Are our stethoscopes contaminated ?

Nos stéthoscopes sont-ils contaminés?

Faten Haddad[1], Jihène Bousselmi[2], Ali Mrabet[3], Kamel Ben Fadhel[2]

1-CHU Mongi Slim La marsa / Faculté de Médecine de Tunis
2-CHU Habib Thameur / Faculté de Médecine de Tunis
3-La direction générale de la santé militaire/ Faculté de médecine de Tunis.

RÉSUMÉ

Introduction: Les infections associées aux soins constituent un réel problème de santé publique. L'équipement médical contaminé, tels que les stéthoscopes, est un vecteur souvent négligé. Nous nous sommes intéressés à prouver l'éventuelle contamination des stéthoscopes et à étudier le profil microbiologique des germes isolés.

Méthodes : Il s'agissait d'une étude transversale sur une période de 2 mois (mai et juin 2014) incluant 39 stéthoscopes personnels de médecins exerçants dans 8 services de l'hôpital Habib Thameur. Des prélèvements par écouvillonnage étaient réalisés sur les membranes des stéthoscopes, acheminés rapidement au laboratoire et mis en culture sur milieu de Gélose au sang. La lecture était réalisée après 24 heures. Etaient considérées positives les cultures qui contenaient plus de 104 unités formants des colonies/ml. Ensuite nous avons procédé à l'identification du germe.

Résultats : Quinze prélèvements sur 39 étaient positifs soit 38%. Le Staphylococcus coagulase négative (SCN) était le germe prédominant (¾ des cas positifs). Des germes pathogènes étaient retrouvés dans 5 prélèvements (12% des prélèvements totaux) répartis comme suit : 2 Staphylococci Aureus Méticilline sensible, 2 SCN Méticilline résistants et un Pseudomonas aeroginosa. Ces derniers étaient retrouvés au niveau des stéthoscopes prélevés en cardiologie et en anesthésie réanimation. En cardiologie, 7/9 stéthoscopes étaient positifs. 5 contenaient des SCN dont 2 méticilline résistants et 2 contenaient un Staphylococcus aureus. En anesthésie réanimation, 6/13 stéthoscopes étaient positifs dont un à Pseudomonas aeruginosa.

Conclusion : Les stéthoscopes constituaient des réservoirs bactériens. La mise en place d'une procédure sur les bonnes pratiques de désinfection est nécessaire.

Mots-clés
Stéthoscope, contamination, épidémiologie, infections liées aux soins.

SUMMARY

Background : Health care-associated infections are a real public health problem. Contaminated medical equipments such as stethoscopes are often an overlooked vector. In our study, we were interested in proving our doctors stethoscopes contamination and in studying the microbiological profile of isolated germs.

Methods : This was about a cross-sectional study that lasted 2 months (May and June 2014) including 39 personal stethoscopes of all grade doctors working in 8 different departments in Habib Thameur Hospital. The swabs were taken from the membranes of the stethoscopes and sent quickly to our bacteriology service. Then, the bacteriological samples were subcultivated on blood agar. The reading tooks place 24 hours later. Were considered positive the cultures that contained more than 104 colony forming units/ml. Then we proceeded to the identification of the germ.

Results : Fifteen samples from 39 were positive that was 38 %. The coagulase- negative Staphylococcus was the predominant germ. The pathogenic germs were found in 5 positive samples that was 12 % from all the samples. They were distributed as follows: 2 Methicillin-susceptible Staphylococci Aureus, 2 methicillin-resistant coagulase- negative Staphylococci and one Pseudomonas aerogenusa. The pathogenic germs were found in stethoscopes taken from cardiology and intensive care unit (ICU). In cardiology, 7/9 stethoscopes were positive (5 coagulase- negative Staphylococcus among them 2 resistant methicillin and 2 Staphylococcus aureus.) In ICU, 6/13 stethoscopes were positive among them one Pseudomonas aerogenusa.

Conclusion : The stethoscopes constitute bacterial reservoirs. It is necessary to perform a procedure for the good practices of disinfection.

Key-words
Stethoscope, contamination, epidemiology, healthcare-associated infections

INTRODUCTION

The healthcare associated infections constitute a real public health problem which generates a considerable economic and human cost.

According to the Tunisian National Prevalence of healthcare associated infections survey (2012) [1], the frequency of healthcare associated infections were found in 6.6 % that is 1 hospitalized patient out of 15.

These infections are frequently caused by organisms living in the health environment, including the contaminated medical equipments such as the stethoscopes.

