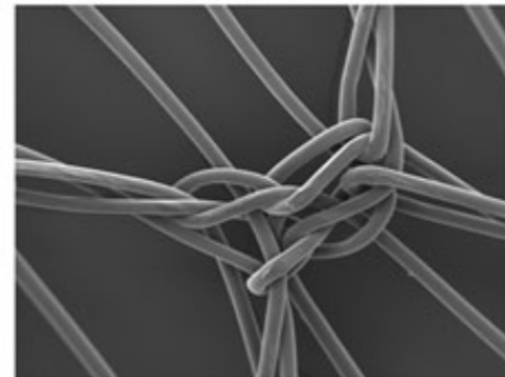
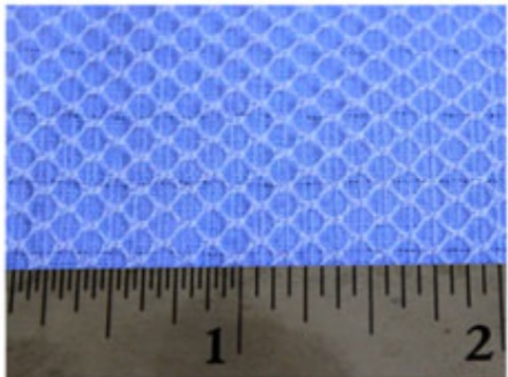
# Mesh Characteristics & Biocompatibility



