UZ LEUVEN

MYCOLOGY

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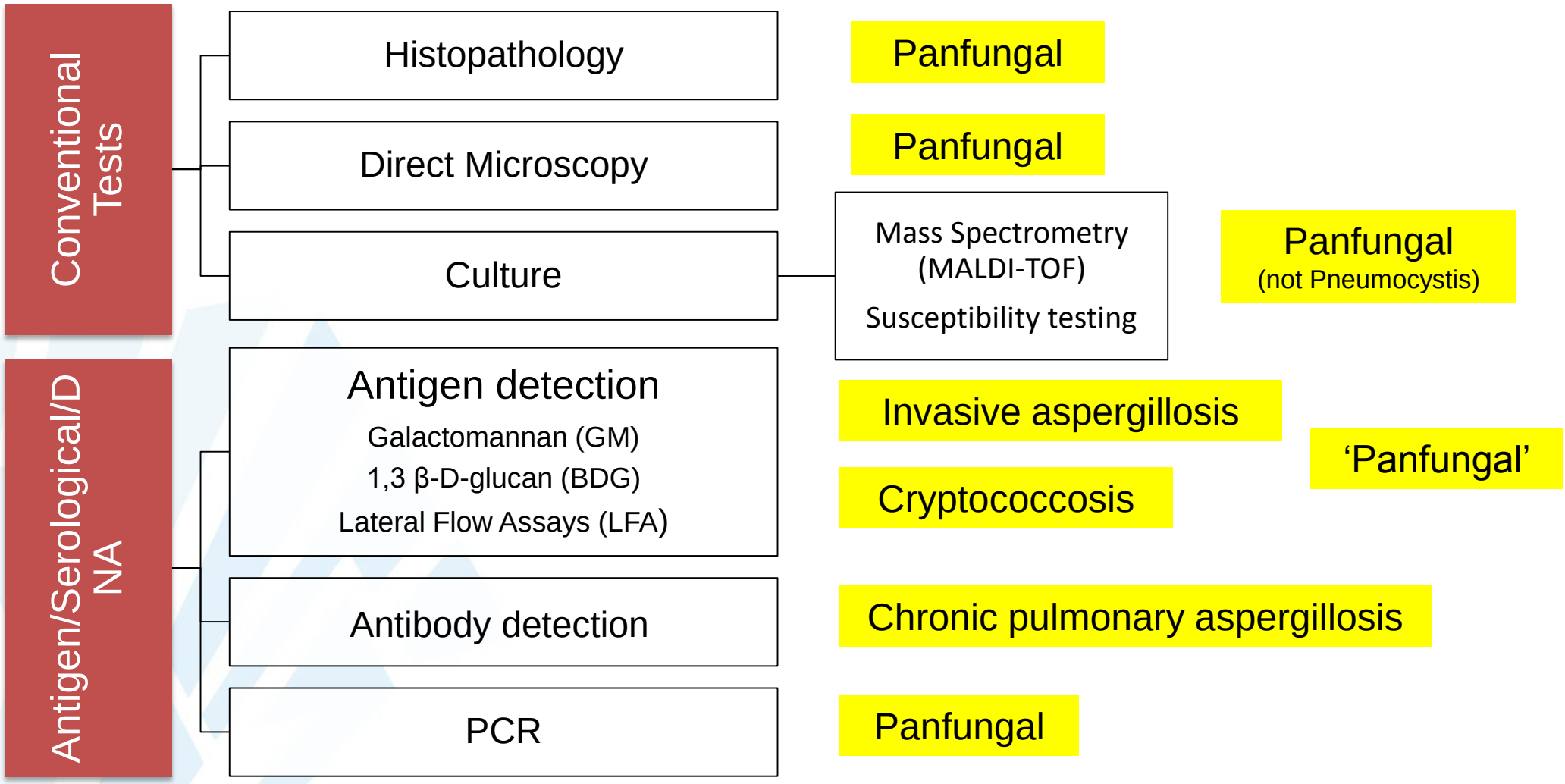
University Hospitals Leuven and KU Leuven, BELGIUM

Which tests can the lab offer to you for the diagnosis of fungal infection?



Casus: V, 80j

- Mei 2015: diagnose MDS-RAEB
- Jan 2016: evolutie naar AML (supportief beleid)
- 24 jan 2017:
  - opname op de dienst hematologie omwille van blijvende malaise met hoest en groene sputa ondanks twee antibioticakuren peroraal
  - RX thorax: verdichting rechteronderkwab, klinisch crepitaties rechts basaal overeenkomend met verdichting op RX thorax
  - Opstarten van meronem. Hieronder oplopend CRP en persisterende koorts ondanks negatieve influenza PCR (hMPV positief, andere parameters van respiratoir panel negatief) en negatieve hemoculturen.
  - HRCT: uitgebreide consolidaties met omgevende matglashalo, compatibel met angio-invasieve aspergillose dd. atypisch infectie.

UZ LEUVEN

30-01-2017 08:00 - bloed

Hemoglobine	7.8	g/dL	12.0 - 16.0
Hematocriet	0.269		0.370 - 0.470
RBC telling	2.84	10**12/L	3.90 - 5.60
MCV	94.7	fL	76.0 - 96.0
MCH	27.5	pg	27.0 - 32.0
MCHC	29.0	g/dL	30.0 - 35.0
RDW (maat voor anisocytose)	18.7	%	11.7 - 14.5
Reticulocyten telling	67	10**9/L	20 - 100
Immature reticulocyten fractie	29.6	%	5.0 - 21.0
Reticulocyten hemoglobinisatie (Ret-He)	24.9	pg	30.3 - 35.7
Erytroblasten telling	0.33	10**9/L	0.00 - 0.07
Erytroblasten telling	1.20	/ 100 WBC	0.00 - 0.70
WBC telling	28.25	10**9/L	4.00 - 10.00

UZ LEUVEN

WBC differentiatie microscopie			
Aantal gedifferentieerde WBC	119		
Blasten %	67	%	≤ 0
Blasten aantal	19.0	10**9/L	
Myelocyten %	21	%	≤ 0
Myelocyten aantal	5.9	10**9/L	
Metamyelocyten %	4	%	≤ 0
Metamyelocyten aantal	1.2	10**9/L	
Neutrofielen %	5	%	38 - 77
Neutrofielen aantal	1.4	10**9/L	2.5 - 7.8
Eosinofielen %	0	%	≤ 6
Eosinofielen aantal	0.0	10**9/L	≤ 0.4
Basofielen %	0	%	≤ 1
Basofielen aantal	0.0	10**9/L	≤ 0.1
Lymfocyten %	2	%	20 - 50
Lymfocyten aantal	0.5	10**9/L	1.2 - 3.6
Monocyten %	1	%	2 - 10
Monocyten aantal	0.2	10**9/L	0.2 - 0.8
Bloedplaatjes telling	327	10**9/L	150 - 450

Bacteriologie Culturen

Respiratoir specimen

30-01-2017 13:27 - bronchuslavage/BAL

Macroscopisch uitzicht	muceus
	bloederig
Gramkleuring	mondepitheelcellen zeldzaam
Gisten/Schimmelcultuur	
positief	
Cultuur	
mondflora zeldzaam	
Aspergillus fumigatus complex zeldzaam	
Screening azole resistentie	negatief

Bacteriologie Serologie

30-01-2017 13:27 - bronchoalveolaire lavage

Aspergillus Ag detectie	positief
Het resultaat is hoger dan het meetbereik. De index is waarschijnlijk groter dan de gerapporteerde waarde.	
index	5.4

31-01-2017 08:00 - bloed

Aspergillus Ag detectie	negatief
index	0.0

INVASIVE FUNGAL DISEASE: EORTC/MSG CRITERIA

PROVEN Sterile material microscopy and/or culture positive

PROBABLE Host factors + Clinical features + Mycology

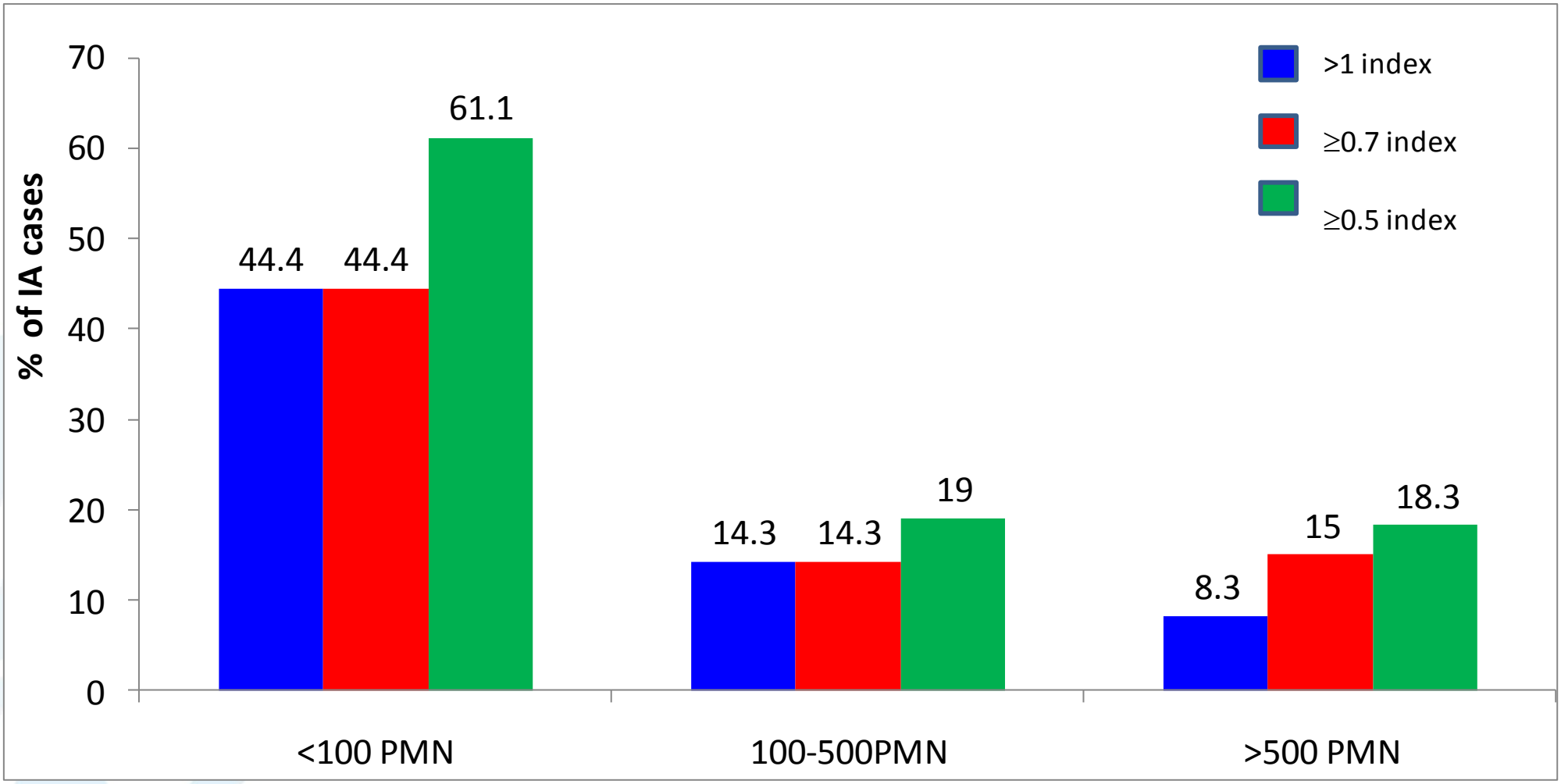
POSSIBLE Host factors + Clinical features

De Pauw B et al., CID 2008: 1813-1821

Host factors	Neutropenia aHSCT Corticosteroids T cell immunosuppressants
Clinical features	CT/MRI signs Clinical criteria
Mycology	Microscopy Culture Antigen (galactomannan, β-D-glucan)