Used repeatedly during a day and coming into contact with the skin of the patients, the stethoscopes have been the subject of several recent studies which have shown that they do indeed constitute a reservoir of germs [3-5].

However, it is frequently reported that due to the lack of information and awareness, their disinfection is not often ensured.

In this perspective, we have tried, in Habib Thameur Hospital of Tunis (Tunisia), to identify the epidemiological situation of the contamination of the sthetoscopes used by doctors.

Our objectives were to determine the percentage of contaminated stethoscopes used by doctors working at the Habib Thameur Hospital departments and to study the microbiological profile of isolated germs.

This would be, for us, the first step to be aware of these infections, an essential step towards an effective prevention.

METHODS

It was a cross-sectional study over a period of two months (May and June 2014) including 39 stethoscopes.

The inclusion criteria were the personal stethoscopes belonging to all ranks of doctors (interns, residents and senior doctors) practicing within the different departments of the Habib Thameur Hospital of Tunis (Tunisia).

Were not included the stethoscopes found at the hospital departments or those used at external consultations even used by doctors but they were not their personal ones.

We performed a twice a week visit (Mondays and Thursdays between 9 a.m and 10 a.m). After the approval of the doctors present during our visit, the swabs were taken from the membranes of the stethoscopes and sent rapidly to the bacteriology department of our hospital.

Then, the samples were cultured on Blood agar. The reading was made 24 hours later. Are considered positive The cultures that contained more than 104 colony forming units/ml (CFU/ml). For these cases, we proceeded to identify germs. If a gram negative bacillus was isolated, we conducted systematically a Gallery identification for Enterobacteria. The Staphylococcus was detected by a positive Catalase reaction.

According to the response to Coagulase, we differentiate the Coagulase-positive staphylococcus from the coagulase-negative staphylococcus and a study of the sensitivity to methicillin was performed.

If a streptococcus was detected by a negative catalase reaction, a search of the Entorecoccus by reacting to Esculin was realized.

Data are presented as frequencies and percentages. Comparison of percentages was made with the Chi square test. Statistical analyses are performed using SPSS statistical software version 20.0 (SPSS Inc., Chicago, Illinois). A p-value of 0.05 was considered significant.

RESULTS

During the study period, 39 stethoscopes have been the subject of a bacteriological sampling. These stethoscopes belonged to practicing physicians in the 8 different departments of the Habib Thameur hospital, as follows (table 1).

Table 1: Distribution of samples by department

Department	Frequency	Percent
Anesthesia	13	33,3
Cardiology	9	23,1
General Surgery	6	15,4
Pediatric surgery	1	2,6
Gastrology	3	7,7
Internal Medicine	3	7,7
Medical intensive care unit	3	7,7
Emergency	1	2,6
Total	39	100,0

Fifteen out of 39 samples were positive that is a percentage of 38,5%.

The coagulase-negative Staphylococcus was the predominant germ since it was isolated in ¾ of the positive cases. Two samples were positive for Bacillus.

A single contaminated stethoscope contained more than one germ (Coagulase-negative staphylococcus and bacillus).

Pathogens were found in 5 samples (12% of total takings) distributed as follows: 2 Methicillin-sensitive staphylococcus Aureus, 2 Methicillin-resistant Coagulase-negative Staphylococcus and a Pseudomonas Aeroginosa. No Methicillin-resistant Staphylococcus aureus nor Clostridium difficile have been found (Table 2).

Table 2: Distribution of germs

Germ	Frequency	Percent
Bacillus	1	2,6
Pseudomonas	1	2,6
Coagulase-negative Staphylococcus	7	17,9
Coagulase-negative Staphylococcus and Bacillus	1	2,6
Methicillin-resistant coagulase-negative Staphylococcus	2	5,1
Methicillin-sensitive coagulase-negative Staphylococcus	1	2,6
Methicillin-sensitive Staphylococcus aureus	2	5,1
No germs	24	61,5
Total	39	100,0

These pathogens were found in stethoscopes collected from the cardiology and anesthesia intensive care departments.

In cardiology, 7/9 stethoscopes were positive. Five contained Coagulase negative staphylococcus among which 2 methicillin resistant and 2 others were positive for Staphylococcus aureus.

In anesthesia intensive care, 6/13 stethoscopes were positive. 3 methicillin sensitive coagulase negative staphylococcus, 1 bacillus and an association between coagulase negative staphylococcus were isolated. A single pathogen (Pseudomonas Aeroginosa) was found.

A methicillin sensitive coagulase negative staphylococcus was isolated in each of the departments of internal medicine and pediatric surgery respectively on 3 and 1 bacterial sample(s).

