Coagulase-negative Staphylococci Pathogens with increasing clinical Significance Essay

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by

Hanann Faissal
M.B.B.CH

Supervised by

Prof Dr. Ibrahim Khalil Ali
Prpfessor of clinical pathology Department
Faculty of Medicine
Ain Shams University

Dr. Malaka Zakaria
Lecturer of clinical pathology Department
Faculty of Medicine
Ain Shams University

clinical pathology Department
Faculty of Medicine
Ain Shams University

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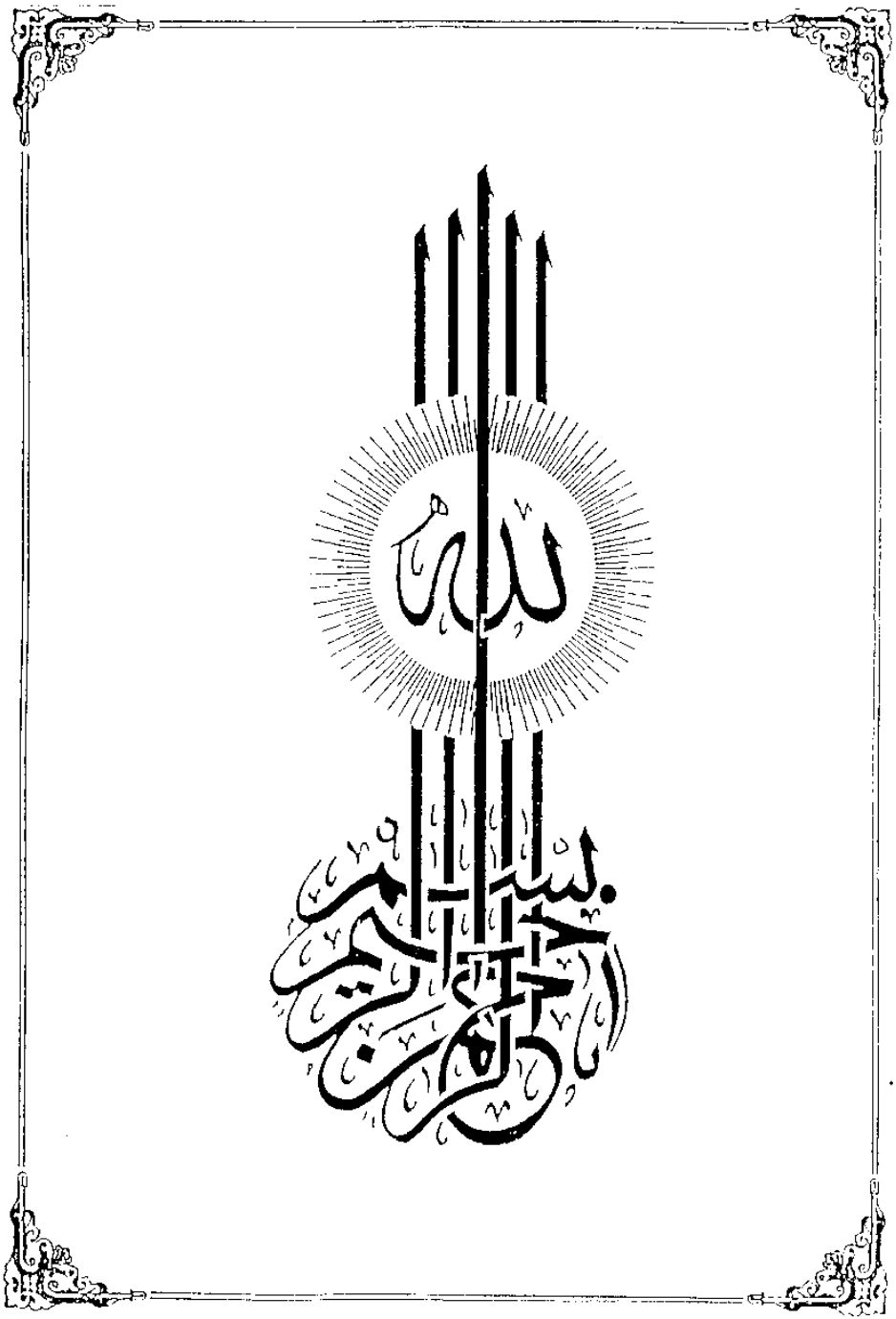

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INTRODUCTION

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Staphylococci are gram positive cocci that have been classified according to coagualse production into two groups; coagulase positive (CNS) and coagualse negative staphylococci.

Historically CNS have been considered as saprophytes and are often regarded as secondary contaminants when cultivated from infection. Recently, there is no doubt that CNS can produce serious human diseases under appropriate conditions and they may represent a major source of infection in a variety of clinical situations. (Christensen et al.,1982).

