MINISTERIO DE SANIDAD

agencia española de medicamentos y productos sanitarios

Plan Nacional Resistencia Antibióticos

CoESAnt

seimc

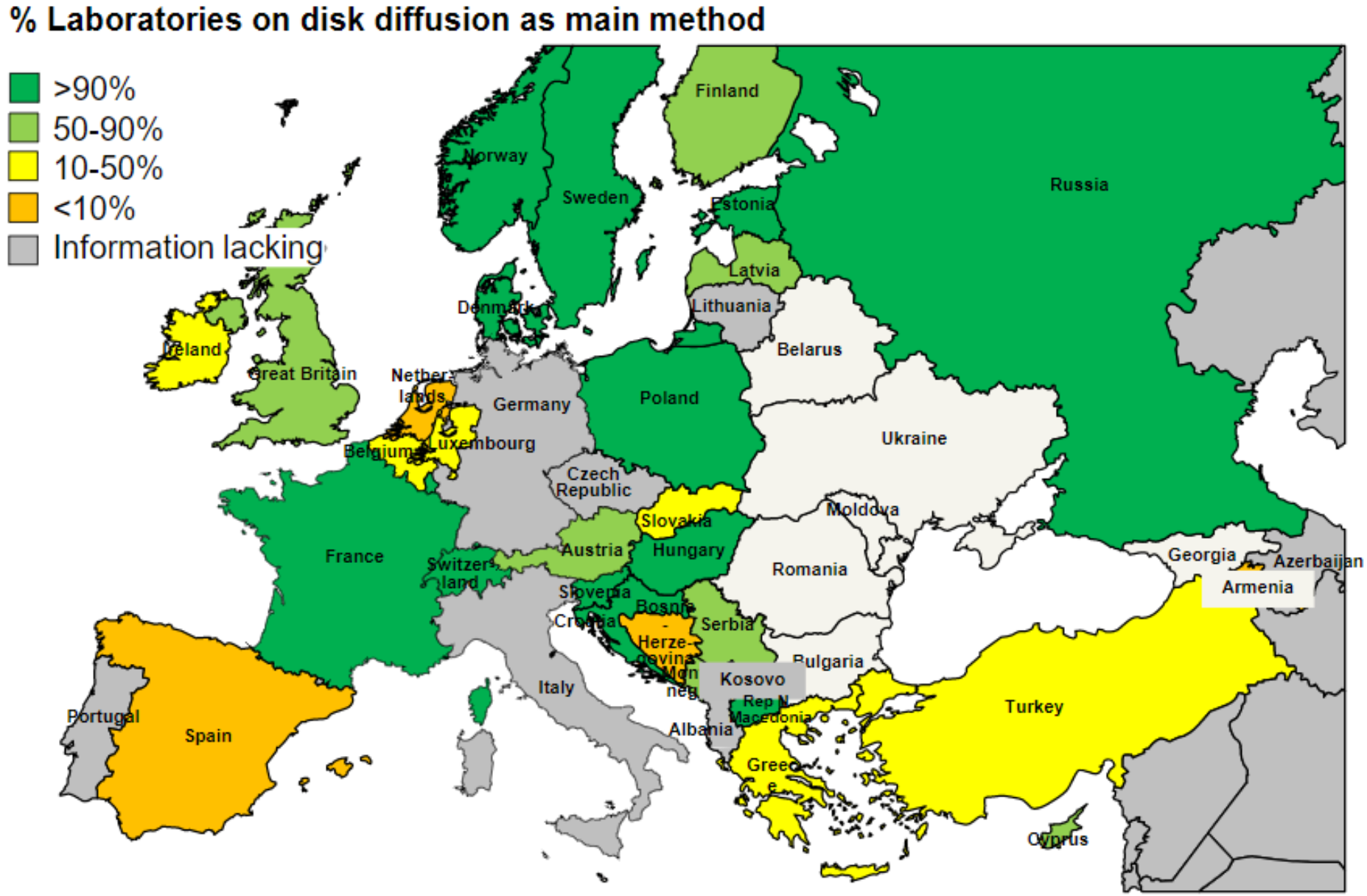
I Jornada del Comité Español del Antibiograma (COESANT)

Madrid 24 de noviembre de 2022

Documento CoEsAnt de paneles disco difusión

Alba Rivera
Servicio de Microbiología
Hospital de la Santa Creu i Sant Pau

Disk diffusion as main AST method, April 2019



https://www.eucast.org

Metodología

Kirby–Bauer disk diffusion method

ANTIBIOTIC SUSCEPTIBILITY TESTING BY A STANDARDIZED SINGLE DISK METHOD

A. W. BAUER, M.D., W. M. M. KIRBY, M.D., J. C. SHERRIS, M.D., AND M. TURCK, M.D.

Am J Clin Pathol 1966; 45:493–496.

ICS (International Collaborative Study) disk diffusion standard

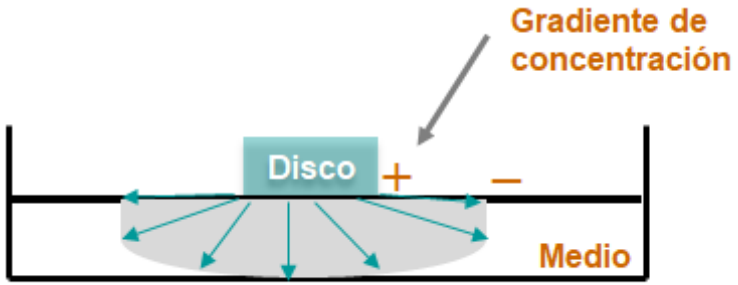
Antibiotic Sensitivity Testing

Report of an International Collaborative Study

BY

HANS M. ERICSSON and JOHN C. SHERRIS

Acta Path Microbiol Scand 1971;217(Suppl):1–90



Metodología

EUCAST EUROPEAN COMMITTEE ON ANTIMICROBIAL SUSCEPTIBILITY TESTING
European Society of Clinical Microbiology and Infectious Diseases

https://www.eucast.org/ast_of_bacteria/disk_diffusion_methodology/

EUCAST EUROPEAN COMMITTEE ON ANTIMICROBIAL SUSCEPTIBILITY TESTING
European Society of Clinical Microbiology and Infectious Diseases

Antimicrobial susceptibility testing

EUCAST disk diffusion method

Version 10.0
January 2022

EUCAST Disk Diffusion Method for Antimicrobial Susceptibility Testing
Version 10.0 (January 2022)
www.eucast.org

Variables

- Antimicrobiano
- Agar
- Incubación
- Microorganismo

Carga, tasa difusión, actividad	
Profundidad, composición	
Temperatura, duración, atmósfera	
Tasa crecimiento, densidad inóculo	

Contents **Page**

EUCAST EUROPEAN COMMITTEE ON ANTIMICROBIAL SUSCEPTIBILITY TESTING
European Society of Clinical Microbiology and Infectious Diseases

AST of bacteria

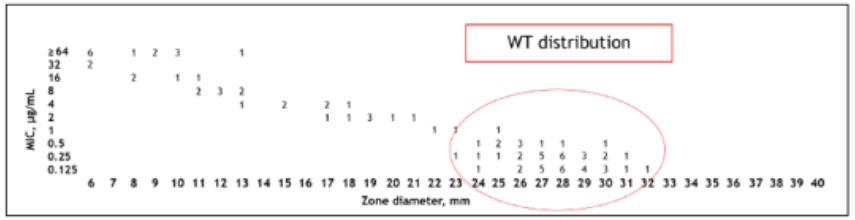
Development and validation of EUCAST Disk Diffusion breakpoints

The EUCAST Disk Diffusion test was developed by EUCAST under the auspices of ESCMID and with the help of many laboratories. The help of these laboratories is gratefully acknowledged. Most are listed under the EUCAST laboratory network. The work started in 2009 and is ongoing - new agents, new species, revsied or new breakpoints and new resistance mechanisms necessitates constant development and recalibration.

The files below list material and graphs used for determining zone diameter breakpoints to match MIC breakpoints (Exam

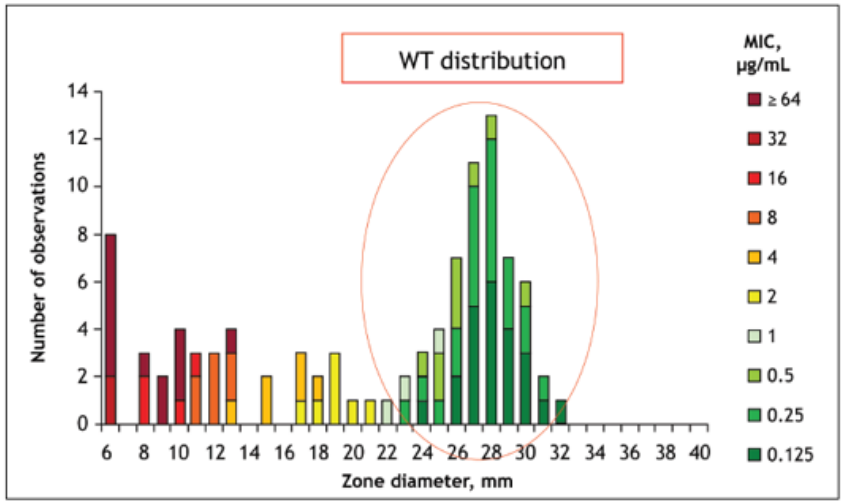
Files from 2022 (previous prese
below the current).
Fles are updated with changes in
bacteria were added and not in p

- Enterobacterales (updated 28
- Salmonella spp
- Yersinia enterocolitica
- Plesiomonas shigelloides
- Pseudomonas aeruginosa
- Pseudomonas non-aeruginos
- Stenotrophomonas maltophili
- Acinetobacter spp. (see belov
- Staphylococcus aureus
- Staphylococcus, coagulase-n



Abbreviations: MIC, minimal inhibitory concentration; WT, wild-type.