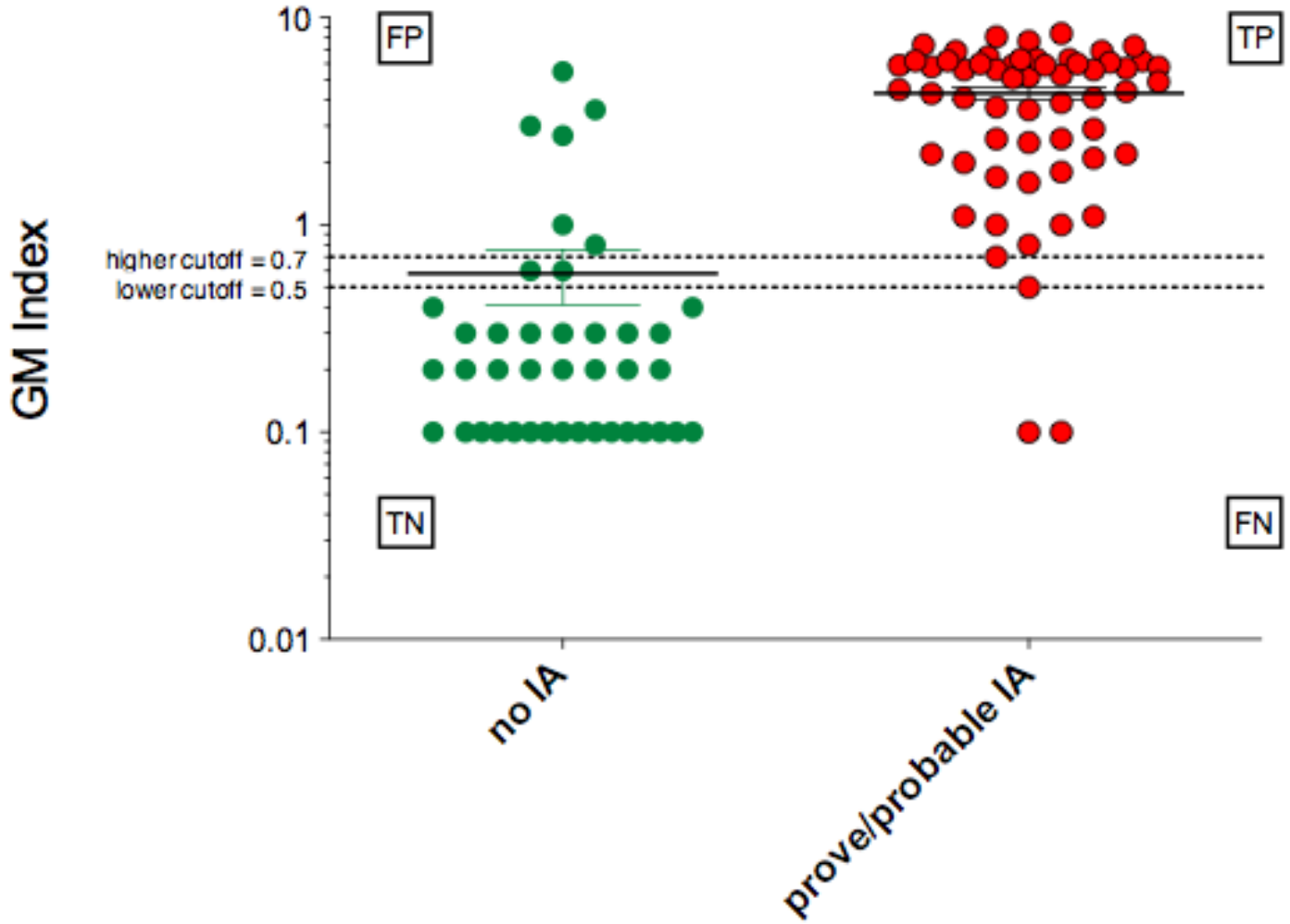
De Pauw B et al., CID 2008: 1813-1821

Serum galactomannan assay: good sensitivity in neutropenic patients only!



Cordonnier et al, CMI 2008, 15: 81-86.

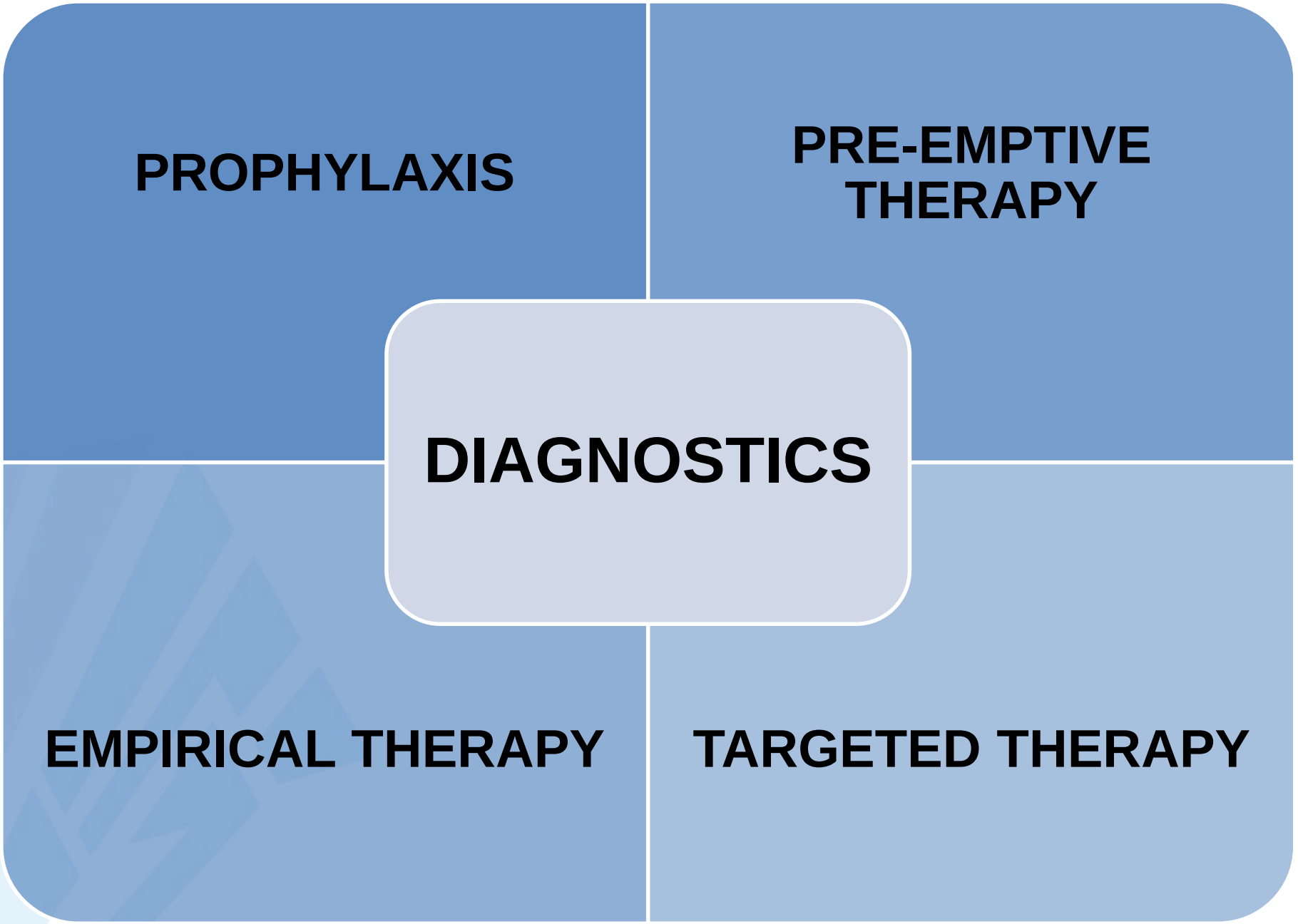
Clear influence of neutropenia on serum GM but not on BAL GM value



Jan 2005 – Sept 2008
58 proven/probable IA
41 controls

	Neutropenic	non-Neutropenic	P-value
BAL, 1.0	100%	94.7%	0.99
Serum, 0.5	90%	36.8%	0.008

Maertens J et al., CID, 2009, 49: 1688-1693.


PROPHYLAXIS
PRE-EMPTIVE THERAPY
DIAGNOSTICS
EMPIRICAL THERAPY
TARGETED THERAPY

Antifungal agents

TARGET

DNA/RNA synthesis

5-FC

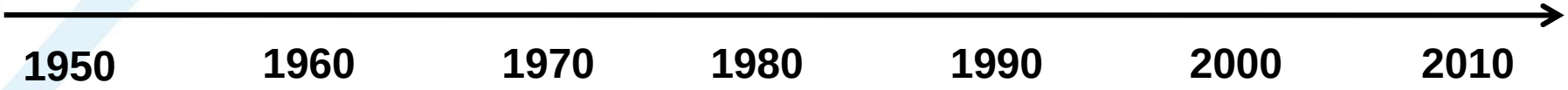
CELL WALL

Caspofungin
Anidulafungin
Micafungin

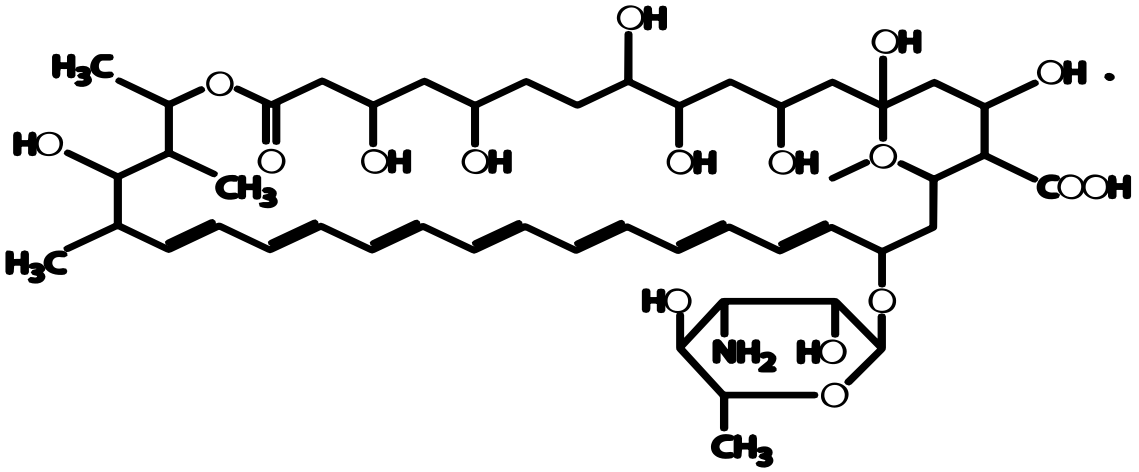
CELL MEMBRANE

Miconazole
Ketoconazole
Fluconazole
Itraconazole
Voriconazole
Posaconazole
Isavuconazole

Nystatin
Amphotericin B
Terbinafine
L-AmB, ABLC
ABCD



Amphotericin B



- Classic amphotericin B deoxycholate formulation is a colloidal suspension of amphotericin B. A bile salt, deoxycholate, is used as the solubilizing agent.
- Many side effects: infusion related, nephrotoxicity, …
- Not available anymore in Belgium
- Very broad spectrum, active against most fungi except *Aspergillus terreus*, *Scedosporium, Trichosporon* and *Candida lusitaniae* (intrinsic resistance)
- Acquired resistance is rare
- Fungicidal

Binds to sterols
(preferentially ergosterol)