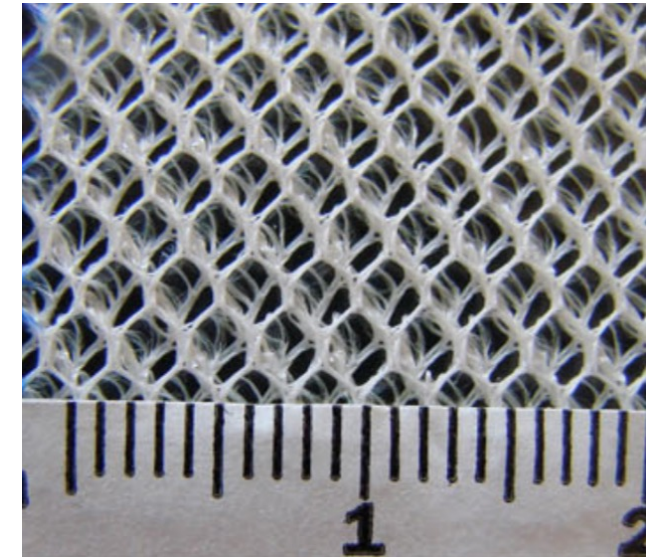
Small-pore,  
monofilament PP



Microporous,  
Laminar ePTFE



Large pore,  
monofilament PP

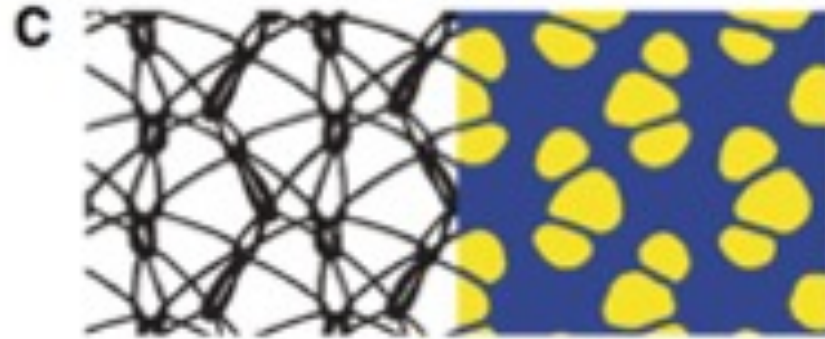


Large-pore,  
Multifilament PE

Sanders D, *Hernia* 2013;17:779-789

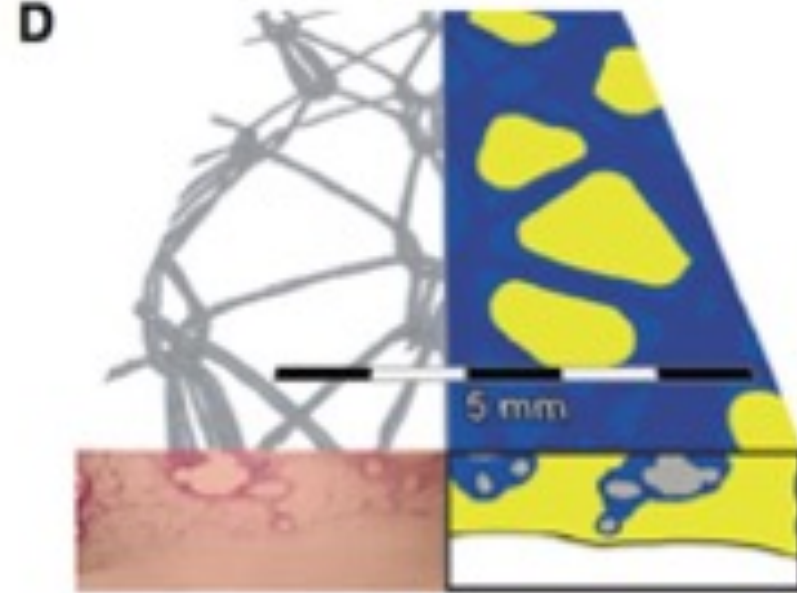
Deeken CR, *Surg Endosc* 2010;25:1541-1552

# Tissue ingrowth



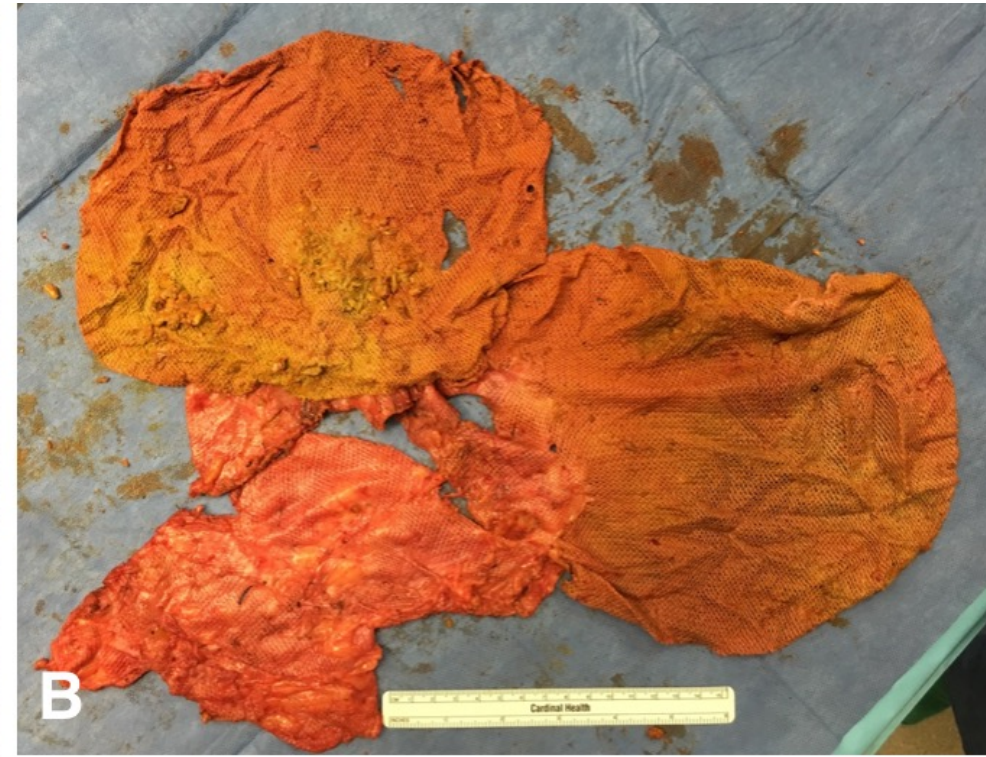
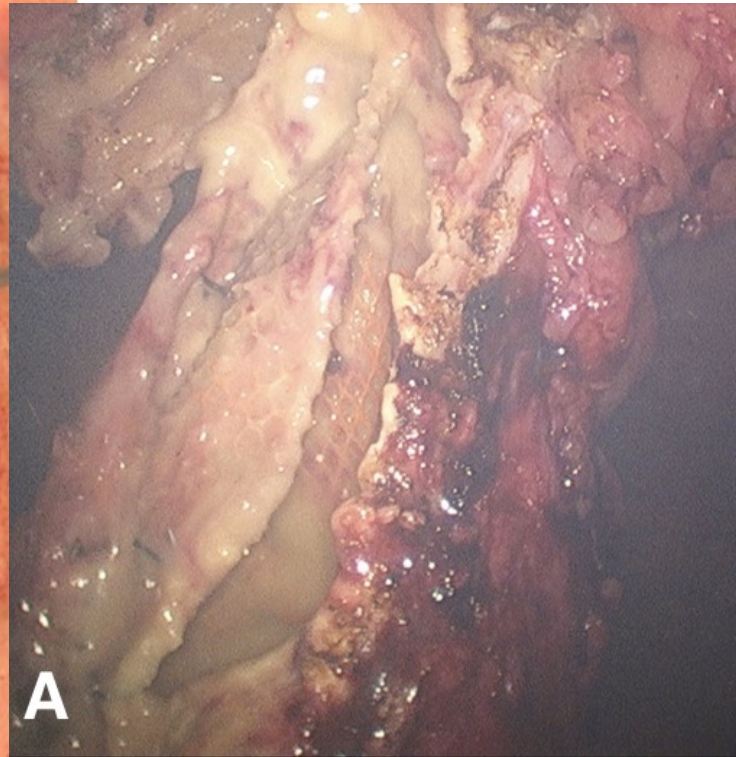
*Porosity:*  
textile  
68%

