Sensitivity and Resistance of Microorganisms in Infected Surgical Wounds on Surgical Floor of Mayo Hospital

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Background: There is an overwhelming concern around the world regarding the increasing number of resistant strains of microorganisms in all sorts of wounds. There is hardly any information about the prevalence and incidence of such resistance pattern in our local hospitals .**Methods:** This study was done to probe into the common microorganisms and their culture sensitivities to antibiotics in surgical wound infections in general surgery wards of Mayo hospital. The study material included the pus specimens sent to pathology lab from general surgical wards. There culture sensitivity results were interpreted to find out the prevalence of individual microorganisms in surgical wounds and sensitivities and resistance to different antibiotics. **Results:** Staphylococcus aureus was the most common organism cultured (54.87%), followed by E.Coli (10%), pseudomonas(10%), proteus (7.9%) and kleibsiella (5.3%). 20 percent of wounds had mixed growth of organisms.. Mixed growth of microorganisms was seen in 20% of cases. **Conclusion:** Most of the bacteria cultured were resistant to routinely used antibiotics.

Key words: Suurgical wounds, pus, microorganisms, sensitivity, resistance

Perioperative infection of the surgical patient is common. Endogenous microbial colonisation of tissues can occur as a consequence of the course of a disease (e.g. perforation of an intra-abdominal viscus) or as a result of operative intervention. Exogenous infection of the patient may occur through non-sterile surgical technique or simply by failure to maintain an acceptable standard of cleanliness on wards or between each patient contact. The prevention of infection is of paramount importance and may be achieved by antiseptic/aseptic precautions, together with the judicious use of prophylactic antibiotics. The management of established infection involves general interventional care of the patient combined with antibiotic therapy. Occasionally, a surgical procedure may be required. Communication with, and the involvement of, microbiologists facilitate rational antibiotic therapy. Indiscriminate use of antibiotics can lead to both microbial resistance and superadded infection, resulting in increased mortality rates, particularly amongst immunosuppressed patients.

The aim of this study was to work out the probable growth of micro organisms in the pus from surgical wounds and their resistance and sensitivities to antibiotics.

Materials and methods:

The study includes the patients whose pus taken from wound site was sent from the general surgery wards of Mayo hospital for culture and sensitivity to the department of pathology from June 2004 to November 2004.

The subjects included both males and females of above 13 years of age. The specimen included only pus from surgical wounds and no other body fluid or specimen was included in this study. Specimens collected from 113 patients admitted in all the 4 surgical wards were cultured and antibiotics like Augmentin (co-amoxiclave), Enoxabid (Enoxacin), Fortum (Ceftazidim), Ciprofloxacin, Oxidil (ceftriaxone), Grasil (Amikacin), Tienem (Imipenem), Tazocin, Klaricid (clarithromycin), Zenacef (cefruxime), Sparaxin, Septran, Sulzone, Erythrocine, vibramycin and tetracycline used for culture sensitivity . Media for growth of microorganisms was Blood culture plates where 2% nutrient agar was mixed with sheep blood in a ratio of 20:1. Other routine media included McConkeys agar and chocolate agar Media used for culture sensitivity was 2% nutrient agar. Sensitivity of different strains were checked by streaking overnight cultures onto nutrient agar having different standard concentrations of antimicrobial drug. Gram Staining was carried out by using crystal violet and iodine

Results:

Out of 113 pus specimen cultures 54% were male and 46% were female. The number of specimen send from each surgical ward are as follows:

Ward name on surgical floor

Unit	Frequency	%age
NSW	33	29.2
ESW	28	24.8
WSW	14	12.4
SSW	38	33.6
Total	113	100.0

The most common organisms were Staph.aureus followed by E. Coli, Pseudomonas and proteus and kleibsiella. Staph aureus was found in 54.87% of specimen. It was sensitive to augmentin in 84%, to Klaricid in 62%, to Tienem in 88%, and to tazocin in 66% of cases. While 24.44% Staph aureus were resistant to klaricid and 8.88% to Augmentin.