↓

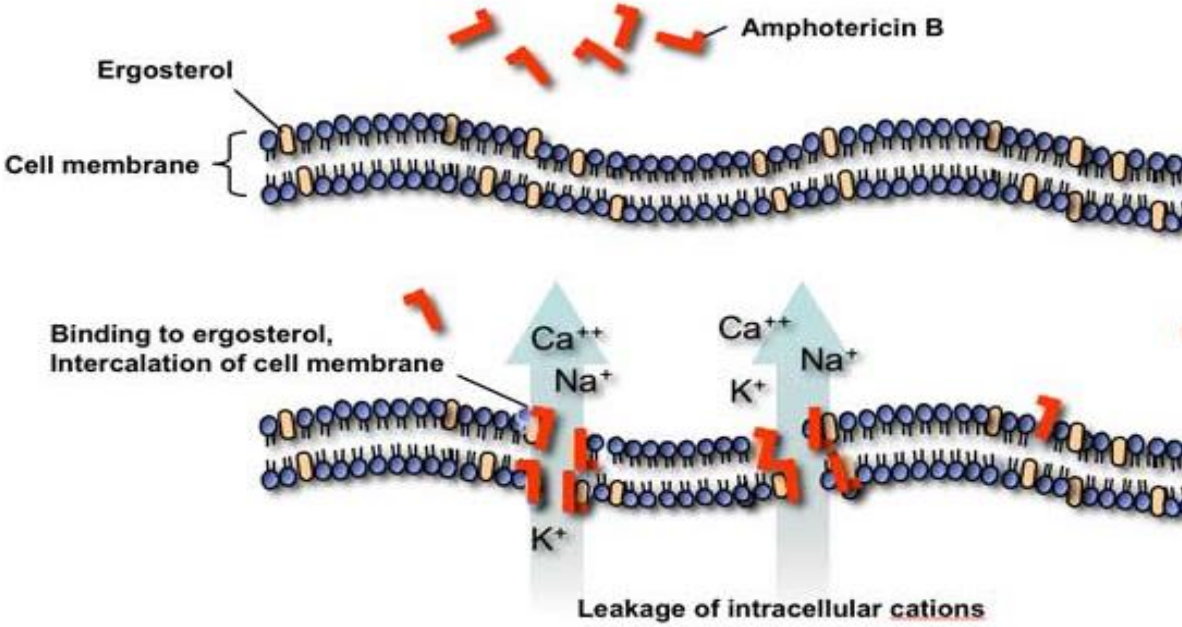
Disruption osmotic integrity
of fungal membrane

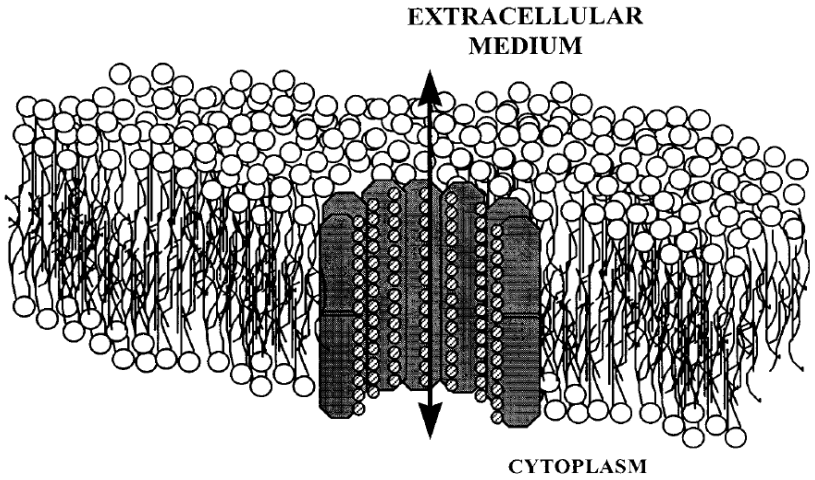
↓

Leakage of intracellular
components

↓

Fungal death



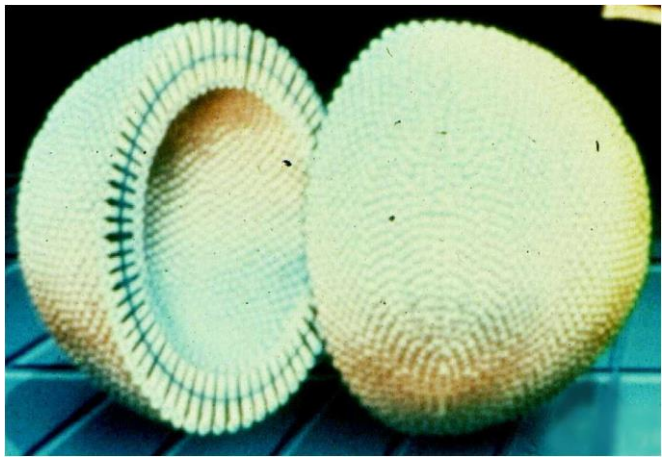


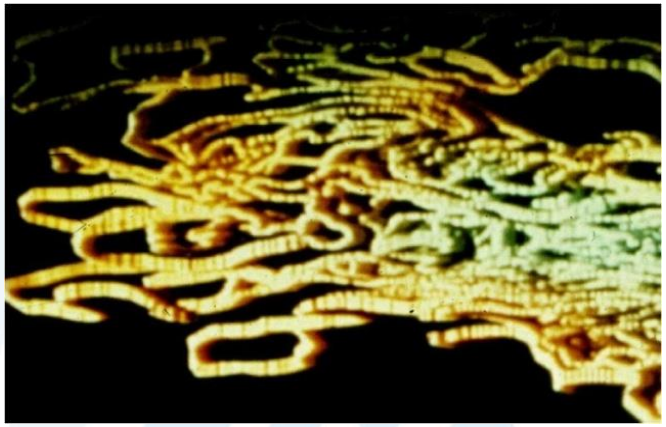
Lipid formulations of amphotericin B

liposomal amphotericin B (0.08 µm)

(L-Amb, Ambisome®): 3 mg/kg IV

higher dose for the treatment of mucormycosis (5-10 mg/kg IV)





amphotericin B lipid complex (1.6-11 µm)

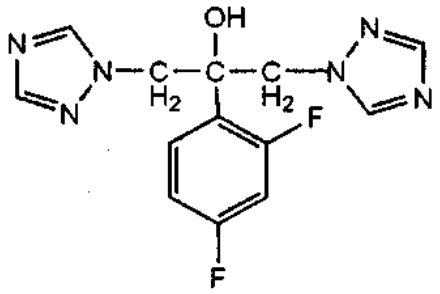
phospholipid ribbons

(ABLC, Abelcet®): 5 mg/kg IV

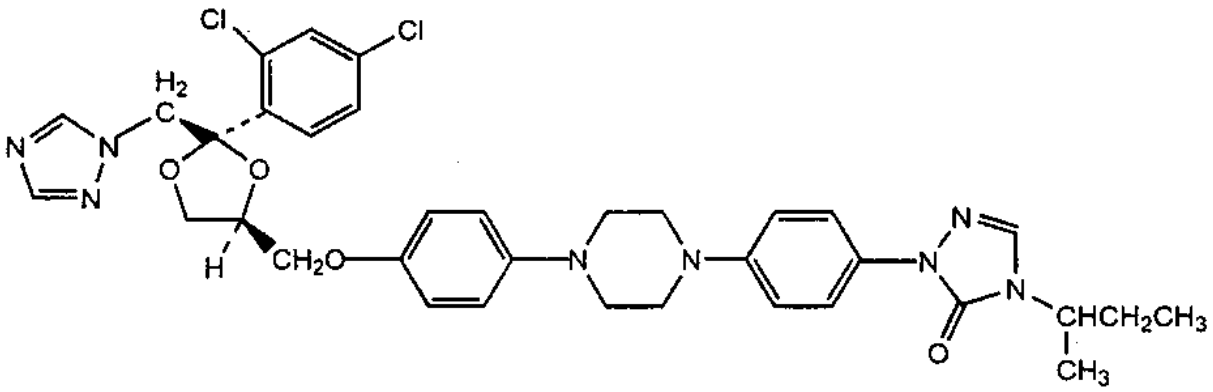
amphotericin B colloidal dispersion (0.12-0.14 µm)