effective  
42%



Klinge U, et al. Hernia 2012;16(3):251-258

# Tissue ingrowth



# Consequences



# Results: Mesh-related complications

## Factors affecting salvage rate of infected prosthetic mesh

Impact of mesh characteristics & position on complete mesh salvage.

Complete mesh salvage by position and mesh group - salvaged/total (%)

Mesh Type	n	Mesh Position				
		Onlay	Inlay	Preperitoneal	Retromuscular	Intraperitoneal
		26	6	15	39	125
MacroPP	40	4/6 (66.7)	na	2/3 (66.7)	20/27 (74.1)	0/4 (0)
MicroPP	32	0/8 (0)	0/2 (0)	0/7 (0)	0/2 (0)	1/13 (7.7)
MultiPE	31	0/2 (0)	na	na	0/5 (0)	1/24 (4.2)
Composite	41	0/1 (0)	0/1 (0)	0/2 (0)	na	0/37 (0)
PTFE	28	0/2 (0)	0/1 (0)	na	na	0/25 (0)
Other	22	0/4 (0)	0/2 (0)	0/2 (0)	1/5 (20)	1/9 (11.1)
Multiple Mesh	17	1/3 (33.3)	na	0/1 (0)	0/1 (0)	0/13 (0)

MacroPP – Macroporous polypropylene; MicroPP – microporous polypropylene; MultiPE – multifilament polyester; PTFE – polytetrafluoroethylene.

