Reducing Surgical Site Infection in Cardiac Surgery

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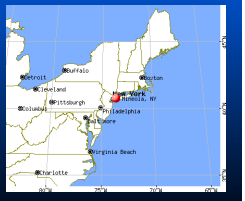
Presentation sponsored by ConvaTec

Introduction
Curriculum Vitae

- Education:
  - Medical degree from Baylor College of Medicine
  - Trained in general surgery at Dartmouth Hitchcock Medical Center
  - Trained in cardiac surgery at University of Pittsburgh
- Physician at Winthrop University Hospital since 1991
- Chairman of Dept. of Thoracic & Cardiovascular Surgery since 2001

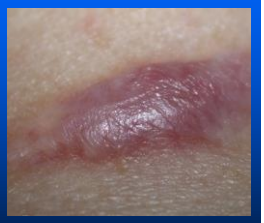
Introduction
Winthrop University Hospital

- Teaching hospital
- Affiliate of SUNY Stony Brook
- Located in Mineola, NY
- 520 open heart procedures done annually by group of 4 surgeons



Surgical Site Infections (SSI)
Defined by CDC

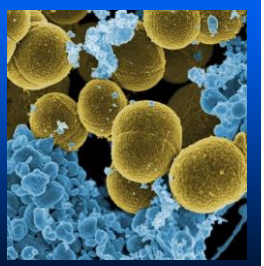
- At or near operative site
- Occurs in post-op period
- Reportable if it occurs within 30 days post-op
- Three major sources
  - ✓ Patient
  - ✓ Healthcare Team
  - ✓ OR environment
- Most common pathogens for sternal wound infections[1]
  - ✓ *Staph aureus*
  - ✓ *Staph epidermis*



[1]Singh, K et al, Overview and Management of Sternal Wound Infection, Seminars in Plastic Surgery, Volume 25, Number 1 2011

SSIs: Scope of the Problem
Surgical wound infections

- MOST common infection in surgical patients
- Common nosocomial infection
- Associated with substantial morbidity and mortality[1]
  - – 60% more likely ICU admit
  - – 2x increase in mortality during perioperative period
- ⇑ post-op LOS[1]
- ⇑ treatment costs[1]



[1]Banbury, MK, Experience in prevention of sternal wound infections in nasal carriers of Staphylococcus aureus, Surgery, 2003 Nov

SSIs: Scope of the Problem
Cardiac Surgery

- Annual US procedural volume:
  - – >600,000 cardiac procedures[1]
  - – 395,000 CABG procedures[2]
- 3.5% infection rate post-CABG procedures[3]
- Cost to treat mediastinitis estimated to be $40,000 - $50,000[3]

[1]Elghamrawy H, et al. First Evidence of Sternal Wound Biofilm Following Cardiac Surgery. PLoS One. 2013 Aug 1;8(8).
[2]http://www.cdc.gov/nchs/fastats/insurg.htm, [3]http://www.infectioncontroltoday.com/articles/2008/03/cabg-infections-are-costly-and-dangerous-staffs-m.aspx

Sternal Wound Infections (SWI)
Risk Factors

- Obesity
- Renal insufficiency
- Diabetes
- COPD
- Peripheral Vascular Disease
- Existing pre-op infection
- Steroid use
- Malnutrition

Sternal Wound Infections

- Incidence of Sternal Wound Infection (SWI): 1-8%[1]
- SWI mortality rates reaching 40%[1]
- Treatment requires:[1]
  - Prolonged antibiotic courses
  - Repeated surgical interventions
  - Longer hospital stay
- Can occur in any procedure requiring median sternotomy

[1] Elgharably H, et al. First Evidence of Sternal Wound Biofilm Following Cardiac Surgery, PLoS One, 2013 Aug 1;8(8)

Deep Sternal Wound Infections

- Increased hospital LOS > 2 full weeks compared to any other post-op complication[1]
- Associated with other complications such as:[1]
  - Prolonged ventilation
  - Bleeding
  - Renal failure
  - Atrial fibrillation
  - Increased rates of stroke
  - Need for inotropic or mechanical cardiac support

[1]Atkins, Z, Wolfe, W. Sternal Wound Complications following Cardiac Surgery, www.intechopen.com

Reimbursement Challenges

- No CMS reimbursement for treatment of:
  - SSI, mediastinitis, following Coronary Artery Bypass Graft (CABG)
  - SSI following Cardiac Implantable Electronic Device (CIED)

http://www.cms.gov/HospitalAcqCond

State Reporting of SSI's

Government Oversight and Physician Data Tracking

- Twenty one (21)states require hospitals to report surgical site infection, **14** states so far have posted the information publicly
- Report and data available to public- CA, OR, WA, CO, IL, MO, PA, OH, SC, NJ, NY, MA, VT And NH

http://www.ama-assn.org/amednews/2012/04/02/prsb0402.htm

Winthrop Story

- Increased Sternal Wound Infection rate
- Infection rate is state and patient reportable
- Hospitals do not get paid for Sternal Wound Infection readmissions

