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Sociedad Española de Infecciones Cardiovasculares

Etiología, diagnóstico microbiológico y tratamiento antimicrobiano de la mediastinitis posquirúrgica

Ponente:

Dolores Sousa (Complejo Hospitalario Universitario A Coruña)

Surgery
October, 1957

Appraisal of Progress in Surgical Therapy

CONDUCTED BY WARREN H. COLE, M.D.

THE MEDIAN STERNAL INCISION IN INTRACARDIAC SURGERY WITH EXTRACORPOREAL CIRCULATION: A GENERAL EVALUATION OF ITS USE IN HEART SURGERY

ORMAND C. JULIAN, M.D., MARIANO LOPEZ-BELIO, M.D.,
WILLIAM S. DYE, M.D., HUSHANG JAVID, M.D., AND
WILLIAM J. GROVE, M.D., CHICAGO, ILL.

(From the Department of Surgery, University of Illinois, and Cardiovascular Surgical Service, St. Lukes Hospital)

A COMPLETE vertical division of the sternum was used by Milton[3] in 1897 in an attempt to explore the posterior mediastinum. The incision has been used sporadically for a variety of purposes since that time. It has usually been considered of use in an approach to the pericardium for its resection. Holman and Willett[1] used incomplete vertical sternotomy with transection at the second intercostal space for pericardectomy. It has been applied also to removal of noncardiac lesions of the anterior mediastinum, such as a substernal thyroid adenoma. No thought was given to the sternal approach for ligation of patent ductus and coaretation surgery. The development of more advanced forms of cardiac operations was initially of procedures, such as mitral commissurotomy, which are best approached through the pleural cavity, usually the left. Intracardiac surgery requiring approach to the heart chambers through the left atrium or left ventricle would be inappropriate for sternal approach because of the posterior position of these structures.

H. Milton: Visionary Surgeon

Martin L. Dalton, MD, Samuel R. Connally, PhD, Macon, Georgia

Current wisdom holds that median sternotomy is the creation of cardiac surgeons as the premier approach to the heart. In fact, this innovative and resourceful procedure was perfected by an obscure English surgeon in Cairo, Egypt (U.A.R.), in 1897. H. Milton designed a vertical sternal-splitting approach for the excision of tuberculous mediastinal nodes and employed it successfully in a patient. Modern medicine owes a great debt to H. Milton for this significant, albeit unrecognized, contribution. The details of the life of this unsung surgeon, such as are known, are presented.

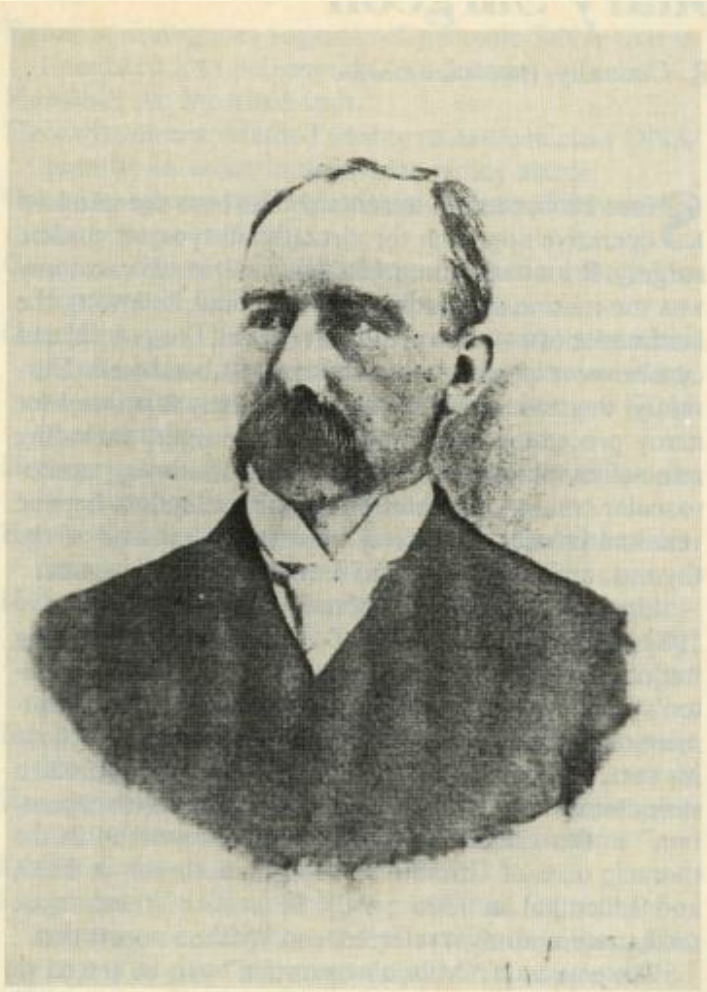


Figure 1. H. Milton.

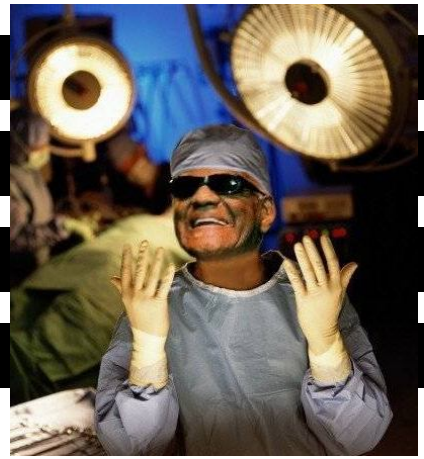
872 THE LANCET,] [MARCH 27, 1897.

MEDIASTINAL SURGERY.

BY H. MILTON, M.R.C.S. ENG.,
PRINCIPAL MEDICAL OFFICER, KASR EL AINI HOSPITAL, CAIRO.

➢ETIOLOGÍA

- Incidencia de distintos microorganismos
- ¿Existen diferencias en relación a ....



... variaciones temporales?

... ámbito geográfico ?

... factores de riesgo?

... al período de incubación de la infección?

➢DIAGNÓSTICO MICROBIOLÓGICO

➢TRATAMIENTO ANTIMICROBIANO

➢ETIOLOGÍA

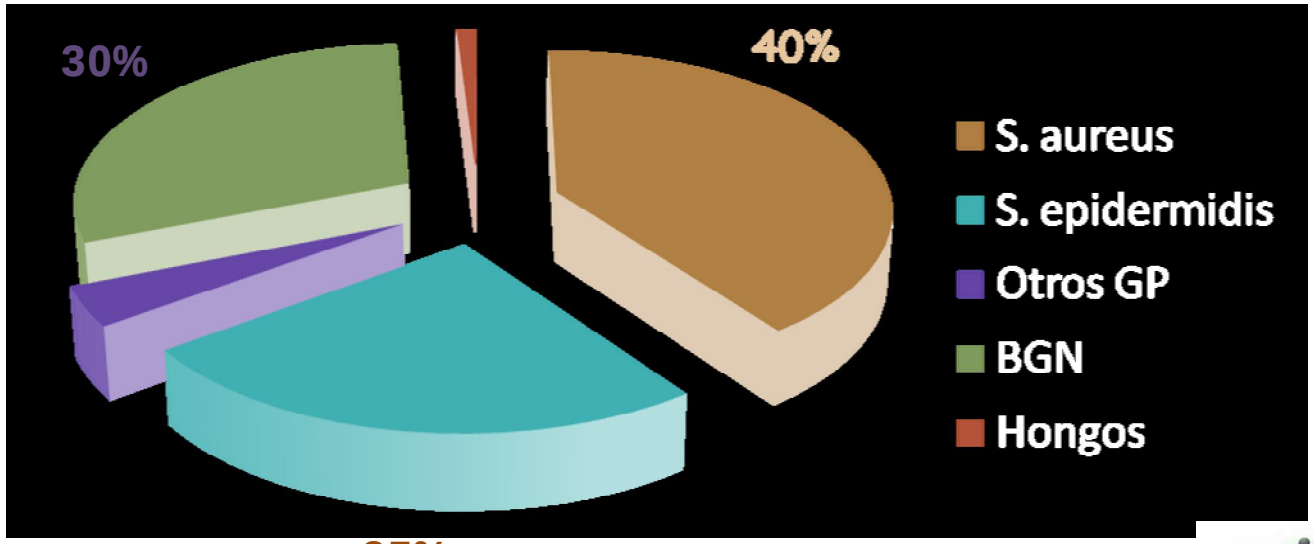


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Tabla 1. Microorganismos en Mediastinitis en Series Recientes

Autor y año	*S. aureus* n (%)	*S. epider* n (%)	BGN n (%)	*P. aerug* n (%)	*S. marc* n (%)	*Cándida* n (%)	Micr. N	Pac. N
Mekontso 2011	101 (43)	38 (16)	73 (31)	6 (3)	-	1 (0,5)	236	197
Sá 2010	7 (33)	3 (14)	10 (48) [1]	0 (0)	0 (0)	1 (5)	21	25
Charbonneau 2010	144 (46)	66 (21)	87 (28)	-	-	-	312	312
Söderquist 2007	28 (27)	49 (48)	5 (5)	-	-	-	103	129
Lepelletier 2005	8 (53)	3 (20)	4 (27)	0 (0)	0 (0)	0 (0)	15	18
Sharma 2004	35 (66)	6 (11)	9 (17)[2]	2 (4)	2 (4)	0 (0)	53	51
Garlund 2002	31(26)	54 (46)	21 (18) [3]	1 (1)	1 (1)	1 (1)	118	126
Muñoz 1997	27 (34)	16 (20)	29 (36) [4]	4 (5)	8 (10)	2 (3)	80	73
Rguez-Hdez 1997	12 (29)	10 (24)	19 (45) [2]	1 (2)	2 (5)	0 (0)	42	45
Fariñas 1995	14 (37)	7(18)	15 (39) [2]	1 (3)	3 (8)	0 (0)	38	31
Total 1.007	**407 (40)**	**252 (25)**	**272 (27)**				**1.018**	

*BGN más frecuente: [1]*Acinetobacter*; [2]*Enterobacter*; [3]*Klebsiella*; [4]*Serratia*

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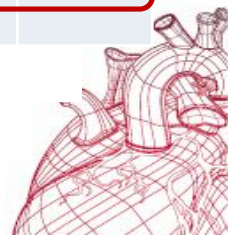
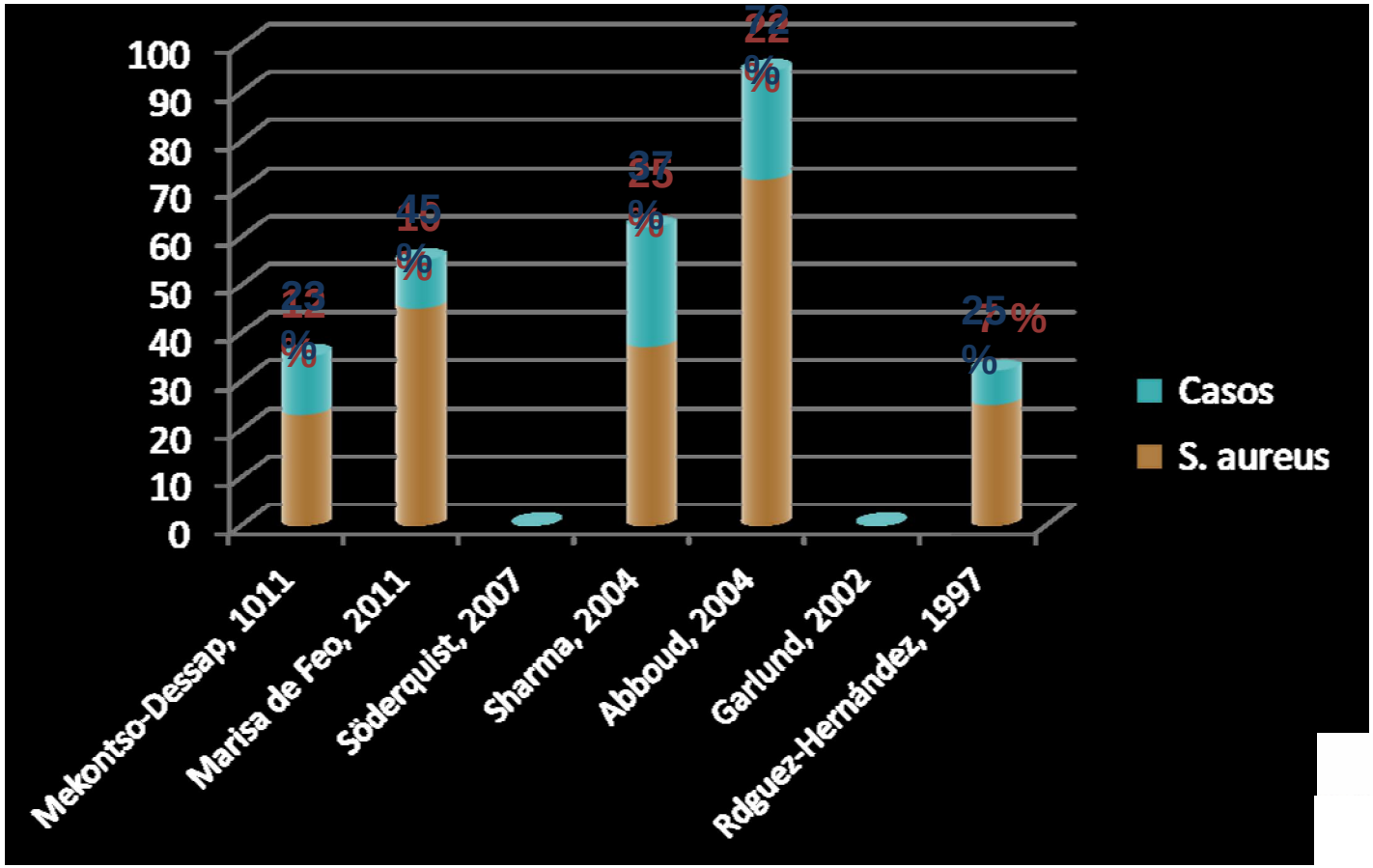
Tabla 2. Microorganismos en Mediastinitis en las Series Publicadas