In the emergency services, the medical intensive care, the gastrology and the general surgery, no germ was isolated on respectively 1, 3, 3 and 6 sample(s) (table 3).

Table 3: Distribution of positive takings by department

Department	Presence of germ	Absence of germ	Total
Anesthesia	6 (40,0%)	7 (29,2%)	13 (33,3)
Cardiology	7 (46,7%)	2 (8,3%)	9 (23,1)
Surgery	0 (0,0%)	6 (25,0%)	(15,4)
Pediatric surgery	1 (6,7%)	0 (0,0%)	1 (2,6)
Gastrology	0 (0,0%)	3 (12,5%)	3 (7,7)
Internal medicine	1 (6,7%)	2 (8,3%)	3 (7,7)
Medical intensive care unit	0 (0,0%)	3 (12,5%)	3 (7,7)
Emergency	0 (0,0%)	1 (4,2%)	1 (2,6)
Total	15 (100,0%)	24 (100,0%)	39 (100,0%)

Both departments which were most contaminated were cardiology and Anesthesia. But there was no statistically significant difference between the number of contaminated stethoscope in Anesthesia versus Cardiology departments (p=0.15). Moreover we did not observe a statistically significant difference of contamination of stethoscopes at the anesthesia department versus all the other services surveyed (p=0.48); or between medical intensive care unit department and anesthesia department versus the rest of the surveyed departments (p=0.91).

While there was a statistically significant difference of contamination of stethoscopes of Cardiology versus all other services surveyed (p=0.009).

We did not observe an association between the stethoscopes' infection and the sampling day (On monday: 33,3% of the germs were positive and on Thursday 66,7% of the germs were positive) with p=0.074 (Table 4).

Table 4: distribution of positive takings by the day

	Presence of germ	Absence of germ	Total
Thursday	10(66,7%)	9(37,5%)	19 (48,7%)
Monday	5 (33,3%)	15(62,5%)	20 (51,3%)
Total	15 (100,0%)	24 (100,0%)	39 (100,0%)

We did not observe an association between infection stethoscopes and ranks of respondents (p=0.98)

Similarly, we did not observe an association between contamination of stethoscopes Seniors vs. internal and / or residents (p=0.6) (Table 5).

Table 5: Distribution of positive takings by the grade of physicians.

	Presence of germ	Absence of germ	Total
Interne	7 (46,7%)	11 (45,8%)	18 (46,2%)
Resident	7 (46,7%)	11 (45,8%)	18 (46,2%)
Senior	1 (6,7%)	2 (8,3%)	3 (7,7%)
Total	15 (100,0%)	24 (100,0%)	39 (100,0%)

DISCUSSION

In our study, we found a proportion of contaminated stethoscopes 38% with 13% of pathogens.

In literature, the contamination of medical equipments such as stethoscopes was the subject of several studies [2-9]. The results that we found varied between 30% and 100% for contamination levels and between 0% [2] and 43% [6] for the rate of pathogens.

In Tunisia, according to our knowledge, only one study [2] in the contamination of stethoscopes and medical equipments was carried out in 2010 in the internal medicine department of the military hospital in Tunis and published in 2011. The authors included 45 stethoscopes; the bacterial samples were performed by Agar contact® in the level of their membrane. They found 100 % positive samples and they didn't isolate any pathogene germ

A study by Huda et al realized in Saudi Arabia in 2004 identified 100 stethoscopes swabs in the membrane. She found 30 % of positive bacterial samples with a percentage of pathogene germs equal to 9% [3]. Fafliora et al compiled in a study published in 2014, 88 stethoscopes taken in the level of their membrane swabs and cultured; 28 samples were positive by more than 104 UFC which corresponds to 31,8% of the total of the samples [4]

In the same context, and in a study published in 2010, Pandey et al realized swabs of 436 medical equipments including 80 stethoscopes. The stethoscopes samples were positive in 55% of cases 27% of stahphylococcus aureus.

Contrary to previous findings, campos-murguia et al found a rate of 94% (containing at least one UFC) with 48% of pathogens. This study brought together 112 stethoscopes in 12 different services and bacterial samples were taken by direct contact [6]. Also, in a panel of 105 stethoscopes, Leprat et al found a fairy high rate of 63.8%, including 100% of staphylococcus [8]. The differences in results may be attributed to the different methods of sampling and/or to the significance levels of different cultures. Indeed, the sampling methods were different direct contact for the studies [2] and [6] and swabs for the remaining studies including ours.

Campus-Murguia et al compared in their study and in a preliminary step these 2 procedures on a sample of 18 samples for each one.