Task force formed to reduce incidence of SWI

Evaluated Current Practices

- Operating room team's sterile technique
- Hand washing technique
- Room ventilation
- Instrument sterilization
- Operating room traffic

Baseline SWI Prevention Strategy

- Adherence to core pre-operative antibiotic protocols
  - Administer antibiotics within 1 hour of incision (2 hours for Vancomycin)

Approach to SWI Prevention

Address all potential sources of infection:

- Pre-operative Preparation
- Operating Room Environment
- Operating Room Team
- Post-operative Care of Patient and Wounds
- Patient Co-morbidities

Operation Room Environment

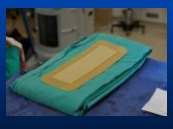
- Limit traffic in and out of OR

Operating Room Team

1. Stopped using Avagard gel and returned to practice of scrubbing hands
2. Change gloves more frequently
3. Educated entire team on sterile field

Patient

1. Use chlorhexidine to cleanse the skin
2. Apply occlusive dressing, AQUACEL® Ag Surgical, in operating room
3. Dressing left on for 5 days, removed prior to discharge
4. Emphasize at discharge patients can wash over incision with soap and water



Considerations When Choosing Surgical Dressing

1. Permeable:
   - Moist wound environment promotes healing
   - Excessive moisture predisposed wounds to maceration and blister formation
2. Barrier:
   - Prevent microbial ingress into wound
   - Waterproof to allow showering
3. Occlusive:
   - Creates hypoxic environment
   - Accelerates angiogenesis

National Institute for Health and Clinical Excellence. *Surgical Site Infection Guideline.*

Gauze Dressings
Disadvantages

- Non-Occlusive
  - Non-optimal wound environment
- Require Frequent Changes
  - Exposure of wound
  - Adhesive can cause skin injury
- Not waterproof

Occlusive Dressings

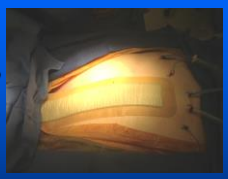
- Improved re-epithelialization
- Increase in collagen synthesis by 2-6x compared to wounds open to the air
- Lower rate of wound infection (Hutchinson study 1990)
  - With occlusive dressing 2.6%
  - With non-occlusive dressing 7.1%

Patel C, Surgical Wound Infections. Current Treatment in Infectious Diseases. 2000;2:147-153. Michie D. Influence of Occlusive and Impregnated Dressings on Incisional Healing: Ann Plastic Surg. 1994. Hulten L. Dressings for Surgical Wounds. Am J Surg. 1994. .Xi et al Wound Repair, 2000. Hutchinson, JJ, McGuckin, M, Occlusive dressings: A microbiologic and clinical review, American Journal of Infection Control, Aug 1990

AQUACEL® Ag Surgical Dressing

Advantages

- Barrier to pathogen transmission[1]
- Microbicidal effects of silver ion[2]
- Dressing may be left in place up to 7 days
  - Less potential hospital exposure of wound
  - Less potential for pain associated with dressing changes
- Patient satisfaction
  - Immediate showering

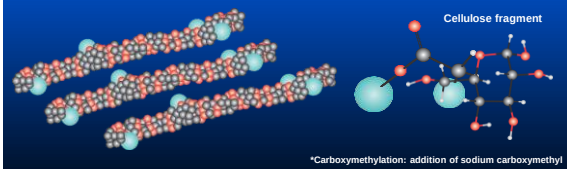


[1] Nelson Laboratories Report, Viral Penetration ASTM Method F1671, Procedure Number :ST0062 Rev07, Protocol Detail Sheet No. 200902139 Rev 1, Laboratory no. 483744, 7th August 2009
[2] Jones SA, Bowler PG, Walker M, Parsons D. Controlling wound bioburden with a novel silver-containing Hydrofiber dressing. Wound Repair Regen. 2004;12(3):288-294.

Advanced Dressings

Hydrofiber® Technology

- Basic component is cellulose
- Carboxymethylation* process alters the absorption capacity
- Hydrofiber® technology allows for fluid to be absorbed directly into the fibers
- A bond is formed with the absorbed fluid to hold it within the fiber



*Carboxymethylation: addition of sodium carboxymethyl

[1]Waring MJ, Parsons D. Physico-chemical characterisation of carboxymethylated spun cellulose fibres. *Biomaterials*. 2001;22:903-912.