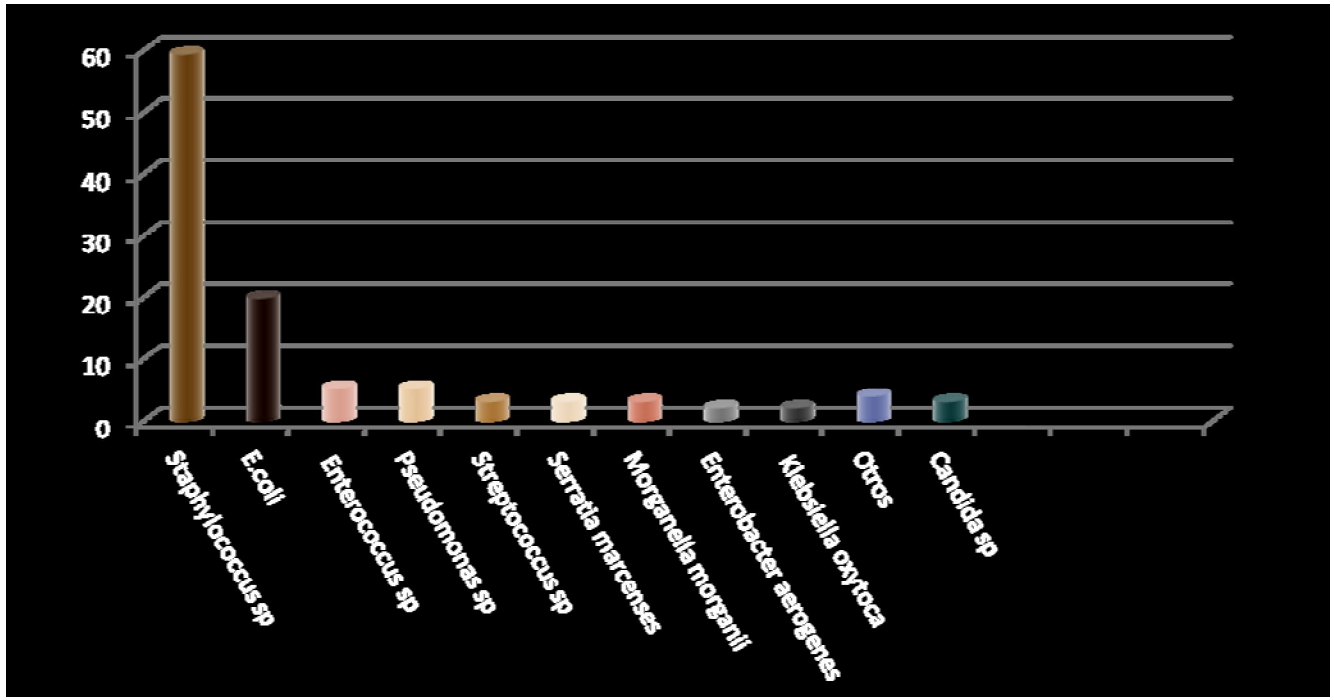
Autor y año	*S. aureus* n (%)	*S. epider* n (%)	BGN n (%)	*P. aerug* n (%)	*S. marc* n (%)	*Cándida* n (%)	Micr. N	Pac. N
Grossi 1985	35 (37)	12 (11)	14 (15)	1 (1)	5 (5)	9 (10)	94	77
Brook 1989	21 (24)	28 (32)	16 (18)	2 (2)	-	-	87	65
Nagachinta 1987	22 (32)	22 (32)	12 (17)	4 (6)	-	-	69	69
Scully 1985	37 (74)	-	13 (26)	3 (6)	-	-	50	41
Culliford 1976	10 (26)	8 (21)	8 (21)	-	-	5 (13)	39	39
Pairolero 1984	15 (43)	5 (14)	8 (23)	5 (14)	1 (3)	3 (9)	35	29
Majure 1986	4 (14)	9 (32)	13 (46)	4 (14)	2 (7)	2 (7)	28	18
Engelman 1973	-	6 (22)	15 (56)	2 (7)	1 (4)	4 (15)	27	17
SanFelippo 1972	2 (8)	9 (35)	9 (35)	2 (8)	2 (8)	2 (8)	26	26
Total	**146 (32)**	**99 (22)**	**108 (24)**			**25 (5)**	**455**	**381**



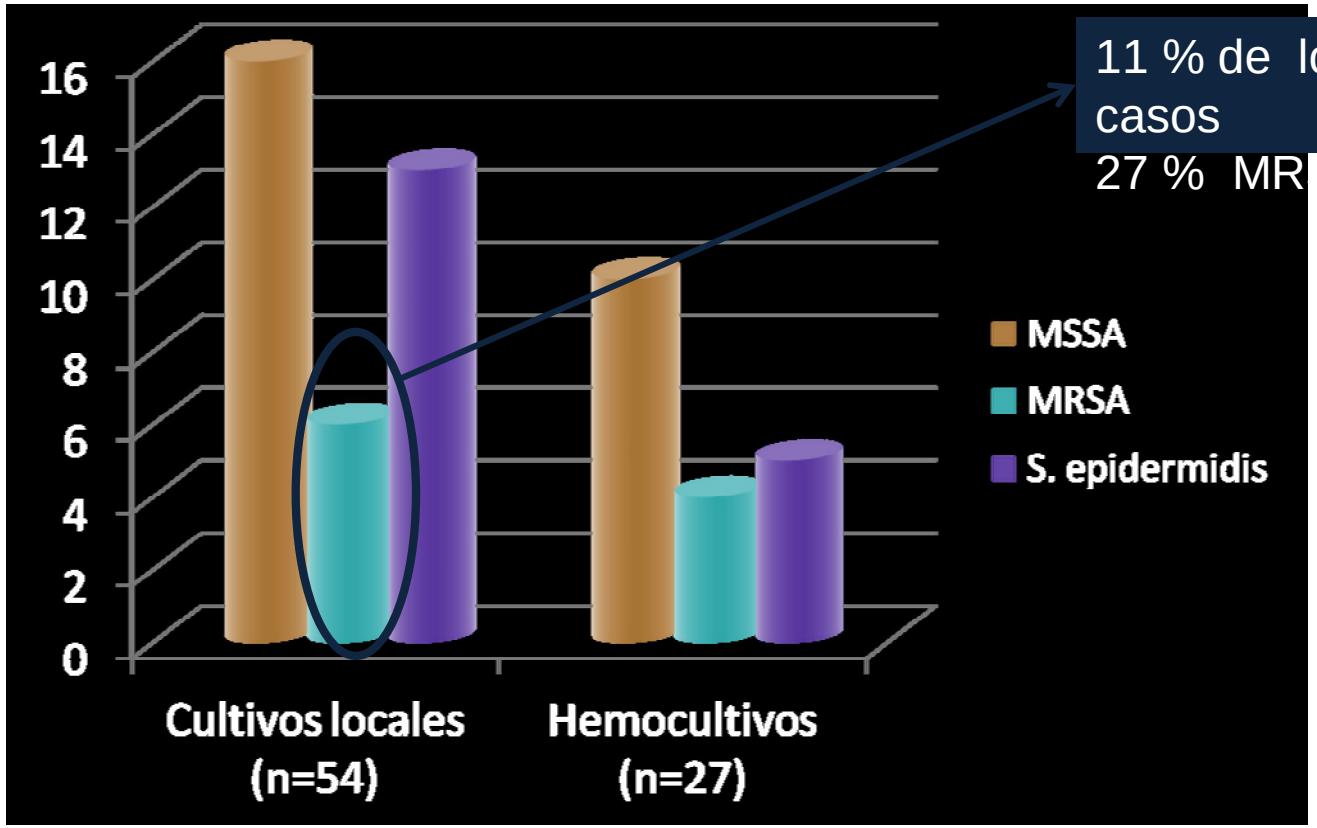
Microorganismos en Mediastinitis: SARM en Series Recientes

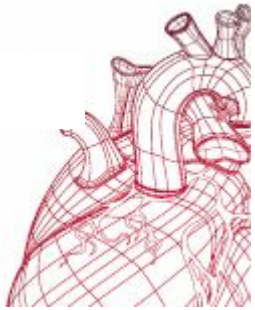


Microorganismos:

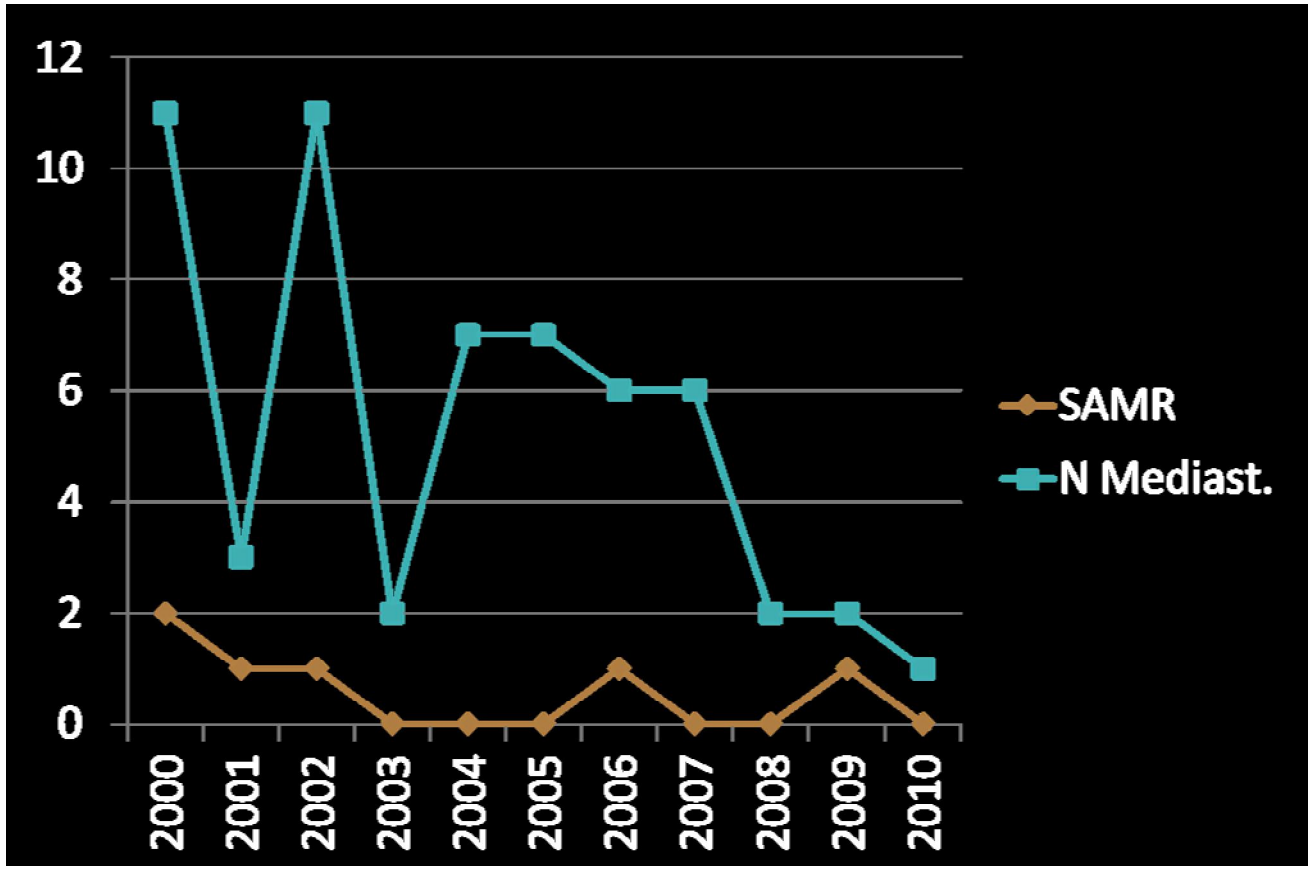


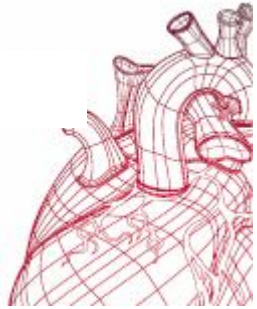
Microorganismos en Mediastinitis: SARM en CHUAC



