

Abstract

Antibiotic resistance currently represents one of the most serious health threats. Infections caused by resistant bacteria have higher mortality rates, particularly among critically ill patients, prolong hospitalization periods, and reduce chances of recovery. Screening is essential in combating the spread of resistant bacteria to detect the carriage (colonization) of these strains in potentially at-risk groups or to identify contamination in exposed environments. Complete elimination of carriage or environmental decontamination is often impossible. However, barrier measures reduce the risk of transmission of resistant bacteria to susceptible individuals and the development of infections, the treatment of which would be lengthy and costly in the case of multidrug-resistant infectious agents. The issue of antimicrobial resistance is not limited to hospitals, resistant bacteria can also circulate in the community, in the environment, and among organisms interacting with humans, such as domestic or farm animals.

This dissertation focuses on monitoring the occurrence of resistant and multidrug-resistant bacteria in the population (travellers, students, hospitalized and outpatient-treated patients) and in the environment of public transportation, where there is a higher risk of occurrence and spread of these bacteria. The first part of the work was focused on medical students in their first and final years, where we investigated the occurrence of bacteria resistant to critically important antibiotics including colistin, carbapenems, vancomycin, tigecycline and third-generation cephalosporins.

Another cohort consisted of hospitalized patients, in whom we investigated the prevalence of intestinal carriage of Enterobacterales with colistin resistance mediated by the *mcr* genes. Simultaneously, we also examined enterobacteria carrying the *mcr-9* gene, which are generally susceptible to colistin but can easily acquire colistin resistance. In another project, we analyzed the molecular epidemiology of methicillin-resistant *S. aureus* (MRSA) isolated from various infection sites.

The last group studied were travellers, particularly those travelling to countries at risk for acquiring multidrug-resistant pathogens or strains resistant to reserve antibiotics. In this study, we again demonstrated intestinal carriage of colistin-resistant enterobacteria.

We also studied the occurrence of resistant bacteria in public transportation in Prague during the first wave of the COVID-19 pandemic and subsequently after the relaxation of the strictest hygiene measures. The study focused on metro, tram and bus lines operating near the Motol University Hospital. Subsequently, we described and characterized an unusual finding of *Staphylococcus aureus* forming aggregates and exhibiting reduced sensitivity to vancomycin.

During the preparation of this dissertation, a review summarizing current knowledge in the field of detection of plasmid-mediated colistin resistance was also conducted and published, reflecting the experiences of our laboratory gained through projects focused on screening for colistin resistance.