

# Epidemiology of Coagulase-Negative *Staphylococci* Isolated from Clinical Blood Specimens at the University Hospital of the West Indies

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## ABSTRACT

*The prevalence and significance of coagulase negative staphylococci (CoNS) isolated from blood cultures at the University Hospital of the West Indies (UHWI) during a six-month period were investigated. Standard and automated microbiological procedures were used to process 3001 blood culture specimens received from 2363 patients and 658 (21.9%) of the blood cultures yielded 854 bacterial isolates. The highest prevalence of positive blood cultures (60%) and the lowest prevalence of blood isolates of CoNS (12%) were found in the intensive care unit (ICU). The blood isolates of CoNS were most frequent in the surgical wards (13%) and lowest in obstetrics and gynaecology (2%). High rates of resistance to methicillin, other anti-staphylococcal penicillins, and cephalosporins used in the treatment of CoNS were observed. All blood isolates of CoNS (100%) were susceptible to vancomycin. In conclusion, the results show that coagulase-negative staphylococci are the most prevalent bacterial isolates in blood cultures at the UHWI occurring mostly as contaminants. The practice of proper venepuncture and hand-washing techniques by medical staff are recommended to facilitate appropriate antibiotic usage.*

# Epidemiología de los Estafilococos Coagulasa Negativos Aislados de Especímenes Clínicos de Sangre en el Hospital Universitario de West Indies

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## RESUMEN

*Se investigó la prevalencia e importancia de los estafilococos coagulasa negativos (ECoN) aislados de cultivos de sangre en el Hospital Universitario de West Indies (HUWI) por un periodo de seis meses. Se utilizaron procedimientos microbiológicos estándar y automatizados para procesar 3001 cultivos de sangre recibidos de 2363 pacientes y 658 (21.9%) de los cultivos dieron 854 aislados bacterianos. La más alta prevalencia de cultivos de sangre positivos (60%) y la más baja prevalencia de aislados de ECoN (12%) se encontraron en la Unidad de Cuidados Intensivos (UCI). Los aislados de sangre de ECoN fueron más frecuentes en las salas de cirugía (13%) y más bajos en las de obstetricia y ginecología (2%). Se observaron altas tasas de resistencia a la meticilina, así como a otras penicilinas antiestafilocócicas y cefalosporinas usadas en el tratamiento de ECoN. Todos los aislados de sangre de ECoN (100%) fueron susceptibles a la vancomicina. En conclusión, los resultados muestran que los estafilococos coagulasa negativos son los aislados bacterianos más prevalentes en cultivos de sangre en el HUWI, presentándose en la mayor parte de los casos como contaminantes. Se recomienda la práctica de técnicas adecuadas de venepuntura y lavado de manos por parte del personal médico a fin de facilitar un uso antibiótico correcto.*

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## INTRODUCTION

Coagulase-negative staphylococci (CoNS) constitute a major component of the normal microbial flora of humans and are often found as contaminants in clinical specimens (1, 2). It is difficult to differentiate contamination from infection, and to decide what should constitute therapy for multiresistant strains of CoNS. The need to institute expensive parenteral

antimicrobial therapy consumes hospital pharmacy budgets (2, 3). The problem has been intensified with surgical wound infections, increased use of prosthetic and indwelling devices and the growing numbers of immunocompromised patients in hospitals (4, 5). Coagulase-negative staphylococci recovered from normally sterile body sites, especially blood, should neither be automatically regarded as contaminants nor routinely lead to the use of antibiotic therapy (1).

This study was carried out to investigate the prevalence, distribution and significance of blood culture isolates of CoNS at the University Hospital of the West Indies.

## MATERIALS AND METHODS

The study was conducted at the University Hospital of the West Indies (UHWI), a 526-bed tertiary referral hospital during July – December 2003. A total of 3001 blood cultures from 2363 patients seen at the hospital were processed by the Microbiology Department. The blood cultures were done using an automated blood culture system (Bactec 9240, Becton Dickinson & Co, Loveton Circle, Sparks Maryland, USA). The identification and antibiotic susceptibility testing of the bacteria isolated from blood cultures were performed using standard microbiological procedures and an automated system (Vitek<sup>®</sup>, BioMerieux Vitek Inc, Hazelwood, Missouri, USA) where appropriate (6, 7). Positive blood cultures from the same patient with the same species of CoNS and the same antimicrobial susceptibility pattern within five days were counted only once. The data were analyzed using the Epi Info 3.3 software (8). Chi-square and Fisher's exact tests were used, where indicated, to compare data.