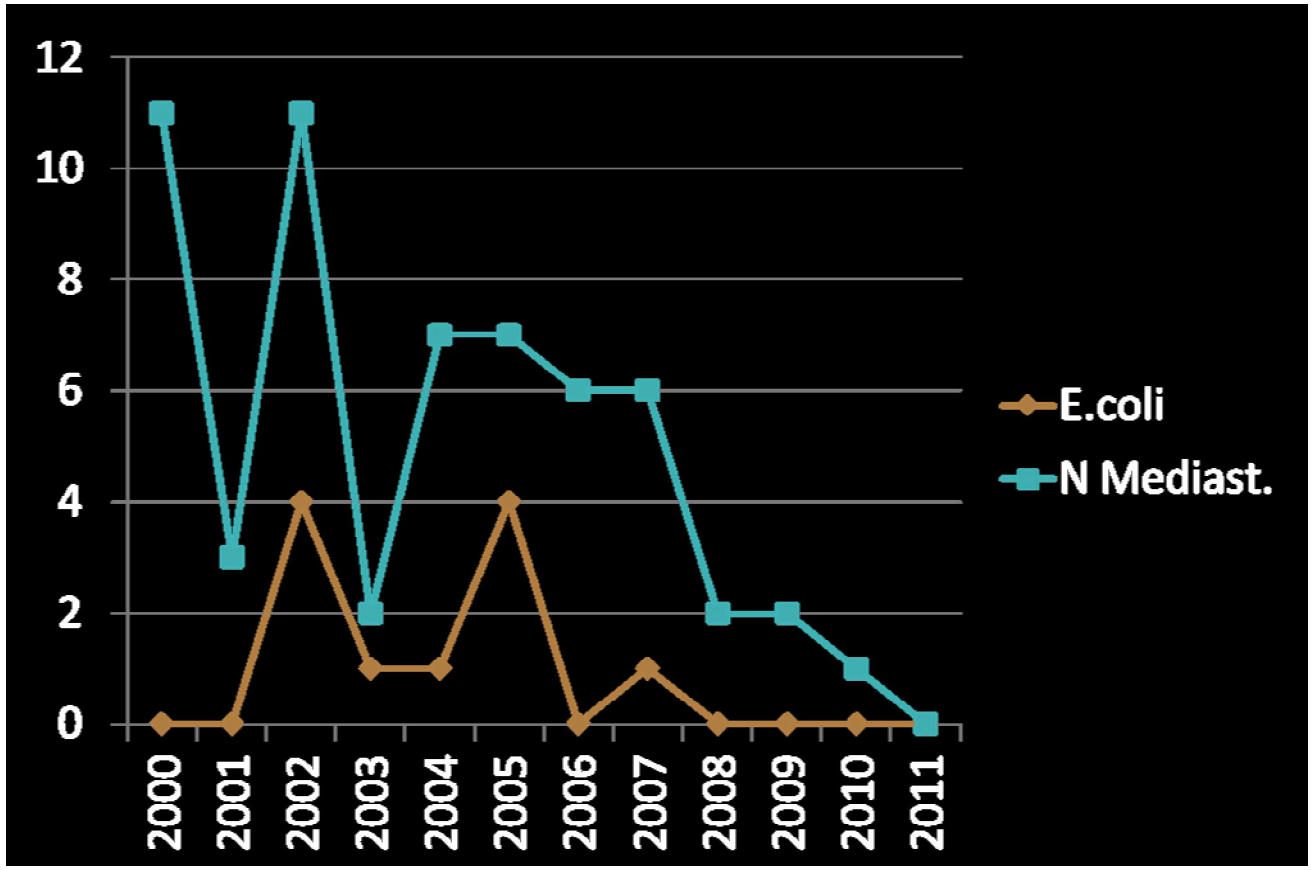


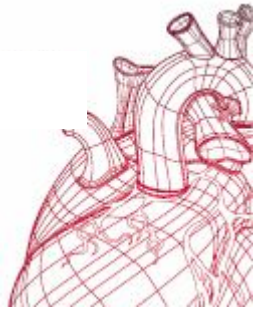
Microorganismos en Mediastinitis: SARM en CHUAC





Microorganismos en Mediastinitis: *E. coli* en CHUAC





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European Journal of Cardio-thoracic Surgery 32 (2007) 113—117

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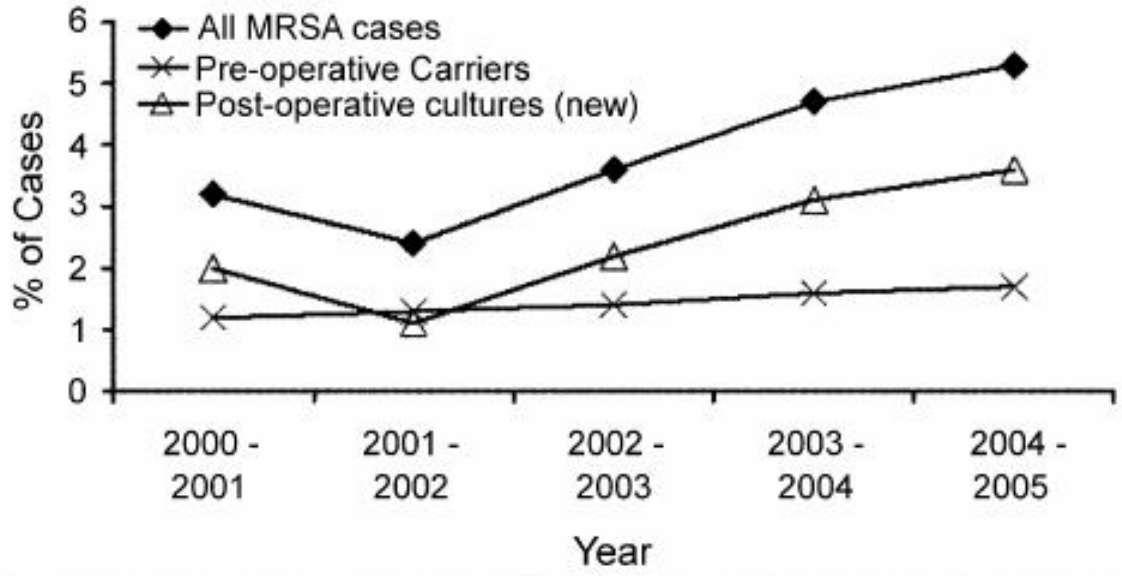
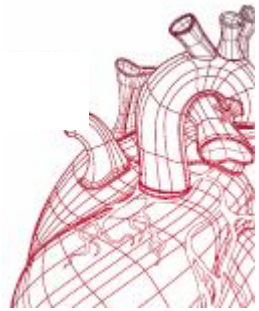


	2000 - 2001	2001 - 2002	2002 - 2003	2003 - 2004	2004 - 2005
All MRSA cases	3.2	2.4	3.6	4.7	5.3
Pre-operative Carriers	1.2	1.3	1.4	1.6	1.7
Post-operative cultures (new)	2	1.1	2.2	3.1	3.6

Fig. 1. Yearly incidence of MRSA infection.



STERNAL SURGICAL-SITE INFECTION FOLLOWING CORONARY ARTERY BYPASS GRAFT: PREVALENCE, MICROBIOLOGY, AND COMPLICATIONS DURING A 42-MONTH PERIOD

Mamta Sharma, MD; Dorine Berriel-Cass, RN, BSN; Joseph Baran, Jr., MD

MICROBIOLOGY, ANI

A 42-M

Mamta Sharma, MD; Dorine

The authors are from the Department of Internal Medici *Detroit, Michigan.*

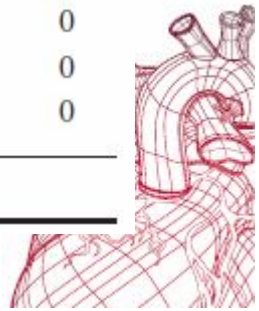
- ✓ Infecc. profundas = 51
- ✓ Infecc. superficiales = 71

ITE INFECTION FOLLOWING

TABLE 2
MICROBIOLOGY OF THE SURGICAL WOUND CULTURES

Isolate	Deep SSI		Superficial SSI	
	Single	Mixed	Single	Mixed
Staphylococcus aureus	30	5	16	4
Coagulase-negative staphylococci	4	2	23	5
Enterococcus	0	2	2	0
Group B *Streptococcus*	0	0	1	0
Corynebacterium	0	0	1	0
Pseudomonas aeruginosa	2	0	2	0
Serratia marcescens	1	1	3	1
Escherichia coli	0	0	1	3
Enterobacter	2	2	1	0
Citrobacter	0	0	2	1
Proteus mirabilis	0	1	1	1
Klebsiella pneumoniae	0	0	0	1
Acinetobacter	0	0	1	0
Prevotella oris	0	1	0	0
Candida kruseii	0	0	1	0

SSI = surgical-site infection.



ORIGINAL ARTICLE

Rev Bras Cir Cardiovasc 2010; 25(1): 19-24

Postoperative mediastinitis in cardiovascular surgery. Analysis of 1038 consecutive surgeries

Mediastinite no pós-operatório de cirurgia cardiovascular. Análise de 1038 cirurgias consecutivas

Michel Pompeu Barros de Oliveira SÁ[1], Débora Oliveira SILVA[2], Érika Nibbering de Souza LIMA[3], Ricardo de Carvalho LIMA[4], Frederico Pires Vasconcelos SILVA[5], Fábio Gonçalves de RUEDA[6], Rodrigo Renda de ESCOBAR[7], Paulo Ernando Ferraz CAVALCANTI[8]

This study was carried out at the Division of Cardiovascular Surgery - HUOC/PROCAPE Hospital Complex - Recife, PE, Brazil.