AQUACEL® Ag

Broad-spectrum Antimicrobial Activity

Aerobic Bacteria

Staphylococcus aureus (NCTC 8532)
Staphylococcus aureus (clinical isolate)
Pseudomonas aeruginosa (clinical isolate, x2 strains)
Enterobacter cloacae (clinical isolate)
Streptococcus pyogenes (clinical isolate)
Klebsiella pneumoniae (clinical isolate, x3 strains)
Enterococcus faecalis (clinical isolate)
Escherichia coli (NCIMB 8545)
Escherichia coli (NCIMB 10544)
Acinetobacter baumannii (NCIMB 9214)

Antibiotic-resistant Bacteria

MRSA (NCTC 10442)
MRSA (NCTC 12232)
MRSA (clinical isolate, x8 strains)
VRE (NCTC 12201)
VRE (clinical isolate, x2 strains)
Serratia marcescens (clinical isolate)
Pseudomonas aeruginosa (NTC 8506)

Anerobic Bacteria

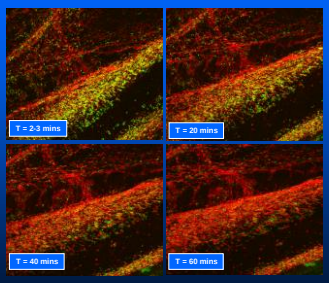
Bacteroides fragilis (clinical isolate)
Peptostreptococcus anaerobius (clinical isolate)
Clostridium ramosum (clinical isolate)
Clostridium clostridioforme (clinical isolate)
Clostridium cadaveris (clinical isolate)
Clostridium perfringens (clinical isolate)
Tissierella praeacute (clinical isolate)

Yeasts

Candida albicans (NCPF 3179)
Candida albicans (NCPF 3265)

Jones SA, Bowler PG, Walker M, Parsons D. Controlling wound bioburden with a novel silver-containing Hydrofiber® dressing. *Would Repair Regen*. 2004;12:288-294.

Hydrofiber® Ag Dressing
Bacterial Sequestration & Bactericidal Activity

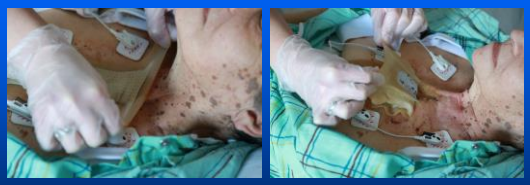


Green = **Alive**
Red = **Dead**
T = **Time in minutes**

Confocal microscopy of *Pseudomonas aeruginosa* on hydrated Hydrofiber® Ag dressing fiber

Newman GR, Walker M, Hobot J, Bowler P. *Biomaterials*. 2006;27(7):1129-1139.

Dressing Change
Technique

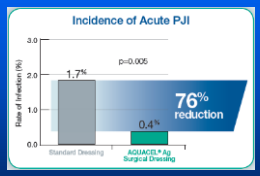


- Stretching of hydrocolloid portion (like stretching "taffy") allows gentle adhesive release from skin.
- Skin traction is avoided

AQUACEL® Ag Surgical Dressing
CLINICAL RESULTS

Rothman Institute Study Results

- Retrospective study- Journal of Arthroplasty, 2014
- 1,778 patients undergoing primary THA/TKA
  - 875 standard gauze dressing
  - 903 AQUACEL® Ag Surgical dressing
- 76% reduction in incidence of surgical site infection in AQUACEL® Ag Surgical group
- Multivariate analysis
  - no other independent variables such as patient co-morbidities, age, or BMI impacted the reduction in infection



Cai J, Karam JA, Parvizi J, Smith EB, Sharkey PF, The Aquacel® Ag Hydrofiber Wound Dressing with Ionic Silver Reduces the Rate of Acute Periprosthetic Joint Infection Following Total Joint Arthroplasty., Poster presented at 22nd annual AAHKS meeting, Nov 2-4, 2012.

OrthoCarolina Clinical Trial Results

- Prospective Randomized Study – American Journal of Orthopedics, 2015
- AQUACEL® Ag Surgical vs. Control
- 300 pts
- Midterm analysis of 150 TKA (AAOS 2013)
- Significant reduction in wound complications (p=0.009)
- Significantly less # dressing changes (p<0.001)
- Improved patient satisfaction, perception of hygiene

Springer, BD, Beaver, W, Griffin, W, Mason, JB, Dennos, A, Odum, S. The Role of Surgical Dressings in Total Knee Arthroplasty: A Randomized Clinical Trial, Poster presented at 2013 AAOS annual meeting; March 19-23, 2013.