Figure 1A. Zone Diameter Scattergram With Zone Diameters Plotted Against Minimal Inhibitory Concentration Values. Figures 1A and 1B represent the same dataset.



https://www.eucast.org/ast_of_bacteria/calibration_and_validation

EUCAST Clinical Breakpoint Tables v. 12.0, valid from 2022-01-01

Enterobacterales
Pseudomonas spp.
Stenotrophomonas maltophilia
Acinetobacter spp.
Staphylococcus spp.
Enterococcus spp.
Streptococcus groups A, B, C and G
Streptococcus pneumoniae
Viridans group streptococci
Haemophilus influenzae
Moraxella catarrhalis
Listeria monocytogenes
Pasteurella multocida
Campylobacter jejuni and *coli*
Corynebacterium spp.
Aerococcus sanguinicola and *urinae*
Kingella kingae
Aeromonas spp.
Achromobacter xylosoxidans
Vibrio spp.
Bacillus spp.
Burkholderia pseudomallei

Bacteroides spp.
Prevotella spp.
Fusobacterium necrophorum
Clostridium perfringens
Cutibacterium acnes

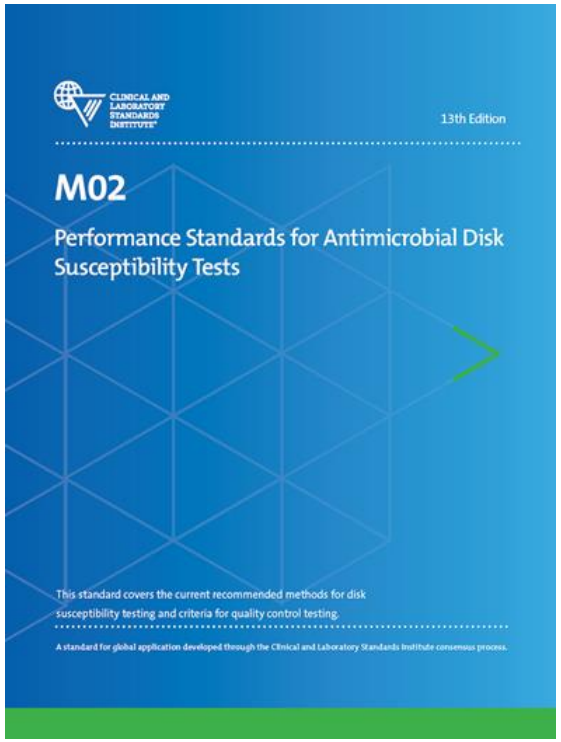
https://www.eucast.org/clinical_breakpoints

Puntos de corte disco difusión añadidos en los últimos años

European Committee on Antimicrobial Susceptibility Testing

Breakpoint tables for interpretation of MICs and zone diameters

Bacteria	Año
Aerococcus sanguinicola and *urinae*	2017
Kingella kingae	2017
Aeromonas spp.	2018
Burkholderia pseudomallei	2020
Achromobacter xylosoxidans	2021
Bacillus spp.	2021
Vibrio spp.	2022
Anaerobios	2022
Corynebacterium diphteriae and *ulcerans*	Prepublicación v. 13.0 2023



Discrepancias metodológicas	EUCAST	CLSI
Temperatura incubación	35 ± 1ºC	35±2ºC
Duración incubación	16-20 h 40-44 h [1]	16-18 h 20-24h[2] 24h[3]
Medio	Mueller Hinton+5% sangre caballo +20 mg/Lβ-NAD (MH-F) Fastidious anaerobe agar+5% sangre caballo (FAA)	Mueller Hinton +5% sangre carnero (MHA) *Haemophilus* Test Medium (HTM) GC + 1% suplemento
Carga discos antimicrobiano		
Benzylpenicillin Ampicillin Amoxicillin-clavulanate Piperacillin Piperacillin-tazobactam Cefotaxime Ceftaroline Ceftazidime Gentamicin (test for HLAR) Vancomycin Linezolid Nitrofurantoin	10 units 10 µg 20–10 µg 100 µg 100–10 µg 30 µg 30 µg 30 µg 120 µg 30 µg 30 µg 300 µg	1 unit 2 and 10 µg[b] 2–1 and 20–10 µg[c] 30 µg 30–6 µg 5 µg 5 µg 10 µg 30 µg 5 µg 10 µg 100 µg
Puntos de corte	Ausencia para *Neisseria gonorrhoeae*, *Neisseria meningitidis*, *Burkholderia cepacia*	Ausencia para *Aerococcus* spp., *Kingella kingae*, *Listeria monocytogenes*, *Corynebacterium* spp., *Bacillus* spp., anaerobios

[1] *Corynebacterium, Aerococcus, Kingella, Campylobacter* si crecimiento insuficiente en 16-20h ; [2]*Acinetobacter* spp., *Burkholderia*, *Stenotrophomonas maltophilia*, *Neisseria gonorrhoeae*, *Neisseria meningitidis*, *Streptococcus* spp., [3]cefoxitina/*Staphylococcus* spp.

Cusack TP et al. Clin Microbiol Infect. 2019; 25:782-785

Larrosa N et al. Enferm Infecc Microbiol Clin.2020; 38:79-83

https://www.eucast.org/ast_of_bacteria/disk_diffusion_methodology/

Disco difusión
Ventajas e inconvenientes

PROS

Flexibilidad

Elección antimicrobianos

Visualización crecimiento:

- detección cultivos mixtos
- heteroresistencia
- interacciones entre antibióticos

Posibilidad de automatización

Lectura de halos de inhibición

Método rápido

Lectura 4, 6, 8 horas

Coste

CONS

No determina CIM

No estandarizado para algunos microorganismos

Nocardia, Actinomyces, Streptomyces, Helicobacter

No adecuado para algunos antibióticos

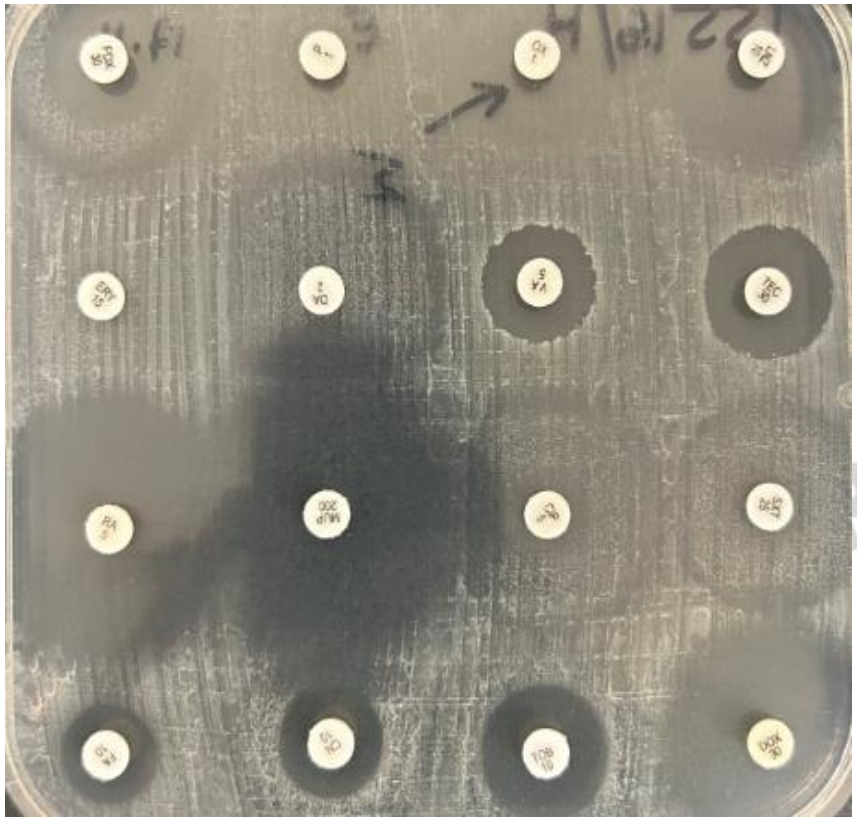
Glucopéptidos, lipoglucopéptidos, polimixinas

Laborioso

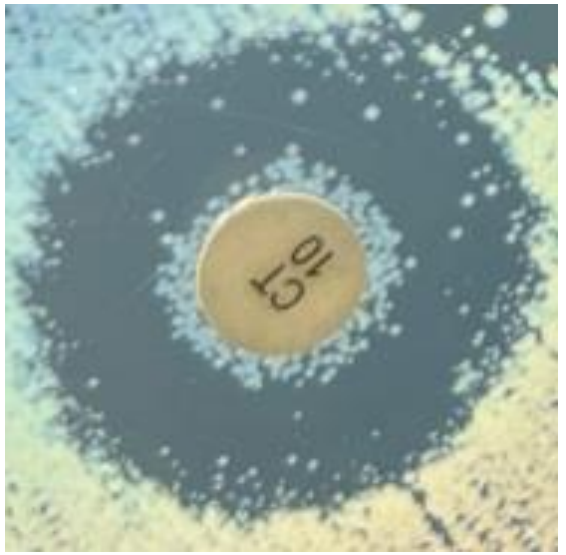
Variabilidad interobservador en resultados