## RESULTS

Of the 3001 blood cultures, 658 (22%) were positive and 854 bacterial isolates were recovered. Less than 5% of the patients had multiple blood culture isolates. Coagulase-negative staphylococci occurred as single isolates in 93% of the cultures and were isolated with other organisms in 7%. The species distribution of the isolates is shown in Table 1. The most frequent isolate was CoNS (284/854, 33%) which occurred as the only isolate in 42% (277/658) of positive blood cultures. The most frequently isolated species of CoNS was *S epidermidis* (42%) followed by *S haemolyticus* (17%) and *S simulans* (15%).

The mean time to detect (TTD) growth in the blood cultures was 25.8 hours (range 4.5 – 135 hours) and 57.4% (163/284) of CoNS isolates were detected during the first 24 hours of incubation.

Prevalence of positive blood cultures was highest in the intensive care unit, ICU (60%, 135/224), followed by surgical wards (35%, 150/428), Accident and Emergency Unit (32%, 99/306) and medical wards (21%, 200/970;  $p < 0.0001$ ). The prevalence of blood isolates of CoNS was highest in the surgical wards (13.2%) and lowest in the obstetrics and gynaecology wards (2.2%;  $p = 0.003$ ).

Table 1: Micro-organisms (n = 854) isolated from blood cultures (n = 658) at the University Hospital of the West Indies Kingston Jamaica, July to December 2003

Organism	Frequency (%)
Coagulase-negative staphylococci (CoNS)	284 (33.2)
Enterobacteriaceae spp	113 (13.2)
<i>Staphylococcus aureus</i>	95 (11.1)
<i>Pseudomonas aeruginosa</i>	65 (7.6)
<i>Enterococcus spp</i>	60 (7.0)
<i>Stenotrophomonas maltophilia</i>	54 (6.3)
<i>Corynebacterium spp</i>	35 (4.0)
<i>Acinetobacter spp</i>	28 (3.2)
<i>Alcaligenes spp</i>	22 (2.5)
<i>Pseudomonas spp</i>	13 (1.5)
<i>Streptococcus pneumoniae</i>	11 (1.2)
Non-albicans candida	8 (0.9)
<i>Streptococcus viridans</i>	6 (0.7)
<i>Cryptococcus neoformans</i>	5 (0.5)
<i>Streptococcus spp</i>	5 (0.5)
<i>Streptococcus Group B</i>	3 (0.3)
<i>Candida albicans</i>	2 (0.2)
<i>Streptococcus Group A</i>	2 (0.2)
<i>Streptococcus Group C</i>	1 (0.1)
Miscellaneous/other	42 (4.9)
<b>Total</b>	<b>854 (100)</b>

Miscellaneous/other include: *Bacteroides spp*, *H influenzae*, aerobic non-spore forming bacilli, *Clostridium welchii*, *Aeromonas hydrophilia* and *Pasteurella haemolytica*

The antibiotic susceptibility patterns of methicillin sensitive and methicillin resistant strains of CoNS are shown in Table 2. High rates of resistance to penicillin (91%), ampicillin (88%), amoxicillin-clavulanate (55%), and cefazolin (53%) were observed with minimum inhibitory concentra-

Table 2: Antibiotic susceptibility patterns of 284 isolates of coagulase-negative staphylococci (CoNS, including 155 methicillin sensitive and 129 methicillin resistant strains) from blood cultures at the University Hospital of the West Indies (UHWI) Jamaica, July to December 2003

Antibiotic (µg/ml)	Per cent sensitive	
	Methicillin-sensitive CoNS (n = 155)	Methicillin-resistant CoNS (n = 129)
Ampicillin (10)	22	0
Amoxicillin-clavulanate (10)	81	2
Cefazolin (30)	83	4
Ciprofloxacin (5)	90	64
Gentamicin (10)	94	12
Ceftriaxone (30)	87	85
Cefuroxime (30)	90	89
Clindamycin (2)	94	65
Erythromycin (15)	61	15
Penicillin (10u)	16	0
Trimethoprim-Sulphamethazole (25)	84	59
Rifampicin (10)	100	98
Vancomycin (30)	100	100

tions (MIC) value > 8 µg/ml. All isolates of CoNS were sensitive to vancomycin.