cholesteryl sulfate complex
not available in Belgium

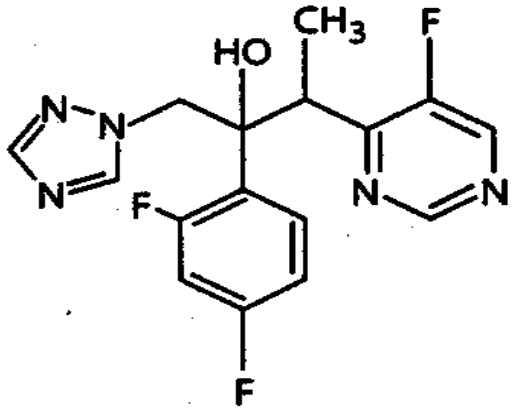
TRIAZOLES



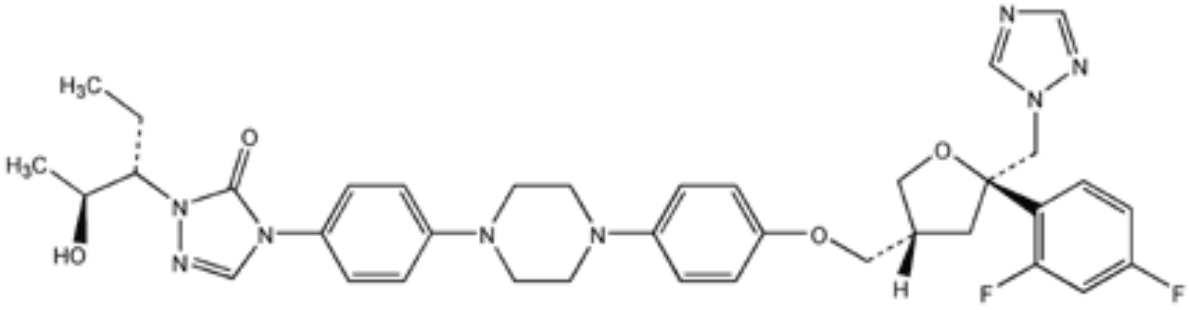
FLUCONAZOLE



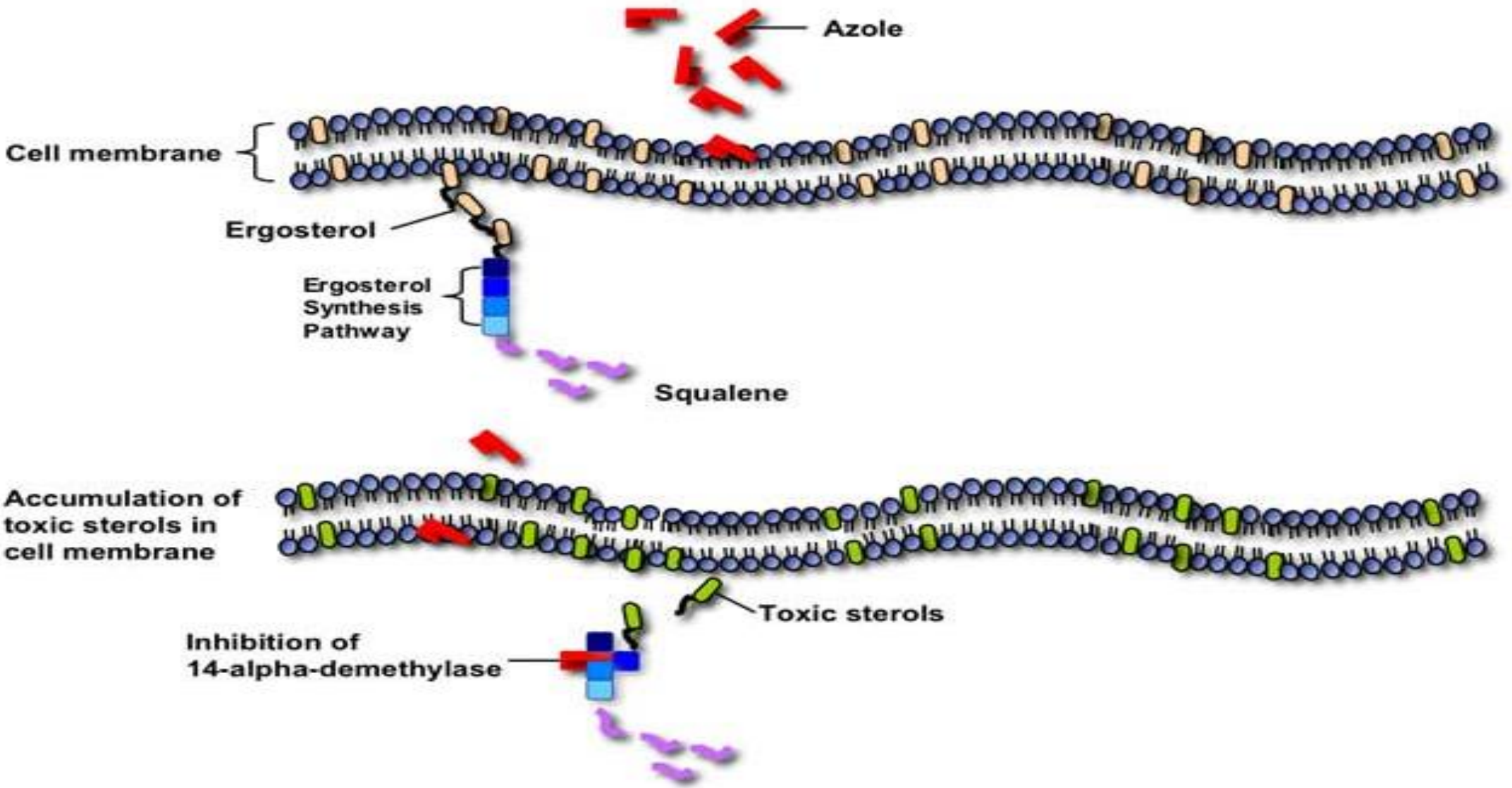
ITRACONAZOLE



VORICONAZOLE



POSACONAZOLE


Azole
Cell membrane
Ergosterol
Ergosterol
Synthesis
Pathway
Squalene
Accumulation of
toxic sterols in
cell membrane
Toxic sterols
Inhibition of
14-alpha-demethylase

Organism	AmB[a]	Flu	Itr	Vor	Pos
Aspergillus species	+	−	+	+	+
A. flavus	±	−	+	+	+
A. fumigatus	+	−	+	+	+
A. niger	+	−	±	+	+
A. terreus	−	−	+	+	+
Candida species	+	+	+	+	+
C. albicans	+	+	+	+	+
C. glabrata	+	±	±	+	+
C. krusei	+	−	±	+	+
C. lusitaniae	−	+	+	+	+
C. parapsilosis	+	+	+	+	+
C. tropicalis	+	+	+	+	+
Cryptococcus neoformans	+	+	+	+	+
Coccidioides species	+	+	+	+	+
Blastomyces	+	+	+	+	+
Histoplasma species	+	+	+	+	+
Fusarium species	±	−	−	+	+
Scedosporium apiospermum	±	−	±	+	+
Scedosporium prolificans	−	−	−	±	±
Zygomycetes	±	−	−	−	+

Active (cidal) against *Aspergillus spp.*

Newer triazoles better activity (static) against *Candida spp.*

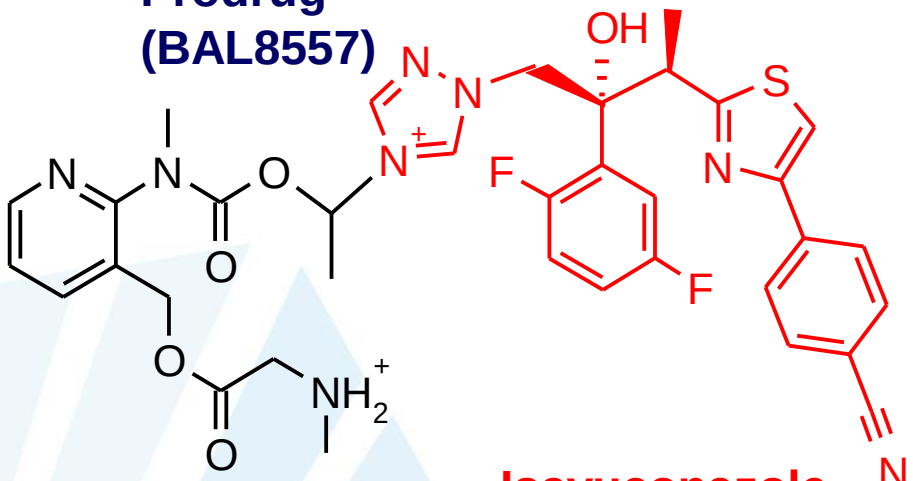
No activity against *Mucorales except posaconazole*

Activity of azoles

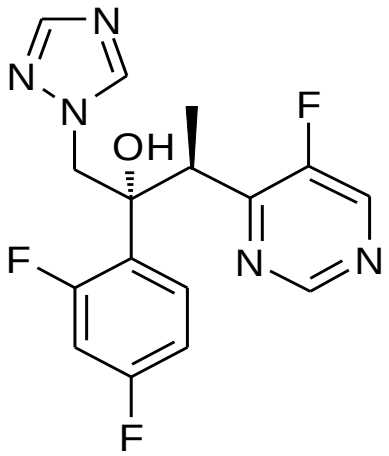
- Binding affinity of each drug defined by:
  - differences in the conformation of the 14α-demethylase binding pocket
  - azole structure
- Resistance in ***Candida***: mutations in *ERG11* and/or overexpression of efflux pumps
  - ***C. krusei***: impaired binding of fluconazole to 14α-demethylase of *C. krusei*, newer triazoles retain activity
  - ***C. glabrata***: often due to expression of multidrug efflux pumps, cross resistance may occur
- Resistance in ***Aspergillus***: mutations in the *Cyp51A* gene (+ promotor region), overexpression of efflux pumps described

Isavuconazole

Prodrug (BAL8557)

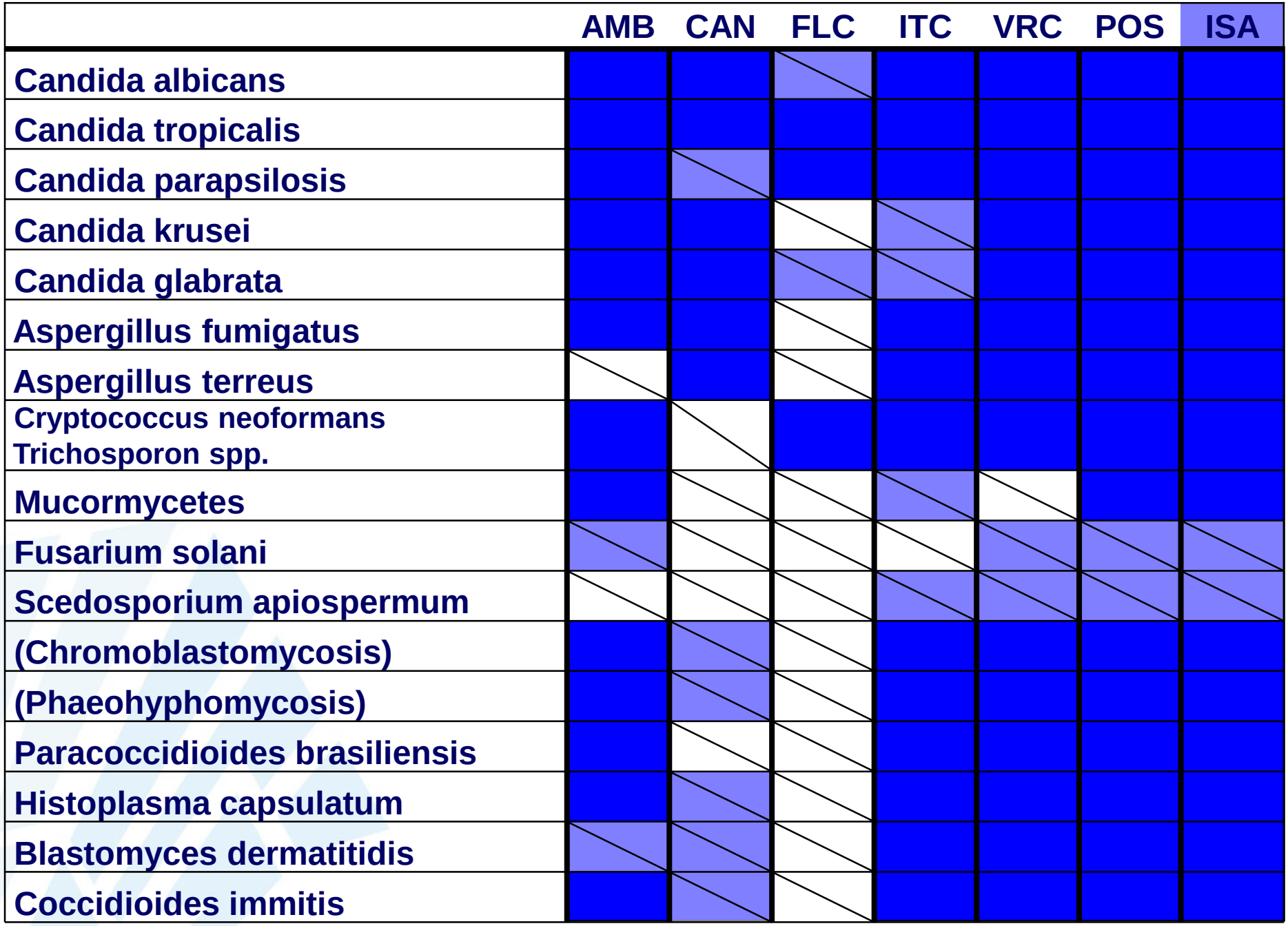


Isavuconazole (BAL4815)