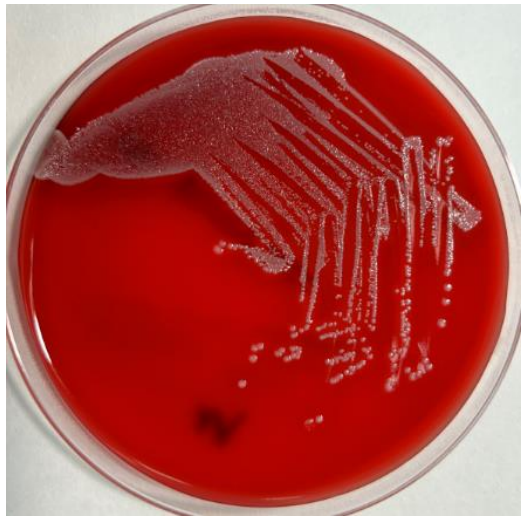
Visualización del crecimiento

Detección cultivos mixtos



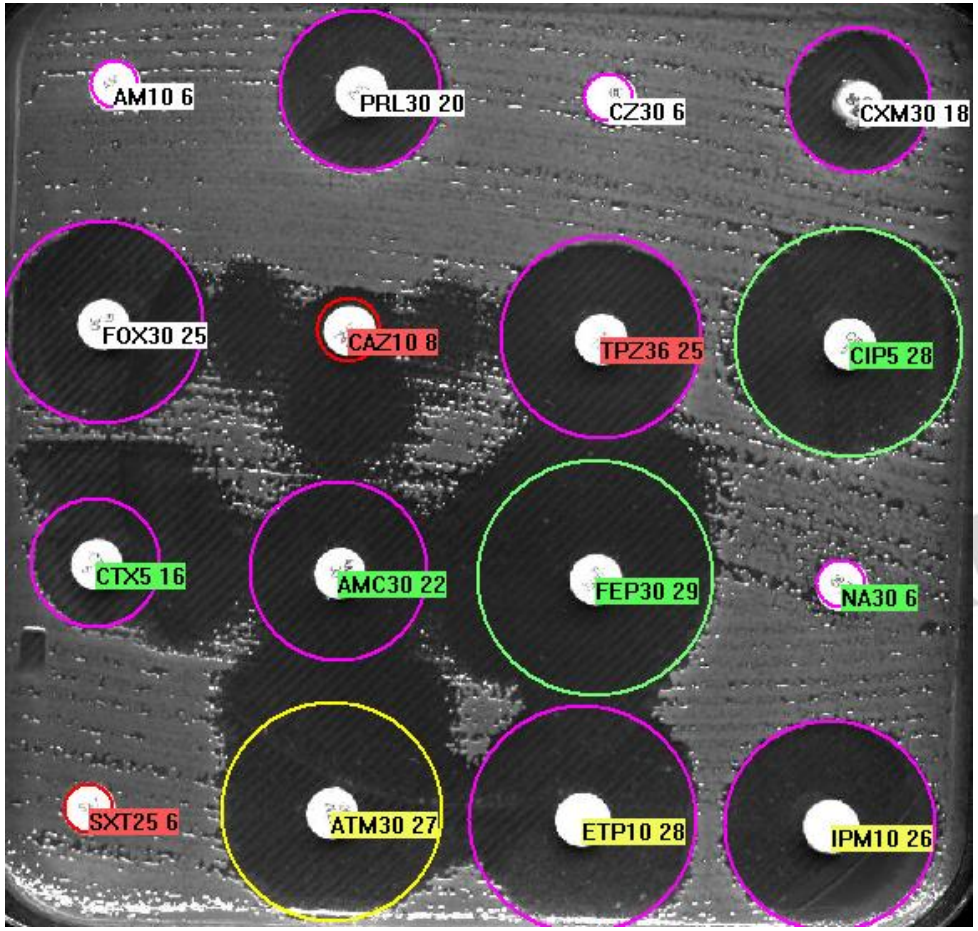
Heteroresistencia



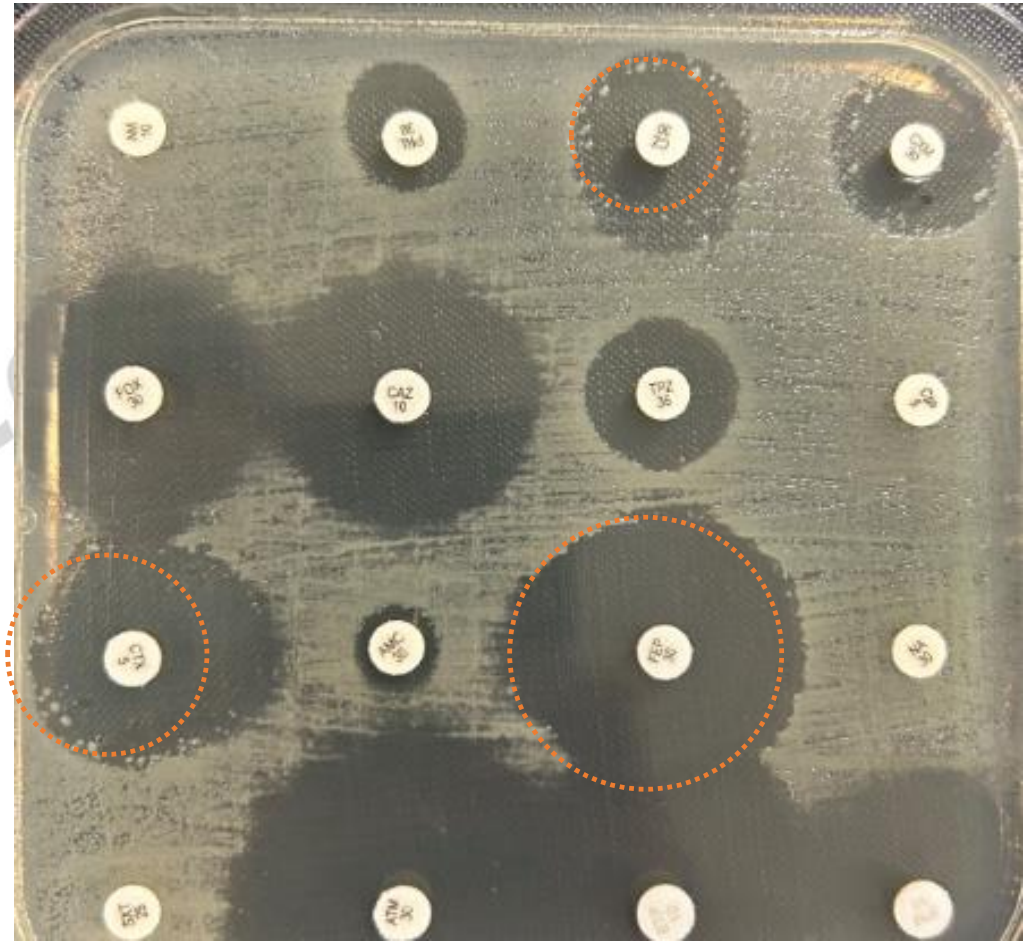


Visualización del crecimiento

Interacciones entre antibióticos



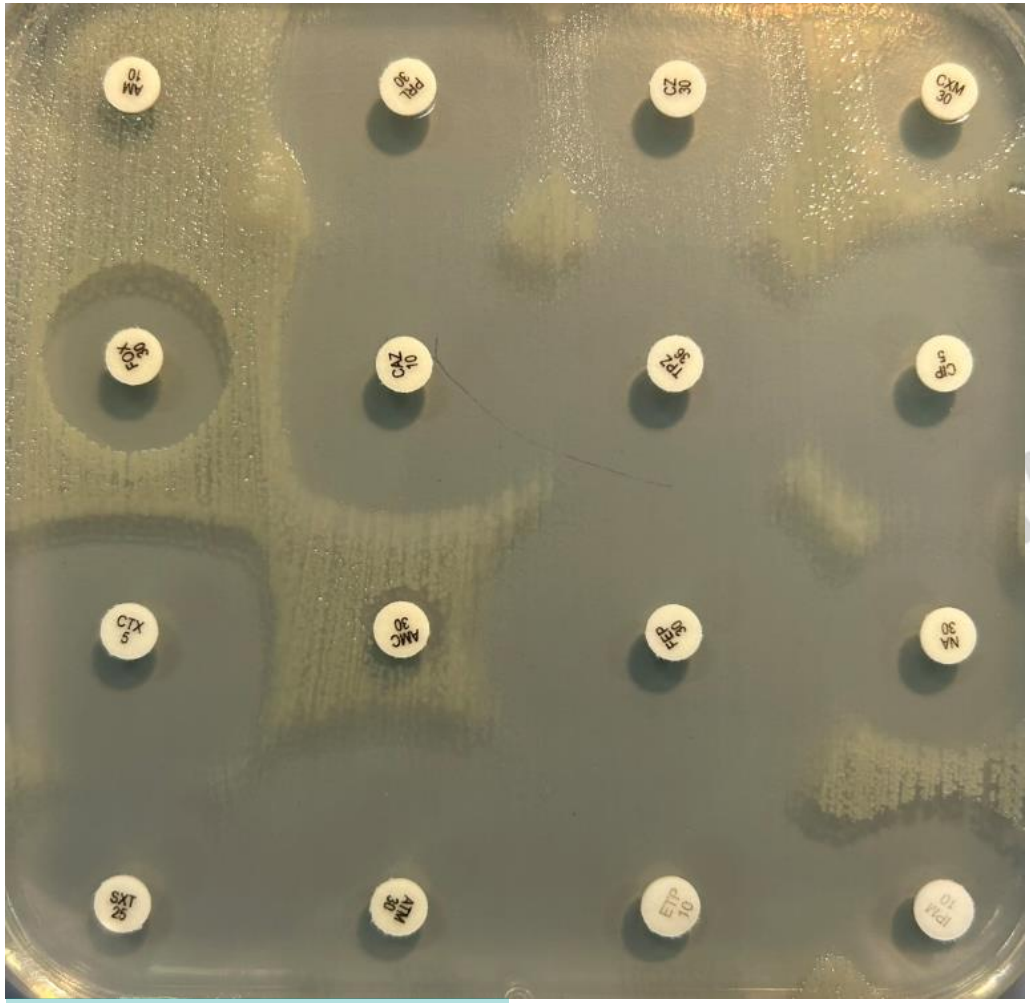
Aeromonas hydrophila
VEB-1



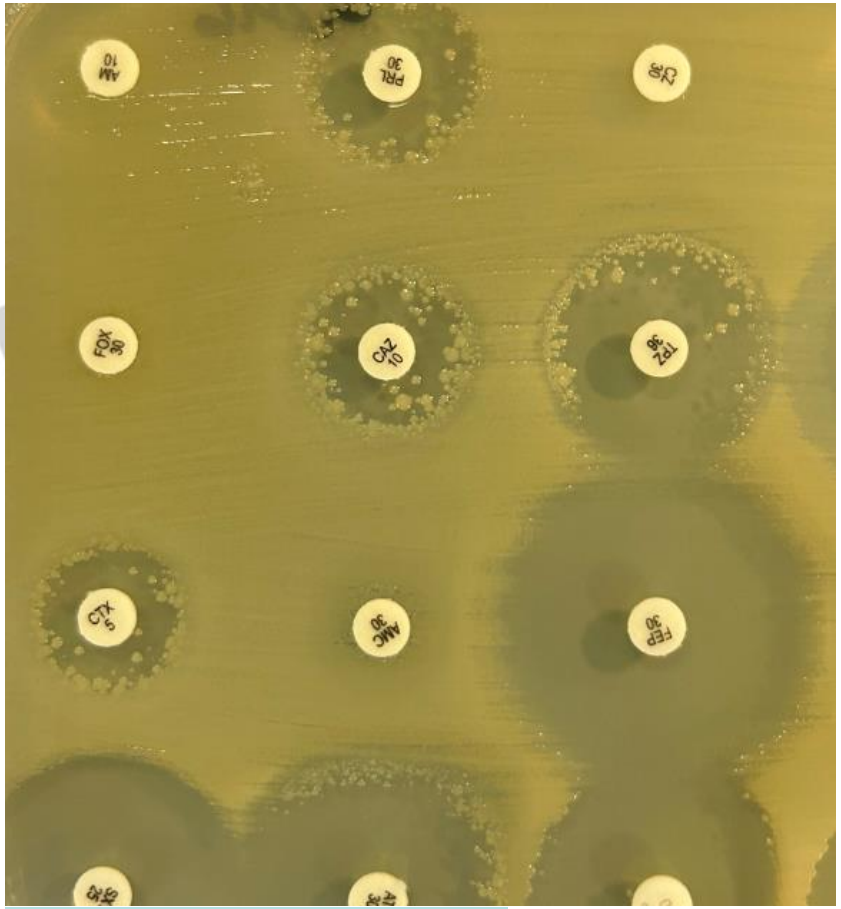
Escherichia coli
CTX-M-15,OXA-1

Visualización del crecimiento

Interacciones entre antibióticos



Morganella morganii



Escherichia coli
CMY-2

Mirelis B, et al. Enferm Infecc Microbiol Clin. 2006;24(6):370-2.

Automatización

SIRScan (i2a, Francia)

BIOMIC V3 (Giles Scientific Inc, USA)

ADAGIO (Bio-Rad, Francia)

- Lectura automática e interpretación resultados disco difusión
- Sistema experto
- Almacenamiento y gestión de datos para su explotación en estudios epidemiológicos

Copan WASP Srl (Copan Diagnostics, Italia)

Colibri, Radian in-Line Carousel, Radian Expert System

BD Kiestra (Becton Dickinson, USA)

Kiestra InoqulA, Kiestra Read A

Automatización completa:

- Preparación inóculo
- Siembra de placas
- Colocación discos
- Lectura e interpretación

Cherkaoui A, et al. J Clin Microbiol. 2021;59:e0077721

Thomson GK et al. Eur J Clin Microbiol Infect Dis. 2021;40:21052112

Método rápido

EUCAST EUROPEAN COMMITTEE ON ANTIMICROBIAL SUSCEPTIBILITY TESTING
European Society of Clinical Microbiology and Infectious Diseases

Methodology - EUCAST rapid antimicrobial susceptibility testing (RAST) directly from positive blood culture bottles.

Version 3.0

April 2022

Screening for ESBL and carbapenemases in *E. coli* and *K. pneumoniae* for epidemiological purposes as part of the RAST procedure.