Winthrop AQUACEL® Ag Surgical Study

- Began using AQUACEL® Ag Surgical in May 2011
- Conducted a study that involved*:
  - Retrospective look at 503 patients with sternal incisions covered with sterile 4x4 gauze pads and tape
  - 208 patients with AQUACEL® Ag Surgical dressing
- Patients included in the study were any patients with a sternotomy incision

*Data not yet submitted for publication

Study Results

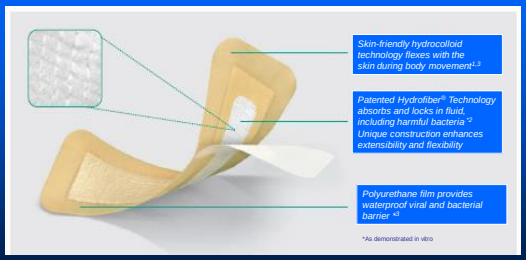
Dressing Type	# of Deep SWI	% of Deep SWI
Gauze and Tape	17	3.4%
AQUACEL® Ag Surgical	0	0%

- To date, approximately 500 patients have had the AQUACEL® Ag Surgical dressing applied to their sternal wound with only 1 deep sternal wound infection.

Thank You

Appendix

AQUACEL® Ag SURGICAL Dressing



[1]Nelson Laboratories Report, Viral Penetration ASTM Method F1671, Procedure Number :ST0062 Rev07, Protocol Detail Sheet No. 200902139, Rev 1, Laboratory no. 483744, 7th August 2009, [2]Walker M, Hobot JA, Newman GR, Bowler PG. Scanning electron microscopic examination of bacterial immobilisation in a carboxymethylcellulose (Aquacel) and alginate dressings. *Biomaterials*. 2003; 24:883-890.8. [3]WHRI 3264 Laboratory Test Comparison of AQUACEL® Surgical Dressing 'New Design'and the Jubilee Method of Dressing Surgical Wounds . 7th Oct 2009

Dressing With Hydrofiber® Technology *

- Locks in fluid*[1]
- Sequesters bacteria[2,3]
- Traps harmful enzymes*[4,5]

Sequestration test: a simple experiment using fluids of different colors to demonstrate the ability of dressings to lock in fluid

[1]Waring MJ, Parsons D. *Biomaterials*. 2001;22:903-912;
[2]Walker M, Hobot JA, Newman GR, Bowler PG. *Biomaterials*. 2003;24(5):883-890;
[3]Newman GR, Walker M, Hobot J, Bowler P. *Biomaterials*. 2006;27(7):1129-1139;
[4]Hoekstra MJ, Hermans MHE, Richters CD, Dutrieux RP. *J Wound Care*. 2002.11(2):113-117;
[5]Walker M, Bowler PG, Cochrane CA. *Ostomy Wound Manage*. 2007:53(9):18-25.

*as demonstrated *in vitro*

Hydrofiber® Technology w/ Ionic Silver
AQUACEL® Ag Dressing

- Reduction in bioburden to reduce risk of infection is key to optimal wound healing [1]
- Ionic silver (Ag) has broad spectrum antimicrobial activity[2]
- Hydrofiber® Ag dressing more effective at killing bacteria *in vitro* on simulated wounds with uneven contours than a nanocrystalline silver-containing dressing [4]

[1]Bowler PG, Cochrane CA. *Ostomy Wound Manage*. 2003:49(8)(suppl):S2-S5;
[2]Maillard J, Denyer SP. London: MEP Ltd, 2006:7-10.;
[3]Bowler PG, Jones SA, Walker M, Parsons D. *J Burn Care Rehabil*. 2004;25:192-196;
[4]Jones S, Bowler PG, Walker M. *Wounds*. 2005;17(9):263-270.

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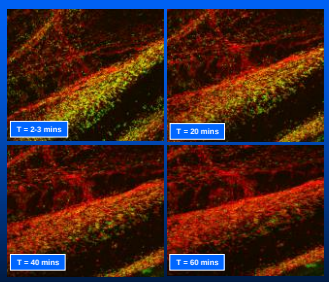

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Confocal microscopy of *Pseudomonas aeruginosa* on hydrated Hydrofiber® Ag dressing fiber

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Incidence & Burden of Infections Following Cardiac Surgery

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May 2, 2016

Disclosures

- Convatec
- Abbott Vascular
- St. Jude
- Edwards
- Mitralign
- Atricure

Outline

- Overview of Major Infections Following Cardiac Surgery
  - Incidence
  - Cost
- DSWI
- Pneumonia

Hospital Acquired Infections

- 1.7 million individuals acquire HAI
- Leads to 100,000 deaths annually
- Results in additional $6.5 billion additional health care expenditures

Perencevich EN, Pittet D. JAMA 2009; 301: 1285-7.