Warren JA, *Am J Surg* 2020;220(3):751-756

# Safety and Efficacy of Synthetic Mesh for Ventral Hernia Repair in a Contaminated Field

	All	None	PSM	ASM	BM	p-value
N	541	46	402	55	38	
Any SSI, N (%)	97 (17.93)	8 (17.39)	57 (14.18)	18 (32.73)	14 (36.84)	<0.001*
Superficial	65 (12.01)	3 (6.52)	64 (15.92)	13 (23.64)	12 (31.58)	<0.001*
Deep	24 (4.44)	2 (4.35)	18 (4.48)	2 (3.64)	2 (5.26)	0.975
Organ Space	24 (4.44)	1 (2.17)	11 (2.74)	9 (16.36)	3 (7.89)	<0.001*



Warren JA, *JACS* 2020;230:405-413

# Results: SSI

	OR	95% CI	
Intercept	0.138	(0.022, 0.77)	
Age	0.989	(0.972, 1.007)	
BMI	1.014	(0.985, 1.043)	
DM	0.793	(0.449, 1.369)	
COPD	2.386	(1.387, <u>4.06</u> )*	←
Current Smoker	1.249	(0.737, 2.093)	
Contaminated	1.644	(0.971, 2.809)	
Dirty	2.27	(1.095, <u>4.685</u> )*	←
PSM	0.905	( <u>0.377</u> , 2.404)	
ASM	1.946	(0.723, 5.587)	
BM	1.925	(0.675, 5.768)	

\* denotes statistically significant result

Warren JA, *JACS* 2020;230:405-413

# Results: Recurrence

	All	None	PSM	ASM	BM	p-value
<b>N</b>	<b>541</b>	<b>46</b>	<b>402</b>	<b>55</b>	<b>38</b>	
<b>Recurrence, N (%)</b>	82 (15.16)	13 (28.26)	42 (10.45)	17 (30.91)	10 (26.32)	<0.001*
<b>Follow-up Time (months)</b>						
<b>Mean ± SD</b>	55.0 ± 64.6	36.2 ± 36.9	46.6 ± 57.2	96.1 ± 71.2	107.8 ± 99.2	<0.001* ←
<b>Median (IQR)</b>	30.2 (6.1, 82.8)	23.9 (6.1, 64.7)	21.3 (5.8, 65.4)	91.2 (43.8, 148.6)	63.3 (29.2, 184.2)	<0.001*

Warren JA, *JACS* 2020;230:405-413

# Results: Mesh-related complications

	All	None	PSM	ASM	BM	p-value
N	541	46	402	55	38	
<b>Mesh removal</b>	14 (1.29)	0 (0)	10 (1)	2 (3.64)	3 (2.63)	0.189
<b>Partial</b>	6 (1.1)	n/a	4 (1.0)	0	2 (5.2)	
<b>Complete</b>	8 (1.5)	n/a	6 (1.5)	2 (3.6)	1 (2.6)	
<b>Mesh related</b>	8 (1.5)	n/a	6 (1.5)	0	2 (5.2)	



## Mesh Related:

SSI: PSM (4), BM (2)

Parastomal ECF: PSM (2)

## Other Intraabdominal Pathology:

Colostomy disruption: ASM + PSM (1), BM (1)

Missed enterotomy: PSM (1)

Anastomotic leak: PSM (1)

Vesicocutaneous fistula: PSM (1)

Open abdomen / ACS: ASM (1)

Warren JA, JACS 2020;230:405-413

# Biologic vs Synthetic Mesh for Single-stage Repair of Contaminated Ventral Hernias

## A Randomized Clinical Trial

- 253 pts randomized to LPP or PADM
  - 126 synthetic, 127 biologic
- 2-year f/u, intention to treat 92% follow-up

# Biologic vs Synthetic Mesh for Single-stage Repair of Contaminated Ventral Hernias

## A Randomized Clinical Trial

	Permanent Synthetic	Biologic	p
<b>SSO</b>	11.1%	7.1%	0.37
<b>SSOPI</b>	24.6%	27.6%	0.70
<b>SSI</b>	15.1%	21.3%	0.27
<b>Recurrence</b>	5.6%	20.5%	0.001
<b>Cost</b>	\$44,936	\$17,289	<0.001

Rosen MJ, et al. *JAMA Surg*;157(4):293-301

Multicenter, Prospective, Longitudinal Study of the  
Recurrence, Surgical Site Infection, and Quality of  
Life After Contaminated Ventral Hernia Repair  
Using Biosynthetic Absorbable Mesh