EUCAST Guidelines for detection of resistance mechanisms and specific resistance of clinical and/or epidemiological importance using EUCAST rapid antimicrobial susceptibility testing (RAST) directly from positive blood culture bottles.

Version 2.0
April 2022

Lectura en 4, 6, 8, 16-20h

The proportion of zone diameters (%) which are possible to read* after 4 – 20 h of incubation.

Organism	4 hours	6 hours	8 hours	16-20 hours
Escherichia coli	90	99	99	100
Klebsiella pneumoniae	96	98	98	100
Pseudomonas aeruginosa	-	88	97	100
Acinetobacter baumannii	99	100	100	ND
Staphylococcus aureus	55**	91	95	100
Enterococcus faecalis	93	99	100	ND
Enterococcus faecium	44	93	99	ND
Streptococcus pneumoniae	68	83	95	100

Incubation conditions for antimicrobial susceptibility test plates

Organism	Incubation time	Medium	Incubation
Escherichia coli *Klebsiella pneumoniae* *Staphylococcus aureus*	4, 6 and 8 hours 16-20 hours	MH	35±1°C in air
Pseudomonas aeruginosa	6 and 8 hours 16-20 hours	MH	35±1°C in air
Acinetobacter baumannii *Enterococcus faecalis* *Enterococcus faecium*	4, 6 and 8 hours	MH	35±1°C in air
Streptococcus pneumoniae	4, 6 and 8 hours 16-20 hours	MH-F	35±1°C in 4-6% CO_2 in air

EUCAST RAST Breakpoint Tables version 5.1 (2022-05-02)

European Committee on Antimicrobial Susceptibility Testing

Zone diameter breakpoint tables for rapid antimicrobial susceptibility testing (RAST) directly from blood culture bottles

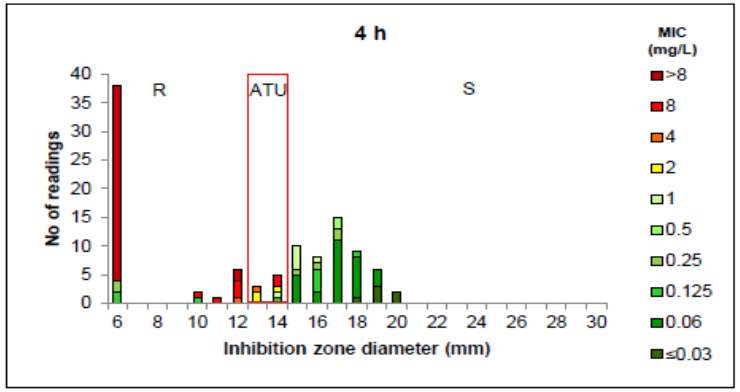
Version 5.1, valid from 2022-05-02

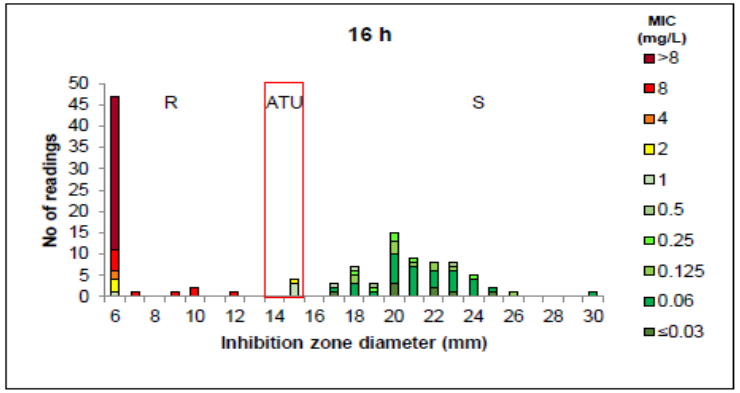
This document should be cited as "The European Committee on Antimicrobial Susceptibility Testing. Zone diameter Breakpoint Tables for rapid antimicrobial susceptibility testing (RAST) directly from blood culture bottles. Version 5.1, 2022. http://www.eucast.org."

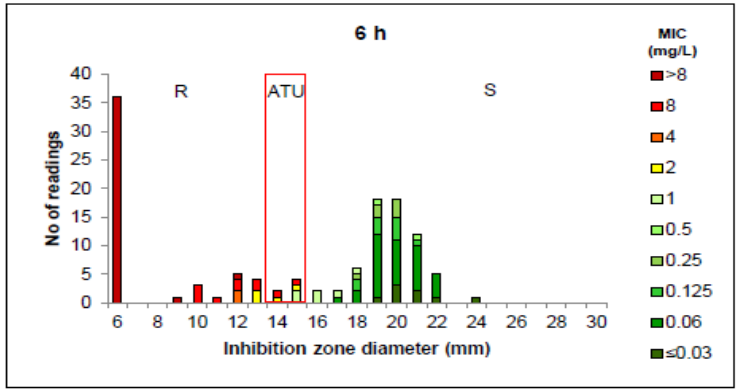
https://www.eucast.org/rapid_ast_in_bloodcultures

