

Risk Factors for Infection and
Molecular Typing in Patients in the
Intensive Care Unit Colonized With
Enterobacter aerogenes

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INTRODUCTION

❖ **An increase of *Enterobacter aerogenes* infections has been reported in european ICUs**

De Gheldre Y. et al. J. Clin. Microbiol., 1997 ; 35 :152-160

Jalaluddin S. et al. J. Clin. Microbiol., 1998 ; 36 : 1846-1852

Ronveaux O. et al. Clin. Microbiol. Infect. 1999; 5 : 622-627

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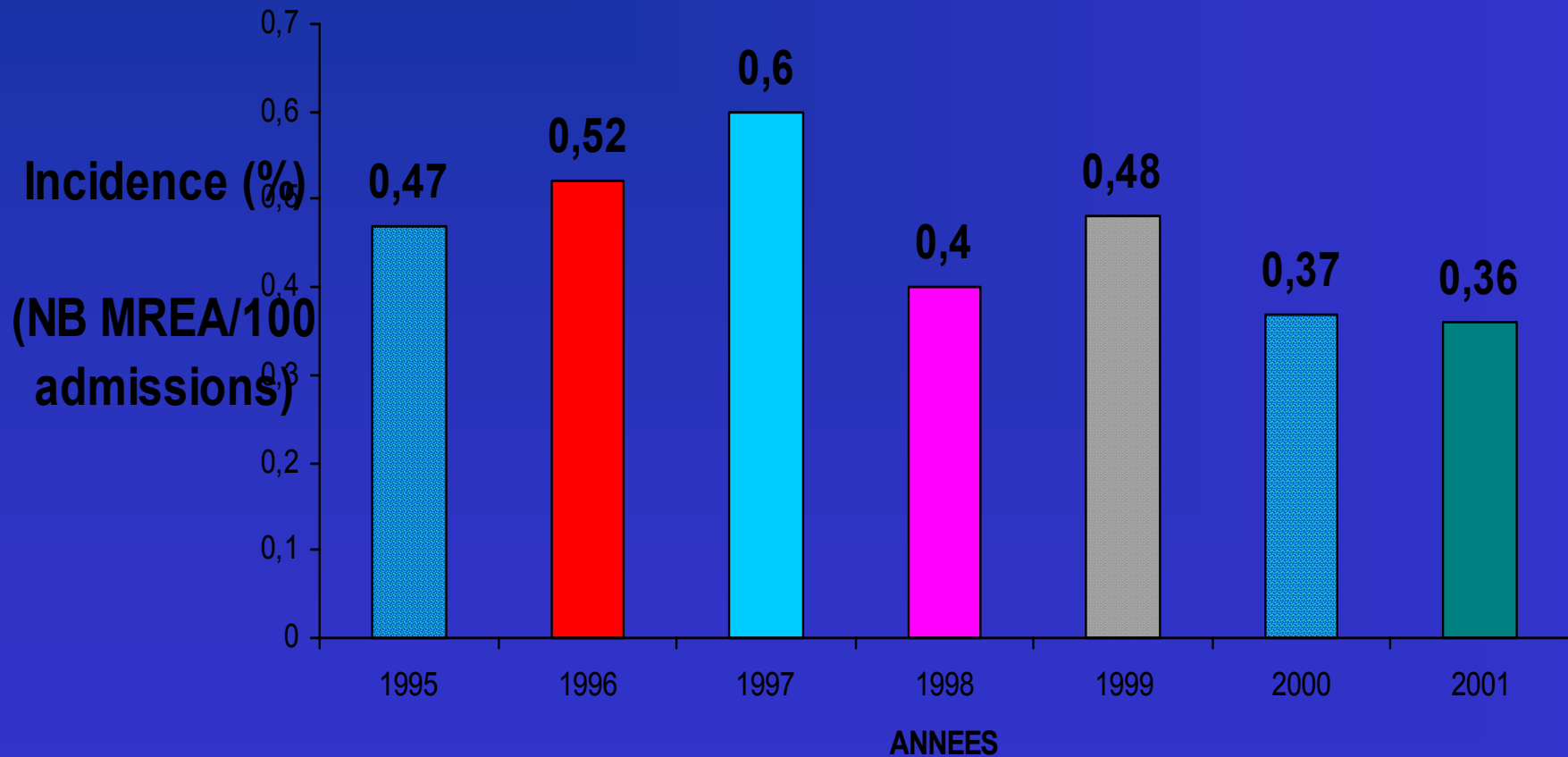
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- ❖ ***Enterobacter aerogenes* is actually considered as the third Gram-negative bacilli in cause of nosocomial infections after *Escherichia coli* and *Pseudomonas aeruginosa***