E.Coli was found in 10.61% of total no. of specimen .7/12(58.3%) were sensitive to Gracil (Amikacin), 6/12 (50%) were sensitive to Tazocin and

Tienem each while 3/12(25%) were sensitive to Enoxacin. Most of e coli were resistant to oxidil (ceftriaxone).

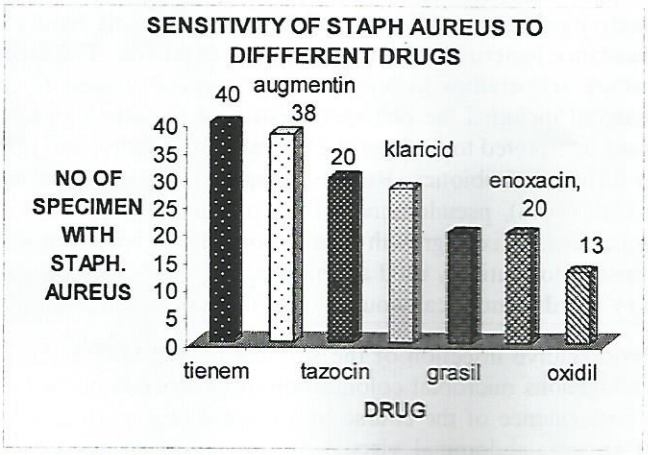
Microorganisms found in pus

Microorganism*	Frequency	%age	Valid %age	Cumulative %age
Acitinobacter	1	.9	.9	.9
E.coli	10	8.8	8.8	9.7
Mixed E. coli & proteus	1	.9	.9	10.6
E.coli with no growth	1	.9	.9	11.5
Klebsiella	4	3.5	3.5	15.0
Klebsiellla no growth	1	.9	.9	15.9
Mixed gram + and gram-	2	1.8	1.8	17.7
Mixed gram+ & klebsiella	1	.9	.9	18.6
Mixed gram+ & proteus	1	.9	.9	19.5
Mixed pseudomonas & proteus	1	.9	.9	20.4
Mixed staph .aureus &e,coli	3	2.7	2.7	23.0
Mixed staph.aureus & p.aurogenosa	1	.9	.9	23.9
Mixed staph aureus & proteus	4	3.5	3.5	27.4
Mixed staph aureus & pseudomonas	9	8.0	8.0	35.4
No growth	23	20.4	20.4	55.8
Proteus	2	1.8	1.8	57.5
Pseudomonas	2	1.8	1.8	59.3
Staph.aureus	45	39.8	39.8	99.1
Streptococci	1	.9	.9	100.0
Total	113	100.0	100.0	

The individual frequencies of micro organism are as follows:

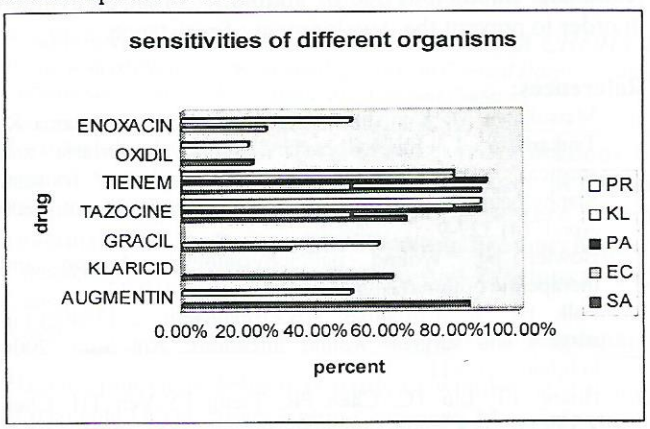
Microrganisms	Frequency
staph.aureus	62
e.coli	10
Klebsiella	6
Proteus	9
Acitinobacter	1
Pseudomonas	12
No organisms	23
Streptococci	1

Pseudomonas were found in 12/113(10%) of total specimens, out of which 2/10 (20%) were isolated growth while rest 80% were mixed growth with other organism such as e coli and proteus. In most of he cases it was sensitive to tienem and tazocin only. Proteus was found in 9/113 (7.96%). In almost all of cases it was sensitive only to tazocin and tienem .Kleibsiella was found in 6/113(5.3%) of specimen, out of which 4 were isolated growth, two were mixed with other organisms. It showed good sensitivity to tienem, tazocin and moderate sensitivity to enoxacine. In 23/113 (20%) of the cases no growth of microorganisms was seen.