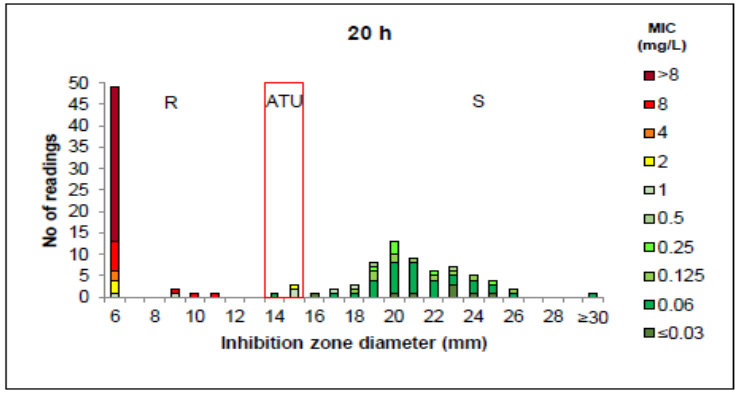
Método rápido

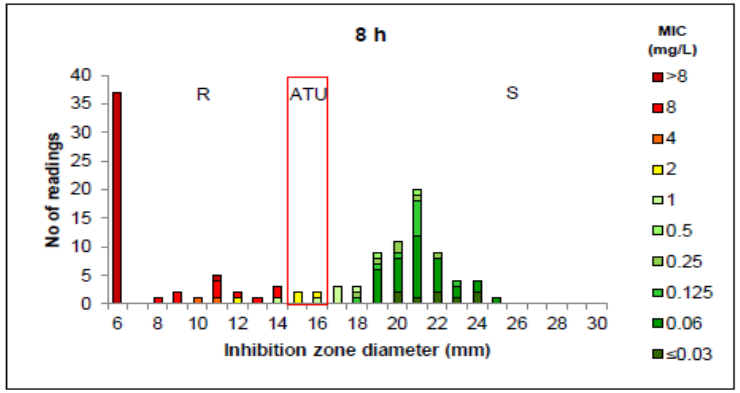
***E. coli* and cefotaxime 5 µg, spiked blood culture bottles**
RAST vs. broth microdilution 16-20h











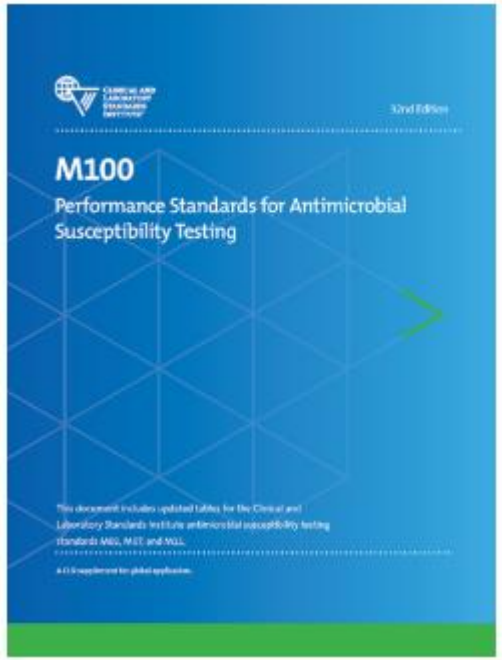
EUCAST rapid antimicrobial susceptibility testing (RAST)

Calibration of zone diameter breakpoints to MIC values.

EUCAST RAST breakpoints version 5.0
April 2022

https://www.eucast.org/rapid_ast_in_bloodcultures

Método rápido



- Table 3E-1. Test for Performing Disk Diffusion Directly From Positive Blood Culture Broth
- Table 3E-2. Zone Diameter Disk Diffusion Breakpoints for Enterobacterales Direct From Blood Culture
- Table 3E-3. Zone Diameter Disk Diffusion Breakpoints for *Pseudomonas aeruginosa* Direct From Blood Culture

Table 3E-2. Zone Diameter Disk Diffusion Breakpoints for Enterobacterales Direct From Blood Culture

General Comments

(1) The dosage regimens shown in the Comments column below are needed to achieve plasma drug exposure (in adults with normal renal and hepatic function) on which breakpoints were based. When new breakpoints are implemented, it is strongly recommended that laboratories share this information with infectious diseases practitioners, pharmacists, pharmacy and therapeutics committees, infection prevention committees, and the antimicrobial stewardship team.

(2) For additional testing and reporting recommendations, refer to Table 2A.

NOTE: Information in boldface type is new or modified since the previous edition.

Test/Report Group	Antimicrobial Agent	Disk Content	Read Times, hours	Interpretive Categories and Zone Diameter Breakpoints, nearest whole mm				Comments
				S	SDD	I	R	
PENICILLINS								
A	Ampicillin	10 µg	8-10	-	-	-	-	(3) Results of ampicillin testing can be used to predict results for amoxicillin.
			16-18	≥ 17	-	14-16	≤ 13	(4) Breakpoints are based on an ampicillin dosage regimen of 2 g parenterally administered every 4-6 h or an amoxicillin dosage regimen of 1-2 g parenterally administered every 6 h.
CEPHEMS (PARENTERAL) (Including cephalosporins I, II, III, and IV. Please refer to Glossary I.)								
B	Ceftriaxone	30 µg	8-10	≥ 23	-	20-22	≤ 19	(5) Breakpoints are based on a dosage regimen of 1 g administered every 24 h.
			16-18	≥ 23	-	20-22	≤ 19	
C	Ceftazidime	30 µg	8-10	≥ 21	-	18-20	≤ 17	(6) Breakpoints are based on a dosage regimen of 1 g administered every 8 h.
			16-18	≥ 21	-	18-20	≤ 17	

Test	Direct Disk Diffusion
Test method	Disk diffusion using positive blood culture broth
Organism group	Enterobacterales **and** ***Pseudomonas aeruginosa***
Medium	MHA
Antimicrobial concentration	Standard disk contents for the antimicrobials **are detailed in Table 3E-2 (Enterobacterales) and Table 3E-3 (*P. aeruginosa*)**
Inoculum	Positive blood culture broth with gram-negative bacilli, used within 8 hours of flagging positive by the blood culture system
Test procedure	1. Invert blood culture bottle 5-10 times to thoroughly mix. 2. Sterilize the top of the bottle with an alcohol wipe (allow to dry) and insert 20-gauge venting needle into the blood culture bottle. 3. Dispense 4 drops of blood culture broth onto an MHA plate. As a purity check, use an inoculated blood agar plate streaked for isolation. 4. Spread blood culture broth across the entire surface of the MHA plate using a sterile cotton swab. 5. Repeat this procedure by streaking twice more, rotating the plate approximately 60 degrees each time to ensure an even distribution of inoculum. 6. Leave the lid ajar for 3-5 minutes (ideally) but no more than 15 minutes. 7. Dispense antimicrobial disks onto the surface of the inoculated MHA plate. 8. Press each disk down to ensure complete contact with the agar surface. 9. Invert the plate and place in the incubator within 15 minutes of disks being applied.
Incubation conditions	35°C ± 2°C; ambient air
Incubation length	**8-10 hours or** 16-18 hours
Results	1. Examine the blood agar purity plate to ensure pure growth. 2. Examine the test plate to ensure confluent lawn of growth appropriate to read disk zone tests per M02.[1] 3. Measure the zone diameters according to routine disk diffusion recommendations in M02.[1] 4. Report results using the interpretive categories and zone diameter breakpoints in **Table 3E-2 or Table 3E-3 if the gram-negative bacillus tested is confirmed to be an Enterobacterales or *P. aeruginosa*, respectively.** If species is identified as another organism, do not interpret or report results.
Additional testing and reporting	• If there is an inconsistent growth pattern on the plate (eg, mixed inoculum, nonconfluent growth, growth is too faint to read), do not interpret or report results from the direct disk diffusion test, and perform standard susceptibility testing from pure colony growth. • Antimicrobial agents to which the organism is intrinsically resistant (see Appendix B) should be reported as resistant, regardless of measured zone size. • If two zones of growth inhibition are observed, measure the inner zone diameter. In case of colonies present within zones, or presence of both inner and outer zones, check the purity plate and, if pure, record the inner zone diameter.
QC recommendations	**• Perform QC according to the standard disk diffusion QC procedures per M021 (eg, daily or weekly).**

https://clsi.org/standards/products/microbiology/documents/m100/

http://em100.edaptivedocs.net/dashboard.aspx

antibiotics

MDPI

Article

Multicentre Evaluation of the EUCAST Rapid Antimicrobial Susceptibility Testing (RAST) Extending Analysis to 16–20 Hours Reading Time

Gabriele Bianco [1,*], Donatella Lombardo [2], Guido Ricciardelli [1,3], Matteo Boattini [1,3], Sara Comini [1,3], Rossana Cavallo [1,3], Cristina Costa [1,3] and Simone Ambretti [2]

Antibiotics **2022**, *11*, 1404. https://doi.org/10.3390/antibiotics11101404

n
641

Multicéntrico (Italia)
Comparación con Microscan
Especies validadas y no validadas (*Enterobacterales* n=61, ConNS n=72)

Lectura 4h >90% excepto: 0% *P. aeruginosa*, 51,7% *Enteroccus* spp., 46,1% *Staphylococcus* spp.

ATU: Piperacilina-tazobactam/*Enterobacterales, P. aeruginosa* (4, 6, 8h)
clindamicina, gentamcina/*Staphylococcus* spp., linezolid, vancomicina/*Enterococcus* spp.

VME: Aminoglucósidos, cefalosporinas/*Enterobacterales*, gentamicina, clindamicina/*Staphylococcus* spp.

	4 h %	6 h %	8 h %	16-20 h %
Readable zones	75,7	96,6	100	100
CA	98,9	-	-	99,4
ME	0,2	0,4	0,3	0,3
VME	3,3	3,7	3,4	1
ATU	9,9	5,9	5	5,2

AMERICAN SOCIETY FOR MICROBIOLOGY | Journal of Clinical Microbiology®

Fully Automated EUCAST Rapid Antimicrobial Susceptibility Testing (RAST) from Positive Blood Cultures: Diagnostic Accuracy and Implementation

October 2022 Volume 60 Issue 10

Abdessalam Cherkaoui,[a,b] Didier Schorderet,[a] Nouria Azam,[a] Luigi Crudeli,[a] José Fernandez,[a] Gesuele Renzi,[a] Adrien Fischer,[a] Jacques Schrenzel[a,c]

Fase 1
n
779

Fase 2
n
534

Bacteriology Laboratory Geneva University Hospitals
Copan System / disco difusión estàndard EUCAST

Fase 1: hemocultivos inoculados 100-200 UFC
Fase 2: estudio clínico prospectivo

Lectura 4h >95% excepto: 0% *P. aeruginosa*, 93,9% *Enteroccus* spp., 87,3% *S. aureus*

ATU: Piperacilina-tazobactam, amikacina, ciprofloxacino, cotrimoxazol/Gram neg (4h), gentamicina, norfloxacino/*S. aureus,* vancomicina, linezolid/*Enterococcus* spp.