Glupczynski Y. et al. Acta Clin. Belgica, 1998 ; 53 : 28-38

INCIDENCE D'ACQUISITION NOSOCOMIALE DE MREA 1995-2001



INTRODUCTION

Comparison ICU > < other units :

1995	RR= 7.39, IC 95% (4.17 – 13.10)	/ p = 10 ⁻⁶
1996	RR= 8.24, IC 95% (4.78 – 14.19)	/ p = 10 ⁻⁶
1997	RR= 6.53, IC 95% (3.81 – 11.19)	/ p = 10 ⁻⁶
1998	RR= 4.0, IC 95% (1.91 – 8.37)	/ p = 10 ⁻⁵
1999	RR= 2.11, IC 95% (0.95 - 4.68)	/ p = 0.06
2000	RR= 4.06, IC 95% (1.95 – 8.45)	/ p = 10 ⁻⁶
2001	RR= 1.24, IC 95% (0.38 – 4.02)	/ p = 0.72

INTRODUCTION

Hospital outbreak

Piagnerelli et al. Infect. Control. Hosp. Epidemiol. 2000; 21 : 651-653

- ❖ **30-bed geriatric acute unit.**
- ❖ **During 3 months (1998).**
- ❖ **12 patients colonized/infected by MREA.**
- ❖ **Risk factors : central and urinary catheters.**
- ❖ **Identical clone by PFGE study.**

INTRODUCTION

Hospital outbreak

Piagnerelli et al. Infect. Control. Hosp. Epidemiol. 2000; 21 : 651-653

- ❖ **Contact isolation after detection of the second patient**
- ❖ **6 new nosocomial cases**
- ❖ **Decision to close the unit to new admissions.**

INTRODUCTION

ICU outbreak

Carlier et al. Crit. Care 1997, 1 : P 35

- ❖ **February 1996, over a 3-day period.**
- ❖ **4 patients colonized at multiple sites .**
- ❖ **Colonization ultimately progressed to infection in 3 patients.**
- ❖ **75 % mortality.**
- ❖ **Identical clone by RAPD study.**

INTRODUCTION

Risk Factors of Colonization/Infection in ICU

Piagnerelli et al. Crit. Care 1998, 2 : P 97

- ❖ **A 3 month prospective study (1995).**
- ❖ **Perineal swabs the admission day, discharge and on a weekly basis.**
- ❖ **146 patients. 9.6 % colonization.**
- ❖ **Risk factors :**
 - **corticoid therapy**
 - **ICU length of stay**
 - **SAPS II**
- ❖ **Mortality : 43 %**

OBJECTIVES

- ❖ To determine the frequency of colonization by *E.a.* in ICU patients hospitalized more than 48 hours.

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- ❖ To evaluate the risk-factors of infection in colonized patients by the same bacteria.

OBJECTIVES

- ❖ **PFGE was used to determine the genotypes of isolates.**

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- ❖ **PFGE was used to determine the genotypes of isolates.**
- ❖ **To determine risks of infection in colonized patients to develop in the future optimal preventive policies in these patients.**

METHODS

- **From January to September 1998**
- **Perineal swabs on admission, weekly and on discharge**

METHODS

Colonization : isolation of E.a. in the absence of signs or symptoms of infections.

Infection : isolation from a normally sterile body site, concurrent with accompanying signs and symptoms of infection.

METHODS

- Antimicrobial susceptibility

Resistance 2/3 : ceftazidime, ciprofloxacin, amikacin.