Bacterium isolated	N	%
Staphylococcus aureus	7	28.8
[illegible]	5	20.0
Staphylococcus epidermidis	3	12.0
Enterobacter spp	3	12.0
Klebsiella pneumoniae	2	8.0
Fungi	1	4.0
Negative Culture	3	12.0
Result not found in the clinical records	1	4.0
Total	25	100.0

Risk Factors for Mediastinitis After Cardiac Surgery

Cely Saad Abboud, MD, Sergio Barsanti Wey, MD, and Valeria Trancoso Baltar

Instituto Dante Pazzanese de Cardiologia, and Universidade Federal de São Paulo, São Paulo, Brazil

Table 3. Agents Isolated in Secretion of Surgical Wounds and Bone Fragments, Obtained Through Surgical Procedures

Isolated Agent	Incision n (%)	Bone n (%)
Total *Staphylococcus aureus*	18 (31)	9 (39)
Methicillin-sensitive *S aureus*	5 (8.6)	4 (17.4)
Methicillin-resistant *S aureus*	13 (22.4)	5 (21.7)
Enterobacter spp	14 (24.2)	5 (21.7)
Negative coagulase *Staphylococcus*	5 (8.6)	2 (8.7)
Enterococcus spp	5 (8.6)	2 (8.7)
Klebsiella spp	5 (8.6)	2 (2.7)
Pseudomonas aeruginosa	5 (8.6)	1 (4.4)
Morganella morganii	2 (3.5)	1 (4.4)
Serratia spp	2 (3.5)	1 (4.4)
Escherichia coli	2 (3.5)	0
Total	58 (100)	23 (100)

39 CASOS
36 :Limpieza Qx

52%
Gramnegativos

Ann Thorac Surg
2004;77:676–83

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Surgical site infections in cardiac surgery: microbiology

BO SÖDERQUIST

Departments of Clinical Microbiology and Infectious Diseases, Örebro University Hospital, Örebro, Sweden

TABLE 1. *Microbiological findings of the sternal wound infections and relative incidence of each agent in the treatment (local gentamicin prophylaxis) and control groups*

Bacterial agent	Treatment (n=983)		Control (n=967)	
	n (%)	% of infections within the treatment group	n (%)	% of infections within the control group
S. aureus	7 (0.71)	16.7%	21 (2.17)	24.1%
CoNS	14 (1.42)	33.3%	35 (3.62)	40.2%
Gram-negative bacteria	1 (0.10)	2.4%	4 (0.41)	4.6%
P. acnes	7 (0.71)	16.7%	6 (0.62)	6.9%
Other or multiple species	2 (0.20)	4.8%	6 (0.62)	6.9%
Negative or missing culture	11 (1.12)	26.2%	15 (1.55)	17.2%
Total	42 (4.27)	100.0%	87 (9.00)	100.0%

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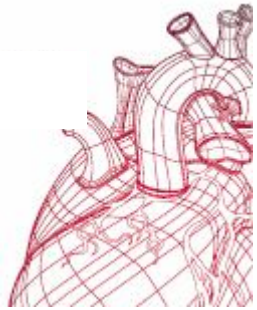
ISSN 0903-4641



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Postoperative mediastinitis in cardiac surgery — microbiology and pathogenesis ☆

B. Gårdlund[a,*], C.Y. Bitkover[b], J. Vaage[b]

[a]*Department of Infectious Diseases, Karolinska Hospital, Stockholm, Sweden*
[b]*Department of Thoracic Surgery, Karolinska Hospital, Stockholm, Sweden*

Table 2
Microbial etiology in 126 cases of postoperative mediastinitis

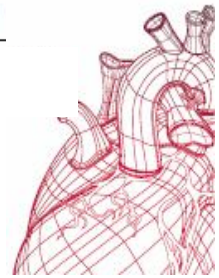
Bacterial etiology	Number of patients	With positive blood cultures	Median time from operation (or reoperation) to symptoms of infection (days)	90-Day all cause mortality
Gram-positive bacteria				
Coagulase negative staphylococci[a]	54	4 (7%)	7.5	11 (20%)
Staphylococcus aureus[b]	31	21 (68%)	7.0	4 (13%)
Alpha streptococci[c]	6	1 (17%)	3.5	0
Propionibacterium	4	1 (25%)	5.5	1 (25%)
Other gram-positive bacteria[d]	2	1 (50%)	6.0	1 (50%)
Gram-negative bacteria				
Klebsiella sp.	6	6 (100%	4.0	2 (33%)
Enterobacter sp.	5	0	7.0	2 (40%)
E. coli	3	2 (67%)	3.0	1 (33%)
Other gram-negatives[e]	6	1 (17%)	7.5	1 (17%)
Fungus				
Candida albicans	1	0	11.0	1 (100%)
Negative cultures	8	0	9.5	0
Sum	126	37 (29%)	7.0	24 (19%)

82 %

17 %

1%

B. Gårdlund et al. / European Journal of Cardio-thoracic Surgery 21 (2002) 825–830



Postsurgical Mediastinitis: A Case-Control Study

P. Muñoz, A. Menasalvas, J. C. L. Bernaldo de Quirós, M. Desco, J. L. Vallejo, and E. Bouza

From the Services of Clinical Microbiology and Infectious Diseases, Experimental Medicine, and Cardiac Surgery, Hospital General Universitario "Gregorio Marañón," Madrid, Spain

Table 4. Organisms isolated from patients with postsurgical mediastinitis.

Organisms	Site of isolation: Mediastinum (n = 80)	Blood (n = 17)	Blood (n = 9)*
Gram-positive bacteria (n = 49)			
Staphylococcus aureus	27	10	7
Staphylococcus epidermidis	16	2	2
Enterococcus faecalis	2	1	2
Streptococcus sanguis	2	1	1
Corynebacterium species	1	. . .	. . .
Group A streptococcus	1	. . .	. . .
Total (%)	49 (61.2%)		
Gram-negative bacteria (n = 29)			
Serratia species	8	3	. . .
Enterobacter species	7	3	3
Escherichia coli	5	1	2
Pseudomonas aeruginosa	4	. . .	1
Klebsiella species	2	. . .	. . .
Proteus mirabilis	2	. . .	1
Salmonella species	1	. . .	. . .
Total (%)	29 (36%)		
Fungi			
Candida albicans	2	. . .	. . .
Total (%)	2 (2.5%)	. . .	. . .

* These bacteremias were polymicrobial.

Suppurative Mediastinitis After Open-Heart Surgery: A Case-Control Study Covering a Seven-Year Period in Santander, Spain

M. Carmen Fariñas, F. Galo Peralta, J. M. Bernal, J. M. Rabasa, J. M. Revuelta, and J. González-Macías

From the Infectious Diseases Unit, Department of Internal Medicine, and the Department of Cardiovascular Surgery, Hospital Universitario "Marqués de Valdecilla," Universidad de Cantabria, Santander, Spain

Table 5. Bacteriologic findings in 31 cases of poststernotomy suppurative mediastinitis.

Organism(s)	No. (%) of isolates from indicated site	
	Mediastinum (n = 38)	Blood (n = 12)
Gram-positive bacteria	23 (61)	12 (100)
*Staphylococcus aureus**	14	10
Staphylococcus epidermidis†	7	1
Enterococcus faecalis‡	1	0
Streptococcus pneumoniae	1	1
Gram-negative bacteria	15 (39)	0 (. . .)
Enterobacter cloacae	6	0
Escherichia coli	3	0
Serratia marcescens	3	0
Morganella morganii	2	0
Pseudomonas aeruginosa	1	0

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Table 2 Co

Suppurative mediastinitis after open-heart surgery: a comparison between cases caused by Gram-negative rods and by Gram-positive cocci

f mediastinitis

M. J. Rodríguez-Hernández[1], A. de Alarcón[1], J. M. Cisneros[1], I. Moreno-Maqueda[1], S. Marrero-Calvo[2], R. Leal[3], P. Camacho[3], R. Montes[4] and J. Pachón[1]

[1]Infectious Diseases Unit, [2]Radiology Service, [3]Intensive Care Service, [4]Cardiovascular Surgery Service, Hospital Universitario Virgen del Rocío, Seville, Spain

Variable	Mean±SD	Mean±SD	*p*
Preoperative f			
Age (years)			NS
Prior debili			NS
Diabetes m			NS
COPD[b]			NS
Preoperativ			NS
Intraoperative factors			
Coronary revascularization[c]	13	9	NS
Valve replacement	5	11	NS
Other surgery[d]	1	3	NS
Duration of bypass (min)	127±36	96±34	0.008
Postoperative factors			
ICU stay[e] (days)	7±7	7±8	NS
Ventilator time[e] (days)	4±7	1±2	0.02
Drainage time (days)	3±2	3±2	NS
Reoperation	3 (15.7%)	3 (13%)	NS
Concomitant infection	11 (58%)[f]	5 (22%)	0.03
Urinary infection	5 (26%)	2 (8.6%)	NS
Pulmonary infection	8 (42%)	3 (13%)	0.04
Prosthetic endocarditis	0 (0%)	2 (8.6%)	NS

ORIGINAL ARTICLE

Suppurative mediastinitis after open-heart surgery: a comparison between cases caused by Gram-negative rods and by Gram-positive cocci

M. J. Rodríguez-Hernández[1], A. de Alarcón[1], J. M. Cisneros[1], I. Moreno-Maqueda[1], S. Marrero-Calvo[2], R. Leal[3], P. Camacho[3], R. Montes[4] and J. Pachón[1]

[1]Infectious Diseases Unit, [2]Radiology Service, [3]Intensive Care Service, [4]Cardiovascular Surgery Service, Hospital Universitario Virgen del Rocío, Seville, Spain

"Conclusions: Preventable postoperative remote-site infection may lead to mediastinitis, specially if Gram-negative rods are involved"

Clinical Microbiology and Infection, Volume 3 Number 5, October 1997

Microbiología y Etiopatogenia

Mecanismo etiopatogénico:

- ✓ Contaminación del sitio quirúrgico durante la cirugía
- ✓ En relación con infecciones nosocomiales concomitantes, en el contexto de diseminación hematógena
- ✓ Mecanismo endógeno *vs*. exógeno
  - Portadores nasales y *S. aureus*

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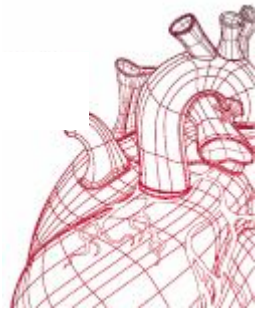
European Journal of Cardio-thoracic Surgery 21 (2002) 825–830

EUROPEAN JOURNAL OF CARDIO-THORACIC SURGERY

Postoperative mediastinitis in cardiac surgery — microbiology and pathogenesis☆

B. Gårdlund[a,*], C.Y. Bitkover[b], J. Vaage[b]

[…]**Conclusions**: Three different types of postoperative mediastinitis can be distinguished: (1) mediastinitis associated with obesity, chronic obstructive pulmonary disease, and sternal dehiscence, typically caused by coagulase negative staphylococci; (2) mediastinitis following peroperative contamination of the mediastinal space, often caused by *S. aureus*, and (3) mediastinitis mainly caused by spread from concomitant infections in other sites during the postoperative period, often caused by gram negative rods. The proposed classification of mediastinitis into three groups with different pathogenic mechanisms may be useful in understanding which prophylactic counter measures have the potentials to be effective in a given situation. © 2002 Elsevier Science B.V. All rights reserved.



Effect of time to onset on clinical features and prognosis of post-sternotomy mediastinitis

A. Mekontso Dessap[1,2,3], E. Vivier[1,3], E. Girou[3,4], C. Brun-Buisson[1,2,3] and M. Kirsch[3,5]

1) AP-HP, Groupe Henri Mondor, Albert Chenevier, Service de Réanimation Médicale, Créteil, 2) INSERM, U955, Créteil, 3) Université Paris Est Créteil Val de Marne, Faculté de Médecine, Créteil, 4) AP-HP, Groupe Henri Mondor, Albert Chenevier, Unité d'Hygiène et Prévention de l'Infection, Créteil and 5) AP-HP, Groupe Henri Mondor, Albert Chenevier, Service de Chirurgie Cardiaque, Créteil, France

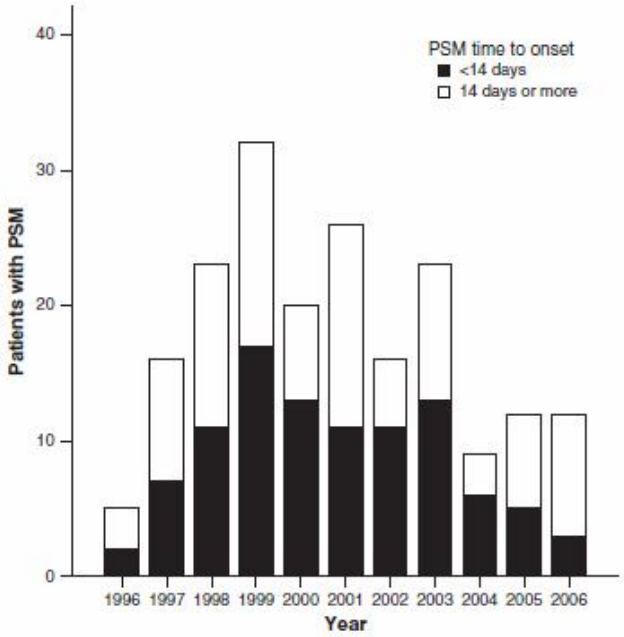


FIG. 1. Patients with early-onset and late-onset post-sternotomy mediastinitis according to year of enrollment.