CA:>95%
VME: imipenem, ciprofloxacino, tobramcina/*P. aeruginosa*

MRSA n=20, identificados 100% a las 4h

ESBL n=122, detectados por sinergia doble disco 67% 4h, 100% 6h

VRE n=30, detectados 97% 4h, 100% a las 6h

Carbapenemasas 100% correlación con cribado por disco difusión estándar

Resistencia inducible a clindamicina n=49, detectados 8,2% 4h, 75,5% 6h, 83,7% 8h

Automatización del procesamiento

- óptimas condiciones de crecimiento con temperatura estable
- lectura programable a diferentes tiempos
- observación aumentada de las imágenes
- sistema experto

Original article

Infect Dis Now. 2022;13:S2666-9919(22)00183-X

Impact of EUCAST rapid antimicrobial susceptibility testing (RAST) on management of Gram-negative bloodstream infection

Emilie Cardot Martin [a,*], Marie Alice Colombier [b], Lucie Limousin [a], Orianne Daude [a], Oscar Izarn [a], Pierre Cahen [a], Eric Farfour [a], Philippe Lesprit [c], Marc Vasse [a]

n RAST 61

n Control 49

Unicéntrico (France)
Episodios bacteriemia por gramnegativos (*E. coli*, *K. pneumoniae, P. aeruginosa*)
Comparación grupo RAST con grupo control (antibiograma directo según SFM 16h incubación)
Evaluación actitud terapéutica y evolución pacientes

Terapia efectiva el día de hemocultivo positivo:
100% grupo RAST vs 88% grupo control (p=0,007)
No diferencia en mortalidad ni estancia hospitalaria

	4 h %	6 h %	8 h %
No Readable zones	7,4	2,3	0,5
CA	99,3	99,6	99,6
ME	0,3	0	0
VME	0,2	0	0
ATU	9,4	5,6	4,4

ANNEXE 4

Antibiogramme direct par dilution à partir de flacons d'hémocultures positives.

Dilution	BGN	Staphylocoques	Streptocoques
Dilution	1/50e	1/50e	1/5e
Equivalent en gouttes*	15 gouttes / 9 mL NaCl 0,9 %	15 gouttes / 9 mL NaCl 0,9 %	15 gouttes / 1 mL NaCl 0,9 %

EUCAST EUROPEAN COMMITTEE ON ANTIMICROBIAL SUSCEPTIBILITY TESTING
European Society of Clinical Microbiology and Infectious Diseases

Combinaciones antibiótico-microorganismo sin puntos de corte para disco difusión

Antibiotic	Group of bacteria
Fosfomycin	*Enterobacterales* except *E. coli*, *Staphylococcus* spp.
Ciprofloxacin	*Salmonella* spp.
Colistin	All Gram-negative bacilli
Tigecycline	*Enterobacterales* except *E. coli*
Beta-lactams	Penicillin non-susceptible *Streptococcus pneumoniae*
Glycopeptides	*Staphylococcus* spp.
Daptomycin	All Gram-positive
Lipoglycopeptides	All Gram-positive
All antibiotics	Some anaerobes, *Neisseria* spp., *Helicobacter pylori*

Recomendaciones CoEsAnt paneles disco difusión

Categories	Definitions
A	Antimicrobials that must be routinely studied and reported. They are relevant for both clinical purpose and for the process of interpretive reading of the antibiogram.
B	Antimicrobials that must be routinely studied but selectively reported. They are useful for the process of interpretive reading of the antibiogram and should be selectively reported according to the type of patient, type of infection or the inferred resistance mechanism.
C	Antimicrobials that should be selectively studied and reported according to the type of patient, type of infection or to the inferred resistance mechanism.
D	Antimicrobials that are recommended to be routinely studied and reported in urine isolates.
E	Antimicrobials that should be studied but not reported. They are useful for the detection of antimicrobial resistance mechanisms, application of an expert rule or as surrogate markers of the susceptibility testing result of other antimicrobials.

Rivera et al. Enferm Infec Microbiol Clin. 2022. https://doi.org/10.1016/j.eimc.2022.04.015

Paneles

Enterobacterales

Enterobacterales

AMP	PIT	AMI	GEN
CXI	CTA	CUR	ERT
CTZ	AMC	AZT	CIP
CTV	CEP	MER	TRS

Enterobacterales ITU

AMP	PIT	AMI	GEN
FOS	CTA	CUR	ERT
CTZ	AMC	AZT	CIP
NIT	CEP	MER	TRS

Categoría	Antibiótico
A	Ampicilina Amoxicilina-ác clavulánico Piperacilina-tazobactam Cefuroxima Ceftazidima Cefotaxima Cefepime Ertapenem Ciprofloxacino Amikacina Gentamicina Cotrimoxazol
B	Aztreonam Meropenem Ceftazidima-avibactam
D	Fosfomicina Nitrofurantoina
E	Cefoxitina

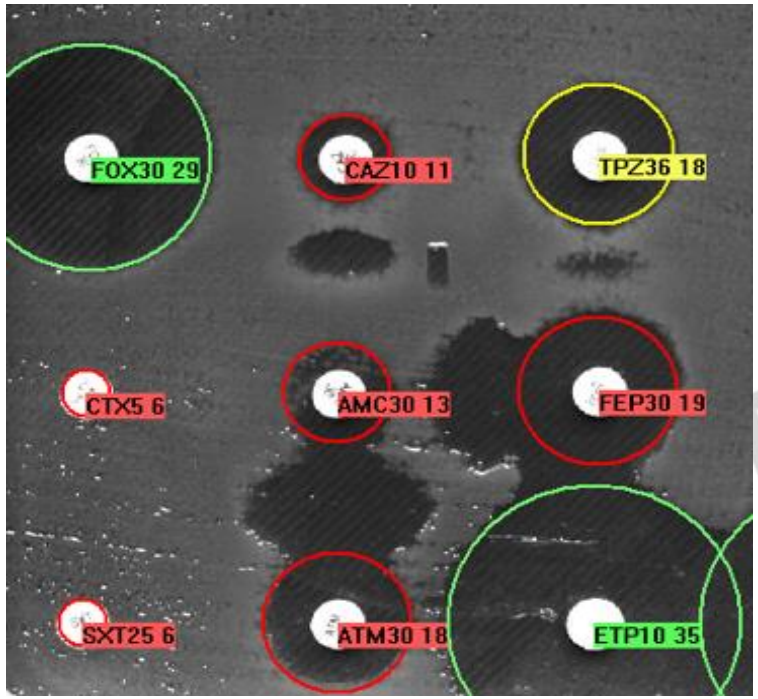
AMC Amoxicillin-clavulanate, AMI Amikacin, AMP Ampicillin, AZT Aztreonam, CEP Cefepime, CIP Ciprofloxacin, CTA Cefotaxime, CTV Ceftazidime- avibactam, CTZ Ceftazidime, CUR Cefuroxime, CXI Cefoxitin, ERT Ertapenem, FOS Fosfomycin, GEN Gentamicin, MER Meropenem, NIT Nitrofurantoin, PIT Piperacillin-tazobactam, TRS Trimethoprim-sulfamethoxazole.

Rivera et al. Enferm Infec Microbiol Clin. 2022. https://doi.org/10.1016/j.eimc.2022.04.015

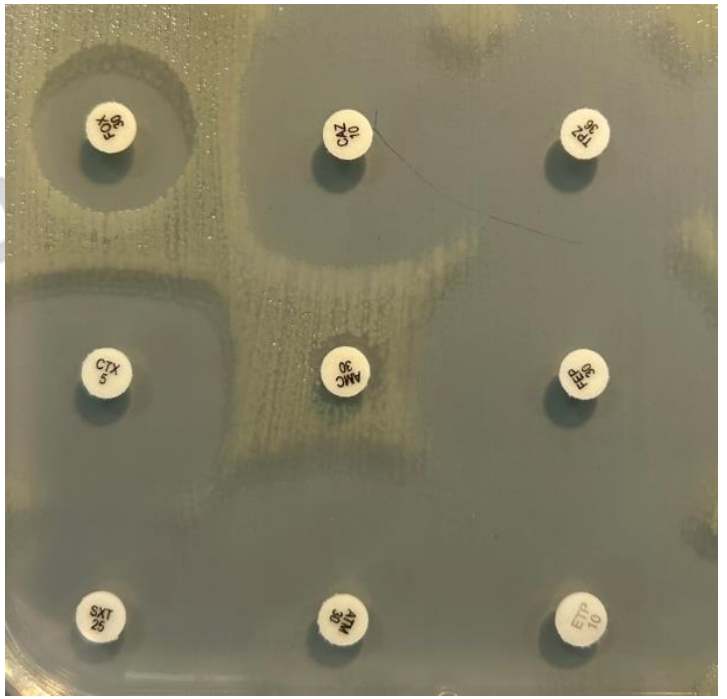
Enterobacterales

Detección de mecanismos de resistencia

- **BLEE: sinergia doble disco**
  Colocación amoxicilina clavulánico cercano a C3G/C4G



- **AmpC inducible**
  Achatamiento halo C3G , aztreonam
  Colocación inductores débiles C3G, aztreonam cercanos a inductores fuertes AMC, FOX, MER



- **Resistencia a fluoroquinolonas en *Salmonella enterica*, Vibrio spp.**
  Disco **pefloxacino 5 µg** permite excluir resistencia a fluoroquinolonas

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Bacilos gramnegativos no fermentadores

BGNNF

PIP	CTZ	AMS	MER
CEP	PIT	AZT	IMI
GEN	TOB	AMI	CIP
CTT	MIN	FOS	TRS

***Pseudomonas* spp.**

Categoría	Antibiótico
A	Piperacilina-tazobactam Ceftazidima Cefepime Imipenem Meropenem Aztreonam Ciprofloxacino Amikacina Tobramicina
B	Ceftolozano-tazobactam
C,D	**Fosfomicina**
E	Piperacilina

***Acinetobacter* spp.**

Antibiótico	
Ampicilina-sulbactam	**Minociclina**
Piperacilina-tazobactam	Cotrimoxazol
Ceftazidima	
Imipenem	
Meropenem	
Ciprofloxacino	
Amikacina	
Gentamicina	
Tobramicina	

AMI Amikacin, AMS Ampicillin- sulbactam, AZT Aztreonam, CEP Cefepime, CIP Ciprofloxacin, CTT Ceftolozane-tazobactam, CTZ Ceftazidime, FOS Fosfomycin, GEN Gentamicin, IMI Imipenem, MER Meropenem, MIN Minocycline, PIP Piperacillin, PIT Piperacillin-tazobactam, TOB Tobramycin, TRS Trimethoprim-sulfamethoxazole.