NIH Public Access
Author Manuscript
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MANAGEMENT PRACTICES AND MAJOR INFECTIONS AFTER CARDIAC SURGERY

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CTSN

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  - National Institute of Neurological Disorders and Stroke
  - Canadian Institutes for Health Research

NIH National Institutes of Health
National Heart, Lung, and Blood Institute
National Institute of Neurological Disorders and Stroke

CIHR IRSC

CTSN

Investigators

- Data Coordinating Center: InCHOIR
- Montefiore – Einstein
- Emory University
- Duke University
- Hôpital Laval
- University of Virginia Health System
- Montreal Heart Institute
- University of Pennsylvania
- Columbia University Medical Center
- Cleveland Clinic Foundation
- University of Maryland
- Brigham and Women's Hospital
- Sacré-Cœur de Montréal
- Ohio State University Medical Center
- East Carolina Heart Institute
- Wellstar / Kennestone
- Baylor Research Institute
- University of Southern California
- St. Michael's Hospital
- Toronto General Hospital
- Mission Hospital
- NIH Heart Center at Suburban Hospital
- Inova Heart & Vascular Institute
- University of Alberta Hospital
- Centre Hospitalier de l'Université de Montréal
- Sunnybrook Health Sciences Centre
- Aarhus University

Methods

- 5,158 patients prospectively enrolled at 10 core CTSN sites
- Infections identified and adjudicated up to 65 days after index surgery
- 4.6% (237 patients) experienced major infection
  - SSI (sternum or secondary site), mediastinitis, infectious pericarditis, endocarditis, cardiac device infection, pneumonia, C Diff colitis

Frequency, Type and Timing of Infection

Frequency, Type and Timing of Infection

Type of Infection	# of Events	# of Patients	% of Patients (N=5158)	Days from surgery to first infection		
				Median	Min	Max
Pneumonia	125	123	2.38	8	1	62
Bloodstream Infection	59	56	1.09	15	0	65
C. Difficile Colitis	52	50	0.97	17	3	63
Deep Incision Surg site infection (chest)*	26	26	0.56	20.5	5	54
Mediastinitis	12	12	0.23	24.5	6	60
Deep Incision Surg site infection (groin)*	10	10	0.21	26	6	49
Myocarditis or pericarditis	5	4	0.08	16	14	27
Empyema	4	3	0.06	56	13	63
Endocarditis	3	3	0.06	25	25	51
Device-related percut site infection	3	3	0.06	54	9	62
Pocket infection†	2	2	2.33	38.5	15	62

*Denominator for patients with a deep SSI is patients having a sternotomy (N=4669).

†Denominator for pocket infection is patients who had LVAD placed, replaced, or removed for heart transplant (N=86).

Organism Type

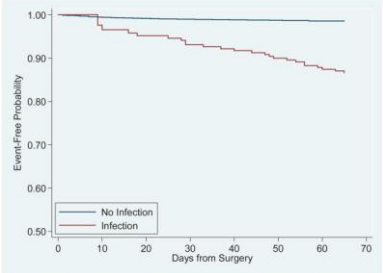
Organisms

Pneumonia	%	Endocarditis	%
Gram Positive Bacteria	12.6	**Gram Positive Bacteria**	100
Staphylococcus Aureus	9.5	*Staphylococcus* Aureus	66.7
Meth Resistant (44%)		Meth Resistant (50%)	
Streptococcus sp	3.2	*Staphylococcus* Hominis	33.3
Gram Negative Bacteria	82.1	**Empyema**	
Enterobacteriaceae	43.2	**Gram Positive Bacteria**	60
Pseudomonas	15.8	*Staphylococcus* Aureus	60
Other Health Care GNR*	13.7	Meth Resistant (67%)	
Serratia Marcesens	6.3	**Gram Negative Bacteria**	20
H. Influenzae	3.2	Pseudomonas	20
Other	5.3	*Other*	20

Organism Type

BSI		SSI	
Gram Positive Bacteria	47.5	**Gram Positive Bacteria**	62.9
Staphylococcus Aureus	13.1	*Staphylococcus* Aureus	40
Meth Resistant (38%)		Meth Resistant (50%)	
Staphylococcus Epi	9.8	*Staphylococcus* Epi	14.3
Meth Resistant (50%)		Meth Resistant (80%)	
Enterococcus	11.5	Enterococcus	5.7
Fungi (Candida)	9.8	Fungi (Candida)	2.9
Streptococcus sp	1.6	**Gram Negative Bacteria**	28.6
Staph Hominis (Coag neg)	1.6	Enterobacteriaceae	17.1
Gram Negative Bacteria	47.5	Pseudomonas	5.7
Enterobacteriaceae	29.5	Other Health Care GNR*	2.9
Serratia Marcesens	8.2	Other (Unidentified)	2.9
Other Health Care GNR*	4.9	*Other*	8.6
Pseudomonas	3.3	**Myocarditis/Pericarditis**	

Survival Impact of Major Infection



Gelijns AC, et al. J Am Coll Cardiol. 64(4):372-81, 2014.