The direct contact method was significantly more sensitive than swabs [6].

The thresholds of significance crop also differed from one study to another. Indeed, in our study we set a threshold of 104 CFU/ml (depending on the standard used in our laboratory), while some authors consider a positive threshold even from 1 UFC. As an example, fofliora et al found 100% positive takings.

If we consider a similar line to ours, the rate would drop to 31.8%.

For the predominant germs, our study isolated the staphylococcus, the predominant germs in the skin flora. This result was found in all the other studies. For pathogens, we found:

- A Pseudomonas aeroginosa: non fermenting BGN known for its involvement in the multiresistant nosocomial infections.

This germ was isolated in the department of anesthesia and intensive care.

- Two staphylococcus aureus and two methicillin-resistant coagulase-negative staphylococcus found in the cardiology department.

The risk of contamination with pathogens seems to increase with the frequency of the use of stethoscopes.

This concept was demonstrated in the study [8] of Leprat et al in which, among 39 decontaminated stethoscopes then handed over to the service of doctors, the 9 stethoscopes used in the examination of more than 5 patients a day were all contaminated; while only one stethoscope among the 30 used for the examination of less than five patients a day was contaminated.

We also noted in our work that no MRSA was isolated, the same reslt as Russel et al, whose study was performed on 44 stethoscopes in four irish hospitals while Fafliora et and Compos-Murguia et al find it respectively in 2/88 and 18/112 stethoscopes.

In our bibliography search, the Clostridium difficile was isolated in only one study [11] : Alleyne et al's one which

was published in 2009. The Clostridium Difficile was isolated in three stethoscopes out of 61 studied ones.

CONCLUSION

Healthcare associated infections are a major public health problem that generates a considerable economic and human cost. The contaminated medical equipment such as the stethoscopes is often an overlooked vector.

In our study, the contamination of the stethoscopes of our physicians was proved 15 contained more than 104 CFU/ml, a result consistent with some studies.

Pathogens have also been found again, a situation requiring a serious reflection on the conditions of using stethoscopes and disinfecting them.

Consciousness, education, awareness and the establishment of a procedure on the good practices of disinfection are necessary in the fight against healthcare associated infections.

REFERENCES

1. National Survey of Prevalence of Nosocomial Infections NosoTun 2012 Summary of results 7 August 2014 http://www.santetunisie.rns.tn/fr/images/noso12.pdf.
2. Ajili F, Battikh R, Bellakhal S, Msadak F, Othmani S. Do medical students disinfect their stethoscope and the electrocardiograph after use? Med Mal Infect. 2011;41:396-403.
3. Bukharie HA, Al-Zahrani H, Rubaish AM, Abdulmohsen MM. Bacterial contamination of sthetoscopes. J Family Community Med. 2004;11(1):31–3.
4. Fafliora E, Bampalis VG, Lazarou N, Mantzouranis G, Anastassiou ED, Spiliopoulou I et al. Bacterial contamination of medical devices in a Greek emergency department: impact of physicians' cleaning habits. Am J Infect Control. 2014;42(7):807-9.
5. Pandey A, Asthana AK, Tiwari R, Kumar L, Das A, Madan M. Physician accessories: doctor, what you carry is every patient's worry? Indian J Pathol Microbiol. 2010;53(4):711-3.
6. Campos-Murquia A, Leon-Lara X, Munoz JM, Macias AE, Alvarez JA. Stethoscopes as potential intrahospital carriers of pathogenic microorganisms. Am J Infect Control. 2014;42(1):82-3.
7. Uneke CJ, Ogbonna A, Oyiho PG, Ekuma U. Bacteriological assessment of stethoscopes used by medical students in Nigeria, implications for nosocomial infection control. World Health Popul. 2008;10(4):53-61.
8. Leprat R, Minary P, Devaux V, de Wazière B, Dupond J, Talon D. Why, when and how to clean stethoscopes. J Hosp Infect. 1998;39(1):80-2.
9. Mitchell A, Dealwis N, Collins J, Chew K, Taylor R, Schwab U, et al. Stethoscope or 'Staphoscope'? Infection by auscultation. J Hosp Infect. 2010;76(3):278-9.
10. Russell A, Secrest J, Schreeder C. Stethoscopes as a source of hospital-acquired methicillin-resistant Staphylococcus aureus. J Perianesth Nurs. 2012;27(2):82-7.
11. Alleyne SA, Hussain AM, Clokie M, Jenkins DR. Stethoscopes: potential vectors of Clostridium difficile. J Hosp Infect. 2009;73(2):187-9.