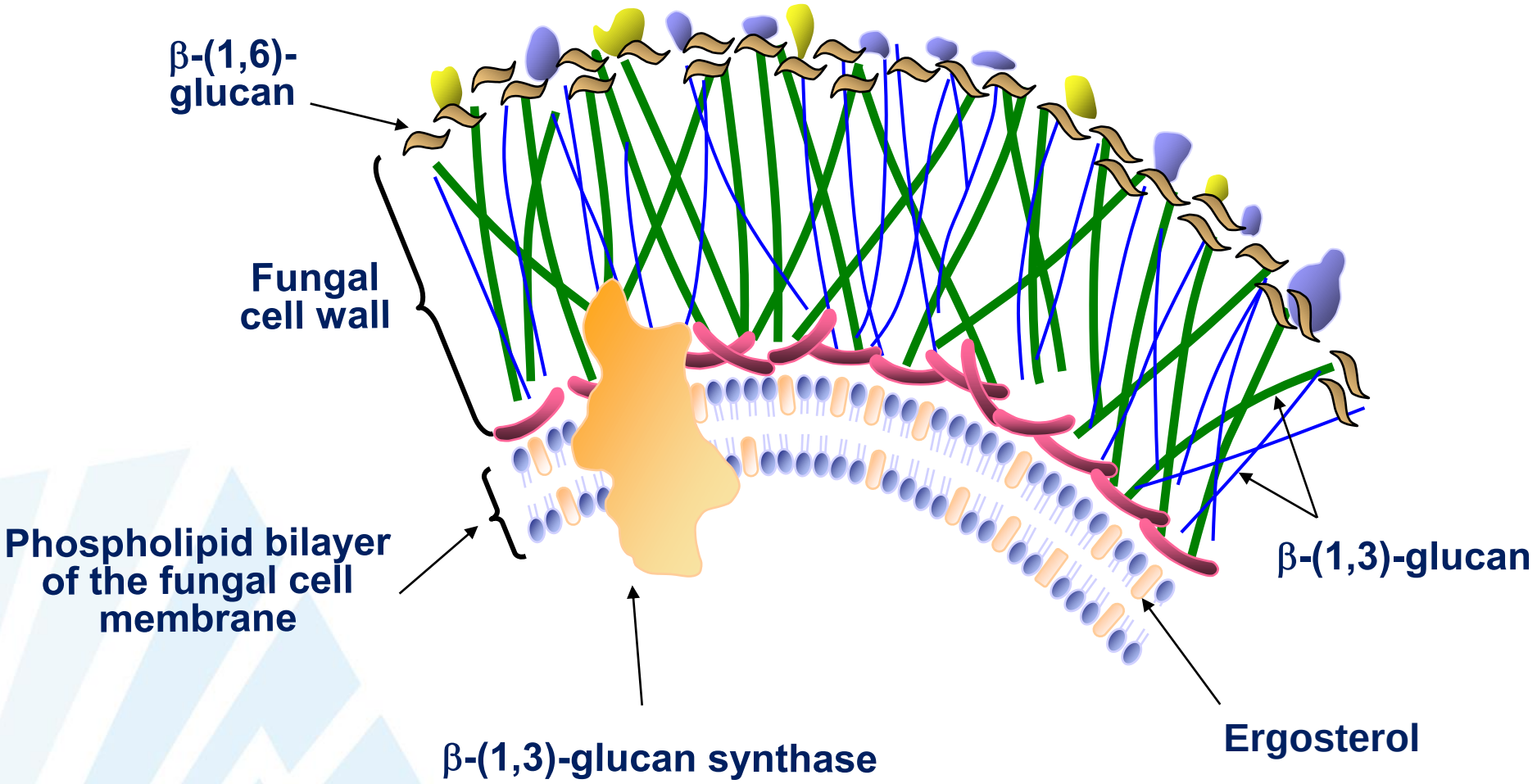


Voriconazole

High water solubility of prodrug isavuconazonium sulfate


AMB
CAN
FLC
ITC
VRC
POS
ISA
Candida albicans
Candida tropicalis
Candida parapsilosis
Candida krusei
Candida glabrata
Aspergillus fumigatus
Aspergillus terreus
Cryptococcus neoformans
Trichosporon spp.
Mucormycetes
Fusarium solani
Scedosporium apiospermum
(Chromoblastomycosis)
(Phaeohyphomycosis)
Paracoccidioides brasiliensis
Histoplasma capsulatum
Blastomyces dermatitidis
Coccidioides immitis
Active
Some resist.
Not active

Echinocandin drugs

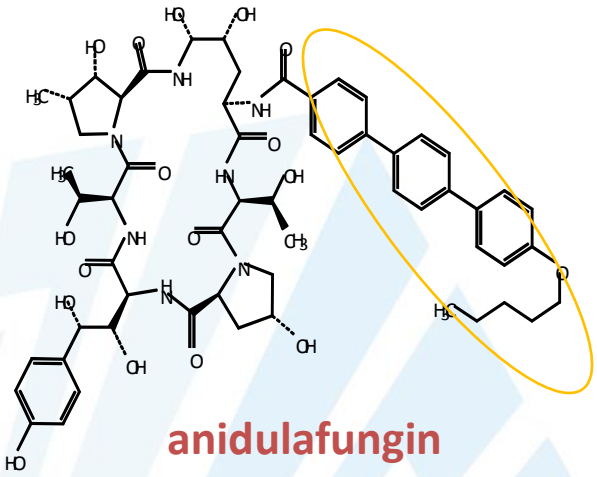


Development of echinocandin resistance during therapy is a relatively rare clinical phenomenon.

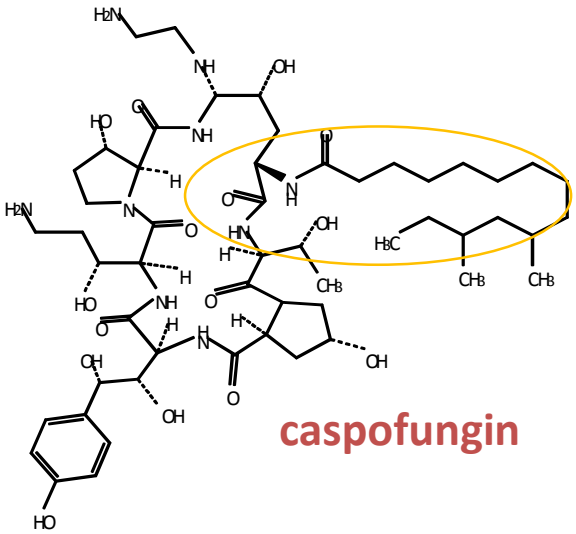
Mutations in 'hot spot' regions of the FKS1 and FKS2 catalytic subunits of the glucan synthase are associated with reduced inhibitory activity.

ECHINOCANDINS

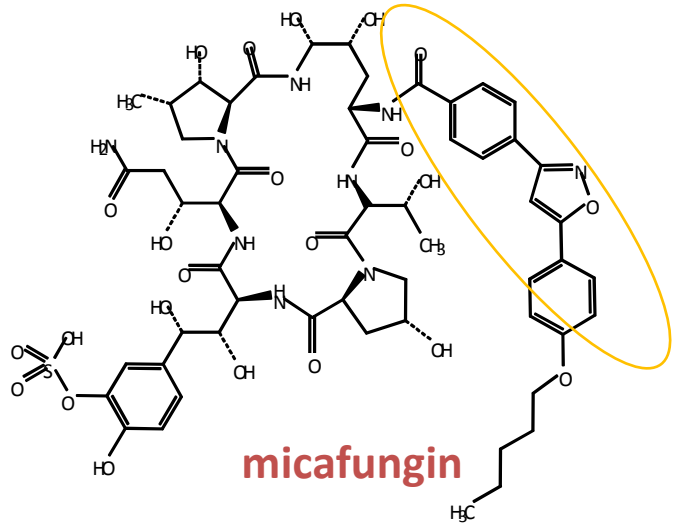
PK is specific for each echinocandin



anidulafungin



caspofungin



micafungin

Side chain determines:
- Activity: interaction with the cell wall
- Pharmacokinetics: more lipophilic → higher distribution volume

Organism	Antifungal agent		
	Anidulafungin	Caspofungin	Micafungin
Aspergillus species	+	+	+
A. flavus	+	+	+
A. fumigatus	+	+	+
A. niger	+	+	+
A. terreus	+	+	+
Candida species	+	+	+
C. albicans	+	+	+
C. glabrata	+	+	+
C. krusei	+	+	+
C. lusitaniae	+	+	+
C. parapsilosis	±	±	±
C. tropicalis	+	+	+
Cryptococcus neoformans	–	–	–
Coccidioides species	±[b]	±[b]	±[b]
Blastomyces	±[b]	±[b]	±[b]
Histoplasma species	±[b]	±[b]	±[b]
Fusarium species	–	–	–
Scedosporium apiospermum	–	–	–
Scedosporium prolificans	–	–	–
Zygomycetes	–	–	–

Active (static) against *Aspergillus spp.*

Active (cidal) against *Candida spp.*

Other fungi than *Candida* or *Aspergillus*

Organism	Antifungal agents								
	AmB	Flu	Itr	Vor	Pos	Isa	Ani	Casp	Mica
Cryptococcus neoformans	+	+	+	+	+	+	-	-	-
Mucorales	+	-	-	-	+	+	-	-	-
Fusarium species	±	-	-	±	±	±	-	-	-
Scedosporium apiospermum	±	-	±	±	±	±	-	-	-
Scedosporium prolificans	-	-	-	-	-	-	-	-	-

Resistance to echinocandins/ amphotericin B

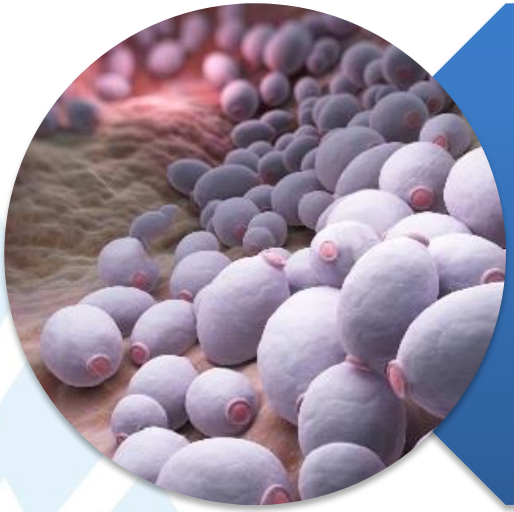
- Echinocandins:

  Little known about echinocandin resistance in *Aspergillus*, susceptibility testing is not routinely performed, technical difficulties, mechanisms not well understood

- Polyenes:
  - Primary and secondary polyene resistance reported but generally considered a rare phenomenon
  - No clear in vitro/in vivo correlation
  - *Aspergillus terreus*: less ergosterol in membrane

Is emergence of (multi)drug resistance in *Candida* and *Aspergillus* a matter of concern?

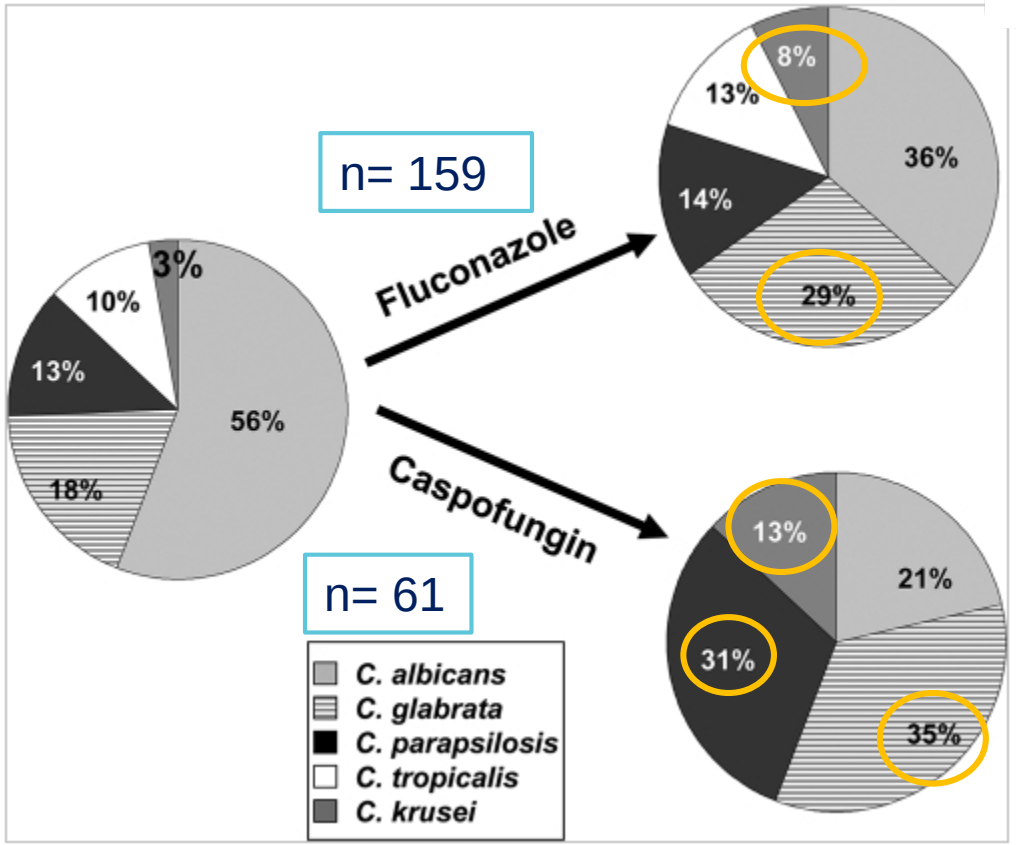
Is susceptibility testing of *Candida and Aspergillus* important to guide therapy?