Rivera et al. Enferm Infec Microbiol Clin. 2022. https://doi.org/10.1016/j.eimc.2022.04.015

Paneles

Sataphylococcus spp.

Staphylococcus spp.

BEN	OXA	VAN	TEI
ERY	CLI	LIN	TET
RIF	GEN	LEV	TRS
FUS	MUP	TOB	CXI

Categoría	Antibiótico
A	Penicilina Oxacilina Eritromicina Clindamicina Levofloxacino Gentamicina Tobramicina **Vancomicina** **Teicoplanina** Cotrimoxazol
B	Tetraciclina Linezolid Ácido fusídico Mupirocina Rifampicina
E	Cefoxitina

BEN Benzylpenicillin, CLI Clindamycin, CXI Cefoxitin, ERY Erythromycin, FUS Fusidic acid, GEN Gentamicin, LEV Levofloxacin, LIN Linezolid, MUP Mupirocin, OXA Oxacillin, RIF Rifampicin, TEI Teicoplanin, TET Tetracycline, TOB Tobramycin, TRS Trimethoprim-sulfamethoxazole, VAN Vancomycin.

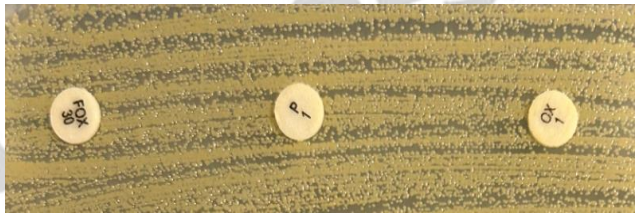
Rivera et al. Enferm Infec Microbiol Clin. 2022. https://doi.org/10.1016/j.eimc.2022.04.015

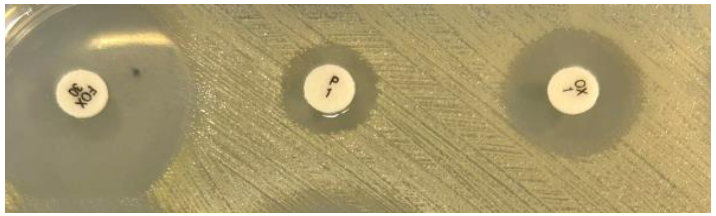
Staphylococcus spp.

Detección de mecanismos de resistencia

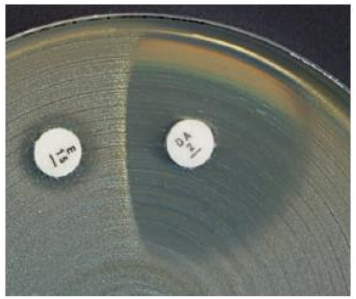
- **Producción de betalactamasa**
  Si diámetro de **pencilina** ≥26 mm y borde de halo cortante interpretar resistente, si borde en bisel interpretar sensible


- **Resistencia oxacilina**
  Disco **cefoxitina 30 µg** predice resistencia a meticilina en estafilococos excepto *Staphylococcus pseudintermedius*, *Staphylococcus schleiferi* y *Staphylococcus coagulans*





- **Resistencia inducible a clindamicina**
  Achatamiento halo de inhibición de **clindamicina** en zona cercana a **eritromicina** (zona efecto-D)



- **Resistencia a fluoroquinolonas**
  Disco **norfloxacino 10 µg** permite excluir resistencia a fluoroquinolonas

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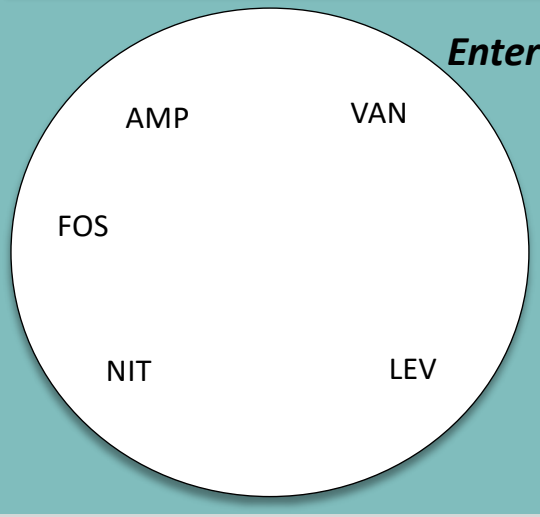
Streptococcus spp. / *Enterococcus* spp.

Streptococcus spp./*Enterococcus* spp.

BEN	AMP	OXA	LIN
ERY	CLI	TET	TEI
VAN	CTA	STR	GEN
LEV	TRS	RIF	

Enterococcus spp. ITU



Estreptococos beta-hemolíticos	
Categoría	**Antibiótico**
A	Penicilina **Cefotaxima** Eritromicina Clindamicina Levofloxacino
B	Rifampicina Cotrimoxazol
C	Vancomicina Teicoplanina Tetraciclina Linezolid
D	
E	

Estreptococos grupo viridans
Antibiótico
Penicilina Ampicilina Cefotaxima **Eritromicina** Clindamicina **Levofloxacino**
Tetraciclina
Vancomicina Teicoplanina **Linezolid** **Rifampicina** **Cotrimoxazol**

S. pneumoniae
Antibiótico
Penicilina Ampicilina **Cefotaxima** Eritromicina Clindamicina Levofloxacino
Tetraciclina Cotrimoxazol
Vancomicina Teicoplanina Linezolid Rifampicina
Oxacilina

Enterococcus spp.
Antibiótico
Ampicilina Vancomicina Teicoplanina Levofloxacino
Linezolid
Gentamicina HL Estreptomicina HL **Rifampicina**
Levofloxacino **Fosfomicina** Nitrofurantoina
Eritromicina **Tetraciclina** **Cotrimoxazol**

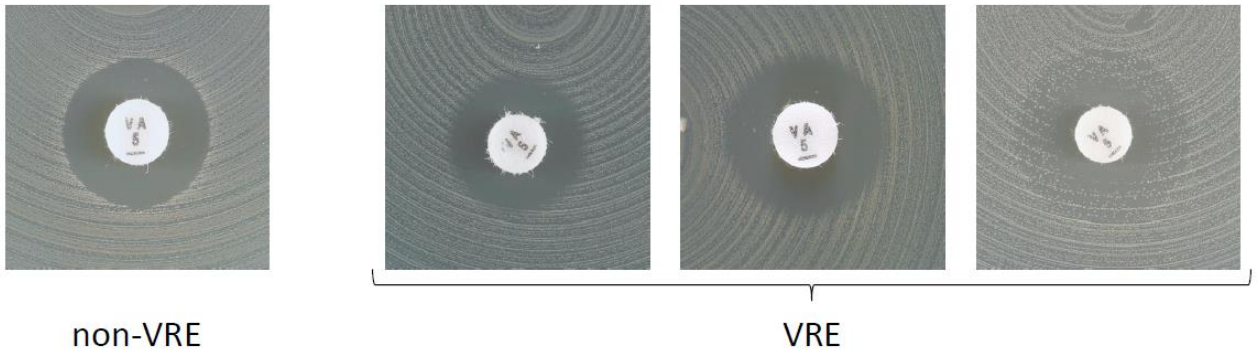
AMP Ampicillin, BEN Benzylpenicillin, CLI Clindamycin, CTA Cefotaxime, ERY Erythromycin, FOS Fosfomycin, GEN Gentamicin, LEV Levofloxacin, LIN Linezolid, NIT Nitrofurantoin, OXA Oxacillin, RIF Rifampicin, STR Streptomycin, TEI Teicoplanin, TET Tetracycline, TRS Trimethoprim-sulfamethoxazole, VAN Vancomycin.

Rivera et al. Enferm Infec Microbiol Clin. 2022. https://doi.org/10.1016/j.eimc.2022.04.015

Streptococcus spp./ Enterococcus spp.

