

## Gram stain microbiological pattern of upper extremities suppuration at Baptist Medical Centre, Ogbomoso Nigeria: a fifteen month review

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### Summary

Sixty-eight (68) patients with serious upper extremity suppurative infections, presenting within a period of fifteen (15) months, were prospectively studied clinically, Gram stain of aspirates/pus were performed, specimen cultured, planted, and where indicated glucose levels and haemoglobin genotype determined. Half of the patients had hand infections. *Staphylococcus aureus* was isolated from thirty-nine (39) patients. Gram Negative bacilli, including *Salmonella* were more isolated from patients with diabetes mellitus or Hgb SS or SC. The Gram stain results correlated with the culture result 90%. When Gram Positive cocci were demonstrated in the primary microscopic examination, cultures were not mandatory. When no organism was demonstrated on primary Gram stain or the patient was diabetic or a sickler, cultures of the specimens were done. The Gram stain, well performed, remains a useful, inexpensive, technologically appropriate laboratory test for abetting decision making in patients with upper extremity suppurative infections. Organisms encountered in this study included: *Staphylococcus aureus*, *Streptococcus pyogenes*, *Salmonella typhi*, *Proteus mirabilis*, *Pseudomonas aeruginosa*, and Coliforms.

**Keywords:** *Suppurative infection, Gram stain, abetting decision.*

### Résumé

Soixante-huit (68) patients souffrant des infections chroniques des extrémités supérieures étaient étudiées cliniquement de façon prospective durant une période 15 mois, les échantillons des grammes/pus étaient faites, échantillons cultivés, plantés, et les taux du glucose sanguin et d'hémoglobine déterminés. La moitié des patients avaient des infections des mains. Le

*Staphylocoque aureus* était isolé chez trente neuf (39) patients. Les bacilles de gramme négative, inclus les *salmonelles* étaient plus isolés des patients avec le diabète mellite ou Hgb SS ou SC. Les résultats corrélaient avec les résultats de la culture à 90%. Lorsque les bactéries Les bacilles à gramme positive avaient démontrés par l'analyse microscopique primaire, les cultures n'étaient pas obligatoires. Aucun microorganisme n'était démontré à l'analyse primaire ou du patient qui était diabétique ou drépanocytaire, les cultures étaient faites. Les grammes teintés, bien fait, reste un test utile, moins coûteux, Technologiquement approprié pour prendre des décisions des patients sur la suppuration des extrémités supérieures. Les microorganismes rencontrés dans cette étude inclus: *Staphylocoque aureus*, *Streptocoques pyogènes*, *Salmonelle typhi*, *Proteus mirabilis*, *Pseudopodes aeruginosa*, et les coliformes.

### Introduction

Hands are the most injured members of the body. Much upper extremity trauma is negligible, often forgotten, frequently neglected. Upper extremity infections comprise a spectrum from the readily treatable to the life threatening, but in reality no hand or upper extremity infection is trivial [1]. This work is a prospective microbiological study of patients seen and treated at the Baptist Medical Centre, Ogbomoso, Oyo State, Nigeria, a 200-bed general hospital in the midst of about one million people, mostly peasant farmers and traders. The study was conducted to find out how useful Gram's stain only could be in abetting decision making, and also identify the organisms incriminated in the infections of upper extremity in the environment. It concentrated on the Gram's stain and culture results, their correlation and discordance, rather than on clinical demography, specifics of treatment, or outcome.

### Materials and methods

Prior to the commencement of the study, ethical approval was sought and obtained from the institution's committee

on the ethics of human experimentation. Informal verbal and written consents were obtained from each patient or their parent/guardian/family in the case of children and adults who were unable to give consent on account of the severity of their illness. Data obtained were recorded on clinical data sheets without personal, identifiable parameters like name or address.

All patients who presented to our accident and emergency department within a period of fifteen months with infections of the upper extremities were entered into the study. All infections of the upper extremities where fluid (purulent/dem/body) could be obtained for microbiology study were included. These ranged from infections of the nail, bed-like paronychia to pyomyositis to osteomyelitis.

After obtaining verbal and written consents both for inclusion in the study and for the required operation, patients were fasted. Pre-incision and drainage, urine sugar estimations were made, utilizing glucose reagent strips. Patients with positive glucosuria on screening were subsequently assessed with fasting blood sugar determinations, using spectrophotometer. X-rays were performed when clinically warranted or needed. All patients with osteomyelitis had their haemoglobin electrophoresis study done in the laboratory.

#### Incision and drainage

Patients were subsequently taken to the operating room. Upon administration of the necessary anaesthesia, the infected lesions were opened up surgically, and specimen taken appropriately for microscopy, culture and sensitivity. The patients were subsequently placed on broad-spectrum antibiotics usually including Cloxacillin, either solely or in combination with others. The specimens were taken to the laboratory for processing. Wounds resulting from these procedures were dressed frequently with sterile physiological saline and wet-to dry dressing until they are healed.

#### Laboratory procedures

Pus/aspirated were Gram stained, and examined microscopically. Specimens were plated on Blood, McConkey and chocolate agars. Incubations were at 37°C aerobically, and CO<sub>2</sub> for 18 hours. No anaerobic culture was done. Biochemical tests (serology where indicated) were done for identification of isolates: isolates characteristics of *Staphylococcus species* were screened for coagulase by slide and tube methods. *Streptococcus species* was identified by Lancefield grouping. *Salmonella* and *Proteus species* were

identified by Triple sugar fermentation, citrate utilization and indole production. *Salmonella species* were confirmed by *Salmonella* typing sera, *Proteus* were confirmed by urease and indole production. *Pseudomonas species* was confirmed by oxidase production, using 1% Tetramethylphenylene diaminohydrochloride solution.