Candida

Recent exposure to caspofungin or fluconazole influences the epidemiology of candidemia

- Prospective multicenter surveillance, Paris
- 2618 isolates from 2441 patients (2002-2009)



MICs were significantly higher in the cases of pre-exposure to fluconazole and caspofungin, respectively.

Lortholary O. et al, AAC 2011, 55: 532-538.

Drug resistant *Candida glabrata* in cancer patients

- Retrospective study
- MD Anderson Cancer Center Houston (Texas)
- March 2005-Sept 2013

146 *C. glabrata* candidemia episodes (144 patients)

30 (20.5%) fluconazole R

15 (10.3%) caspofungin R

30% 66.6%

10 (6.8%) multidrug R

9 fluco/caspo
1 caspo/amphoB

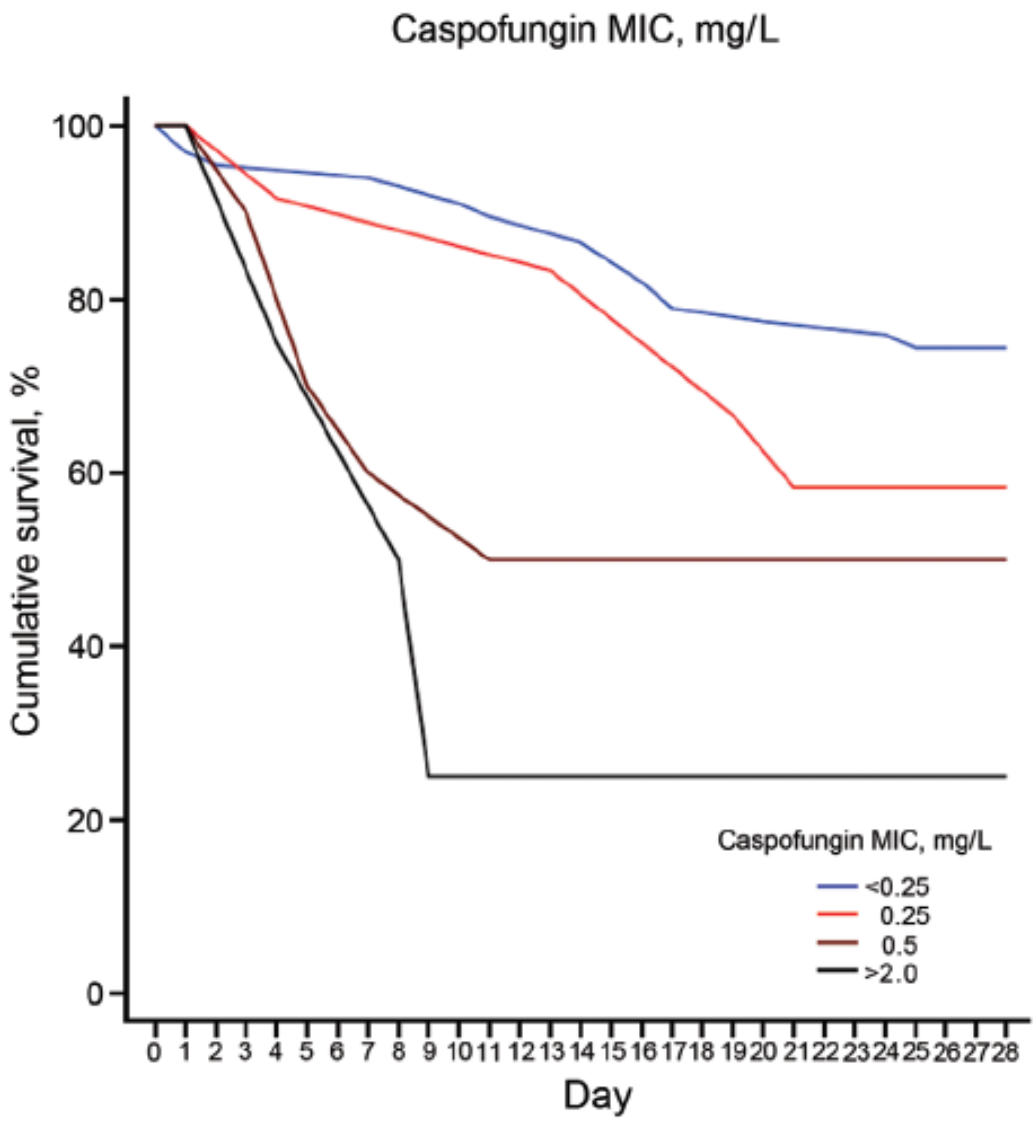
Independently associated with:

- Echinocandin preexposure
- Total parenteral nutrition

D. Farmakiotis et al, EID 2014

Drug resistant *Candida glabrata* in cancer patients

Strong correlation of all-cause mortality rates with in vitro caspofungin MICs but not with other factors classically associated with poor outcomes



2012 intermediate susceptiblity

2012 breakpoint for R

2008 breakpoint for R

D. Farmakiotis et al, EID 2014

Société belge d'infectiologie et de microbiologie clinique
Belgische vereniging voor infectiologie en klinische microbiologie

BELGIAN DATA

Eur J Clin Microbiol Infect Dis
DOI 10.1007/s10096-016-2841-3

ORIGINAL ARTICLE

Epidemiology and reporting of candidaemia in Belgium: a multi-centre study

C. Trouvé[1] · S. Blot[2,3] · M.-P. Hayette[4] · S. Jonckheere[5] · S. Patteet[1,9] · H. Rodriguez-Villalobos[6] · F. Symoens[7] · E. Van Wijngaerden[8] · K. Lagrou[1,9]

Objectives TANSIR study

Time to cANdida Species Identification and Reporting

- **Gather epidemiological data on candidemia in Belgium**
  - Incidence
  - Species distribution
  - Antifungal profiles
- **Assess clinical reporting times in “real life” setting**
  - Blood sampling => positive blood culture
  - Positive blood culture => ID communication to clinician
  - Positive blood culture => AB communication to clinician

Species distribution per ward

Top 5 ward species distribution of the 325 patients which had an episode of candidemia during the study period

	No. of isolates (%)					
	C. albicans	*C. glabrata*	*C. parapsilosis*	*C. tropicalis*	Other species	Overall
Ward						
ICU	70 (71.4)	18 (18.4)	5 (5.1)	3 (3.1)	2 (2.0)	98 (100)
Internal medicine	49 (52.7)	30 (32.3)	11 (11.8)	1 (1.1)	2 (2.1)	93 (100)
Surgery	20 (43.5)	19 (41.3)	4 (8.7)	2 (4.3)	1 (2.2)	46 (100)
Haematology-Oncology	18 (51.4)	5 (14.3)	2 (5.7)	5 (14.3)	5 (14.3)	35 (100)
Pediatrics	9 (50.0)	1 (5.6)	4 (22.2)	1 (5.6)	3 (16.6)	18 (100)

➔ Different species distribution according to ward (P<0.001)

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	FLC		VRC		POS		AND		MCF		AMB	
	% S	% R	% S	% R	% S	% R	% S	% R	% S	% R	% S	% R
C. albicans	92.7	3.9	96.1	3.9	96.6	3.4	100	0	100	0	100	0
C. glabrata	0	11.3	/*	/*	/*	/*	99.0	1.0	99.0	1.0	100	0
C. parapsilosis	94.4	5.6	94.4	5.6	97.2	2.8	0**	0**	0**	0**	100	0
C. tropicalis	75.0	20.0	80.0	20.0	80.0	20.0	100	0	/*	/*	100	0
Total	65.5	7.6	/*	/*	/*	/*	99.7	0.3	99.7	0.3	100	0

FLC: fluconazole; VRC: voriconazole; POS: posaconazole; AND: anidulafungin; MCF: micafungin; AMB: amphotericin B

*No EUCAST breakpoints available

**All strains were classified as intermediate susceptible

Published online: 17 November 2016

Drug resistance
The Observer

Millions at risk as deadly fungal infections acquire drug resistance

Researchers believe widespread use of fungicides on crops is reducing effectiveness of frontline medicines

Robin McKie Science Editor

Saturday 27 August 2016 21.00 BST

Aspergillus fumigatus, one of the most common aspergillus species to cause disease in individuals with an immunodeficiency. Photograph: Alamy

Scientists have warned that potentially deadly fungal infections are acquiring resistance to many of the medicines currently used to combat them. **More than a million people die of fungal infections every year,** including about 7,000 in the UK, and deaths are likely to increase as resistance continues to rise. **Researchers say the widespread use of fungicides on crops is one of the main causes of the rise in fungal resistance,** which mirrors the rise of resistance to antibiotics used to treat bacterial infections in humans.

“There are close parallels between bacterial and fungal resistance, though the problems we face with the latter are particularly worrying,” said Prof Adilia Warris, a co-director of the newly opened Centre for Medical Mycology at Abderdeen University.

“There are more than 20 different classes of antibacterial agents. By contrast, there are only four classes of anti-fungal agents. Our armory for dealing with deadly fungi is much smaller than the one we have for dealing with bacteria.

Doctors have recently uncovered another worrying development: outbreaks of fungal infections – mainly cryptococcus – that have appeared in previously healthy people. In one outbreak, in the northwest US, dozens of people died.

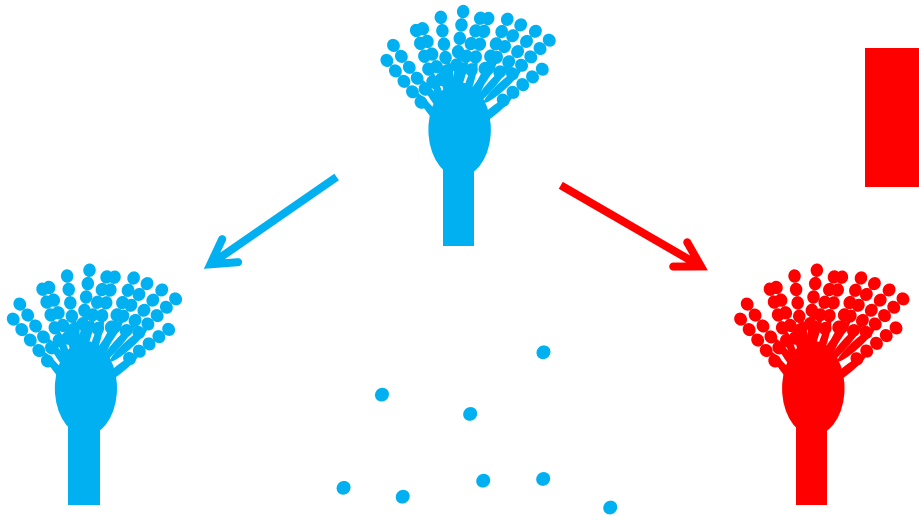
In the wake of these developments, it was decided by Britain’s Medical Research Council to open its Aberdeen mycology centre earlier this year.

It will employ experts in the field to gain new understanding of how fungi move into the human body and survive there. It will also work on the development of new drugs and tests for pinpointing specific fungi that are infecting patients.

“Fungal infections are going to be an increasing problem in coming years and we need to develop the best defences,” said Brown.