	All patients (*n* = 197)	Early-onset mediastinitis (*n* = 98)	Late-onset mediastinitis (*n* = 99)	p
Gram-positive cocci				
Staphylococcus aureus				
Methicillin susceptible	78 (40)	27 (28)	51 (52)	<0.01
Methicillin resistant	23 (12)	12 (12)	11 (11)	0.83
Coagulase-negative *Staphylococcus*	38 (19)	23 (23)	15 (15)	0.15
Enterococcus spp.[a]	17 (9)	15 (15)	2 (2)	<0.01
Streptococcus spp.	4 (2)	3 (3)	1 (1)	0.37
Gram-negative bacilli				
KES	27 (14)	15 (15)	12 (12)	
Escherichia coli	22 (11)	14 (14)	8 (8)	0.18
Proteus spp.	9 (5)	5 (5)	4 (4)	0.75
Pseudomonas spp.	6 (3)	1 (1)	5 (5)	0.21
Citrobacter	5 (3)	3 (3)	2 (2)	0.68
Morganella	4 (2)	2 (2)	2 (2)	>0.99
Mycoplasma	2 (1)	1 (1)	1 (1)	>0.99
Negative culture	5 (3)	2 (2)	3 (3)	>0.99
Fungi	1 (1)	0 (0)	1 (1)	>0.99
Polymicrobial	38 (19)	20 (20)	18 (18)	0.72

[a]All *Enterococcus* spp. were susceptible to vancomycin.
KES, *Klebsiella*, *Enterobacter* and *Serratia*; data are *n* (%).

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MAJOR ARTICLE

Outbreak of Invasive Aspergillosis After Major Heart Surgery Caused by Spores in the Air of the Intensive Care Unit

T. Peláez,[1,2,3] P. Muñoz,[1,2,3] J. Guinea,[1,2,3] M. Valerio,[1,2] M. Giannella,[1,2] C. H. W. Klaassen,[4] and E. Bouza[1,2,3]

CID 2012:54 (1 February) • Peláez et al

MAJOR ARTICLE

Candida albicans Sternal Wound Infections: A Chronic and Recurrent Complication of Median Sternotomy

Preeti N. Malani, Shelly A. McNeil, Suzanne F. Bradley, and Carol A. Kauffman

CID 2002:35 (1 December) • Malani et al.

doi:10.1510/icvts.2010.244608

INTERACTIVE CARDIOVASCULAR AND THORACIC SURGERY

Interactive CardioVascular and Thoracic Surgery 11 (2010) 857–858

www.icvts.org

Case report - Aortic and aneurysmal

Mycoplasma hominis mediastinitis after acute aortic dissection repair

Patrick O. Myers[a,b,*], Ebrahim Khabiri[a], Gilbert Greub[c], Afksendiyos Kalangos[a]

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Available online at www.sciencedirect.com

ScienceDirect

Diagnostic Microbiology and Infectious Disease 58 (2007) 245–249

DIAGNOSTIC MICROBIOLOGY AND INFECTIOUS DISEASE

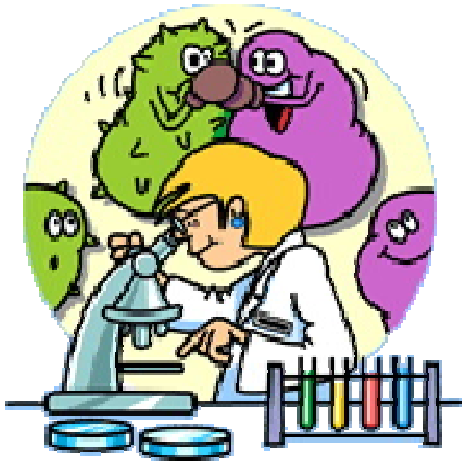
www.elsevier.com/locate/diagmicrobio

Mycobacterium tuberculosis sternal wound infection after open heart surgery: a case report and review of the literature

Teresa K. Wang[a], Chi-Fong Wong[b], Wing-Kuk Au[c], Vincent C. Cheng[a], Samson S. Wong[a,*]

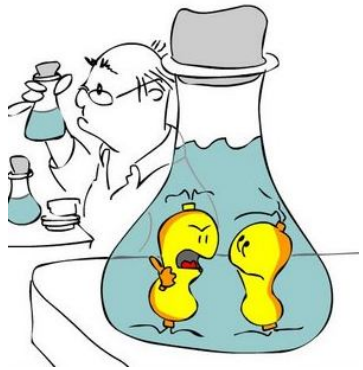
- ETIOLOGÍA

- **DIAGNÓSTICO MICROBIOLÓGICO**
  - **Definitivo: material purulento mediastínico obtenido durante el tratamiento quirúrgico de la entidad.**
  - **Otras muestras:**
    - **Hemocultivos**
    - **Punción subxifoidea**
    - **Electrodos MP temporal**



Problemas:

- **Contaminación *vs.* infección**
- **Dificultad de un diagnóstico temprano**



- TRATAMIENTO ANTIMICROBIANO

Eur J Clin Microbiol Infect Dis (2005) 24: 182–189
DOI 10.1007/s10096-005-1302-1

ARTICLE

266 pacientes

Table 6 Validity of blood cultures (BC) over the entire study period (60 days post surgery)

Criterion for assigning a positive BC result	Sensitivity (95%CI)	Specificity (95%CI)	NPV (95%CI)	PPV (95%CI)	PLR	1/NLR
Bacteremia	79% (66–92)	95% (92–98)	96% (94–99)	73% (59–87)	2.73	27.25
Staphylococcal bacteremia	71% (56–85)	97% (94–99)	95% (92–98)	79% (66–93)	3.86	20
S. aureus bacteremia	68% (53–83)	98% (96–99)	95% (92–98)	87% (74–99)	6.5	18.6
Cardiac transplantation		1 (2.6%)	1 (3%)			
Presenting symptom						
Fever		20 (52.6%)	17 (56.7%)	3 (37.5%)		
Sternal pain		8 (21.1%)	6 (20%)	2 (25%)		
Sternal dehiscence		6 (15.8%)	3 (10%)	3 (37.5%)		
Sternal drainage		4 (10.5%)	4 (13.3%)			
Mean days[a] to 1st sign (95%CI)		12.76 (10–15.44)	12.76 (9.72–15.79)	12.75 (5.36–20.14)		

Table 7 Validity of blood cultures (BC) in the risk period for postsurgical mediastinitis (7–20 days post surgery)

Criterion for assigning a positive BC result	Sensitivity (95%CI)	Specificity (95%CI)	NPV (95%CI)	PPV (95%CI)	PLR	1/NLH
Bacteremia	85% (71–98)	95% (90–99)	96% (92–99)	81% (67–96)	4.4	23
Staphylococcal bacteremia	77% (61–93)	96% (92–99)	94% (89–98)	83% (68–99)	5	15.5
S. aureus bacteremia	73% (56–90)	98% (95–99)	93% (88–98)	90% (78–99)	9.5	13.6

NPV, negative predictive value; PPV, positive predictive value; PLR, positive likelihood ratio; NLR, negative likelihood ratio

Staphylococcus aureus Bacteremia After Median Sternotomy

Clinical Utility of Blood Culture Results in the Identification of Postoperative Mediastinitis

Vance G. Fowler, Jr, MD, MHS; Keith S. Kaye, MD, MPH; David L. Simel, MD, MHS;

Unique patients undergoing median sternotomy for coronary artery bypass grafting during 60 month study period (5500 patients)

TABLE 2. Clinical Utility of Blood Culture Results in the Identification of Mediastinitis in 855 Patients Undergoing Median Sternotomy for CABG

Blood Culture Results	Mediastinitis Present (n=98)	Mediastinitis Absent (n=757)	Likelihood Ratio (95% CI)
S aureus	46	14	25 (14.7 to 44.4)
Other pathogen	15	111	1.0 (0.64 to 1.7)
No growth	37	632	0.45 (0.35 to 0.58)

44 Med/4.645

bypass grafting (855 patients)

46 Med/81

15 Med/126

Blood cultures yield No growth (669 patients)

37 Med/669

Conclusions—Among patients with blood cultures drawn after CABG, *S. aureus* bacteremia strongly suggests the presence of mediastinitis.

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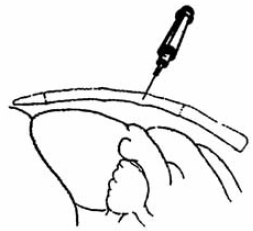
Sternal puncture allows an early diagnosis of poststernotomy mediastinitis

Sidney Benlolo, MD[a]



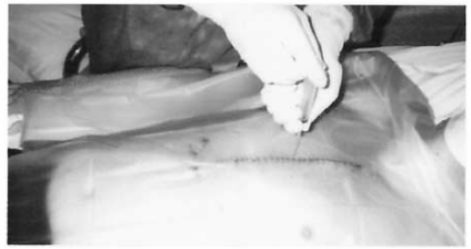


TABLE 1. Results of EW cultures, sternal puncture Gram stains, and sternal puncture cultures

	True mediastinitis	No mediastinitis	Total
Sternal puncture cultures			
Positive	23	2	25
Negative	0	24	24
Total	23	26	49

Results were considered as true positive when bacterial findings were identical to samples obtained during surgical intervention.

TABLE 3. Comparison … itis was diagnosed with sternal puncture versus those … cal signs

	… mediastinitis …sed by means of …sence of classic …inical signs	*P* value
No. of patients	20	
Delay between initial car… and the diagnosis of m…	13 ± 8	.04
Postoperative course in I…		
SAPS II score*	40 ± 13	.0001
Mortality (n)	4	NS
Length of mechanical …	10 ± 13	.02
Delay for mediastinal sterilization (d)	16 ± 12	14 ± 6	NS
Primary debridement failure (n)	1	2	NS
Discharge from ICU (d)	9 ± 7	18 ± 15	.02

JOURNAL OF CLINICAL MICROBIOLOGY, Nov. 2004, p. 5245–5248 Vol. 42, No. 11
0095-1137/04/$08.00+0 DOI: 10.1128/JCM.42.11.5245–5248.2004
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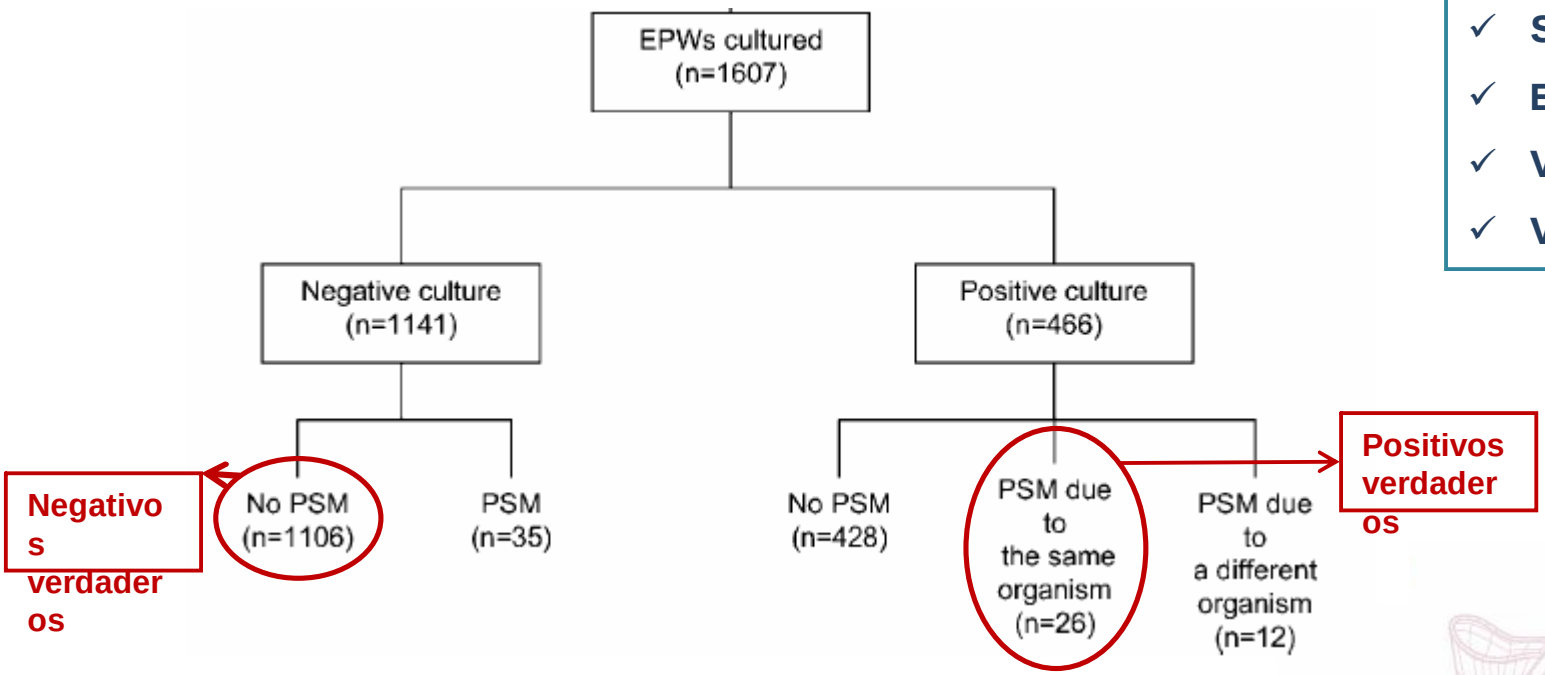
Usefulness of Routine Epicardial Pacing Wire Culture for Early Prediction of Poststernotomy Mediastinitis

Armand Mekontso-Dessap,[1]* Stéphanie Honoré,[2] Matthias Kirsch,[3] Rémi Houël,[3] Daniel Loisance,[3] and Christian Brun-Buisson[1]



- ✓ S = 36%
- ✓ E = 72%
- ✓ VPP = 6%
- ✓ VPN = 96%

Therefore, a strategy of routine culture of EPWs to predict PSM seems questionable.

