



IX Congresso
Novas Fronteiras
em Medicina
Cardiovascular

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The Village Praia
D'El Rey - Óbidos

INFECÇÃO AÓRTICA/ AORTIC INFECTION

Infecção de enxertos cardíacos e vasculares:
qual é a realidade microbiológica em Portugal?/

Cardiac and vascular graft infections:
what is the microbiologic reality in Portugal?



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CARDIAC AND VASCULAR GRAFT INFECTIONS

Evolution of microbiological aetiology of VGI over the years

- In early studies, *Staphylococcus aureus* was the predominant microorganism.
- However, microbiological epidemiology is **changing** because:
 - Improvements in surgical technique;
 - Prophylactic antistaphylococcal antimicrobial therapy;
 - Vascular graft surgery performed on patients with multiple comorbidities and with complicated vascular anatomy;
 - Increased frequency of emergency procedures;
 - Multiple revisions of previous vascular surgery;
 - Changes in hospital flora.
- More **diverse** microbiological spectrum of infection, which includes **multidrug resistant strains, polymicrobial infection, and *Candida* species.**

Wilson WR, *et al.* Circulation. 2016;134:e412-e460.

CARDIAC AND VASCULAR GRAFT INFECTIONS

Nonvalvular Cardiovascular Device-Related Infections

Type of Device	Incidence of Infection, %
Intracardiac	
Pacemakers (temporary and permanent)	0.13–19.9
Defibrillators	0.00–3.2
LVADs	25–70
Total artificial hearts	To be determined
Ventriculoatrial shunts	2.4–9.4
Pledgets	Rare
Patent ductus arteriosus occlusion devices (investigational in the United States: plugs, double umbrellas, buttons, discs, embolization coils)	Rare
Atrial septal defect and ventricular septal defect closure devices (Bard clamshell occluders, discs, buttons, double umbrellas)	Rare
Conduits	Rare
Patches	Rare

Type of Device	Incidence of Infection, %
Arterial	
Peripheral vascular stents	Rare
Vascular grafts, including hemodialysis	1.0–6
Intra-aortic balloon pumps	≤5–26
Angioplasty/angiography-related bacteremias	<1
Coronary artery stents	Rare

Left Ventricular Assist Device (LVAD)

Baddour LM, *et al.* Circulation. 2003;108:2015–31.

VASCULAR GRAFT INFECTIONS

Frequency:

- Extracavitary 1.5-2%
 - Groin 3.6%
- Intracavitary 1-5%
 - Duodenal–aorta fistula 1-2% with aortic reconstruction

Microbiology:

- Extracavitary
 - CoNS 15%
 - *S. aureus* 30%
 - Gram-negative bacillus 10% (*Pseudomonas* most common)
- Intracavitary
 - CoNS 30%
 - *S. aureus* 30%
 - Gram-negative 35% (polymicrobial)

Wilson WR, *et al.* Circulation. 2016;134:e412-e460.

Revest M, *et al.* International Journal of Antimicrobial Agents. 2015;46 (3):254-65.