- Clonality using PFGE

*Sma*I –digested DNA of *Staphylococcus aureus* NCTC 8325

Strains with more than 70 % similarity were considered identical

RESULTS

- **Screening of 204 patients :**
 - **24 (11.4 %) were colonized by MREA**
 - **8 became infected during their ICU stay**
 - **2 infected without prior colonization**

RESULTS

➤ **52 strains : for clinical infected**

- - 7 respiratory tract
- - 4 urinary tract
- - 1 wound infection
- - 1 blood infection

: for colonization

- 24 rectal swabs

RESULTS

- Antimicrobial Susceptibility

- Ceftazidime- R 76 %
- Ciprofloxacin- R 59 %
- ESBL + 66 % 47 % clone 1
 17 % clone 2

RESULTS OF THE ANALYSIS OF RISK FACTORS FOR EA COLONIZATION

	<u>Patients without colonization</u>	<u>With colonization</u>	<u>RR</u>	<u>CI 95</u>	<u>p</u>
	N = 170 (%)	N = 24 (%)			
Male	101 (59)	14 (58)	0.98	0.68-1.41	0.92
Mean age	69	79.5			0.09
Admission via					
Long term	7 (4)	1 (4)	1.01	0.13-7.87	0.99
Other unit	106(62)	18(75)	1.2	0.93-1.56	0.23
Home	55 (32)	4(17)	0.52	0.21-1.29	0.12

RESULTS OF THE ANALYSIS OF RISK FACTORS FOR EA COLONIZATION

	<u>Patients without colonization</u>	<u>With colonization</u>	<u>RR</u>	<u>CI 95</u>	<u>p</u>
	N = 170 (%)	N = 24 (%)			
Chronic dis.	108 (63)	13 (54)	0.85	0.58-1.25	0.38
SAPS II	35	42			0.03*
<u>Surgery</u>	46(27)	11(46)	1.69	1.03-2.79	0.06
<u>Infection on ICU admission</u>	74 (43)	14 (58)	1.34	0.92-1.96	0.17
<u>AB</u>	124(73)	22(92)	1.26	1.08-1.46	0.047*
<u>Corticoids</u>	74 (43)	10(42)	0.96	0.58-1.58	0.86

RESULTS OF THE ANALYSIS OF RISK FACTORS FOR EA COLONIZATION

	<u>Patients without colonization</u>	<u>With colonization</u>	<u>RR</u>	<u>CI 95</u>	<u>p</u>
	N = 170 (%)	N = 24 (%)			
IS	3 (2)	1 (4)	2.36	0.26-21.8	0.44
CVP	155(92)	24(100)	1.1	1.05-1.15	0.13
Arterial Line	153(90)	23(96)	1.06	0.97-1.17	0.36
Surgical drain	43 (25)	10 (42)	1.65	0.96-2.82	0.09
Urinary cath	146(86)	22 (92)	1.07	0.93-1.22	0.44
Nasogastric tube	95 (56)	18(75)	1.34	1.03-1.75	0.08

RESULTS OF THE ANALYSIS OF RISK FACTORS FOR EA COLONIZATION

	<u>Patients without colonization</u>	<u>With colonization</u>	<u>RR</u>	<u>CI 95</u>	<u>p</u>
	N = 170 (%)	N = 24 (%)			
Endoscopy	55 (32)	15 (62)	1.93	1.32-2.8	0.004*
MV	73(43)	16(67)	1.55	1.11-2.16	0.029*
Hosp/ICU (days)	1.0	6.5			0.028*
ICU stay Days	5	9			0.003*
Mortality	33(19)	8 (33)	1.72	0.9-3.27	0.12

RESULTS OF THE ANALYSIS OF RISK FACTORS FOR EA INFECTION

	<u>Colonized Patients</u>	<u>Infected Patients</u>	<u>RR</u>	<u>CI 95</u>	<u>p</u>
	N = 24 (%)	N = 10 (%)			
Male	14 (58)	6 (60)	1.03	0.56-1.89	0.93
Mean age	76.5	63.5			0.039*
Admission via					
Long term	1 (4)	0 (0)	0	0-45.4	0.52
Other unit	18(75)	5(50)	0.67	0.34-1.29	0.16
Home	4 (17)	5(50)	3.0	1.01-8.91	0.047*

