CLINICAL STUDY

The role of non-critical health-care tools in the transmission of nosocomial infections

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Abstract

The authors performed the cultivation of swabs taken from membranes of 110 stethoscopes of physicians, medical students and shared stethoscopes from ward consultant rooms. In addition to that, 24 random samples from other non-invasive health-care tools and the hospital environment were taken. In order to find out about the disinfection habits and knowledge of medical students, 97 of them were addressed in an anonymous questionnaire.

Out of 110 stethoscopes, microbial colonisation was not present only in nine cases (8 %). Staphylococcus sp. was present on 94 stethoscopes (85 %), out of which 19 (20 %) were methicillin-resistant staphylococci of various species. S. aureus was found in 16 cases (14 %), out of which MRSA made 12 % (two cases). Cultivation of 24 additional samples discovered methicillin-resistant staphylococci in four cases – two of them were MRSA present on the esmarch and a blood-presure cuff. The questionnaire revealed that only six (6 %) addressed medical students have ever disinfected their stethoscopes in the past.

Disinfection of non-critical tools should become an integral part of under-graduate and postgraduate education *(Tab. 1, Fig. 2, Ref. 7)*.

Key words: MRSA, stethoscopes, colonisation, infection, prevention.

Methicillin-resistant *Staphylococcus aureus* (MRSA) is becoming more and more prevalent in most countries in the world. However, when compared to methicillin-sensitive *S. aureus*, MRSA was not found to be more virulent. It is associated with prolonged hospitalisation, significantly higher financial expenses and increased occurence of secondary nosocomial complications due to prolonged duration of in-patient stay.

After having the opportunity to limit the impact of the worldwide spread of MRSA by making advantage of earlier experience of Western European countries and USA with MRSA control and prevention, it seems that Central and Eastern European (CEE) countries have missed their chance. Although some health-care institutions still seem to be generally MRSA-free, more and more hospitals in CEE report MRSA infections in patients and colonisation of the nosocomial environment. Our 950-bed tertiary care teaching institution was one of the first hospitals in Slovakia, where MRSA occurrence reached epidemic proportions in the first half of 2004. The index case was a patient with trauma admitted to the Traumatology Clinic and subsequently transferred to the Clinic of Intensive Medicine where the environment and other patients also became colonised. Despite immediate and complex efforts to eliminate MRSA, e.g. by means of isolation of colonised/infected patients, as well as to decolonise them and temporarily close and decontaminate thoroughly the affected departments, it was shown to be unsuccessful. Not only that all of applied measures did not lead to MRSA elimination but MRSA in the meantime had spread to other departments and clinics of the teaching hospital in a way that has not been successfully clarified.

The primary attention to nosocomial infections prevention is usually paid to high-risk invasive diagnostic and therapeutic health-care tools while the importance of less critical health-care tools tends to be underestimated. Several studies published in the past reported the spread of nosocomial microbial flora by

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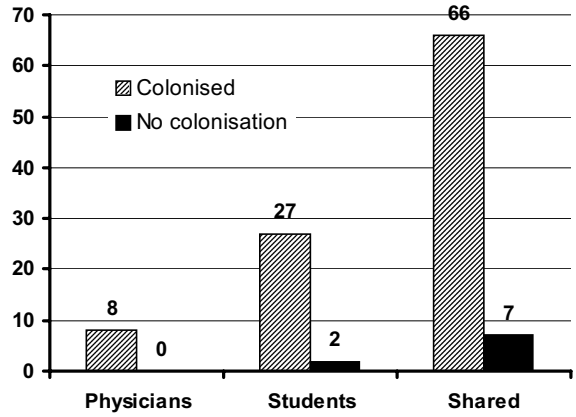

Fig. 1. Results of swabs cultivation from stethoscope membranes according to groups.

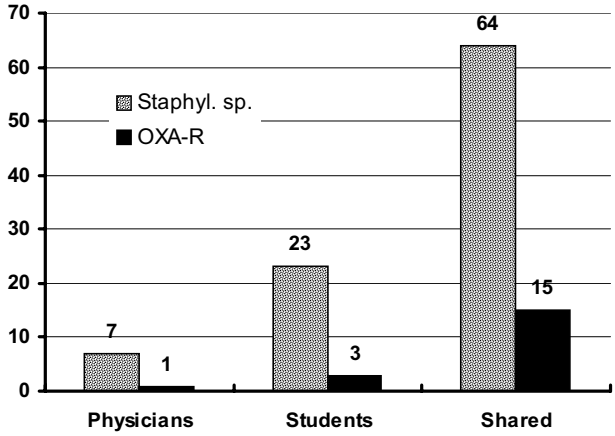

Fig. 2. Proportion of methicillin-resistant (oxacillin-resistant – OXA-R) staphylococci out of total number of staphylococci on stethoscope membranes.

means of non-critical health-care tools (1–3). In order to ascertain its role in MRSA transmission in our hospital, the attention has been focused on one of the diagnostic tools used on a daily basis – the stethoscope.

Methods

The authors performed cultivation of swabs taken from the membranes of 110 stethoscopes of clinical physicians, medical students and stethoscopes from ward consultant rooms shared by nurses and doctors e.g. for the measuring of blood pressure of in-patients. The profile of antibiotic resistance was obtained for the staphylococci species. In order to find out the knowledge and habits of medical students in the fifth (the last but one) year of their studies, 97 randomly selected students were addressed in an anonymous questionnaire focused on the disinfection of their stethoscope membranes. In order to utilise daily available capacity of our microbial laboratory, 24 random samples were taken from other non-invasive health-care tools (esmarch, blood-pressure cuffs) as well as from the environment of clinical departments.