*The COBRA Study*

- 104 patients with 24-month follow-up
- Wound events occurred in 28% (18% SSI)
- Recurrence rate 17%

Rosen MJ, *Ann Surg* 2017;265:205-211

# Five-Year Follow-Up of a Slowly Resorbable Biosynthetic P4HB Mesh (Phasix) in VHWG Grade 3 Incisional Hernia Repair

- 84 pts, VHWG 3
- SSI – 11.5%; SSO – 26.2%
- 15.9% recurrence
- 1 mesh explant for infection

Van den Dop LM, *Ann Surg Open* 2023;4(4):e366

# My Algorithm

## Intraoperative contamination: Stable patient

Laparoscopic IPOM?

Primary closure with delayed repair

Convert to extraperitoneal approach / open

# My Algorithm

**Intraoperative contamination: Stable patient**

Robotic retromuscular / TAPP?

Continue as planned with extraperitoneal mesh

# My Algorithm

**Intraoperative contamination: Stable patient**

Open?

Continue as planned with extraperitoneal mesh

# My Algorithm

## Preoperative contamination

Chronic wound?

Optimize risk factors

Wound care

Heal first!

# My Algorithm

## Preoperative contamination

Colostomy reversal?

Reprep and drape

Retromuscular repair with synthetic mesh

Antibiotic irrigation

# My Algorithm

## Preoperative contamination

Fistula?

Most likely staged repair

Limited / focal contamination?

Good quality tissue?

# My Algorithm

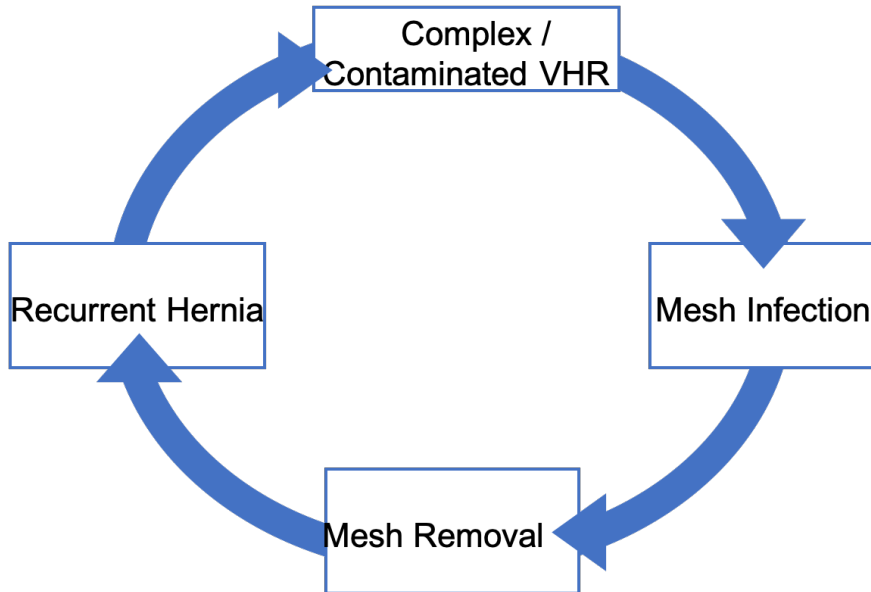
## Preoperative contamination

Infected mesh?

Staged repair

# Synthetic Mesh in a Contaminated Field

## *Risks*



## *Benefits*

- Lower cost
- Lower risk of recurrence
- Similar risk of infection and mesh removal *if*:
  - proper technique (RM / PP)
  - proper mesh (large-pore, monofilament PP)

# Conclusion

- Contaminated VHR can be done in a single stage
- Large pore polypropylene in extraperitoneal position is preferred
- Unclear role of absorbable, biologic meshes

**Just Remember ...**

***The primary indication should take precedence.  
Staged approach is appropriate!***