RESULTS OF THE ANALYSIS OF RISK FACTORS FOR EA INFECTION

	<u>Colonized Patients</u>	<u>Infected Patients</u>	<u>RR</u>	<u>CI 95</u>	<u>p</u>
	N = 24 (%)	N = 10 (%)			
Chronic dis.	13 (54)	9 (90)	1.66	1.09-2.53	0.049*
SAPS II	42	44.5			0.97
Surgery	11(46)	4 (40)	0.87	0.36-2.09	0.76
Infection on ICU admission	14 (58)	5 (50)	0.86	0.42-1.74	0.66
AB	22(92)	10(100)	1.09	0.97-1.23	0.35
Corticoids	10 (42)	5(50)	1.2	0.55-2.62	0.66

RESULTS OF THE ANALYSIS OF RISK FACTORS FOR EA INFECTION

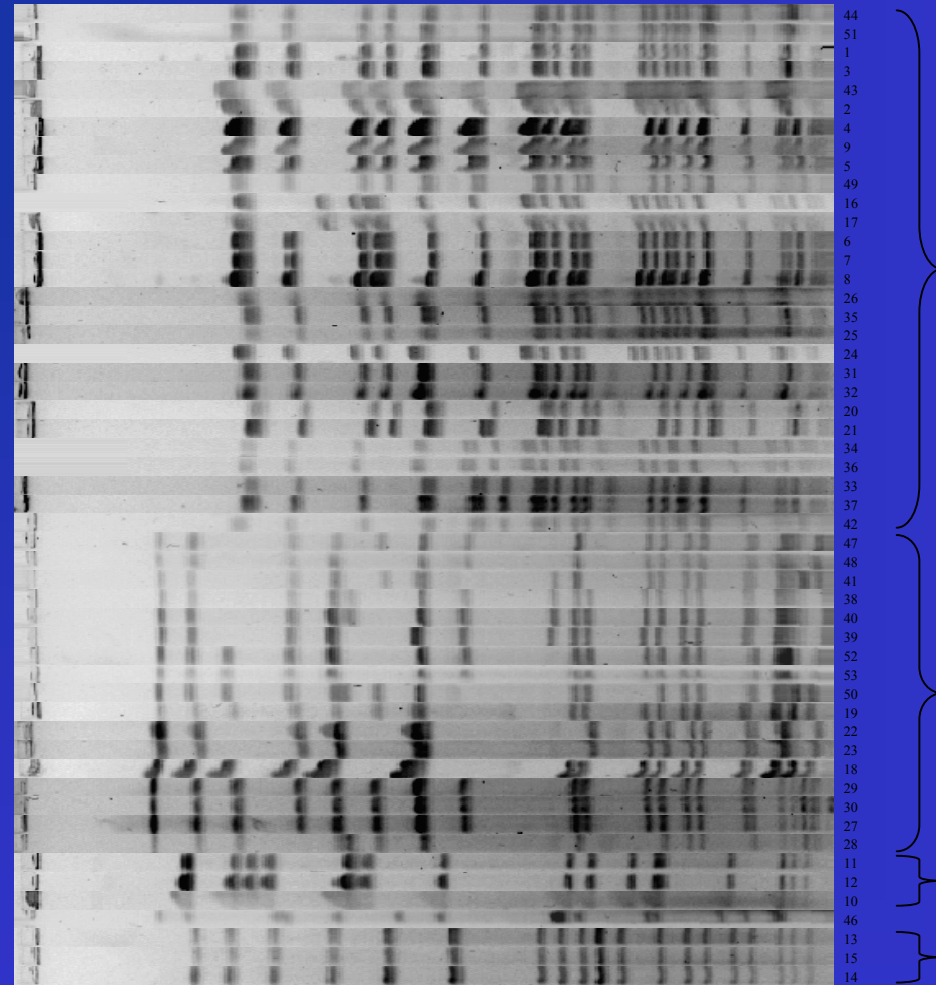
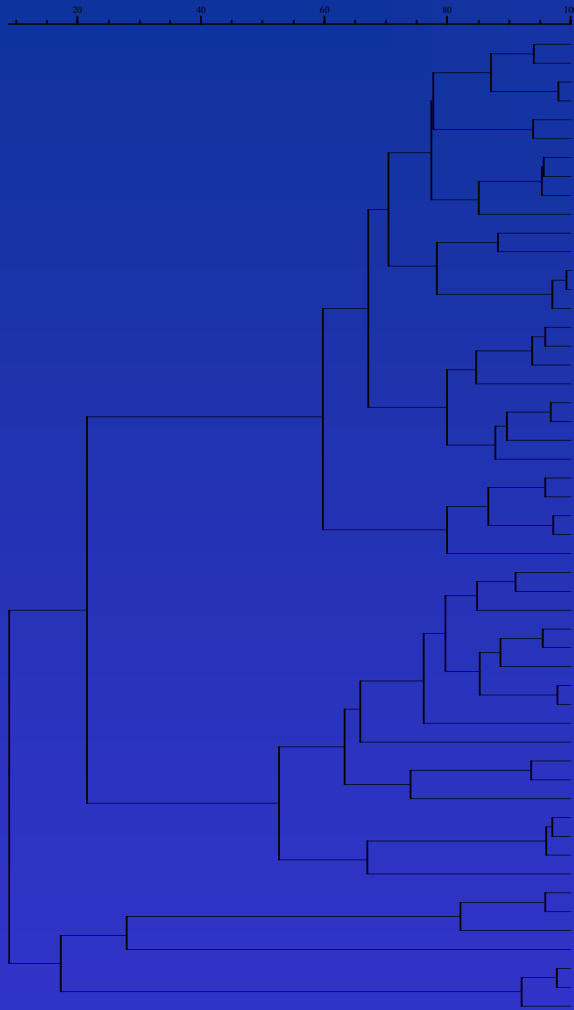
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	N = 24 (%)	N = 10 (%)			
IS	1(4)	0 (0)	0	0-45.4	0.52
CVP	24 (100)	10 (100)			
Arterial Line	23(96)	10 (100)	1.04	0.96-1.13	0.52
Surgical drain	10 (42)	4 (40)	0.96	0.39-2.35	0.93
Urinary cath	22 (92)	10 (100)	1.09	0.97-1.23	0.35
Nasogastric tube	18 (75)	10 (100)	1.33	1.06-1.68	0.86