VASCULAR GRAFT INFECTIONS

Variable	Thoracic-Aortic PVGI (n = 24)	Abdominal-Aortic PVGI (n = 27)	Peripheral-Arterial PVGI (n = 10)	p-Value [†]
Microbiological Characteristics: Patients with a identified microorganism^{††}				
<i>Staphylococcus aureus</i> ^{§§} , n	4 (16.7%)	6 (22.2%)	4 (40.0%)	0.362
Coagulase-negative staphylococci, n	8 (33.3%)	3 (11.1%)	5 (50.0%)	0.030
<i>Propionibacterium acnes</i> , n	5 (20.8%)	0 (0.0%)	0 (0.0%)	0.015
<i>Enterococcus</i> spp., n	5 (20.8%)	11 (40.7%)	2 (20.0%)	0.257
<i>Escherichia coli</i> , n	0 (0.0%)	4 (14.8%)	0 (0.0%)	0.068
<i>Pseudomonas aeruginosa</i> , n	1 (4.2%)	1 (3.7%)	1 (10.0%)	0.717
<i>Enterobacter</i> spp., n	1 (4.2%)	8 (29.6%)	1 (10.0%)	0.041
<i>Proteus mirabilis</i> , n	1 (4.2%)	1 (3.7%)	0 (0.0%)	0.813
<i>Klebsiella</i> spp., n	0 (0.0%)	2 (7.4%)	0 (0.0%)	0.272
<i>Stenotrophomonas maltophilia</i> , n	0 (0.0%)	2 (7.4%)	0 (0.0%)	0.272
<i>Serratia marcescens</i> , n	0 (0.0%)	0 (0.0%)	1 (10.0%)	0.075
<i>Morganella morganii</i> , n	0 (0.0%)	1 (3.7%)	0 (0.0%)	0.527
Anaerobic bacteria, n	2 (8.3%)	10 (37.0%)	1 (10.0%)	0.243
<i>Candida</i> spp., n	1 (4.2%)	10 (37.0%)	0 (0.0%)	0.003
Patients with polymicrobial infections, n	5 (20.8%)	18 (66.7%)	4 (40.0%)	0.004

Erb S, et al. PLoS ONE 2014;9(11):e112947.

VASCULAR GRAFT INFECTIONS

- The microbiological epidemiology of VGIs:
 - *Staphylococcus aureus*, 20–53%;
 - Enterobacteriaceae, 14–41%;
 - Coagulase-negative Staphylococci (CoNS), 15%;
 - *Pseudomonas aeruginosa*, *Streptococcus* sp. and *Enterococcus* sp., 10–15%;
 - Polymicrobial infection, 20%;
 - Obligate anaerobic bacteria (always associated with other bacteria), 5%;
 - Yeast, 1–2%.

Revest M, *et al.* International Journal of Antimicrobial Agents. 2015;46(3):254-65.

VASCULAR GRAFT INFECTIONS

- what is the microbiologic reality in Portugal?

Angiol Cir Vasc. 2014;10(2):52-57



ANGIOLOGIA E CIRURGIA VASCULAR

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ORIGINAL ARTICLE

Prosthetic vascular graft infections: a center experience

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VASCULAR GRAFT INFECTIONS

- what is the microbiologic reality in Portugal?

Table 1 Demographic data.

June 1 2007-December 31 2012	
<i>n</i>	18
Average age	70.4 ± 12.61 years
Ratio men: women	14:4
Primary vascular reconstruction (infected/total)	
Aorto-(bi)-femoral	2/135 (1.5%)
Femoral-femoral	1/47 (2.6%)
Femoral-popliteal	8/69 (11.6%)
Axillary-femoral	4/14 (28.6%)
Others	3/215 (1.4%)
Time from de primary reconstruction to the infection:	8.1 ± 11.7 months
Functional infected reconstruction	9 (50%)

Sousa JV, et al. Angiol Cir Vac. 2014;10(2):52-7.

Bacterial culture was available :

- 28% wound exsudate,
- 38% intra-operative peri-graft liquid
- 72% culture of the graft

Microbiology:

- *Staphylococcus sp.* organisms **most often**
- *Staphylococcus aureus* (16%) - MRSA (50%)
- Gram negative organisms
- *Pseudomonas aeruginosa*, *Klebsiella*, *Morganella*
(33%)
- Enterococcus (16%)
- Anaerobic *sp.* (1 case).
- Polymicrobial (17%)

VASCULAR GRAFT INFECTIONS

- what is the microbiologic reality in **HSM, CHULN**?

Casuistic of CardioVascular Department CHULN, 2008-2018

Infected Vascular Graft		Population	
Cases, n	107	Age, years, mean $\pm$ SD	66.2 $\pm$ 11.1
Patients, n	99	Male gender, rate	77.0
Second episode, n	8	Comorbidities*, rate	52.3
Time between episodes, months, mean $\pm$ SD	16.7 $\pm$ 14.7	Related & Global Mortality, rate	7.5/55.1

*Hypertension, Diabetes, Smoking, Malignancies, Immunosuppression (HIV and Renal Transplantation)