Sites of Infection

Site of infection	N, %	Incidence
Bacteremia	9 (30%)	5.23%
Sternotomy site infection	8 (26.7%)	4.65%
Infection of vascular catheters	5 (16.7%)	2.90%
Pneumonia	4 (13.3%)	2.32%
Mediastinitis	1 (3.3%)	0.58%
Urinary tract infection	1 (3.3%)	0.58%
Total	30 (100%)	17.42%

Lola, et. Al Journal of Cardiothoracic Surgery2011 6:151

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Costs Associated With Health Care–Associated Infections in Cardiac Surgery

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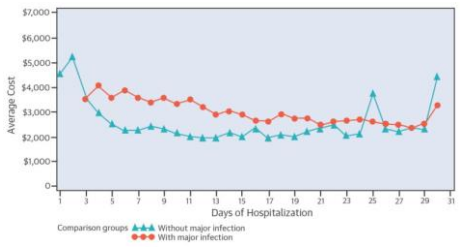
Cost of Infection

TABLE 3 Mean Extra Costs and Length of Stay During Index Hospitalization

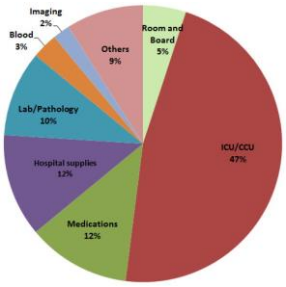
Patient Type	Cost, Median (95% CI), U.S. $			Length of Stay, Median (95% CI), Days	
	Median	Unadjusted Mean	Adjusted* Incremental	Unadjusted Mean	Adjusted* Incremental
VAD and transplantation included					
No infection (n = 4,201)	24,513	31,530 (30,654-32,407)	Reference	9.4 (9.2-9.7)	Reference
Infection (n = 119)	83,833	110,155 (94,664-125,646)	37,513 (30,403-45,318)	33.4 (29.4-37.5)	14 (11-17)
VAD and transplantation excluded					
No infection (n = 4,108)	24,308	28,577 (27,980-29,174)	Reference	8.9 (8.8-9.1)	Reference
Infection (n = 102)	73,268	93,363 (80,215-106,513)	39,264 (32,532-49,700)	30.0 (26.4-33.7)	14.1 (11.8-16.8)

*Adjusted using generalized linear model.
CI = confidence interval; VAD = ventricular assist device implantation or explantation.

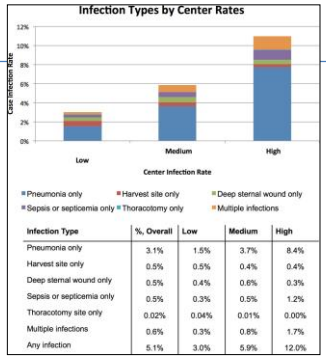
Average Cost Per Day With Infection



Incremental Costs By Type



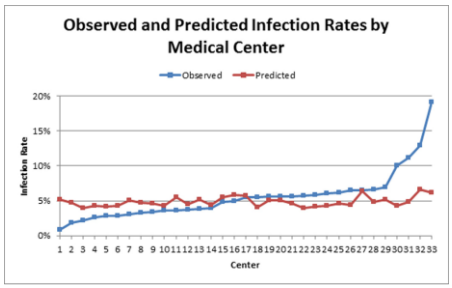
Center Variability in Infection



Infection Type	%, Overall	Low	Medium	High
Pneumonia only	3.1%	1.5%	3.7%	8.4%
Harvest site only	0.5%	0.5%	0.4%	0.4%
Deep sternal wound only	0.5%	0.4%	0.6%	0.3%
Sepsis or septicemia only	0.5%	0.3%	0.5%	1.2%
Thoracotomy site only	0.02%	0.04%	0.01%	0.00%
Multiple infections	0.6%	0.3%	0.8%	1.7%
Any infection	5.1%	3.0%	5.9%	12.0%

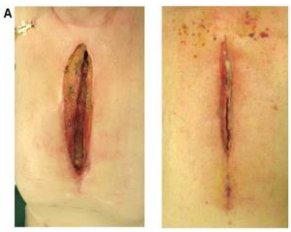
Circ Cardiovasc Qual Outcomes. 2014 Jul; 7(4): 567–573