As shown in Table 3, the highest percentages of methicillin resistant coagulase negative *staphylococci* occurred in

Table 3: Species distribution of 129 strains of methicillin-resistant coagulase-negative staphylococci (MRSE) isolated from blood cultures from patients in various facilities at the University Hospital of the West Indies (UHWI), Jamaica, July to December, 2003.

Methicillin resistant strain (n)	Facility (%)					
	Surgical (n = 54)	Medical (n = 28)	SCN (n = 14)	A&E unit (n = 12)	ICU (n = 8)	Others (n = 4)
<i>S epidermidis</i> (69)	30 (43.4)	13 (19)	10 (14.5)	6 (8.7)	7 (10.1)	3 (4.3)
<i>S haemolyticus</i> (26)	12 (46)	6 (23)	3 (12)	2 (8)	2 (8)	1 (4)
<i>S simulans</i> (13)	6 (46)	4 (31)	1 (8)	2 (16)	0 (0)	0 (0)
<i>S auricularis</i> (9)	4 (44)	3 (33)	0 (0)	1 (10)	1 (10)	0 (0)
<i>S warneri</i> (3)	1 (33)	1 (33)	0 (0)	1 (33)	0 (0)	0 (0)
<i>S capitis</i> (2)	1 (50)	1 (50)	0 (0)	0 (0)	0 (0)	0 (0)

n = total number of isolates encountered, SCN = Special Care Nursery, A&E = Accident and Emergency Unit, ICU = Intensive Care Unit; Others = patients coming from private and other clinics.

the surgical (42%) and medical wards (22%) while it was 6% in the intensive care unit (ICU). More than half of the CoNS (71/129, 55%) were methicillin resistant *staphylococcus epidermidis* (MRSE).

## DISCUSSION

The prevalence of positive blood cultures observed in the present study is comparable to that observed in similar studies conducted at other healthcare institutions (9–11). The predominance of coagulase-negative *staphylococci* and the hospital distribution of these organisms were in agreement with previously documented reports (2, 12). Colonization of body surfaces by CoNS, the large patient population and poor venepuncture techniques may contribute to the high prevalence of CoNS in blood cultures from patients on the surgical wards (2, 4, 13).

The predominance of *Staphylococcus epidermidis* among the CoNS isolated from blood cultures is in keeping with previous reports (12). *S epidermidis* is a ubiquitous member of the normal flora and the species most commonly encountered in clinical specimens, usually as a contaminant (7, 12–14). Infection with *S epidermidis*, and less commonly with *S haemolyticus*, usually involves implantation of medical devices (14); and the majority of the patients that had positive growth of CoNS in their blood cultures in this study had prosthetic and indwelling devices such as intra-vascular lines. This was seen more in patients admitted to the medical wards, intensive care units and the surgical wards. The growth times observed for the blood isolates of CoNS also suggested that most were more likely contaminants than pathogens (15, 16).

The high levels of resistance to methicillin and empirically applied anti-staphylococcal penicillins and cephalosporins in CoNS are well documented (11, 17–19). Resistance to multiple antibiotics usually active against Gram-positive cocci, including vancomycin is more common in CoNS than *S aureus* (6). The heavy use of these antibiotics in certain hospital facilities may select for multiple-resistant commensal organisms such as methicillin resistant *S epidermidis* (MRSE) (20). It is important to note that no vancomycin resistance was found in CoNS in the present study and the current drug policies at the UHWI which support prudent use of vancomycin should be maintained.

In conclusion, this study revealed that CoNS is the leading bacterial isolate from blood cultures at the UHWI. The high prevalence of CoNS is mostly attributable to skin contamination. The practice of proper venepuncture and hand-washing techniques by medical staff are recommended to circumvent the difficulty of interpreting blood cultures which grow CoNS and facilitate appropriate antibiotic usage.

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