Coagulase - negative staphylococci can cause bacteraemia especially in neutropenic patients with malignancy (Wade et al.,1982). They account for 10% of cases of urinary tract infections. Staphylococcal saprophyticus is the most common species of CN-S that cause lower and upper urinary tract infections predominantly in sexually active women (Latham et , al,1983).

Staphylococcal epidermidis is the most common cause of prosthetic valve endocarditis accounting for 25% to 60% with a mortality rate of 70% (Masur and Johnson, 1980). Also CNS- may cause native valve endocarditis in 22% of pediatric patients (Johnson and Rhodes,1982).

Furthermore, many case reports have increased the range of CNS associated infections involving indwelling medical devices, infection in or around prosthetic joints (Fitzgerald et al.,1977). In addition, staphylococcal epidermidis is the major pathogen associated with central venous catheter infection (Haslett et al.,1988).

The pathogenesis of CNS ifnection is unclear and there is scant information about the organism's virulence and host defence mechanisms·the most important immune dysfunction leading to CNS infection is the lack 0f effective opsonophagosytosis (Fleer et al.,1985) and the probable virulence factor of CN-S is the adherence factors which allow colonization and infection (Gristina,1987).

Diagnostic problem in the evaluation of CNS infection locates in the natural habitats of the organism which include the skin and nares (Christensen et al.,1983). Clincial specimens could therefore contain both contaminants and pathogens of these species. For differentiation, many test have been suggested and are considered as indicators of pathogenicity. These include, slime production or adherence (Christensen et al.,1982), exotoxin production (Hebert and Hancock,1985), biotyping scheme combined with antibiogram and phage-typing (Parisi and Hecht,1980).

Our aim is to stress on the clinical importance of different infections caused by CNS and to represent the methods used for diagnosis and differentiation between pathogens and contaminants isolated from clinical specimens.

REVIEW OF LITERATURE

TAXONOMY OF COAGULASE - NEGATIVE STAPHYLOCOCCI

Staphylococci are cluster- forming gram positive cocci of medical interest. It belogns to the family micrococcaeae which includes 4 genera, Staphylococcus, micrococcus, aerococcus and peptococcus. Their distinguishing characters are shown in Table (1).

Of these genera, only staphylococci and peptococci are commonly present as parasites in man and only one species, staphylococcus aureus, is an important primary pathogen. It causes a variety of superficial and deep pyogenic infections. (Duguid,1989).

Staphylococci are classified into 23 species, staphylococcus aureus (S.aureus), staphylococcus intermedius (S. Intermedius) and 21 species of coagulase - negative staphylococci (C-NS) (Pfaller et al.1988).

Staphylococcus aureus

It is differentiated from other species by the production of certain extracellular products e.g. coagulase, deoxyribonulcease (DNAase), α . β. γ haemolysin, leucocidin, protein A, fibrinolysin and hyaluronidase. In addition it is capable of anaerobic fermentation of mannitol, susceptibility to phages of the S. aureus typing set, and agglutinated by S. aureus typing sera (Duguid, 1989).

Rarely few strains of staph aureus are coagulase negative but they show most of the biochemical toxin - production and other characters of coagulase positive staphylococci (Duguid, 1989).

Table (1) Distinguishing characters of four genera of cluster-forming Gram-positive cocci

Genus	Predominant grouping	Atmosphereic requirement	Catalase production	Glucose breakdown	Ecological character
Staphylococcus	Irregular (grape-like) clusters	Facultative (aerobic growth greater than anaerobic)	+	Fermentative (acid formed anaerobically as probically)	Pathogenic and commensal parasites
Micrococcus	Irregualr clusters or tetrads	Strictly aerobic	+	Oxidative (acid formed only aerobially) or inactive	Free-living saprophytes
Aerococcus	Tetrads and small clusters	Facultative (aerobic growth greater than anaerobic)	- or weak	Fermentative	Free-living saprophytes
Peptococcus	Irregular clusters or tetrads	Strictly anaerobic	weak or variable	Fermentative or inactive	Commensal parasites, opportunistic pathogens

Staphylococcus intermedius

It presents only in animals. It resembles S. aureus in that, it is coagulase positive, DNAase positive, but it differs from S. aureus in their growth requirements and biochemical reactions as shown in table (2).

Table (2) Usual reactions of sStaph.aureus in medius

Staph		
	aureus	**intermedius**
Yellow or orange pigment	+	-
Coagulase*	+	+
Heat-stable DNAase	+	+
Acid from :	+	-
mannitol (AnO_2)	+	-
mannitol (O_2)	+	-
maltose (O_2)	+	-
lactose (O_2)	+	+
VP reaction	+	-
Phosphatase	+	+
Lysis by human and bovine phages	+	-
Requriement forbiotin	-	+

AnO_2 = anaerobically, O_2 = aerobically; others negative
* Clots rabbit plasma

Quoted from Topley & Willison, 1982

Coagulase - Negative Staphylocci (C-NS)

They are non pathogenic cocci, Recently they are considered as the single cause of many critical infections. They may cause peritonitis in patients on peritoneal dialysis and septicaemia in patients with indwelling medicaldevices and immunodefective patients (Pfaller et al.,1988).