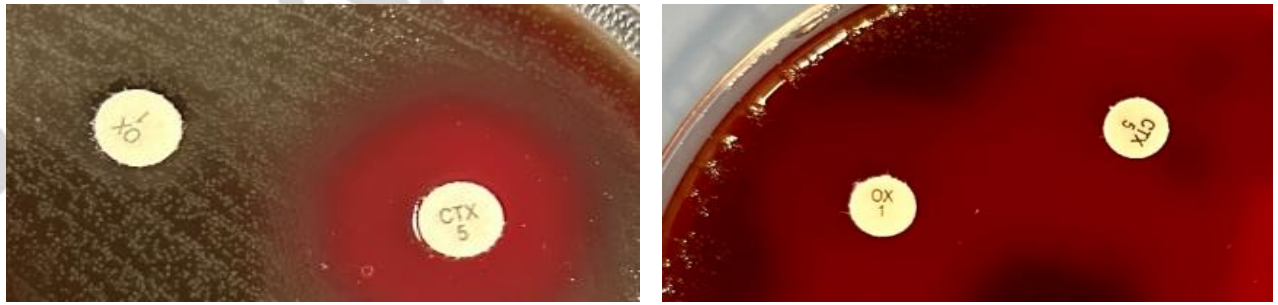
Detección de mecanismos de resistencia

- **Resistencia a glucopéptidos en *Enterococcus* spp.**
  Borde del halo de vancomicina en bisel o colonias en la zona de inhibición



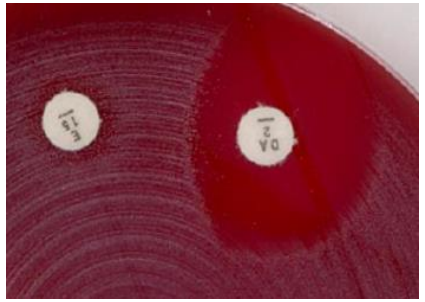
- **Resistencia a betalactámicos en *S. pneumoniae***
  Disco **oxacilina 1µg** permite excluir resistencia a betalactámicos

- **Resistencia a betalactámicos en estreptococos grupo viridans**
  Disco **penicilina 1U** permite excluir resistencia a betalactámicos



- **Resistencia inducible a clindamicina**
  Achatamiento halo de inhibición de **clindamicina** en zona cercana a **eritromicina** (zona efecto-D)

- **Resistencia a fluoroquinolonas**
  Disco **norfloxacino 10 µg** permite excluir resistencia a fluoroquinolonas



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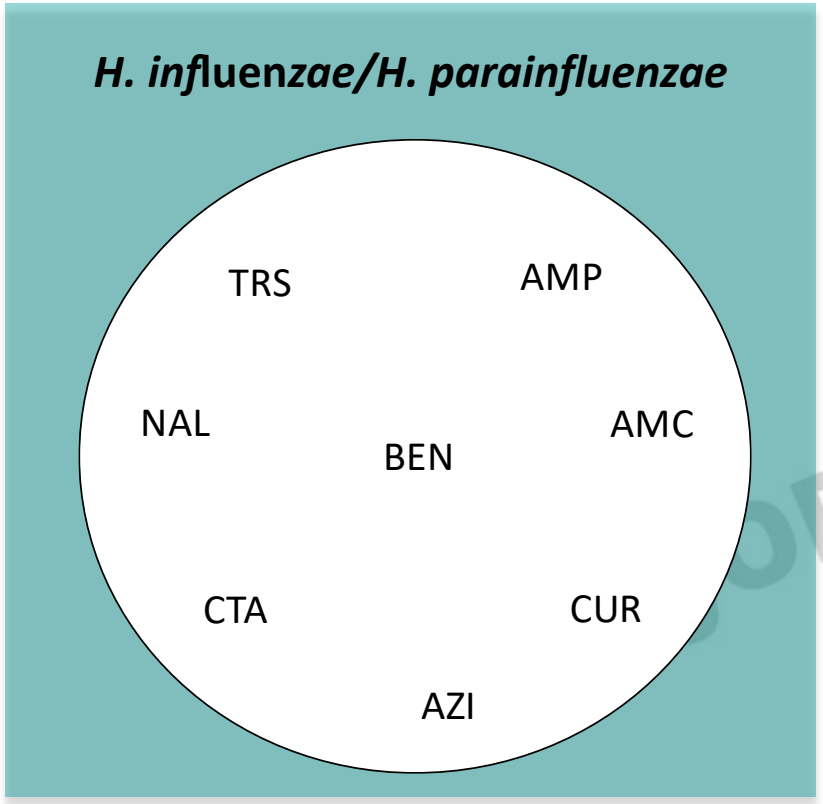
Haemophilus influenzae / Haemophilus parainfluenzae



Categoría	Antibiótico
A	Ampicilina Amoxicilina-clavulánico Cefuroxima Cefotaxima Ciprofloxacino/Levofloxacino **Azitromicina**
B	Cotrimoxazol
E	Penicilina Ácido nalidíxico

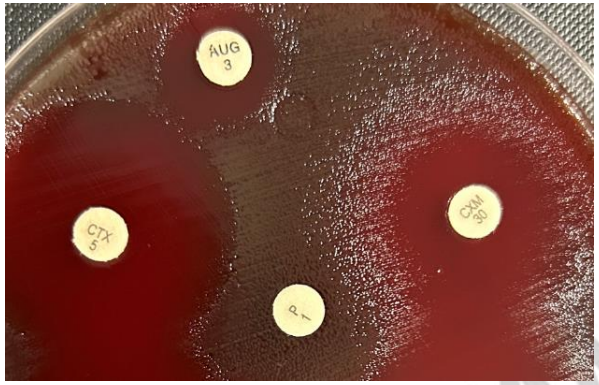
AMC Amoxicillin-clavulanate, AMP Ampicillin, AZI Azithromycin, BEN Benzylpenicillin, CTA Cefotaxime, CUR Cefuroxime, NAL Nalidixic acid, TRS Trimethoprim-sulfamethoxazole.

Rivera et al. Enferm Infec Microbiol Clin. 2022. https://doi.org/10.1016/j.eimc.2022.04.015

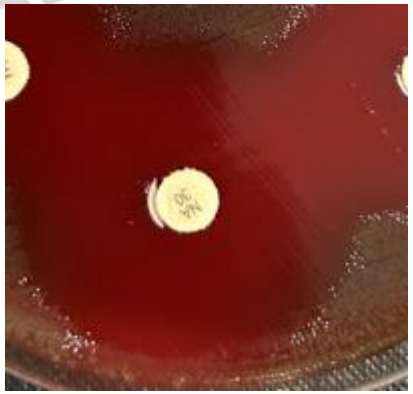
H. influenzae / H. parainfluenzae

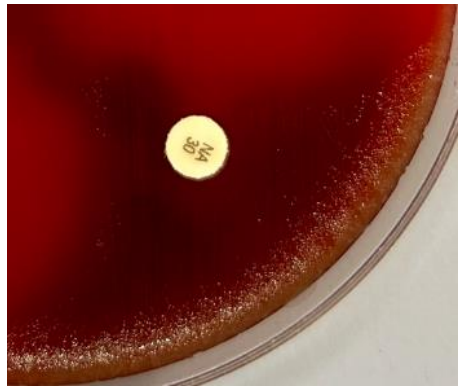
Detección de mecanismos de resistencia

- **Resistencia a betalactámicos en *H. influenzae***
  Disco **penicilina 1U** permite excluir resistencia a betalactámicos



- **Resistencia a fluoroquinolonas en *H. influenzae***
  Disco **ácido nalidíxico 30 µg** permite excluir resistencia a quinolonas





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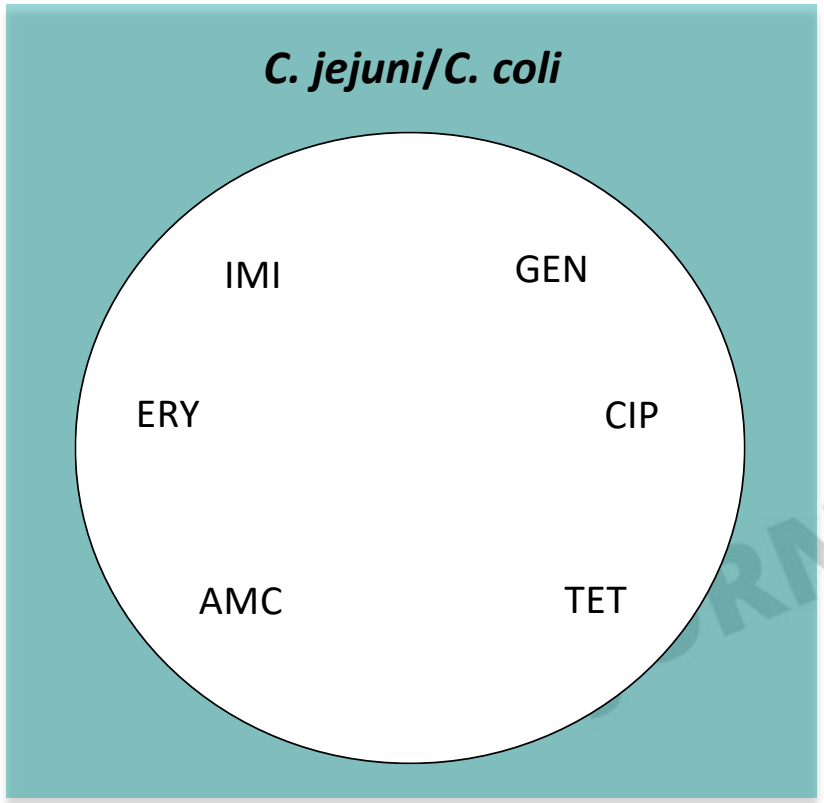
Campylobacter jejuni / Campylobacter coli



Categoría	Antibiótico
A	**Amoxicilina-ác clavulánico** Eritromicina Ciprofloxacino
B	Imipenem **Gentamicina** **Tetraciclina**

AMC Amoxicillin-clavulanate, CIP Ciprofloxacin, ERY Erythromycin, GEN Gentamicin, IMI Imipenem, TET Tetracycline.

Rivera et al. Enferm Infec Microbiol Clin. 2022. https://doi.org/10.1016/j.eimc.2022.04.015

Conclusiones

- La técnica de disco difusión constituye un método estandarizado con puntos de corte calibrados que combina flexibilidad en la elección de antimicrobianos y bajo coste.

- El método rápido validado por EUCAST para el estudio de sensibilidad por disco difusión a partir de hemocultivos positivos se presenta como una herramienta de fácil implementación para mejorar el tiempo de respuesta.

- Las recomendaciones sobre los antimicrobianos a incluir en los paneles se basan en las indicaciones y la utilidad para detección de mecanismos de resistencia y deben adaptarse las necesidades de cada centro.