Data collected by Ryan Melo

VASCULAR GRAFT INFECTIONS

Casuistic of CardioVascular Department HSM, CHULN, 2008-2018

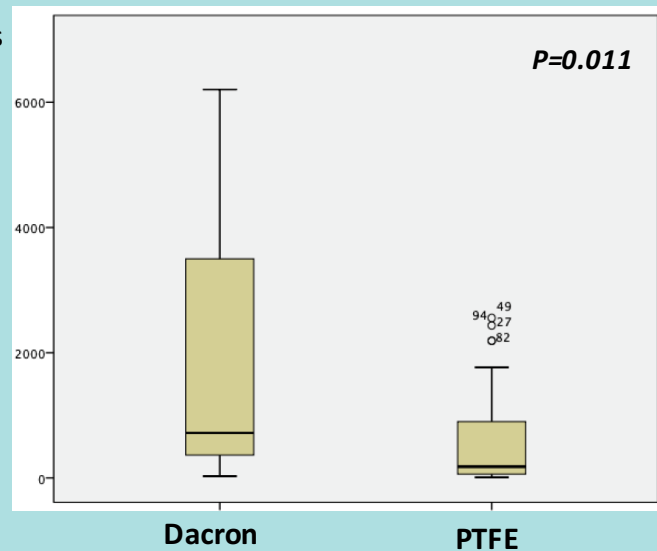
Infection	n=107	Type of Surgery	n=99	
Mono, n/%	79/ 73.8	Aorto(bi)femoral Bypass	15	Intracavitary
Polymicrobial, n/%	28/ 26.2	Axillo(bi)femoral Bypass	13	
Dual	23	Femoro-femoral bypass	5	Extracavitary
Triple	3	Femoro-popliteal bypass	32	
>3 bacterial isolation	3	Endarterectomy w/ Dacron patch	4	
		Haemodialysis graft	30	

VASCULAR GRAFT INFECTIONS

Casuistic of CardioVascular Department HSM, CHULN, 2008-2018

Type of Surgery	Type of graft (n= 100)		
	Dacron	Silver Impregnated Dacron	PTFE
Aorto(bi)femoral Bypass (AxFB)	15		
Axillo(bi)femoral Bypass			13
Femoro-femoral bypass			5
Femoro-popliteal bypass	1	1	30
Endarterectomy w/ Dacron patch	4		
HD graft			30
ND	1		

days

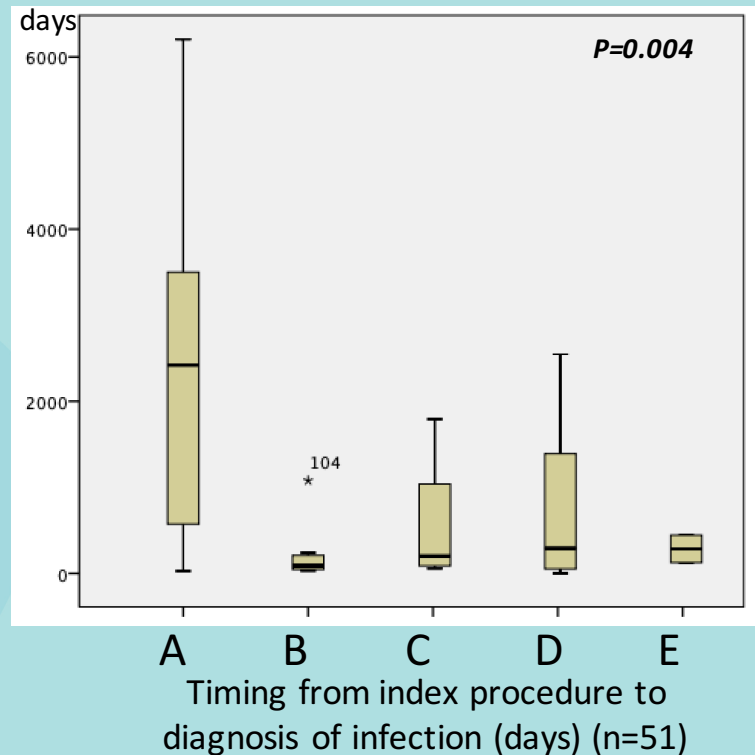


Timing from index procedure to diagnosis of infection(days) (n=100)