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	<u>Colonized Patients</u>	<u>Infected Patients</u>	<u>RR</u>	<u>CI 95</u>	<u>p</u>
	N = 24 (%)	N = 10 (%)			
Endoscopy	15 (62)	10 (100)	1.5	1.17-2.18	0.026*
MV	16 (67)	10 (100)	1.5	1.13-1.99	0.039*
Hosp/ICU (days)	6.5	2.5			0.5
ICU stay Days	9	31			0.007*
Mortality	8 (33)	3 (30)	0.9	0.3-2.71	0.85

PFGE ANALYSIS (52 samples)

Figure 2



1 28 strains

2 17 strains

3

5

4

RESULTS

- **Attack rate of colonization or infection**
of 28 % for clone 1
of 20 % for clone 2

7 / 8 infected patients had the same genomic profile for colonization and infection

CONCLUSIONS

- **Risk factors for infection were not new :**

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Prolonged ICU stay and invasive procedures, especially pulmonary procedures – endotracheal intubation

- **mechanical ventilation**
- **bronchoscopy**

→ most infections were pulmonary

CONCLUSIONS

- **PFGE analysis :**

CONCLUSIONS

- **PFGE analysis :**
 - **2 principal clones as described in studies in Belgian hospitals**

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CONCLUSIONS

- **Colonization is a prerequisite of infection**
- **Infection is usually due to the same clone causing prior colonization.**