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Role of Epicardial Pacing Wire Cultures in the Diagnosis of Poststernotomy Mediastinitis

Luis C. Maroto, José M. Aguado, Yolanda Carrascal, Ana Pérez, Enrique Pérez-de-la-Sota, José M. Cortina, Rafael Delgado, Enrique Rodriguez, Luis Molina, and Juan J. Rufilanchas

From the Department of Cardiac Surgery, Infectious Diseases Unit, and Department of Microbiology, Hospital Universitario "12 de Octubre," Madrid, Spain

Table 3. Culture results for all patients whose epicardial pacing wires (EPWs) were cultured.

	No. of patients		
EPW culture result	With no infection	With mediastinitis	Total
Positive*	91	12	103
Negative	458	4	462
Total	549	16	565

* A culture was considered to be positive when the same organism grew simultaneously in the EPW culture and in the culture of the material obtained during surgery.

- ✓ **S = 75%**
- ✓ **E = 83%**
- ✓ **VPP = 12%**
- ✓ **VPN = 99%**

[··· We conclude that a sterile culture of the epicardial pacing wires strongly contradicts a diagnosis of postsurgical mediastinitis.]

Maroto et al. CID 1997;24 (March)

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Diagnostic Microbiology and Infectious Disease 56 (2006) 345–349

DIAGNOSTIC MICROBIOLOGY AND INFECTIOUS DISEASE

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Bacteriology

Cultures of sternal wound and mediastinum taken at the end of heart surgery do not predict postsurgical mediastinitis

Emilio Bouza[a], Patricia Muñoz[a], Luis Alcalá[a,*], María Jesús Pérez[b], Cristina Rincón[b], José María Barrio[b], Angel Pinto[b]

- ✓ **229 intervenciones (Cirugía Cardiaca)/ 227 pacientes**
- ✓ **Período de 6 meses (Oct 2004 – Mar 2005)**
- ✓ **Muestras:**
  - **frotis del borde esternal y tejido subcutáneo**
  - **2ª muestra tras lavado de espacio mediastínico**
- ✓ **Cultivos semicuantitativos y cuantitativo del lavado mediastínico.**
- ✓ **7 casos de mediastinitis**

Available online at www.sciencedirect.com
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Diagnostic Microbiology and Infectious Disease 56 (2006) 345–349
DIAGNOSTIC MICROBIOLOGY AND INFECTIOUS DISEASE
www.elsevier.com/locate/diagmicrobio

Bacteriology

Cultures of sternal wound and mediastinum taken at the end of heart surgery do not predict postsurgical mediastinitis

Emilio Bouza[a], Patricia Muñoz[a], Luis Alcalá[a,*], María Jesús Pérez[b], Cristina Rincón[b], José María Barrio[b], Angel Pinto[b]

"The value of intraoperative cultures as a test for prediction of PM depending on the breakpoint chosen were as follows: sensitivity (0%), specificity (66.2-97.3%), and positive (0%) and negative predictive values (96.8-98.0%).

We recommend against surveillance taken intraoperatively in patients undergoing MHS"

JOURNAL OF CLINICAL MICROBIOLOGY, Aug. 2002, p. 2936–2941 Vol. 40, No. 8
0095-1137/02/$04.00+0 DOI: 10.1128/JCM.40.8.2936–2941.2002
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Mediastinitis after Cardiac Surgery: Improvement of Bacteriological Diagnosis by Use of Multiple Tissue Samples and Strain Typing

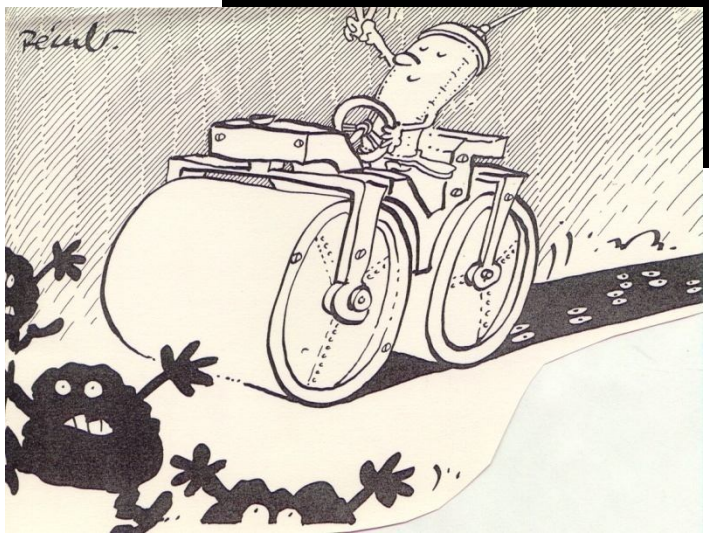
Ann Tammelin,[1]* Anna Hambræus,[1] and Elisabeth Ståhle[2]

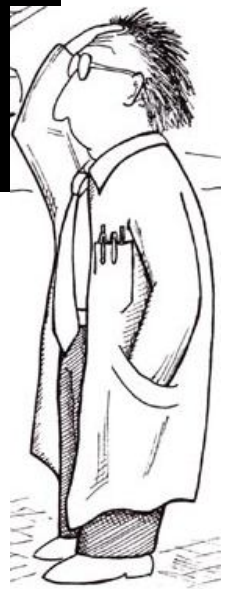
- ✓ **Sujetos estudio: 41 re-esternotomías tras cirugía cardiaca**
- ✓ **Protocolo: 5 muestras/paciente de esternón o mediastino**
- ✓ **Criterio microbiológico de dx de infección:**
  - **SCN o *S. aureus*: misma cepa (Pulsed Field Gel Electrophoresis) en ≥ 50% muestras**
  - **Otros: misma especie en ≥ 50% muestras**
- ✓ **Comparación del diagnóstico clínico con diagnóstico microbiológico**

Hasta un 30% de episodios causados por SCN pueden ser mal interpretados como "no infección"

"The patient in the next bed is highly infectious. Thank God for these curtains."

- ETIOLOGÍA
- DIAGNÓSTICO MICROBIOLÓGICO
- TRATAMIENTO ANTIMICROBIANO
  - Tratamiento empírico
  - Tratamiento dirigido
    - Nuevos antimicrobianos frente a grampositivos
      - Daptomicina
      - Linezolid





Protocolos Clínicos SEIMC
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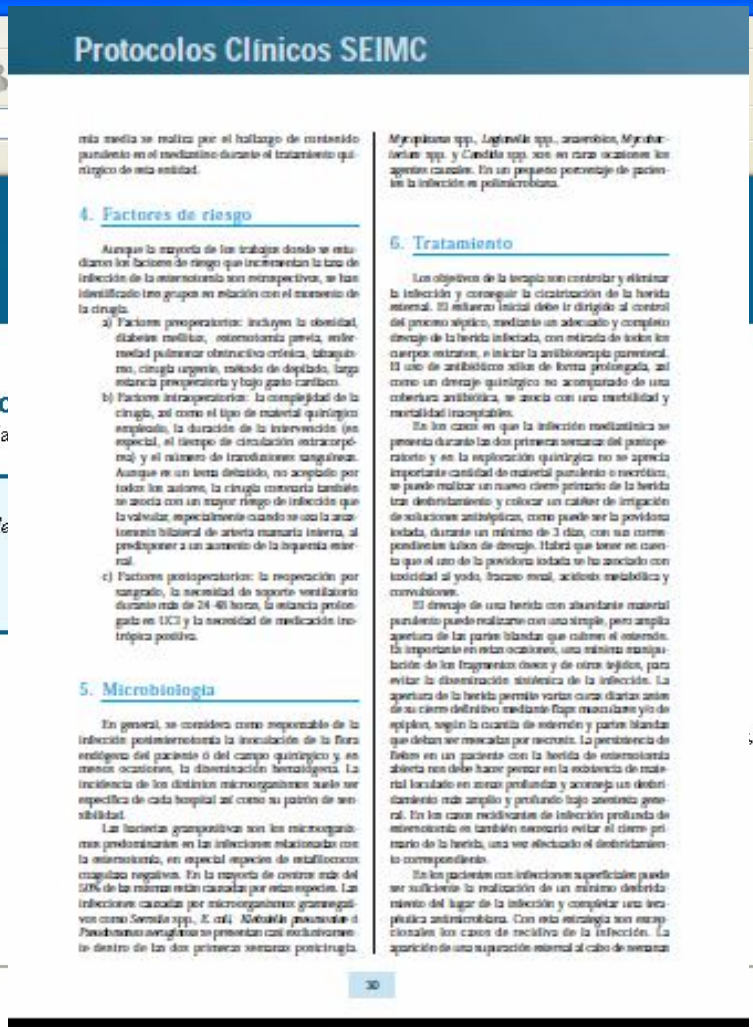
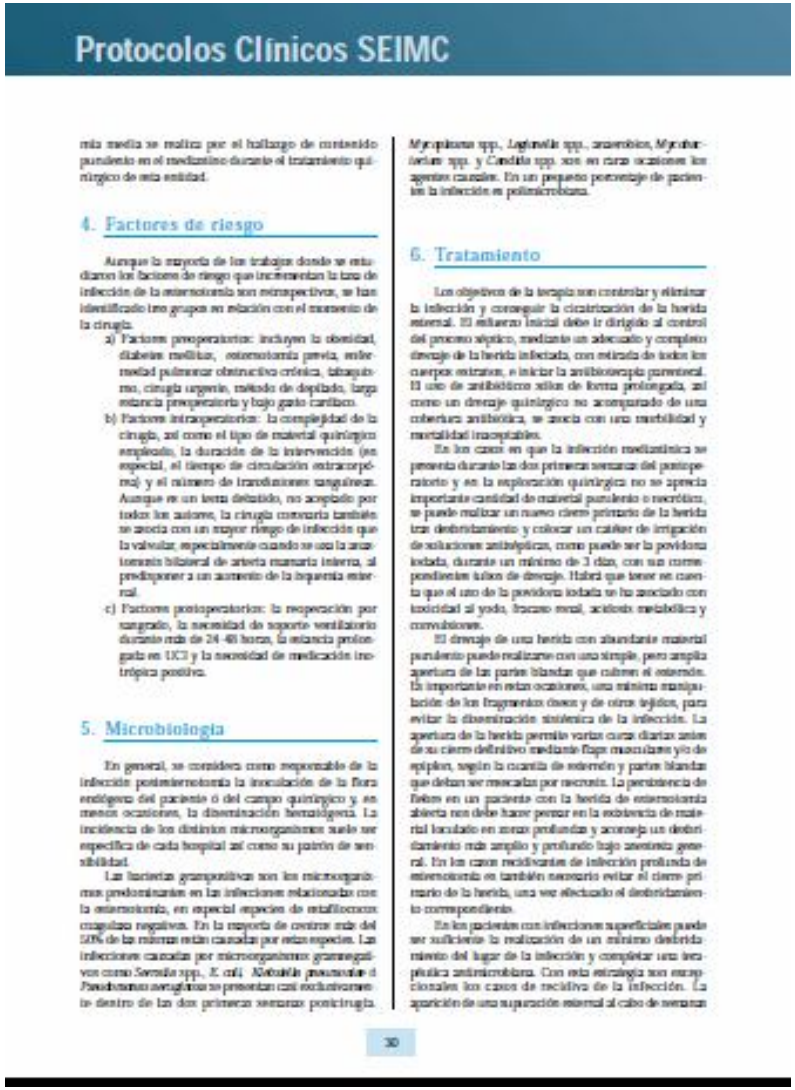
Endocarditis e infecciones cardiovasculares
SEIMC
SOCIEDAD ESPAÑOLA DE ENFERMEDADES INFECCIOSAS Y MICROBIOLOGÍA CLÍNICA


Protocolos Clínicos SEIMC
4. Factores de riesgo
5. Microbiología
6. Tratamiento



Protocolos Clínicos SEIMC

mía media se realiza por el hallazgo de contenido purulento en el mediastino durante el tratamiento quirúrgico de esta entidad.