Results

Out of 110 randomly selected stethoscopes at various clinical departments, microbial colonisation was not proved to be present only in nine cases (8 %). *Staphylococcus spp.* were present on 94 stethoscopes (85 %), out of which 20 % (19 cases) were methicillin-resistant staphylococci of various species: *S. haemolyticus* (6), *S. xylosus* (4), *S. simulans* (3), *S. aureus* (2), *S. sciuri* (2), *S. hominis* (1) and a further undefined *Staphylococcus sp.* (1). *S. aureus* was found in 14 % (16) of swabbed membranes, out of which the methicillin-resistant strains made up 12% (2).

A high degree of stethoscope membranes colonisation was found in all three groups (Fig. 1). Out of 29 stethoscopes of medical students, 27 (93 %) were colonised. In three cases (10 %), methicillin-resistant coagulase-negative staphylococci (MRCoNS) were present. In shared stethoscopes, at least one microbial species was present on 66 (90 %) of membranes. *Staphylococcus sp.* was found on 64 (87 %) of shared stethoscopes, out of which 13 (20 %) were MRCoNS and two (3 %) MRSA. All eight sampled stethoscopes of clinical physicians were colonised – in six cases (75 %) CoNS (*S. epidermidis* and *S. xylosus*) were present, *S. aureus* and *Pseudomonas sp.* were found, namely each species on one stethoscope (Tab. 1, Fig. 2.)

Beside staphylococci, other microbial flora were detected on stethoscope membranes including *Acinetobacter sp.* (2), *Pseudomonas sp.* (2), mycotic agents (3) and sporulants (5). Concomittant colonisation by two microorganisms was found in six shared stethoscopes (8 %) – in all cases the coincidence of *staphylococci* with other microorganisms, mainly with mycotic agents, was present.

Tab. 1. Swabs cultivation results according to subgroups.

Subgroup	No of sampled stethoscopes	No of colonised stethoscopes	CoNS	MRCoNS	S. aureus	MRSA
Shared	73	66	56	13	7	2
Students	29	27	17	3	3	0
Physicians	8	8	6	1	1	0
Total	110	101	79	17	11	2

Cultivation of 24 samples taken randomly from non-critical health-care tools as well as from the environment of clinical departments discovered the presence of methicillin-resistant staphylococci in four cases – two of them were MRSA on esmarch and blood-pressure cuff together with other two MRCoNS detected on a refrigerator handle and a door handle of the students' dressing room.

A simultaneous anonymous questionnaire study revealed that only six out of 97 (6 %) addressed medical students have ever disinfected the membranes of their stethoscopes in the past. Regular disinfection of stethoscopes was not reported.

Discussion

The cultivation of swabs taken from stethoscope membranes showed that these non-critical health-care tools might play a role in the spread of microbial flora including methicillin-resistant staphylococci. Their importance is emphasised by the fact that they are used on a daily basis in examinations of a number of patients. Finding MRSA on the surfaces of esmarch and blood pressure cuffs stresses the need for regular disinfection of a wider spectrum of non-critical health-care tools.

Hospital control measures focused on nosocomial infections prevention should not omit non-critical health-care tools.

Even though the clinical importance of detecting MRCoNS is with respect to their high degree of primary resistance to methicillin limited, the comparison of their occurrence before (pre-epidemic years) and after the origin of outbreak in our teaching hospital indicates that their spread can take place also via exogenous routes. Although the presence of CoNS in cultivations is often regarded as contamination (false positivity), they are also increasingly recognised as potentially important causative agent of nosocomial blood-stream infections. Therefore their new presence at hospital departments should not be underestimated.

A similiar spectrum of microbial contamination of stethoscope membranes was found also in other published studies, some of them detected also *Neisseria spp.*, *Enterococcus spp.* (including vancomycin-resistant *enterococci*, – *Corynebacterium spp*., *Micrococcus luteus*, as well as *Candida spp.* and *Aspergillus spp.* (4, 5, 6).

Even though the transmission of microorganisms to patients via contaminated stethoscopes does not necessarily present an immediate high risk for a patient, skin colonisation may lead to potentially serious wound infections, catheter-related infections or a patient may become a source of:

– infection for other high risk patients,
– contamination for health-care workers,
– nosocomial environment contamination.

Although contaminated stethoscopes were reported to be responsible for several outbreaks of nosocomial infections in the past, their disinfection is often neglected and this was also proved in our study both by swab cultivation as well as by outcomes of anonymous questionnaire. Disinfection of non-critical health-care tools should become an integral part of under-graduate as well as postgraduate curricula of medical personnel.

Since it has been proven that colonisation of a previously disinfected stethoscope membrane occurs already after one common examination lasting for 40 seconds in average (7), disinfectant should be applied after every use. In accordance with this are also recommendations of the Association for Professionals in Infection Control and Epidemiology (APIC) advising the use of any kind of disinfection solution commonly available at clinical departments. This will significantly reduce the rate of microbial flora contaminating stethoscope membranes. A similar effect was also noted after the use of antiseptic soap with subsequent water rinse.

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