Routes of resistance development in A. fumigatus

ENVIRONMENT

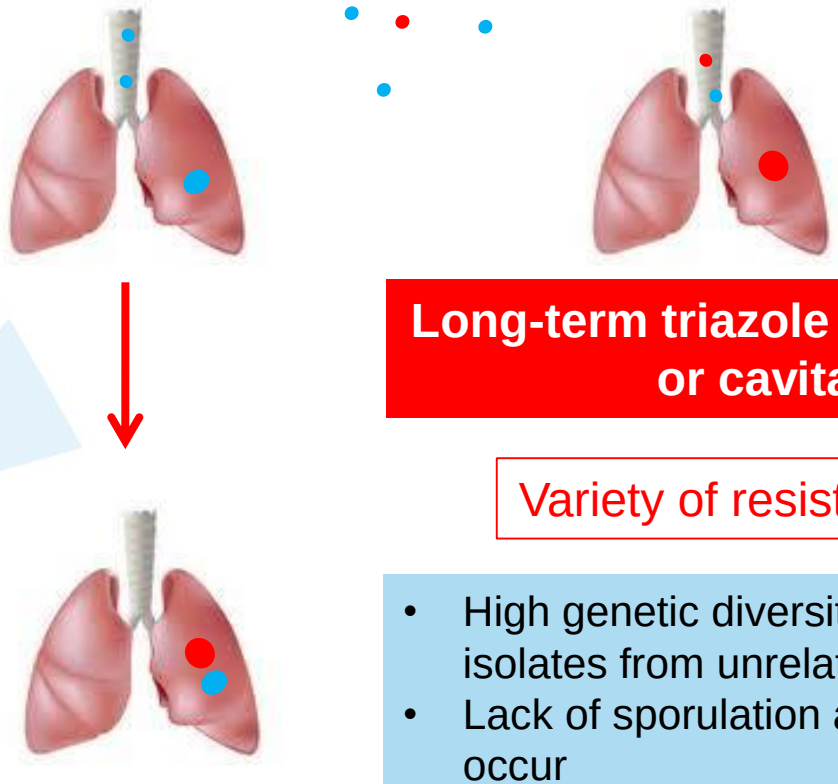


Triazole fungicides in agriculture

TR_{34}/L98H
TR_{46}/Y121F/T289A

- Patients with IA and chronic Aspergillus diseases
- Low genetic diversity between azole-resistant isolates from unrelated patients
- No apparent fitness cost

PATIENT



Long-term triazole treatment for aspergilloma or cavitary lung disease

Variety of resistance mechanisms

- High genetic diversity between azole-resistant isolates from unrelated patients
- Lack of sporulation and reduced growth rate may occur

PE Verweij et al, CID 206, 62:362-368.

Global presence of azole resistance in A. fumigatus

Countries that reported the TR_{34}/L98H and TR_{46}/Y121F/T289A resistance mechanism in clinical or environmental A. fumigatus

PE Verweij et al, CID 206, 62:362-368.

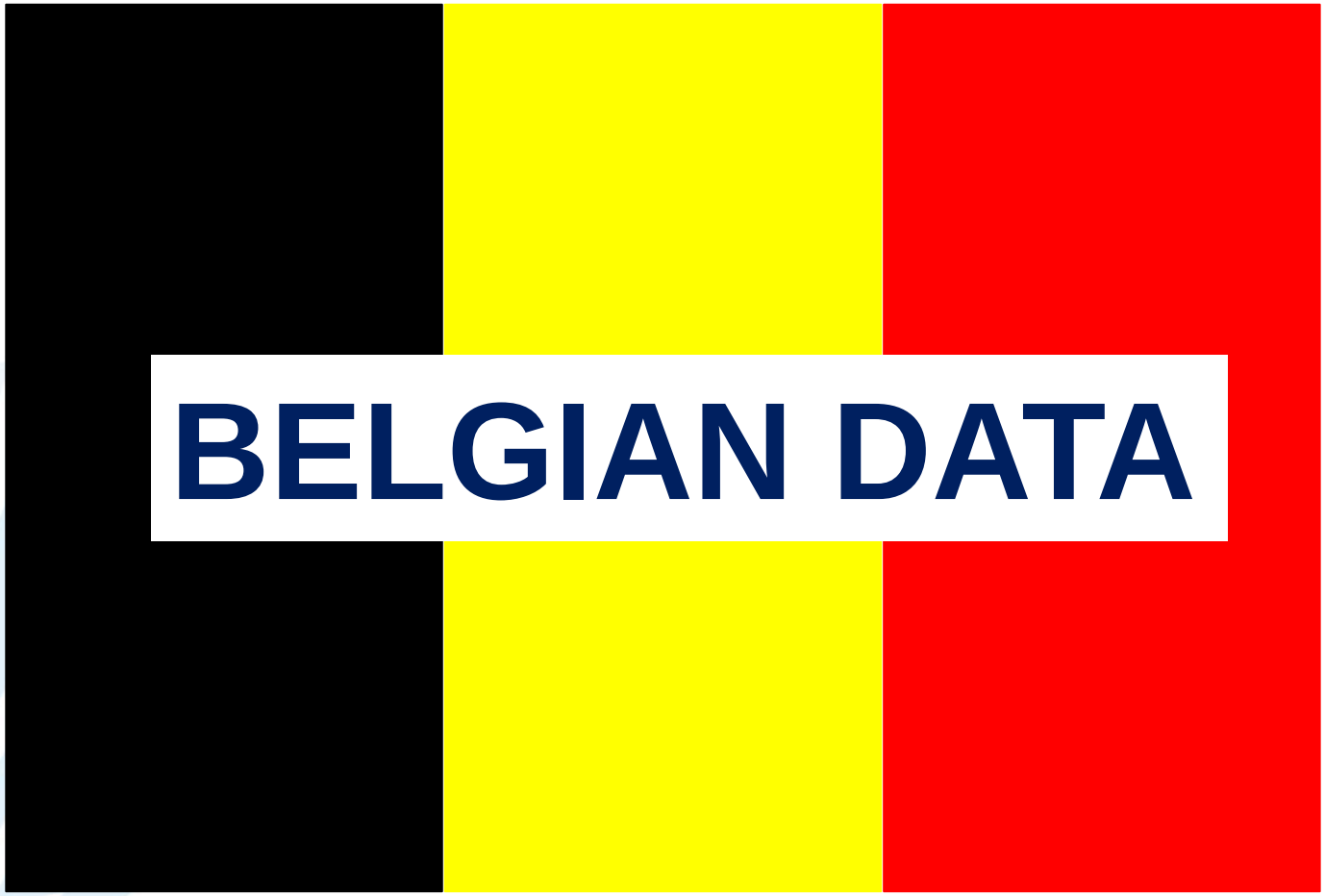
High prevalence of azole resistance in patients on the hematology ward in Utrecht

Patient characteristics											
Year	No. of patients	Age (years), median (range)	Male, %	Hospital ward	No. of patients (percentage of voriconazole-resistant isolates)	Resistance to voriconazole[a]		Resistance to itraconazole[a]		Resistance to posaconazole[a]	
						phenotype	no. of patient isolates (%)	phenotype	no. of patient isolates (%)	phenotype	no. of patient isolates (%)
2011	30	58.5 (10–80)	70.0	Haematology ICU	20 (50.0) 10 (0.0)	susceptible intermediate resistant	20/30 (66.7) 0 10/30 (33.3)	susceptible intermediate resistant	19/30 (63.3) 0 11/30 (36.7)	susceptible intermediate resistant	18/30 (60.0) 2/30 (6.7) 10/30 (33.3)
2012	42	63.5 (1–82)	42.9	Haematology ICU	19 (5.3) 23 (8.7)	susceptible intermediate resistant	34/42 (81.0) 5/42 (11.9) 3/42 (7.1)	susceptible intermediate resistant	36/42 (85.7) 0 6/42 (14.3)	susceptible intermediate resistant	34/42 (81.0) 3/42 (7.1) 5/42 (11.9)
2013	33	58 (9–78)	57.6	Haematology ICU	22 (18.2) 11 (0.0)	susceptible intermediate resistant	27/33 (81.8) 2/33 (6.1) 4/33 (12.1)	susceptible intermediate resistant	29/33 (87.9) 0 4/33 (12.1)	susceptible intermediate resistant	24/33 (72.7) 5/33 (15.2) 4/33 (12.1)
Total	105	60 (1–82)	55.2	Haematology ICU	61 (24.6) 44 (4.5)	susceptible intermediate resistant	81/105 (77.1) 7/105 (6.7) 17/105 (16.2)	susceptible intermediate resistant	84/105 (80.0) 0 21/105 (20.0)	susceptible intermediate resistant	76/105 (72.4) 10/105 (9.5) 19/105 (18.1)

[a]Voriconazole: resistant MIC >2 mg/L and susceptible MIC ≤1 mg/L; itraconazole: resistant MIC >2 mg/L and susceptible MIC ≤1 mg/L; posaconazole: resistant MIC >0.25 mg/L and susceptible MIC ≤0.12 mg/L.[8,9] Values between resistant and susceptible were considered intermediate.[8,9]

- 105 positive cultures collected; proven IA (5), probable IA (48) and no infection (52)
- 21/105 (20%) isolates were resistant to at least one azole
- 16/105 (15.2) isolates showed pan-azole resistance
- 16/17 (94.1%) of voriconazole resistant isolates exhibit *cyp51A* gene mutation

Fuhren et al., JAC 2015, 70: 2894-2898.


BELGIAN DATA

Belgium nationwide surveillance

	# Isolates	# Patients	Rate of azole-resistance	Prevalence of azole-resistance	Mechanism of resistance (number of patients)
Invasive aspergillosis	**134**	**122**			
A. fumigatus	115	108	5/115 (**4·4%**)	5/108 (**4·6%**)[4]	4 TR_{34}/L98H, 1 non-Cyp51A
A. niger	9	9	8/9 (89%)	8/9 (89%)	8 intrinsic (8 *A. tubingensis*)
Other species	10	10	0/10	0/10	
ABPA and bronchitis	**66**	**46**			
A. fumigatus	62	44	6/62 (**9·7%**)	4/44 (**9·1%**)	2 TR_{34}/L98H, 1 TR_{46}/Y121F/T289A, 1 non-Cyp51A mediated
A. niger	1	1	1/1	1/1	1 intrinsic (1 *A. tubingensis*)
Other	3	2	0/3	0/2	/
Chronic aspergillosis[1]	**20**	**15**			
A. fumigatus	15	13	0/15 (0%)	0/13 (0%)	/
A. niger	0	0	/	/	/
Other	5	3	0/5	0/3	/
Total	**220**	**182**			
A. fumigatus	192	164	11/192 (**5·7%**)	9/164 (**5·5%**)	6 TR_{34}/L98H, 1 TR_{46}/Y121F/T289A, 2 non-Cyp51A mediated
A. niger	10	10	9/10 (90%)	9/10 (90%)	9 intrinsic (9 *A. tubingensis*)
Other	18	15	0/18 (0%)	0/15 (0%)	/