VASCULAR GRAFT INFECTIONS

Casuistic of CardioVascular Department HSM, CHULN, 2008-2018

Type of Surgery	Timing from index procedure to diagnosis of infection, days (n=51)
Aorto(bi)femoral Bypass (A)	2420 (28-6205)
Axillo(bi)femoral Bypass (B)	90 (30-1080)
Femoro-femoral bypass (C)	175 (30-1565)
Femoro-popliteal bypass (D)	300 (9-2555)
Endarterectomy w/ Dacron patch (E)	205 (45-365)



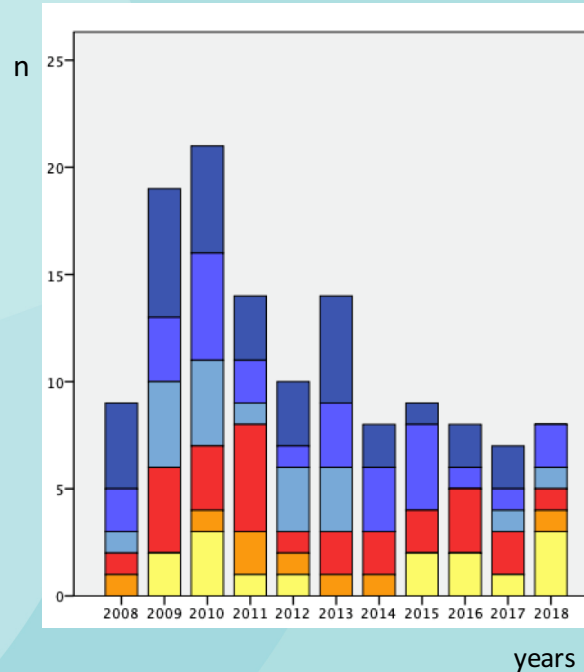
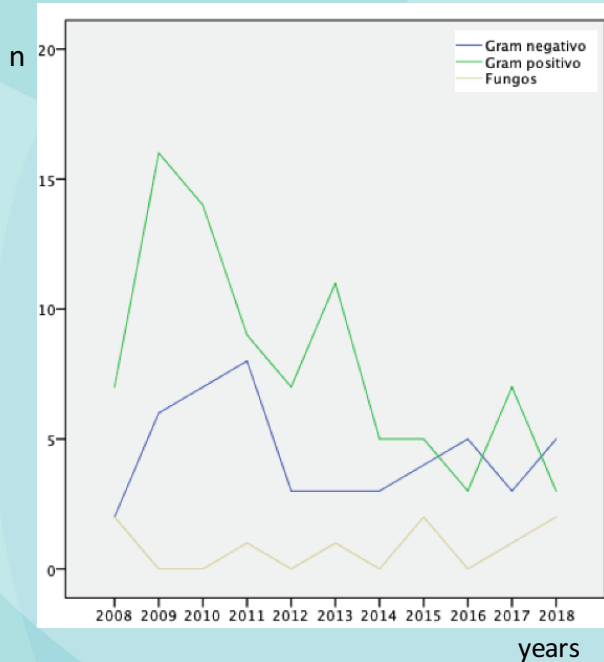
VASCULAR GRAFT INFECTIONS

Casuistic of CardioVascular Department HSM, CHULN, 2008-2018

Identified microorganism	Intracavitary (n=24)	Extracavitary (n=76)
Gram-positive	10 (41.7%)	44 (57.9%)
<i>Staphylococcus aureus</i>	-	14 (18.4%)
Coagulase-negative Staphylococci (CoNS)	5 (20.8%)	14 (18.4%)
<i>Enterococcus</i> sp.	4 (16.7%)	11 (14.5%)
<i>Streptococcus</i> sp.	1 (8.3%)	1 (1.3%)
<i>Corynebacterium</i> sp.	-	3 (3.9%)
Obligate anaerobic (<i>Propionibacterium granulosum</i>)		1 (1.3%)
Gram-negative	13 (54.2%)	26 (34.2%)
Enterobacteriaceae	6 (25.0%)	20 (26.3%)
Non fermenters	7 (29.2%)	6 (7.9%)
Fungus	1 (8.3%)	6 (7.9%)
Polymicrobial infection	4 (16.7%)	15 (19.7%)

