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Antibiotic Resistance: Mastitis Pathogens

Subcommittee of the NMC Research Committee

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agroscope LIEBEFELD-POSIEUX

Content:

- **Introduction**
- **How do we measure antibiotic resistance ?**
- **What do we measure ?**
- **Mastitis pathogens and trends in antibiotic resistance**

Facts:

- ✓ Mastitis is one of the most important diseases in dairy cattle
- ✓ Mastitis is an infectious disease, usually caused by bacteria
- ✓ Mastitis is the single most common cause for antibiotic treatment in dairy cattle

Use of Antibiotic Udder Preparations in Switzerland

Results of a Market Research Study 1993

Intramammaries	Amount
Lactation products:	
• syringes (pieces)	1 264 000
• suspensions in bottles (liters)	10 500
Dry cow products:	
• syringes	1 642 000

CH dairy cow population in 1993: 805 000

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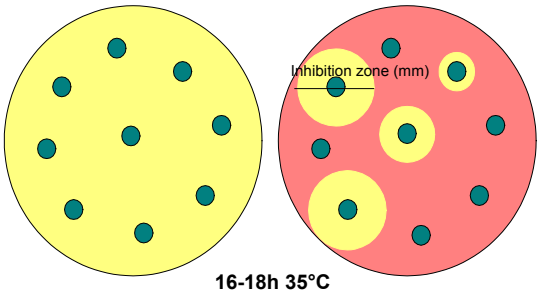
Antibiotic Susceptibility Testing

1. **Agar Diffusion Test (Disc Diffusion Method)**
2. **Determination of the Minimal Inhibititory Concentration (MIC) or the Minimal Bacteriocidal Concentration (MBC)**
3. **Other Methods (e.g. Impendance)**

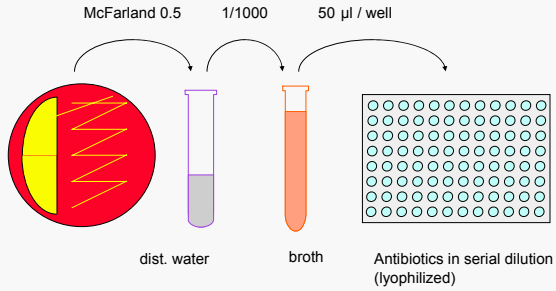
➔➔➔ same basic principle

Disk Diffusion Test

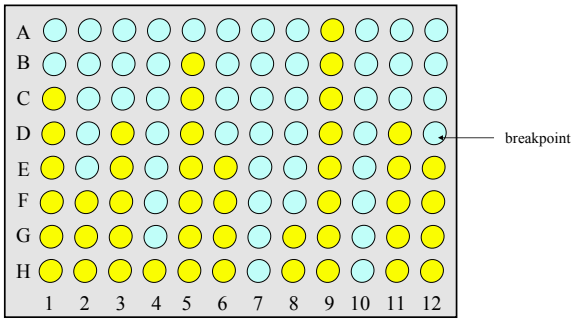


16-18h 35°C

MIC Determination (Sensititre® System)



MIC Determination: Result After Incubation



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Principle of Antibiotic Susceptibility Testing

Determination of the minimal concentration of a specific antimicrobial substance which is needed to inhibit the growth of a specific bacterial strain or to kill it.

A bacterial strain is considered to be resistant, *„if the concentration of a specific antimicrobial substance to kill or inhibit its growth is higher than achievable in vivo“.* **(Normenausschuss Medizin DIN 1979)**

The Breakpoint Problem

Achievable concentration in vivo:

- ❖ where? (blood, milk, tissue)
- ❖ different pharmacokinetics (man vs. animal, cow vs. cat)
- ❖ mode of treatment (systemic vs. intramammary)

- **Introduction**
- **How do we measure antibiotic resistance ?**
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- **Mastitis pathogens and trends in antibiotic resistance**

Key questions of the NMC study:

1. After 4 decades of antibacterial drug use in dry cow and lactation therapy, does scientific data exist to demonstrate emerging antimicrobial resistance in mastitis pathogens?
2. Does scientific data exist that supports the need for systematic change in dry cow therapy to prevent the development of resistance of mastitis pathogens antibacterial drugs within a herd?

Overview of Literature

Comparison of resistance data from different resistance studies: Mission impossible !

- **different techniques, different laboratory skills**
- **different breakpoints**
- **lack of species differentiation**
- **different geographical regions**

Resistance Monitoring of Mastitis Pathogens in Switzerland

- ✓ **the same laboratory, the same people**
- ✓ **the same technique (MIC determination)**
- ✓ **the same breakpoints**
- ✓ **bacterial isolates from the same regions of Switzerland**

Antimicrobial resistance of the major mastitis pathogens in Switzerland

Survey 1980-1998

Antibiotic	*S. aureus* (% resistant strains) 1980	1986	1992	1998	Streptococci (non agal.) (% resistant strains) 1980	1986	1992	1998
Penicillin G	47.8 *	33.3 *	9.4	9.0	0.5	0	0	0.1
Cloxacillin	0	0	0.4	0	5.6	9.7	10.1	8.5
Cefoperazon	0 **	0 **	0	0	NT	3.2	5.8	4.3
Spiramycin	0.2	0.4	0.4	0.4	1.2	6.8	4.8	3.4
Chloramphenicol	5.3	2.0	2.9	3.1	1.8	4.3	0.5	2.8
Neomycin	0.2	0.4	0.4	0.5	NT	NT	NT	NT
Amoxycillin (Clavulanate potent..)	NT	NT	0	NT	NT	NT	NT	NT
Rifamycin	NT	NT	0	0	NT	NT	6.9	7.4
Gentamicin	NT	0	0	0.1	NT	1.4	3.2	2.7
Norfloxacin	NT	NT	NT	NT	NT	NT	12.7	14.8

* : Penicillinase - producers ** : Cefalotin NT: not tested

Antimicrobial resistance of the major mastitis pathogens in Switzerland

Survey 1980-1998

Antibiotics	Coliforms (% resistant strains) 1980	1986	1992	1998
Ampicillin	16.0	26.8	23.3	24.2
Cefoperazon	3.7*	9.8*	2.1	5.8
Chloramphenicol	12.4	14.7	6.2	3.2
Neomycin	13.4	12.9	10.4	11.8
Polymyxin	0	2.2**	2.1**	0.3
Gentamicin	0	0	0.5	1.1
Norfloxacin	NT	NT	0	0
Cotrimoxazol	3.7	8.9	6.7	5.9

* : Cefalotin ** : Proteus NT : not tested

Conclusion

(based on an *overall appreciation* of resistance data in literature)

Key Question 1

After 4 decades of antibacterial drug use in dry cow and lactation therapy, does scientific data exist to demonstrate emerging antimicrobial resistance in mastitis pathogens?

NO

Key Question 2

Does scientific data exist that supports the need for systematic change in dry cow therapy to prevent the development of resistance of mastitis pathogens antibacterial drugs within a herd?

NO