E. Vermeulen et al., AAC 2015

Drug Resistance Updates 21–22 (2015) 30–40

Contents lists available at ScienceDirect

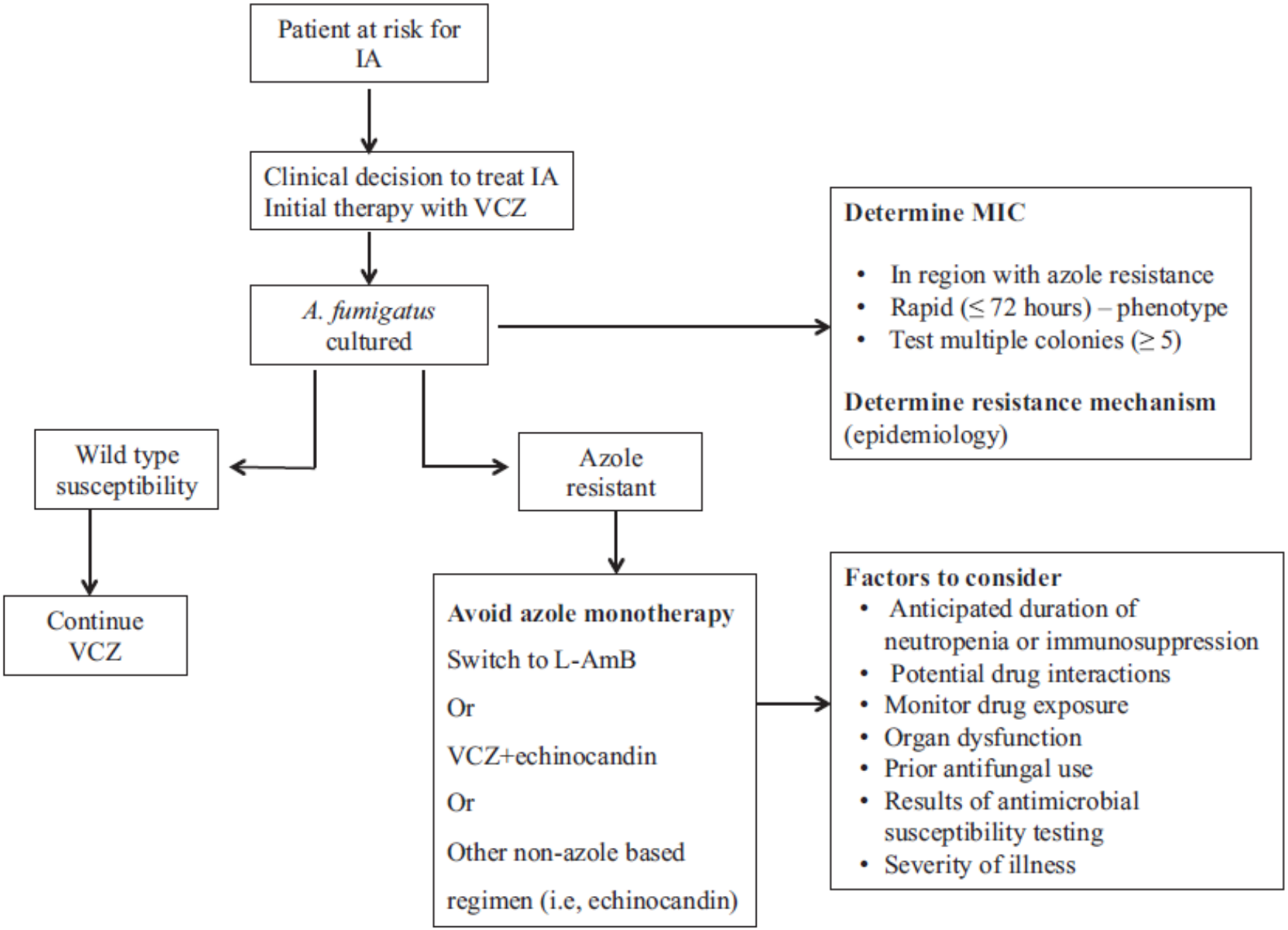
Drug Resistance Updates

journal homepage: www.elsevier.com/locate/drup

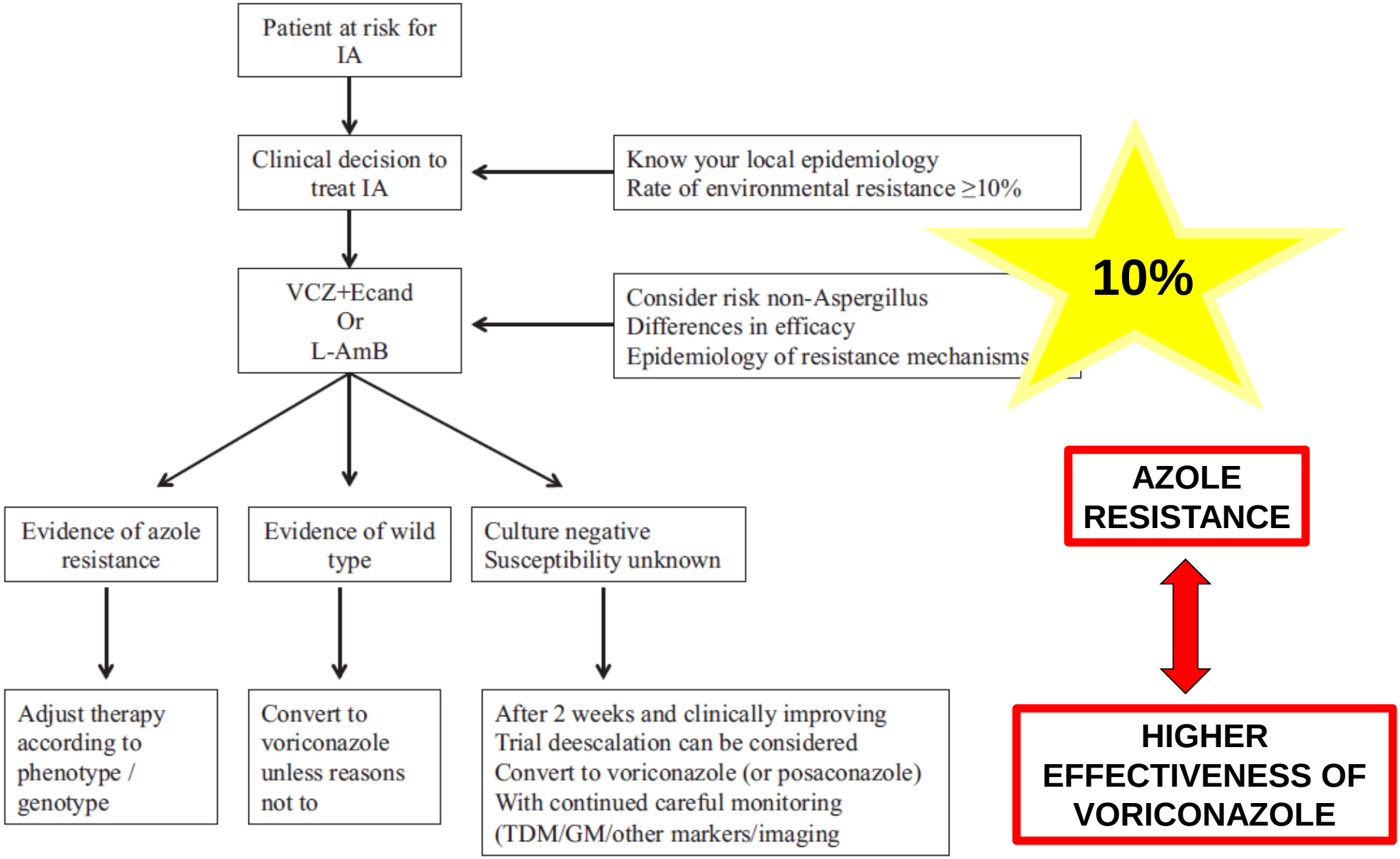
International expert opinion on the management of infection caused by azole-resistant *Aspergillus fumigatus*

Paul E. Verweij[a,*], Michelle Ananda-Rajah[b], David Andes[c], Maiken C. Arendrup[d], Roger J. Brüggemann[e], Anuradha Chowdhary[f], Oliver A. Cornely[g], David W. Denning[h], Andreas H. Groll[i], Koichi Izumikawa[j], Bart Jan Kullberg[k], Katrien Lagrou[l], Johan Maertens[m], Jacques F. Meis[a,n], Pippa Newton[h], Iain Page[h], Seyedmojtaba Seyedmousavi[a], Donald C. Sheppard[o], Claudio Viscoli[p], Adilia Warris[q], J. Peter Donnelly[r]

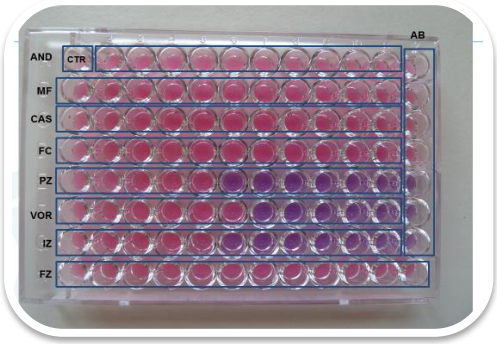
Management of patients with IA in regions with no/minimal azole resistance in the environment



Management of patients with IA in regions with ≥ 10% environment resistance



Triazole resistance detection in Aspergillus



MIC determination

- CLSI/EUCAST
- Commercial systems

Triazole resistance screening agar (VIPcheck™)

Sensitivity 97%
Specificity 98%

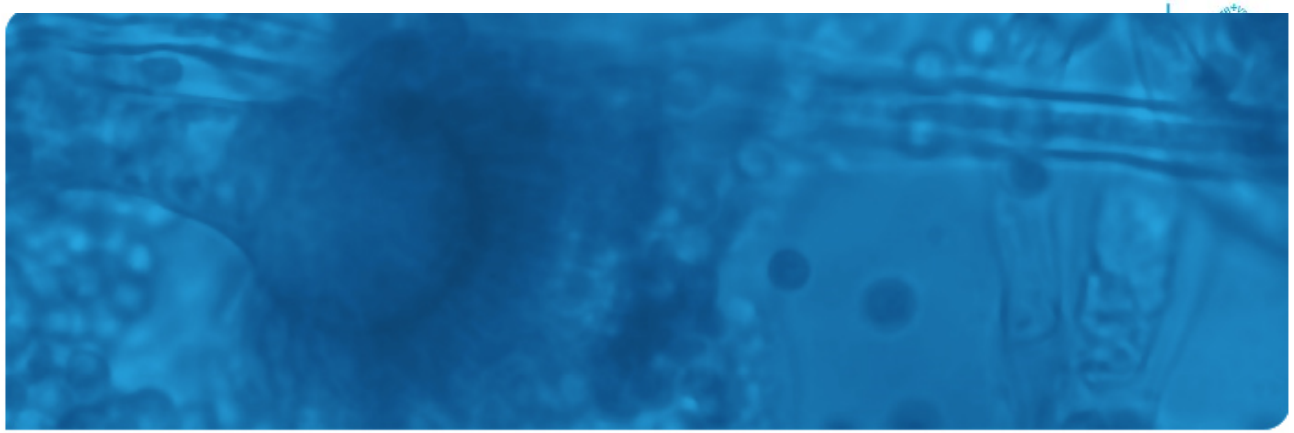
Molecular methods

- In house
- AsperGenius® assay

Resistance multiplex
– L98H
– Tandem repeat 34
– T289A
– Y121F

- Always perform susceptibility testing if antifungal therapy is intended – contact the lab!
- Both azole-susceptible and azole-resistant phenotypes can be simultaneously present in culture, test multiple colonies!

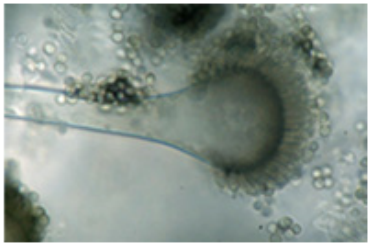
Belgian Society Human Animal Mycology



Belgian Society of Human and Animal Mycology

The **Belgian Society for Human and Animal Mycology (BSHAM)** was created in 1964 by Raymond Vanbreuseghem, physician, Professor of Parasitology at the Free University of Brussels, and Professor of Medical Mycology at the Institute of Tropical Medicine in Antwerp.

It is an VZW/ASBL concerned with pathologies induced by fungi and yeasts such as fungal allergies, mycotoxicoses, mycetism and mycoses.



BSHAM is a bilingual society with about 85 members presently.

It is directed by a Board meeting 2 or 3 times per year, most of the information being given by e-mail. A plenary administrative meeting (general meeting) is organised once a year. The annual scientific meeting takes place successively in Brussels, Flanders and Wallonia.

All BSHAM members are automatically members of the European Confederation of Medical Mycology. Many of them are also member of the **International Society for Human and Animal Mycology (ISHAM)**.

Account: IBAN BE 35 0011 2595 0637- BIC GEBABEBB

http://www.medmycol.be/