Survival Impact of Infection



Circ Cardiovasc Qual Outcomes. 2014 Jul; 7(4): 567–573

DSWI

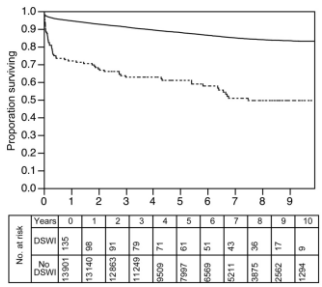


DSWI Incidence and Impact

- Incidence ranges: 0.5% -6.8%
- In hospital Mortality: 7-35%
- 1 year survivors of DSWI: 15% survival disadvantage
- 10 yr survival after CABG:
  - Without DSWI: 70%
  - With DSWI: 39%!

Cotogni P, et al. World J Crit Care Med. 4(4), 2015.

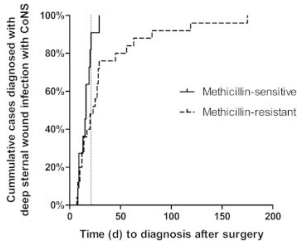
Survival Impact of DSWI



No. at risk	Years	0	1	2	3	4	5	6	7	8	9	10
	DSWI	135	98	91	79	71	61	51	43	36	17	9
	No DSWI	13901	13140	12863	11249	9509	7997	6569	5211	3875	2562	1294

Bilal H, et al. Interact Cardiovasc Thorac Surg. 2013 17(3):479-484.

Timing of DSWI

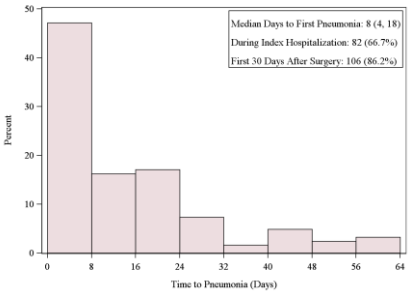


Pneumonia

CTSN: Pneumonia

- 2.4% (123 of 5,158 patients)
- 40% of all major infections
- 67% diagnosed during index hospitalization
- 86% diagnosed within 30 days
  - 14% developed pneumonia after 1st month

Time to Pneumonia



Impact of Pneumonia on Mortality

Variable	HR (95% CI)	P Value
Pneumonia	8.89 (5.02, 15.75)	<0.001
Age (year)	1.03 (1.01, 1.05)	<0.001
Male	0.60 (0.39, 0.91)	0.02
Diabetes* (yes/no)	1.57 (1.03, 2.41)	0.04
Heart Failure (yes/no)	1.86 (1.24, 2.80)	0.003
Creatinine, mg/dL	1.17 (1.06, 1.30)	0.002
Hemoglobin, g/dL	0.85 (0.75, 0.95)	0.005

Conclusions

- Increasing patient comorbidities
- Surgical infections still prevalent
- Significant financial burden of infections
- Significant mortality effect from infections

Conclusions

- Increasing patient comorbidities
- Surgical infections still prevalent
- Significant financial burden of infections
- Significant mortality effect from infections

- No consensus on Best Management!

Thank You

- Questions?
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Risk Factors of Infections After Cardiac Surgery

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* No other disclosures

Infections Following Cardiac Surgery

* Infection following cardiac surgery associated with significant cost
* Increases hospital LOS
* Increases Morbidity
* Increases need for further surgery
* Increases mortality

Types of Infections After Cardiac Surgery

- Pneumonia
- Surgical Site Infections
  - Superficial Sternal Wound Infections
  - Deep Sternal Wound Infections
  - Saphenectomy Site
- Septicemia

Why do Infections Occur?

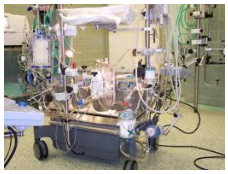
- Preoperative Factors
- Intraoperative Events
- Postoperative Course

Preoperative Risk Factors

- Age >70
- Obesity with BMI >30 kg/m2
- Immunosuppression
- COPD
- Diabetes (NIDDM as well as IDDM)
- Renal Insufficiency
- Critical preoperative status (infections, sepsis, cardiogenic shock)

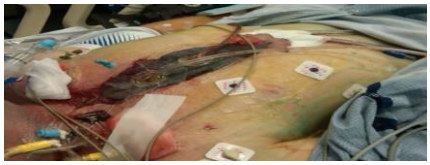
Intraoperative Risk Factors

- Prolonged operative time
- Prolonged bypass time
- Use of Bilateral Internal Mammary Artery
- Intraoperative use of blood products



Postoperative Risk Factors

- Prolonged mechanical ventilation
- Vasopressor support
- Need for transfusions
- Reoperation for bleeding (data is variable)