Antibiotic sensitivity testing of *Proteus*, *Salmonella*, *Coliform*, *Pseudomonas* and *Staphylococcus species* were done by disc diffusion technique on Muller Hinton; *Streptococcus species* on Blood and chocolate agars [2-8].

Fasting blood sugars were estimated using Glucose oxidase method. Haemoglobin electrophoresis were done with Lead acetate paper electrophoresis machine [3].

#### Results

Sixty-one (61) patients were so prospectively studied with Gram stain and culture in the fifteen (15) months period, and additional seven (7) having Gram stains but no culture. Six (6) patients' cultures yielded no growth, two (2) of whom Gram positive cocci were demonstrated on primary Gram stain (prior antibiotic self medication strongly suspected), and four (4) of whom no organism was demonstrated on primary Gram stain.

In fifty-five (55) patients, the following organisms were isolated: *Staphylococcus aureus* 39 (70.9%), *Streptococcus pyogenes* 4 (7.2%), *Coliforms* 5 (9.0%), *Salmonella typhi* 4 (7.2%), *Proteus mirabilis* 2 (3.6%), *Pseudomonas aeruginosa* 1 (1.8%). (Table 1)

**Table 1:** Organisms and frequency of occurrence in fifty-five cultures.

Organisms	Frequency	Percentage (%)
<i>Staphylococcus aureus</i>	39	70.9
<i>Streptococcus pyogenes</i>	4	7.3
<i>Salmonella typhi</i>	4	7.3
<i>Proteus mirabilis</i>	2	3.6
<i>Pseudomonas aeruginosa</i>	1	1.8
<i>Coliforms</i>	5	9.1

There was agreement between the primary Gram stain results and culture in 55 of 61 instances (90%), and disagreement on six instances. In three instances where no organism was demonstrated on the primary Gram stain, Gram Negative organism were isolated from cultures, while in three instances where Gram Positive cocci were demonstrated in the primary Gram's stain, no organism was isolated on culture.

In eight instances, Gram Negative bacilli were demonstrated on primary Gram stain. All the eight cultures subsequently yielded Gram Negatives: *Salmonella typhii* (4), *Proteus* (1) and *Coliforms* (3). On four occasions Gram Negatives were isolated where no organisms were detected on primary Gram stain.

Six patients had haemoglobinopathies: "SS" 4, "SC" 2. From these 6, *Salmonella typhii* was isolated on three occasions, *Coliforms* twice, and *Staphylococcus aureus*, once. (Table 2).

**Table 2:** Organisms and frequency of occurrence in six haemoglobinopathies.

Organisms	Frequency	Percentage (%)
<i>Salmonella typhii</i>	3	50.0
<i>Coliforms</i>	2	33.3
<i>Staphylococcus aureus</i>	1	16.7

*Note:* *Coliforms* are Gram Negative Bacilli that were not speciated due to high cost of reagents.

Only one patient, a 45 year old female had diabetes mellitus. *Coliforms* were isolated from her deep palmar space abscess.

### Discussion

We noted agreement in 55 of 61 (90%) instances between the Gram's stain result and the culture results. The Gram's stain appeared particularly helpful if Gram Positive cocci were demonstrated. If no organism was reported from primary Gram's stain, yet purulent discharge had been drained or noted, one can suspect difficulty to detect Gram Negatives. This occurred in 3 of 9 instances. Prior antibiotics therapy (suboptimal dosage through self medication) could also be responsible. This also occurred in 3 of 6 instances. In this situation, Gram's stain only seems not helpful. In the analysis of the six sicklers and one diabetic, concordance occurred in 5 of 7 instances. *Coliforms* grew from one sickler who had no organism on Gram stain.

Were finances, supplies, and personnel not in short or erratic supply, ideally culture and sensitivity of all specimens from suppurative process would be recommended and advocated. The instance where culture may be less efficacious, hence less necessary, is when Gram Positive cocci are demonstrated in the non-sickler, non-diabetic patient.

Drainage alone likely would suffice often for many staphylococcal infections, and Cloxacillin or other agents can treat the various Gram Positive cocci effectively. When Gram Negative bacilli are demonstrated, the specimen and sensitivities become more important. Treatment choices between oral Chloramphenicol or parenteral Gentamycin or other agents may become pertinent.

Similarly, culture seems advisable when dealing with sicklers, diabetics, or when the Gram's stain of purulent materials fails to reveal organisms microscopically, since Gram Negatives may have been overlooked in the microscopic examination. *Staphylococcus aureus* seems to be the most common organism in the non-diabetic and non-sickler with suppurative infection of the upper extremities (Table 1), whereas Gram Negatives were predominant in sicklers (Table 2).

### Conclusion

If patient's factor, e.g. self medication prior to presenting in hospital could be controlled, then Gram's stain remains a useful, inexpensive, technologically appropriate laboratory test for abetting decision making in patients with upper extremity infections. If Gram Positive cocci are demonstrated on Gram staining in the non-sickler or non-diabetic, then culture and sensitivity test seem not mandatory, to save cost on patients. When Gram Negative organism or no organism is demonstrated, and when the patient is either a sickler or diabetic, both Gram's staining and culture-sensitivity investigations are recommended.

Adequate drainage remains the principle in dealing with upper extremity, and other suppurative infections.

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