

Colonization with selected antibiotic resistant bacteria among a cohort of Sri Lankan university students

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Abstract

This study was conducted to identify the rates of colonization with selected antibiotic resistant organisms among a group of university students in Sri Lanka.

A self collected nasal swab and a peri-rectal swab collected after passing stools were obtained. Routine microbiological methods were used for the isolation *S. aureus* from the nasal swab and *E.coli* and *Klebsiella* species from the peri-rectal swab. Antibiotic sensitivity testing was performed as recommended by clinical and laboratory standard institute (CLSI).

The 322 participants had 156 males and 166 females between 21 – 28 years representing 5 different faculties of study. Seventy one (22.0%) were colonized with *S.aureus* and 14 among them with MRSA, making the MRSA colonization rate of 4.3%. Forty five (15%) of the participants were colonized with an ESBL producing *E.coli* or *Klebsiella* spp. No one was colonized with carbapenem resistant *E.coli* or *Klebsiella* species.

Background

Infections caused by Methicillin Resistant *Staphylococcus aureus* (MRSA), ESBL producing enterobacteriaceae (ESBLE) and carbapenem resistant enterobacteriaceae (CRE) in hospital settings has been well studied in Sri Lanka. However, data on colonization with these resistant bacteria among healthy young adults is limited.

Colonized individuals may act as a reservoir for the spread of these bacteria in the community. Furthermore, with the increasing international travel, individuals colonized with resistant bacteria may contribute to spread such bacteria beyond their own countries.

Objectives

This study was conducted to identify the rates of colonization with selected antibiotic resistant organisms among a group of university students in Sri Lanka and to identify factors associated with such colonization.

Research Question

What are the rates of colonization with Methicillin Resistant *Staphylococcus aureus* (MRSA), Extended Spectrum β lactamase (ESBL) producing and carbapenamase producing *Escherichia coli* and *Klebsiella* species among a group of Sri Lankan university students?

What factors are associated with colonization with above organisms?

Methodology

- This was a descriptive cross sectional study conducted among students at a residential university in Sri Lanka.
- Ethical clearance was obtained from institutional ethics review committee, Faculty of Medicine, University of Peradeniya, Sri Lanka.
- A self administered questionnaire was used to obtain data.
- A self collected nasal swab and a peri-rectal swab collected after passing stools were obtained.
- Routine microbiological methods were used for the isolation *S. aureus* from the nasal swab (Figure 1).
- The peri-rectal swab was inoculated on MacConkey agar plates supplemented with ceftazidime and TSB broth supplemented with ertapenem (Figure 2).
- Identification and confirmation of MRSA, ESBL producers and carbapenem resistance were performed as recommended by clinical and laboratory standard institute (CLSI).
- Possible associations were analysed with Chi-square test and Fisher's exact test.

Processing of nasal swabs

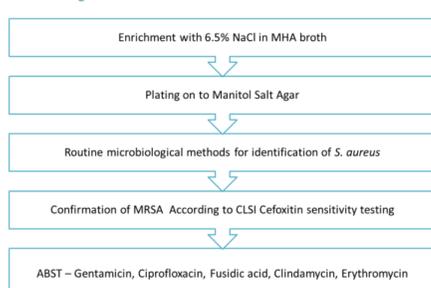


Figure 1: Processing of nasal swabs

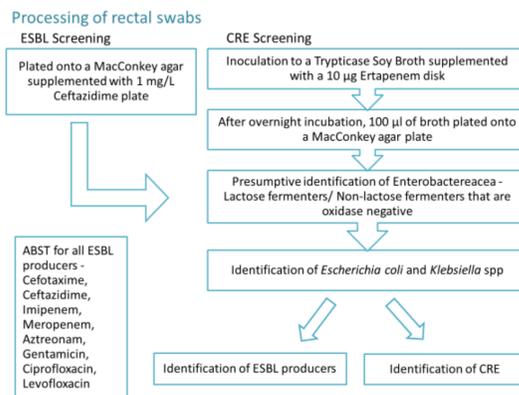


Figure 2: Processing of peri-rectal swabs

Results

The 322 participants had 156 males and 166 females between 21 – 28 years representing 5 different faculties of study.

Colonization with MRSA

Seventy one (22.0%) were colonized with *S.aureus* and 14 among them with MRSA, making the MRSA colonization rate of 4.3%. Sensitivity of the staphylococcus isolates are given in Table 1.