JACC Journals

From: Management Practices and Major Infections After Cardiac Surgery

J Am Coll Cardiol. 2014;64(4):372-381. doi:10.1016/j.jacc.2014.04.052

Baseline Variable	HR (95% CI)	p Value
COPD (yes/no)	1.66 (1.21-2.26)	0.002
Heart failure (yes/no)	1.47 (1.11-1.95)	0.007
Corticosteroids (yes/no)	1.91 (1.19-3.05)	0.007
Creatinine, mg/dl	1.15 (1.08-1.22)	<0.001
Hemoglobin, g/dl	0.90 (0.84-0.97)	0.008
LVAD/Tx (yes/no)	2.89 (1.86-4.50)	<0.001
Open sternum (yes/no)	6.35 (2.62-15.38)	<0.001
Duration of surgery, h	1.31 (1.21-1.41)	<0.001

Table Title:

Baseline and Procedure Characteristics Associated With Infection

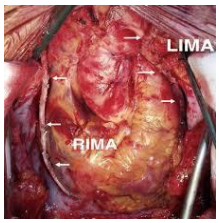
Mitigation of Risk Factors

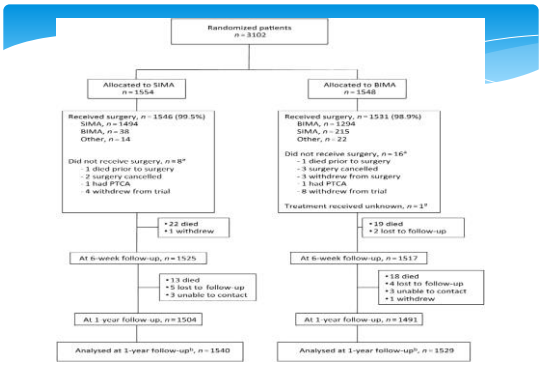
- Optimization of blood glucose (HbA1C < 8.0%)
- Reduce Obesity (BMI <30 kg/m2)
- Cessation of Cigarette Smoking
- Optimization of COPD
- Avoid operative time > 7 hours
- CPB time <180 min
- Optimize postoperative cardiac output
- Minimize bleeding and postoperative transfusion

Sajja LR, International Journal of Surgery 16 (2015) 171-178

Bilateral Internal Mammary Artery

- The use of Bilateral Internal Mammary Artery (BIMA) requires special consideration
- Emerging data that BIMA improves survival following CABG
- Increased risk of Deep Sternal Wound Infection???

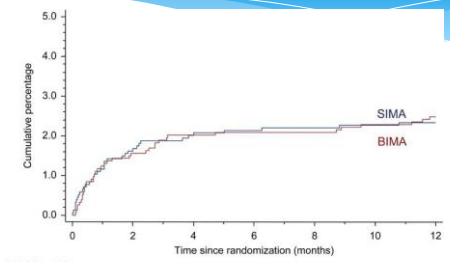




David P. Taggart et al. Eur Heart J 2010;31:2470-2481

European Heart Journal

Survival to 1 year.



At risk (events):

SIMA	1554 (25)	1521 (6)	1515 (2)	1513 (1)	1512 (1)	1511 (1)	1497
BIMA	1548 (24)	1508 (7)	1499 (1)	1498 (0)	1498 (3)	1495 (3)	1473

David P. Taggart et al. Eur Heart J 2010;31:2470-2481

European Heart Journal

Table 3
Adverse event data by randomized group

	SIMA (*n* = 1552)	BIMA (*n* = 1542)	Relative risk (95% CI)
Sternal wound reconstruction	9 (0.6%)	29 (1.9%)	3.24 (1.54–6.83)
No history of diabetes	4	15	
Insulin-dependent diabetes	2	5	
Non-insulin-dependent diabetes	3	9	
MI event at 30 days	23 (1.5%)	22 (1.4%)	0.96 (0.54–1.72)
CVA event at 30 days	19 (1.2%)	15 (1.0%)	0.79 (0.40–1.56)
Revascularization at 30 days	6 (0.4%)	11 (0.7%)	1.85 (0.68–4.98)
MI event at 1 year	31 (2.0%)	30 (2.0%)	0.97 (0.59–1.60)
CVA event at 1 year	28 (1.8%)	23 (1.5%)	0.83 (0.48–1.43)
Revascularization at 1 year	20 (1.3%)	27 (1.8%)	1.36 (0.77–2.41)

Conclusion

- Infections following cardiac surgery increase cost, morbidity and mortality
- Risks of Infection are multifactorial
- Mitigation of these risks, when possible, can significantly reduce the sequeli of these infection
- The benefits of the use of BIMA should be carefully weighed against the added risk of infection