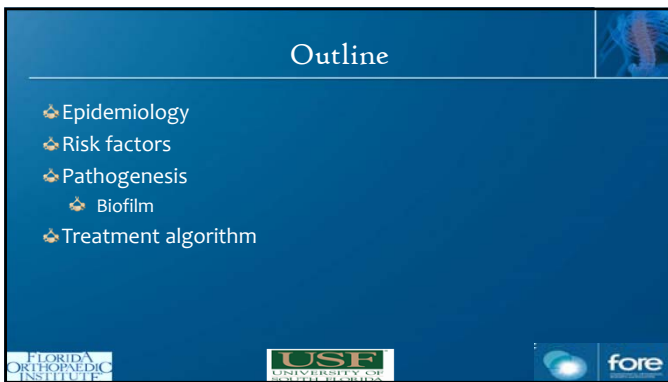


Infected Hardware

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This slide features a blue background with a faint image of a human spine. The text is centered and includes the title, speaker name, affiliation, and logos for the Florida Orthopedic Institute, USF, and fore.

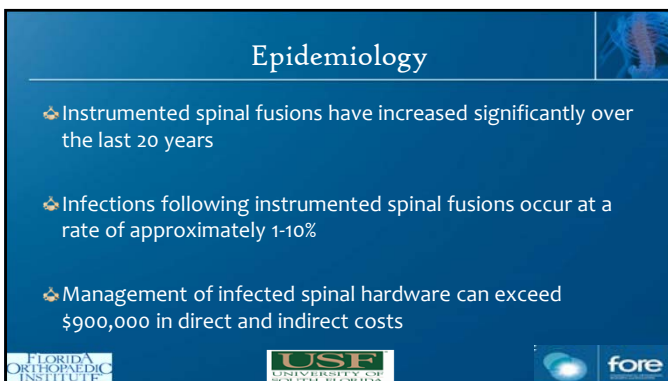


Outline

- ❖ Epidemiology
- ❖ Risk factors
- ❖ Pathogenesis
 - ❖ Biofilm
- ❖ Treatment algorithm

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Epidemiology


- ❖ Instrumented spinal fusions have increased significantly over the last 20 years
- ❖ Infections following instrumented spinal fusions occur at a rate of approximately 1-10%
- ❖ Management of infected spinal hardware can exceed \$900,000 in direct and indirect costs

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This slide has a blue background with a faint spine image. It provides epidemiological data on spinal fusions and infections, including logos for the Florida Orthopedic Institute, USF, and fore.


Risk Factors

- ✦ Can be broken down in several ways
 - ✦ Modifiable vs. Non-modifiable patient factors
 - ✦ Modifiable vs. Non-modifiable surgical factors
- ✦ Prevention of spine infections begins in the preoperative setting




Modifiable Risk Factors

Patient Related <ul style="list-style-type: none">✦ BMI > 35<ul style="list-style-type: none">✦ Increased soft tissue✦ HbA1c > 7.5✦ Smoking✦ Malnutrition	Surgical Related <ul style="list-style-type: none">✦ Implant materials✦ Length of surgery > 5 hours✦ Posterior approach open surgery✦ Use of O-arm/C-arm/Microscope✦ Exposure of implants to open air✦ Use of allograft✦ Timing of preoperative antibiotics✦ Not using a post-operative drain✦ Non use of Vancomycin powder (controversial)
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Pathogenesis

- ✦ Infections can be broken down into
 - ✦ Acute (<3 months)
 - ✦ Delayed (>3 months)






Pathogenesis

Acute < 3 months

- ❖ Generally due to inoculation at the time of surgery
- ❖ Fever is often absent
- ❖ Wound drainage is most common symptom occurring in up to 90%
- ❖ Organisms
 - ❖ MSSA – most common
 - ❖ MRSA – escalating and more virulent
 - ❖ Beta-hemolytic strep
 - ❖ Gram neg rods

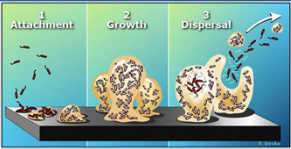
Delayed > 3 months




- ❖ Chronic pain, implant failure, pseudoarthrosis
- ❖ Wound drainage less common than acute
- ❖ Majority occur following deformity surgery
- ❖ Organisms
 - ❖ Often culture negative
 - ❖ P. acnes
 - ❖ Staph epi

Biofilm




- ❖ S. aureus, coag neg staph, P. acnes are known to form biofilms
- ❖ Anchor permanently to the surface and new bacteria attach to each other developing a protective surface
- ❖ Community grows and becomes resistant to immune response and antibiotics
- ❖ Inflammatory response still occurs causing tissue damage
- ❖ Fragments of bacteria are released over time to further infect the area



Biofilm

- ❖ Risk factors for development
 - ❖ Rough surfaces for adherence
 - ❖ Hydrophobic tendency of spine implants
 - ❖ Presence of a seroma or hematoma can alter the surface properties of an implant in vitro
 - ❖ Less likely to adhere to titanium implants than PEEK or stainless steel
- ❖ The more delayed the infection, the more difficult it is to eradicate biofilm off the implants

Number of Debridements

Postoperative Infection Treatment Score for the Spine	
Problems	PITSS SCORE
Spine location	
Cervical	1
Thoracic/thoracic	2
Lumbosacral	4
Comorbidities	
None/other	0
Cardiovascular/pulmonary	1
Diabetes	4
Microbiology	
Gram positive	2
Gram-negative or polymicrobial without MRSA	4
Polymicrobial with MRSA or MRSA alone	6
Distant site infection	
None	1
Urinary tract infection/pneumonia	3
Bacteremia alone	5
Bacteremia + PNA/UTI	6
Instrumentation	
Yes	6
No	2
Bone graft	
None	1
Autograft	3
Other (allograft, BMP, and synthetic)	6

- ❖ Scoring system to determine number of debridements
- ❖ Low risk = 7-14
- ❖ Indeterminate risk = 15-20
- ❖ High risk = 21-33

Conclusions

- ❖ Prevention of infection begins and ends with patient selection
- ❖ Intraoperative changes to work flow and implant selection can decrease changes of infected spinal hardware
- ❖ Consider multiple debridements in patients with multiple comorbidities and distant infections
- ❖ Removal of hardware in delayed infections without replacement can lead to loss of correction

Treatment Algorithm

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    graph TD
      A[Infection Suspected] --> B[WBC, ESR, CRP, +/- MRI w/wo contrast]
      B --> C[Acute]
      B --> D[Delayed]
      C --> E[D&I with retention of implants with culture and IV abx 6-8 weeks]
      D --> F[D&I with removal and replacement of implants with IV abx 6-8 weeks with possible long term suppressive oral abx]
    
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References



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