Table 1: Antibiotic sensitivity of MRSA and MSSA isolates

	MSSA strains	MRSA strains
Gentamicin (10 µg)	58 (95.1%)	14 (93.3%)
Ciprofloxacin (5 µg)	46 (75.4%)	11 (73.3%)
Clindamycin (2 µg)	54 (88.5%)	11 (73.3%)
Including inducible resistant isolates		
Clindamycin (2 µg)	54(88.5%)	15 (100.0%)
Excluding inducible resistant isolates		
Fusidic acid (5 µg)	52 (85.2%)	13 (86.7%)
Erythromycin (15 µg)	27 (44.3%)	4 (26.7%)

Colonization with MRSA was not significantly associated with any of the factors studied (Table 2).

Though statistically not significant, those who had a history of antibiotic use within 3 months had higher rates of MRSA carriage (6.6% vs 2.7%)

Table 2: Factors associated with colonization with MRSA

Variables	Number of participants (n=322)		Significance*
	Participants colonized with MRSA	Participants not colonized with MRSA	
Sex			0.28
Male (n=156)	9 (5.8 %)	147 (94.2 %)	
Female (n=166)	5 (3.0 %)	161 (97.0 %)	
Faculty			0.78
Health Science related (n=210)	10 (4.8 %)	200 (95.2 %)	
Non-Health related (n=112)	4 (3.6 %)	108 (96.4 %)	
Antibiotic intake			0.27
Yes (n=133)	8 (6.0 %)	125 (94.0 %)	
No (n=189)	6 (3.2 %)	183 (96.8 %)	
Chronic diseases			0.49
Yes (n=15)	1 (6.7%)	14 (93.3 %)	
No (n=307)	13 (4.2 %)	294 (95.8 %)	
Residence			0.09
Residents (n=225)	7 (3.1 %)	218 (96.9 %)	
Non-residents (n=97)	7 (7.2 %)	90 (92.8 %)	

Colonization with ESBL producers

Forty five (15%) of the participants were colonized with an ESBL producing *E.coli* or *Klebsiella* spp. One participant was colonized with both MRSA and ESBL producers. All ESBL producers were sensitive to carbapenems. Sensitivity rate for levofloxacin was 48% and other sensitivities are given in Table 3.

Table 3: Antibiotic sensitivity of ESBL producers

	ESBL producers (n=50), N (%)
Aztreonam (30 µg)	2 (4.0%)
Meropenem (10 µg)	50 (100%)
Imipenem (10 µg)	50 (100 %)
Ciprofloxacin (5 µg)	19 (38.0%)
Levofloxacin (5 µg)	24 (48.0%)
Gentamicin (10 µg)	47 (94.0%)

Colonization with ESBL producers was significantly higher among those with chronic diseases than others. Though statistically not significant, those who had a history of antibiotic use within 3 months had higher rates of ESBL producers (18.4% vs 10.8%) compared to those who did not (Table 4).

Table 4: Factors associated with colonization with ESBL producers

Variables		Number of participants (n=322)		Significance*
		Participants colonized with ESBL	Participants not colonized with ESBL	
Sex	Male (n=156)	24 (15.4 %)	132 (84.6 %)	0.52
	Female (n=166)	21 (12.7 %)	145 (87.3 %)	
Faculty	Health Science related (n=210)	31 (14.8 %)	179 (85.2 %)	0.35
	Non Health related (n=112)	14 (12.5 %)	98 (87.5 %)	
Antibiotic intake	Yes (n=136)	23 (17.3%)	110 (82.7%)	0.19
	No (n=186)	22 (11.6 %)	167 (88.4 %)	
Chronic diseases	Yes (n=15)	5 (33.3 %)	10 (66.7 %)	0.04
	No (n=307)	40 (13.0 %)	267 (87.0 %)	
Residence	Residents (n=225)	30 (13.3 %)	195 (86.7 %)	0.72
	Non-residents (n=97)	15 (15.5 %)	82 (84.5 %)	

Colonization with carbapenem resistant E.coli and Klebsiella species

All isolates from ESBL screening plates and those obtained from TSB enrichment were sensitive to imipenem and meropenem.

None of the participants were therefore colonized with carbapenem resistant isolates.

Discussion and conclusions

While the resistance rates in hospital isolates in Sri Lanka is very high, there is a relatively lower colonization rate among healthy young adults.

However, the relatively higher rate of ESBL producers identified is a reason for concern. Further, The lower rate of susceptibility to levofloxacin is also a reason to be concerned.

As limitations we recognise that the current study was conducted at a single university with a relatively smaller sample size. Also, peri-rectal swabs after defecation were collected rather than stool samples for determining ESBL carriage

In conclusion, the asymptomatic colonization rate of Methicillin Resistant *Staphylococcus aureus* and *Staphylococcus aureus* in the study cohort were 4.3% and 22% respectively. The asymptomatic colonization rate of selected ESBL producers was 14% including 13.7 % and 0.3% of *E. coli* and *K. pneumoniae* respectively. None of the participants were colonized with carbapenem resistant *E.coli* or *Klebsiella* species.

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