VASCULAR GRAFT INFECTIONS

Casuistic of CardioVascular Department HSM, CHULN, 2008-2018



Distribution of microbiological aetiology between 2008-2018 (n=145)

VASCULAR GRAFT INFECTIONS

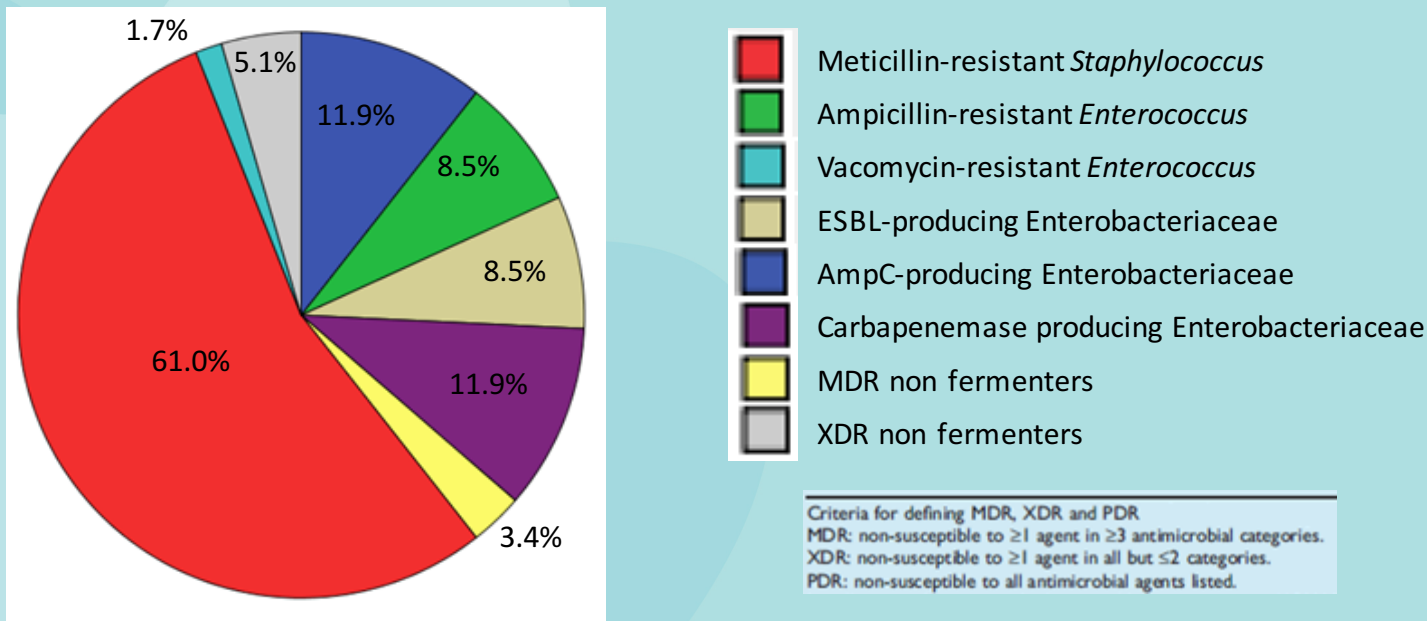
Casuistic of CardioVascular Department HSM, CHULN, 2008-2018

Identified microorganism (n=145)

		<i>Streptococcus</i>	<i>Staphylococcus</i>	<i>Enterococcus</i>	Other Gram +	Enterobacteriaceae	Non-fermenters	Fungus	Polymicrobial
Year	2008	0	6	1	0	2	0	2	0
	2009	1	9	4	2	4	2	0	1
	2010	0	10	4	0	4	3	0	6
	2011	1	5	1	2	7	1	1	6
	2012	0	4	3	0	2	1	0	2
	2013	0	8	3	0	3	0	1	2
	2014	0	5	0	0	3	0	0	3
	2015	0	5	0	0	2	2	2	1
	2016	0	3	0	0	3	2	0	2
	2017	1	3	1	2	2	1	1	2
	2018	0	2	1	0	2	3	2	3
Total		3	60	18	6	34	15	9	28