They are classified into 21 species of different clinical significance as shown in Table 3.

Table (3): Classifiation of coagulase-negative staphylococci and their pathogenic significance .

Specieds	Pahogenic significance
S. epidermidis species group	
S. epidermidis	Common
S. haemolyticus	Uncommon
S. saccharolyticus	Uncommon
S. warneri	Uncommon
S. capitis	Rare/undetermiened
S. caprae	Rare/undertermined
S. auricularis	Rare/undertermined
S saprophyticus species group	
S. saprophyticus	Common
S. cohnii	Uncommon
S. xylosus	Rare/undertermined
S. arlettae	Rare/undertermined
S equorum	Rare/undertermined
S. gallinarum	Rare/undertermined
S. klossil	Rare/undertermined
S. simulans species gorup	
S. simulans	Uncommon
S. carnosus	Rare/undetermined
S. sciruri species group	
S. scuri	Rare/undertermined
S.lentus	Rare/undertermined
Unspecified species group	
S. caseolyticus	Rare/undertermined
S. hyicus	Rare/undertermined

(Quoted from Pfaller and Herwaldt,1988

The classification of CNS depend upon different morphological, physiological and biochemical characters and cell wall peptidoglycan and techoic acid composition (Pfaller et al.,1988). The important distinguishing charcters of some these species are shown in table 4.

C-NS are collectively known as albus staphylococci, the most important species of them are S. epidermidis and S. saprophyticus which furtherly classified into different biotypes as shown in table (5).

Table (5) Biotype of Stap. epidermidis and Staph. saprophyticus

Earlier biotyipe designation	Staph epdermidis biotype				Staphysaprophyticus biotype			
	1 SH.SV	2 SIII	3 SIV	4 SVI	1 M1	2 M2	3 M3	4 M4
Phosphatase	+	+	-	-	-	-	-	-
VP reaction	+	-	+	+	+	+	+	+
Acid from:								
mannitol	-	-	-	+	-	-	+	+
lactose	+*	v	-	v	-	+	v	+
maltose	+*	-	v	v	v	+	+	+

v = Some strains positive, ohers negative
• Baird - Parker (1974)
+ Baird Parker (1963)
* Usual reaction
Also acidifies arabinose

Quoted from Tapelly & Willsons, 1982)

Table (4) Characters distinguishing 10 speices of staphylococci (Adapted from Baird-Parker).

Character	S.aureus	S.intermedius	S.hyticus	S.epidermidis	S.capillis	S.homoinis	S.warneri	S.haemolyticus	S.cohni	S.saprophyticus
Occurrence in man	+	-	-	+	±	±	-	+	+	+
Thermostable DNA nuclease	+	+	+/-	-	+/-	+/-	-	-	-	-
Coagulase produced	+	+	+/-	-	-	-	-	-	-	-
Haemolysis on human blood	+	+/-	-	-	-	-	-	+	-	-
Acetoin produced	+	-	-	+	+/-	+/-	+	+	+/-	+
Acid produced aerobicalluy										
from : sucrose	+	+	+	+	+	+	+	+	-	+
trehaloe	+	+	+	-	-	+	+	+	+	+
mannitol	+	±	-	-	+	-	+/-	+/-	+	+
Phosphatase produced	+	+	+	+	-	-	-	-	-	-
Growth on medium with 1.6 mg/litre novobiocin	-	-	-	-	-	-	-	-	+	-

COAGULASE - NEGATIVE STAPHYLOCOCCI

Coagulase negative staphylococci (CNS) are normally found on the skin and mucous membrane of man and other animals. Their isolation from clinical materials was previously thought as a contamination. Recently the capabilities of CNS as opportunistic pathogens are just fully realized (Christensin et al., 1982).

CNS is morphologically similar to S.aureus, they are gram positive non motile, non spore forming cocci occurring usually in irreugular grape like clusters but it may also present singly or in pairs.

Most human species of CNS can tolerate relatively high concentrations of salt (7.5 to 10%) but all are coagulase negative and even non manitol fermenter except S.saprophyticus and few strains of S.haemolyticus and S. cohni (Bailey and Scott, 1974).

Cultural characters

Staphylococci are facultative anaerobes optimum PH for growth is 7.4 - 7.6 and optimum temperature is 37 ^{o} C with a range of 12 - 44 ^{o}C (Duguid, 1989).

1. Blood agar:

S.epidermidis usually produce pale, translucent, gray white non hemolytic colonies, few strains may be slightly hemolytic. S.saprophyticus colonies are usually white but can be yellow or