

# Multidrug-resistant *Pseudomonas aeruginosa* outbreak in a surgical intensive care unit: association with contaminated patient care oil for aromatherapy

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## Abstract

Multidrug-resistant *Pseudomonas aeruginosa* (MDR-P) appears to have become an increasingly frequent cause of hospital-acquired infections. A surveillance study was initiated in order to determine an outbreak due to MDRP affecting 8 patients in a 16-bed intensive care unit (ICU) at the University Hospital of Innsbruck, Austria during August to September 2012. DNA genotyping of the MDR-P isolates obtained from patients and wards using Random arbitrary polymorphic DNA (RAPD) was performed to investigate the genetic relationships among MDR-P strains. Within 145 environmental samples MDRP was detected in 13.8% (20 of 145) in the ICU and genotyping confirmed seven patients and four environmental strains, including the isolate of a patient care oil being identical. The oil applied was shared among patients colonized or infected with MDR-P. Discontinuation of sharing the oil stopped further cases and DNA genotyping and epidemiological data suggested that an outbreak had occurred. Our study emphasizes the significance of exogenous sources as risk factors for MDRP infections and recommends not sharing cosmetic products within the hospital setting.

## Objectives

*Pseudomonas aeruginosa* (*P. aeruginosa*) is a major nosocomial pathogen and is associated with a broad spectrum of human infections, especially among mechanically ventilated or immunocompromised patients in intensive care units (ICUs). *P. aeruginosa* can persist in moist environments in hospital settings and skin, oropharyngeal or fecal carriage is not uncommon. Most infections are endemic but numerous nosocomial outbreaks have been linked to environmental contamination (i.e. contaminated water), patient-to-patient transmission, contaminated medical devices and medical care products. An increase in hospital outbreaks caused by multidrug-resistant *P. aeruginosa* (MDR-P) have been described over the past decade. During August and September 2012 8 patients (5 male, 3 female) in the surgical intensive care unit (SICU) at the University Hospital of Innsbruck were colonized with a MDR-P at different body sites. Active epidemiological surveillance was commenced and implied descriptive analysis, observation of patient care / procedures, compliance to hygienic measures, environmental sampling and molecular typing of MDR-P isolates. The objectives of this investigation were to determine a potential common source and risk factors for transmission in order to implement infection control measures to terminate the outbreak.

## Methods

The strains of the patients, obtained from routine diagnostic samples, were collected from diverse body sites, including nose and throat, central venous catheter, tracheal secret and catheter urine. Cases were identified through microbiological data and review of medical records was conducted. Healthcare workers (HCWs) of the ICU were interrogated by members of the hospital hygiene and practices or procedures that might have contributed to acquisition of *P. aeruginosa* were discussed. Performances of hygienic measures (i.e. hand hygiene, wound care, disinfection of surfaces, handling of medical devices, etc.) were observed to identify potential gaps of infection control procedures. Several samples, i.e. water samples, swabs, contact samples from surfaces of the patients' environment and HCWs hands, samples of medical devices and medical care products were taken throughout the outbreak period. Screening of all patients admitted to the ICU was performed and samples were collected on admission, weekly and accordingly to clinical indication. For identification of *P. aeruginosa* standard microbial methods were used. To determine resistance in isolates disk diffusion method according to the EUCAST protocol was performed. Multidrug-resistance was defined as non-susceptibility to at least one agent in three or more antimicrobial categories. Investigation of genetic relationship among the strains was performed by Random arbitrary polymorphic DNA (RAPD).

## Results

From August to September 2012, 8 consecutive patients, located at the surgical ICU were colonized by a MDRP strain. Within 145 environmental samples *P. aeruginosa* was detected in 13.8% (20 of 145), 40% (8 of 20) were found to be MDR-P. RAPD typing of all strains revealed the presence of 14 genotypes whereat the same type (type A) was found in isolates of 7 patients and in 4 samples of the environment (Table 1).

Whilst performing controls of hygienic measures and sampling occasional suboptimal hygienic practices were discovered, including gaps in cleaning and disinfection, discharging wash water from patients directly into the basin (allowing splash back onto the water outlet and vicinity of the basin) or no contamination precaution between the basin and the aseptic work space where the medical devices and care product, i.e. care oil, were located. Moreover, patient care oils were shared among patients. Cohort barrier precautions for patients colonized with MDR-P were forced. Contact precautions required health care workers to wear protective equipment for all interactions that might involve contact with the patient or potentially contaminated areas. Adherence to hand hygiene and strict disinfecting procedures were also approved and sharing the care oil was stopped.

Information / education of the staff and performance of surveillance cultures from the HCWs and environment were conducted repeatedly throughout the outbreak period. After implementation of patient-related use of the oil the outbreak was terminated.

Table 1: Reservoirs of *P. aeruginosa* during the outbreak.

Site of isolation	First isolation of <i>P.a.</i> *	MDRP**	Room no.	Genotype***
<b>Patient no.</b>				
1	07.08.2012	yes	3	A
2	05.08.2012	yes	2	A
3	04.08.2012	yes	2	A
4	07.08.2012	yes	2	A
5	17.08.2012	yes	3	A
6	11.09.2012	yes	4	A
7	27.08.2012	yes	3	A
8	04.08.2012	no	1	B
<b>Environment</b>				
Tap	07.08.2012	yes	2	A
Overflow of basin	07.08.2012	yes	2	A
Surface of basin	07.08.2012	yes	2	A
Patient care oil	31.08.2012	yes	2	A
Extraction tube for the ultra-filtration can (patient no. 8)	08.08.2012	yes	1	C
Overflow of basin	23.08.2012	yes	2	D
Overflow of basin	23.08.2012	no	1	D
Overflow of basin	07.08.2012	no	3	E
Ultra-filtration can	09.08.2012	no	-	F
Rinse water of the automatic endoscope reprocessor	12.09.2012	no	-	G
Tap	07.08.2012	no	1	H
Throat swab of HCW	17.09.2012	no	-	I
Overflow of basin	07.08.2012	no	3	J
Tap	07.08.2012	yes	2	K
Extraction tube for the ultra-filtration can	09.08.2012	no	-	L
Ultra-filtration can inside (patient 8)	09.08.2012	no	1	M
Transesophageal tube	31.08.2012	no	-	N

\* *Pseudomonas aeruginosa*; \*\* multidrug-resistant *P. aeruginosa*; \*\*\* Genotypes were numbered with capital letters

## Conclusion

The results of our outbreak investigation elucidates the importance of exogenous sources for *P. aeruginosa* in ICUs. The knowledge of the significance of different transmission routes displays a major role for the design of optimal infection control strategies.