4. Factores de riesgo

Aunque la mayoría de los trabajos donde se estudiaron los factores de riesgo que incrementan la tasa de infección de la esternotomía son retrospectivos, se han identificado tres grupos en relación con el momento de la cirugía.

a) Factores preoperatorios: incluyen la obesidad, diabetes mellitus, esternotomía previa, enfermedad pulmonar obstructiva crónica, tabaquismo, cirugía urgente, método de depilado, larga estancia preoperatoria y bajo gasto cardíaco.

b) Factores intraoperatorios: la complejidad de la cirugía, así como el tipo de material quirúrgico empleado, la duración de la intervención (en especial, el tiempo de circulación extracorpórea) y el número de transfusiones sanguíneas. Aunque es un tema debatido, no aceptado por todos los autores, la cirugía coronaria también se asocia con un mayor riesgo de infección que la valvular, especialmente cuando se usa la anastomosis bilateral de arteria mamaria interna, al predisponer a un aumento de la isquemia esternal.

c) Factores postoperatorios: la reoperación por sangrado, la necesidad de soporte ventilatorio durante más de 24-48 horas, la estancia prolongada en UCI y la necesidad de medicación inotrópica positiva.

5. Microbiología

En general, se considera como responsable de la infección postesternotomía la inoculación de la flora endógena del paciente ó del campo quirúrgico y, en menos ocasiones, la diseminación hematógena. La incidencia de los distintos microorganismos suele ser específica de cada hospital así como su patrón de sensibilidad.

Las bacterias grampositivas son los microorganismos predominantes en las infecciones relacionadas con la esternotomía, en especial especies de estafilococos coagulasa negativos. En la mayoría de centros más del 50% de las mismas están causadas por estas especies. Las infecciones causadas por microorganismos gramnegativos como *Serratia* spp., *E. coli*, *Klebsiella pneumoniae* ó *Pseudomonas aeruginosa* se presentan casi exclusivamente dentro de las dos primeras semanas postcirugía. *Mycoplasma* spp., *Legionella* spp., anaerobios, *Mycobacterium* spp. y *Candida* spp. son en raras ocasiones los agentes causales. En un pequeño porcentaje de pacientes la infección es polimicrobiana.

6. Tratamiento

Los objetivos de la terapia son controlar y eliminar la infección y conseguir la cicatrización de la herida esternal. El esfuerzo inicial debe ir dirigido al control del proceso séptico, mediante un adecuado y completo drenaje de la herida infectada, con retirada de todos los cuerpos extraños, e iniciar la antibioterapia parenteral. El uso de antibióticos sólos de forma prolongada, así como un drenaje quirúrgico no acompañado de una cobertura antibiótica, se asocia con una morbilidad y mortalidad inaceptables.

En los casos en que la infección mediastínica se presenta durante las dos primeras semanas del postoperatorio y en la exploración quirúrgica no se aprecia importante cantidad de material purulento o necrótico, se puede realizar un nuevo cierre primario de la herida tras desbridamiento y colocar un catéter de irrigación de soluciones antisépticas, como puede ser la povidona iodada, durante un mínimo de 3 días, con sus correspondientes tubos de drenaje. Habrá que tener en cuenta que el uso de la povidona iodada se ha asociado con toxicidad al yodo, fracaso renal, acidosis metabólica y convulsiones.

El drenaje de una herida con abundante material purulento puede realizarse con una simple, pero amplia apertura de las partes blandas que cubren el esternón. Es importante en estas ocasiones, una mínima manipulación de los fragmentos óseos y de otros tejidos, para evitar la diseminación sistémica de la infección. La apertura de la herida permite varias curas diarias antes de su cierre definitivo mediante flaps musculares y/o de epiplon, según la cuantía de esternón y partes blandas que deban ser mescadas por necrosis. La persistencia de fiebre en un paciente con la herida de esternotomía abierta nos debe hacer pensar en la existencia de material loculado en zonas profundas y aconseja un desbridamiento más amplio y profundo bajo anestesia general. En los casos recidivantes de infección profunda de esternotomía es también necesario evitar el cierre primario de la herida, una vez efectuado el desbridamiento correspondiente.

En los pacientes con infecciones superficiales puede ser suficiente la realización de un mínimo desbridamiento del lugar de la infección y completar una terapéutica antimicrobiana. Con esta estrategia son excepcionales los casos de recidiva de la infección. La aparición de una supuración esternal al cabo de semanas

30

"El tratamiento antibiótico inicial debe tener en cuenta los microorganismos más habituales de cada institución, así como sus patrones de resistencia antimicrobiana.

La combinación de vancomicina más un monobactámico o una cefalosporina de 3ª o 4ª generación con actividad antipseudomónica puede ser la opción más adecuada hasta conocer los resultados de los cultivos y de los test de sensibilidad.

La duración del tratamiento antimicrobiano no debería ser inferior a las 4 semanas en los casos más graves de infecciones profundas de la esternotomía."

Problemas Actuales con Glicopéptidos

- ✓ Descenso de sensibilidades. Aumento fracaso clínico
- ✓ Pobre respuesta ante alto inóculo
- ✓ Lentos bactericidas o bacteriostáticos
- ✓ Problemas de tolerabilidad o toxicidad
- ✓ Baja eficacia en biofilms
- ✓ Baja eficacia en la fase estacionaria

Clinical Infectious Diseases Advance Access published February 2, 2012

MAJOR ARTICLE

The Clinical Significance of Vancomycin Minimum Inhibitory Concentration in *Staphylococcus aureus* Infections: A Systematic Review and Meta-analysis

S. J. van Hal,[1,2] T. P. Lodise,[3] and D. L. Paterson[4]

ture review. First, high vancomycin MIC (≥1.5 μg/mL by Etest) was associated with a higher mortality rate associated with MRSA infection; this association predominantly occurred in BSIs with an Etest vancomycin MIC ≥2 μg/mL. Second, higher vancomycin MIC values (≥1.5 μg/mL), irrespective of MIC testing methodology and infection source, were predictive of treatment failure. Again, the relationship between high vanco-

J Antimicrob Chemother 2012; **67**: 736–741
doi:10.1093/jac/dkr531 Advance Access publication 14 December 2011

Journal of Antimicrobial Chemotherapy

Influence of teicoplanin MICs on treatment outcomes among patients with teicoplanin-treated methicillin-resistant *Staphylococcus aureus* bacteraemia: a hospital-based retrospective study

Hong-Jyun Chang[1], Po-Chang Hsu[1], Chien-Chang Yang[1], Leung-Kei Siu[2], An-Jing Kuo[3,4], Ju-Hsin Chia[3,4], Tsu-Lan Wu[3,4], Ching-Tai Huang[1] and Ming-Hsun Lee[1]*

Table 4. Multivariate analysis of risk factors for unfavourable outcomes

	OR (95% CI)	*P*
MIC >1.5 mg/L	5.024 (1.913–13.192)	0.001
Pittsburgh bacteraemia score	1.287 (1.020–1.625)	0.034
Pneumonia	3.373 (1.039–10.946)	0.043

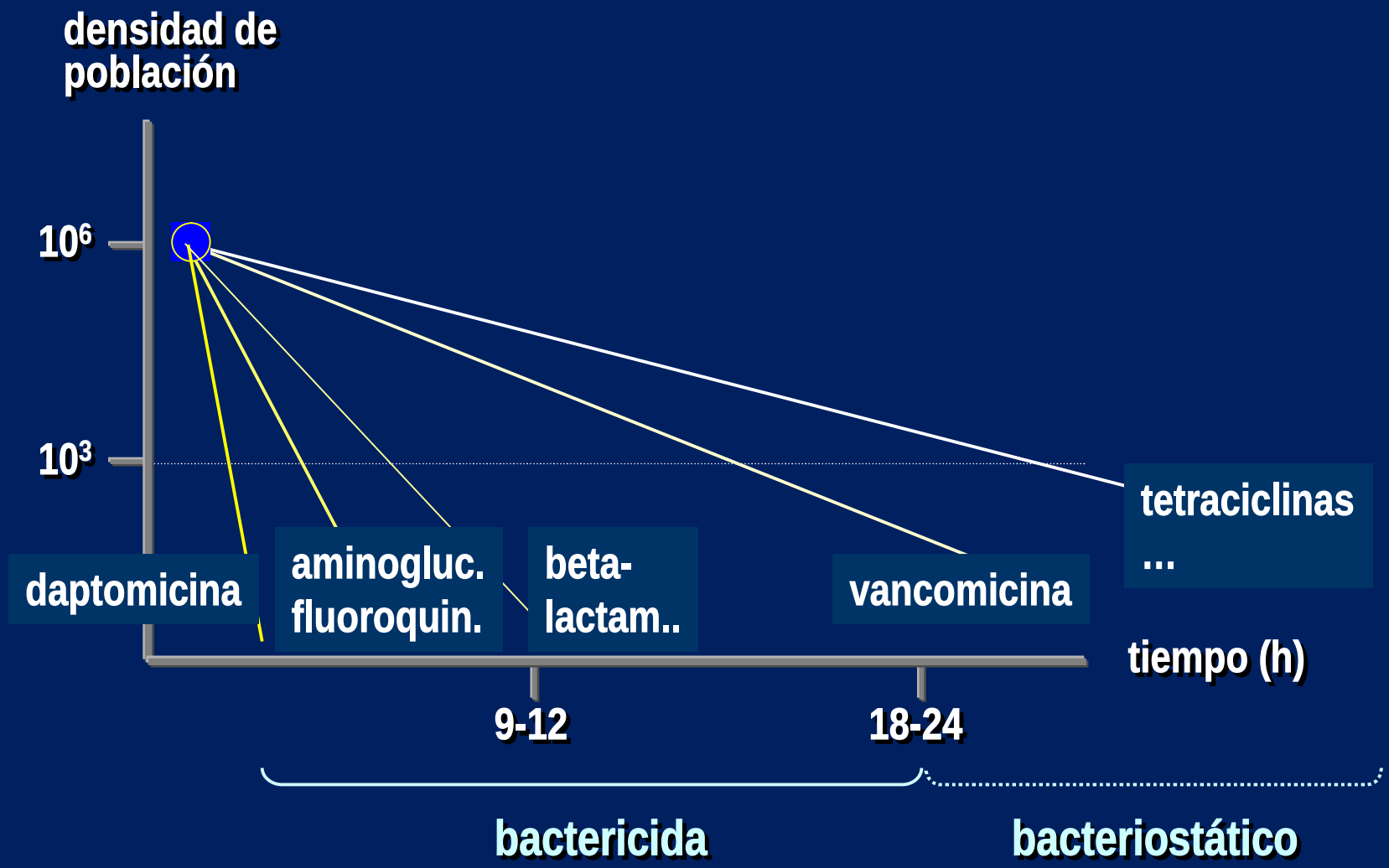
S. aureus RM – *Tratamiento*

Antibióticos clásicos	Antibióticos nuevos
Vancomicina	Linezolid
Teicoplanina	Daptomicina
	Tigeciclina
	Telavancina
	Dalbavancina

Infección *S. aureus* – *Tratamiento*

Características	Vanco	Line	Dapto
Actividad (menor CMI)	1	2	0,5
Acción bactericida	+	±	++
Acción intracelular	-	+	+
Biopelículas	-	+	++
Fase vegetativa	-	-	++
Efecto antiinflamatorio	-	+	+
Seguridad	±	±	+

velocidad de lisis bacteriana por efecto de un antibiótico



SERVIZO GALEGO de SAÚDE | Xerencia Xestión Integrada A Coruña

INFECCIONES DE LA HERIDA DE ESTERNOTOMIA

Unidad de Enfermedades Infecciosas
Servicio de Cirugía cardiaca

2012

SERVIZO GALEGO de SAÚDE | Xerencia Xestión Integrada A Coruña

"La combinación de un antibiótico frente a grampositivos que sea eficaz frente a estafilococos meticilin -resistentes, con poca toxicidad renal y con penetración en hueso es muy importante.