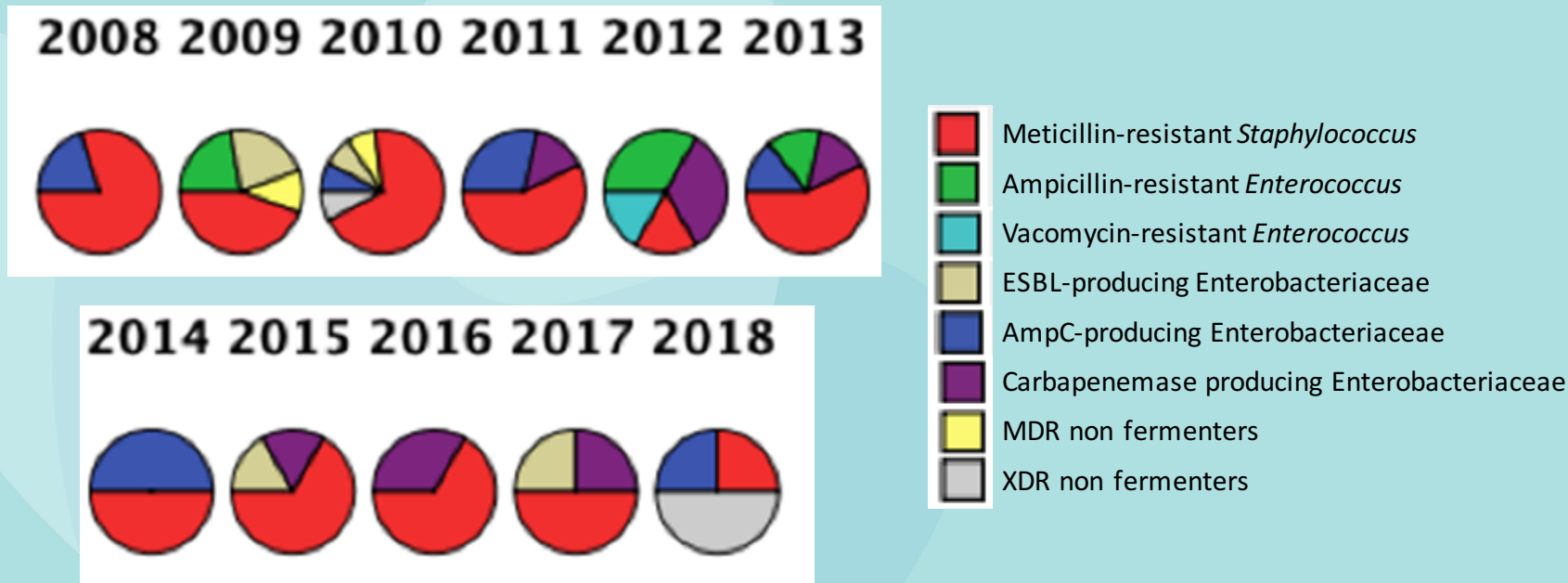
VASCULAR GRAFT INFECTIONS

Casuistic of CardioVascular Department HSM, CHULN, 2008-2018



VASCULAR GRAFT INFECTIONS

Casuistic of CardioVascular Department HSM, CHULN, 2008-2018



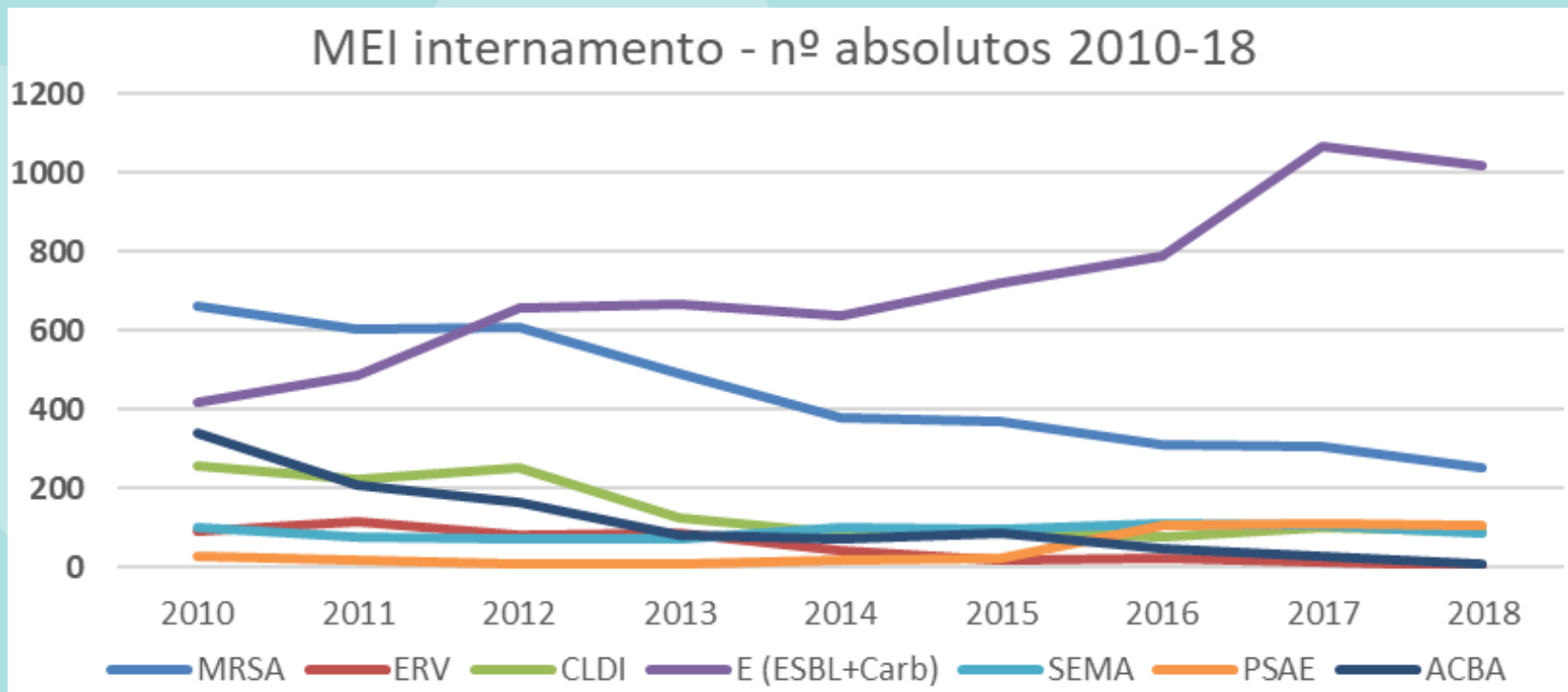
VASCULAR GRAFT INFECTIONS

Casuistic of CardioVascular Department HSM, CHULN, 2008-2018

Antibiotic for methicillin-resistant <i>Staphylococcus</i> sp.	Susceptibility Rate
Co-trimoxazole (n=36)	69.4%
Rifampicin (n=28)	85.7%
Ciprofloxacin (n=37)	10.8%
Median vancomycin MIC (n=10)	1.0 (0.5-1.0)

VASCULAR GRAFT INFECTIONS

Epidemiologic Surveillance GCL-PPCIRA CHULN, 2010-2018



VASCULAR GRAFT INFECTIONS

Take Home Messages

- ***Staphylococcus* sp. is no longer** the sole predominant microorganism.
- Microbiological epidemiology **has changed in the last decade** in CHULN reflecting the changes in **hospital flora**.
- Gram-positive infections have declined and **Gram negative have increased**.
- Vancomycin MIC in MRSA **remains stable**.
- The most impressive **decline** was in ***Staphylococcus aureus***.
- The **MDR/XDR Gram negative**, namely *Pseudomonas aeruginosa* and carbapenemase-producing Enterobacteriaceae **is increasing**.
- **Antimicrobial Stewardship** is crucial for achieving a better outcome in VGI.