Daptomicina cumple estos requisitos como tratamiento inicial.

Para la cobertura de bacterias gramnegativas se puede asociar un carbapenémico , al tener actividad antipseudomónica y ser sensible frente a las enterobacterias productoras de BLEE"

Después Dx microbiológico y sensibilidad ajuste antibiótico

XUNTA DE GALICIA
CONSELLERÍA DE SANIDADE

SERVIZO GALEGO de SAÚDE | Xerencia Xestión Integrada A Coruña

- **<u>Estudio presentado en SEIMC Bilbao 2012</u>**

- **96 pacientes con infección superficial y profunda post esternotomía**
  - **Edad media 70 años**
  - **Insuficiencia renal 20%**

SEICAV
Sociedad Española de Infecciones Cardiovasculares

"En pacientes con una mediastinitis con buena evolución causada por *Staphylococcus sp* meti S, se podrían completar las últimas semanas de tratamiento de forma ambulatoria, con una combinación de levofloxacino y rifampicina en el caso de que fueran sensibles.

En el caso de *Staphylococcus* meti R, linezolid ± rifampicina es una buena alternativa para completar el tratamiento domiciliario"

XUNTA DE GALICIA
CONSELLERÍA DE SANIDADE

SEICAV

Journal of Cardiothoracic Surgery

BioMed Central
The Open Access Publisher

This Provisional PDF corresponds to the article as it appeared upon acceptance. Fully formatted PDF and full text (HTML) versions will be made available soon.

Daptomycin as supportive treatment option in patients developing mediastinitis after open cardiac surgery

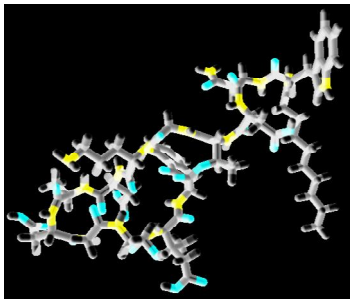


Table 3 Organisms causing the mediastinitis

Organism associated with mediastinitis	Number (%)
Staphylococcus aureus	8 (38.1)
Gram-positive organisms	5 (23.8)
Enterococcus faecium	3 (14.3)
MRSA	3 (14.3)
No germ isolated	2 (9.5)

21 pacientes

Table 4 Clinical alteration after therapy with daptomycin

Therapeutical success	Number (%)
Healing without residues	17 (81.0)
Healing with residues	2 (9.5)
Unsuccessful	2 (9.5)

90,5% Curación

Table 3 Infection Parameter

Variable	n = 23 (%)	Percentage [%] or range
El Oakly-Wright Score		
Type I	3	13
Type II	6	26
Type IIIa	1	4
Type IIIb	7	30
Type IVa	2	8
Type IVb	0	
Type V	4	16
Mediastinal cultures		
Staph. aureus	11	
MRSA	6	
MRSE	6	
Additional Enterococcus faecium	4	
Duration from operation to culture (d)	34 ± 37	5-155
Previous antibiotic therapy	17	
0	6	
1	5	
2-3	7	
4-6	5	
Daptomycin application		
Daptomycin-Application (mg)	4.4 ± 0.9	4-6
Duration (d)	14.47 ± 7.33	9-43
Vacuum therapy	19 (83)	83
Omentumplastic	3	13
Duration from infection to sternal closure (d)	22 ± 13.4	8-58
Duration from Daptomycin application to sternal closure (d)	18 ± 13.9	8-55

MRSA: methicillin resistant S. aureus, MRSE: methicillin resistant S. epidermidis,

JOURNAL OF CARDIOTHORACIC SURGERY

Open Access

ositive deep sternal wound
urgery -experiences with

oran[1], Christian Bireta[1], Martin Friedrich[1], Direndra Rajaruthnam[2],
heodor Tirilomis[1] and Friedrich A Schoendube[1]

"In conclusion, our study indicates that the treatment of DSWI of susceptible gram-positive organisms with a daptomycin-containing antibiotic regimen is feasible.

Daptomycin is efficacious in the treatment

EUROPEAN SOCIETY OF INTENSIVE CARE MEDICINE

24th ANNUAL CONGRESS, ICC—BERLIN–GERMANY, 1–5 OCTOBER 2011

ESICM LIVES 2011 BERLIN

Supplement 1
September 2011

Abstracts

ESICM LIVES 2011
24th Annual Congress

Berlin, Germany
1–5 October 2011

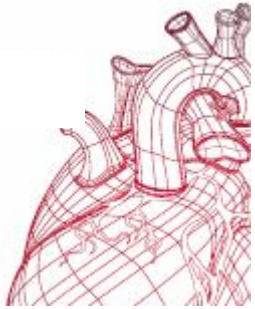
1040

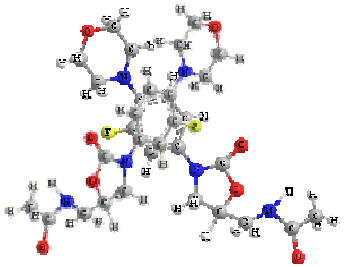
POSTCARDIAC SURGERY MEDIASTINITIS TREATMENT WITH DAPTOMYCIN

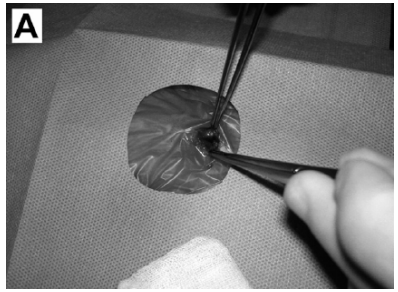
L. Suárez Gonzalo[1], I. Moreno Gómez-Limón[1], E. Maseda Garrido[1], B. Jusdado Sánchez[2], N. Pérez Chuliá[2], N. Peña del Ser[1], F. Gilsanz Rodríguez[1]

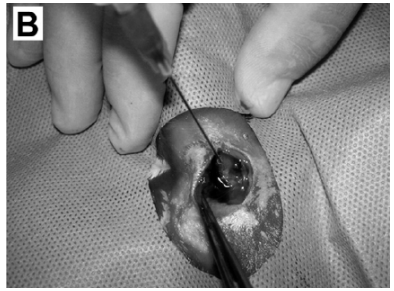
[1]Hospital Universitario 'La Paz', Unidad de Reanimación de Cirugía Cardíaca, Madrid, Spain, [2]Hospital Universitario 'La Paz', Madrid, Spain

"Conclusions. Intravenous daptomycin at 10 mg/Kg/day is efficient and safe in the treatment of mediastinitis"





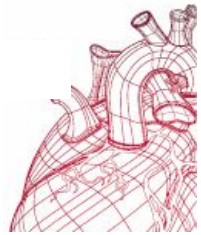


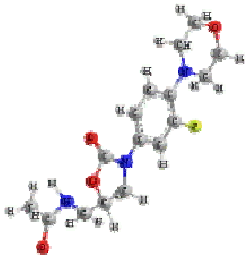


International Journal of Infectious Diseases (2008) 12, 396–401

Conclusiones:

- ✓ Linezolid puede ser una opción terapéutica en el caso de mediastinitis causadas por SAMR
- ✓ La infección se acompaña de una amplia reacción inflamatoria
- ✓Buena penetración en hueso
- ✓ La adicción de rifampicina no resultó en un significativo cambio en el recuento bacteriano respecto al tratamiento con LNZ en monoterapia





International Journal of Antimicrobial Agents 33 (2009) 368–370

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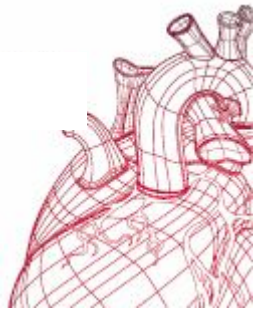
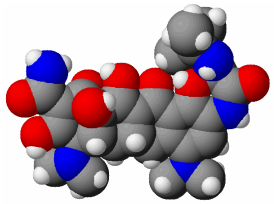
Short communication

Pharmacokinetics and tolerance of linezolid for meticillin-resistant *Staphylococcus aureus* mediastinitis in paediatric patients

Tadashi Kosaka[a,*], Takatoshi Kokufu[a], Nobuaki Shime[b], Nobuyuki Sugioka[c], Ryuichi Kato[d], Kenji Hamaoka[d], Naohisa Fujita[e]

- ✓ **Cuatro pacientes pediátricos (0,4 a 2,3 años)**
- ✓ **Mediastinitis tras cirugía cardiaca por MARSA, refractaria a tratamiento con glicopéptidos**
- ✓ **LNZ: 10-15 mg/Kg/8 h (iv → vo)**
- ✓ **Con la administración oral se detectaron menores niveles séricos**
- ✓ **No intolerancia ni efectos adversos**





Multidrug-Resistant *Klebsiella pneumoniae* Mediastinitis Safely and Effectively Treated with Prolonged Administration of Tigecycline

To the Editor—A recent article in *Clinical Infectious Diseases* reported the clinical and microbiological outcomes of 18 multidrug-resistant (MDR) gram-negative infections treated with tigecycline [1]. We report our experience with a case of mediastinitis caused by an MDR metallo-β-lactamase–producing *Klebsiella pneumoniae* that was treated with prolonged administration of tigecycline. [...]

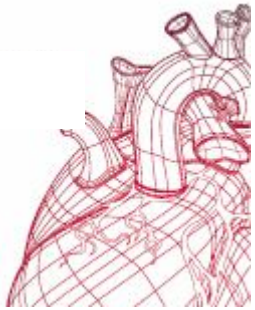
Penelope Evagelopoulou,[1] Pavlos Myrianthefs,[1] Antonios Markogiannakis,[2] George Baltopoulos,[1] and Athanassios Tsakris[2]

[1]Intensive Care Unit, KAT Hospital, Nursing School, University of Athens, Kifissia, and [2]Department of Microbiology, Medical School, University of Athens, Athens, Greece

Pan-Resistant *Acinetobacter baumannii* Mediastinitis Treated Successfully with Tigecycline: A Case Report

Ayşe Yasemin Tezer Tekçe, Ayşe Erbay, Hatice Çabadak, Serap Yağcı, Nihal Karabiber, and Süha Şen

Surgical Infections. April 2011, Vol. 12, No. 2: 141-143

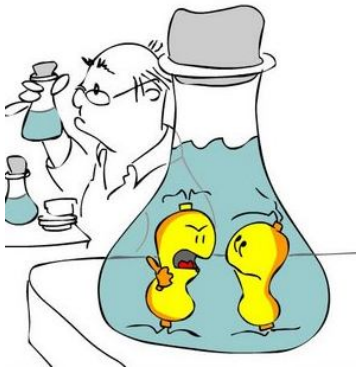


Conclusiones

- **Las estafilococos son los microorganismos predominantes.**
- **La etiología puede estar relacionada con distintos factores de riesgo y con el período de incubación de la infección.**

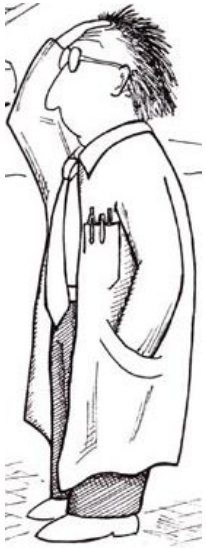
Conclusiones

- La bacteriemia por *S. aureus* sugiere fuertemente la presencia de mediastinitis.
- Los cultivos de los electrodos del MP temporal y de la incisión esternal/espacio mediastínico no predicen la mediastinitis post-quirúrgica.
- La punción aspirativa del mediastino puede ser útil en determinados casos.



Conclusiones:

- El tratamiento de la mediastinitis post-quirúrgica no está bien estandarizado.
- Los antimicrobianos iniciales deben ser de amplio espectro y tener en cuenta los microorganismos más frecuentes en cada institución.
- Daptomicina en primera línea y Linezolid de modo secuencial pueden ser dos nuevas opciones terapeúticas en meticilín-R.



¡ gracias por vuestra atención !