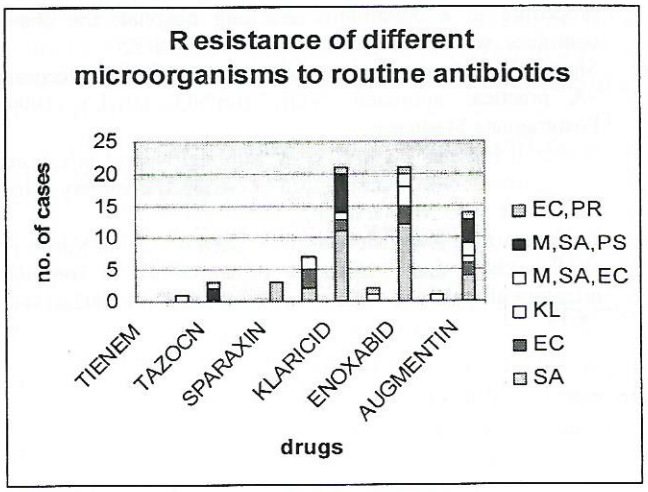


Antibiotics	Sensitivity to Organisms	Resistant Organisms
Amikacin	E.coli and klebsiella	Gram +ve cocci &pseudomonas
Enoxacine	Staph, a few Pseudmonas	Proteases
Co-amoxiclav	Staph, a few Pseudomonas	Proteases
Cefuroxime	Sensitive in many cases against Stpah & E.coli	Pseudomonas, Proteases
ceftriaxone	Less sensitive for staph,good gram-ve coverage	Pseudomonas ,proteases
Ceftazidime	Sensitive in many cases against Staph & E.coli	Pseudomonas
Erythromycin	poor sensitivity	Pseudomonas, Proteases, & Staph
Tetracycline	Poor sensitivity	Pseudomonas, Proteases, & Staph
Clarithromycin	Mild to moderate sensitivity	Pseudomonas, Proteases, & Staph
Sparaxin	Moderately good sensitivity to staph.	rest
Imipenem	Good sensitivity to staph, pseudomonas &proteus	Almost none resistant
Piperacillin+tazobactum	Good sensitivity to pseudomonas &proteus	Very little resistance

The sensitivity of other microorganisms to various drugs can be depicted as follows:



The resistance pattern of various antibiotics in our study was as follows:



Discussion:

Wound infection is the most important issue among the patients admitted in surgical wards. In this study we found out that most common organism is staphylococcus aureus. This might be due to presence of this organism in normal flora of skin and adjacent cavities or due to cross contamination. In 20% of the specimen no organism was cultured from pus sent for c/s. This shows one out of every five specimen sent for c/s are either not properly collected or adequately transferred to the laboratory.

The house staff should take following precautionary measures while sending samples: Samples should be sent before the commencement of antibiotic therapy. If the patient is already taking antibiotics, the type, dose and length of treatment should be written on the request form.

Samples should be collected in a sterile manner to avoid false positive results due to cross contamination. Blood should be sent for microbiology, culture and sensitivities if the patient is systemically unwell.

Specimen of pus should be collected by a medical officer or an experienced nurse Pus from an abscess is best collected at the time pus is first drained or after it has ruptured naturally When collecting pus from an abscess ,wound or other sites special care should be taken to avoid contaminating the specimen with commensal organisms from the skin. As far as possible, a specimen from a wound should be collected before an antiseptic dressing is applied In hospital, using a sterile technique aspirate in a drainage tube upto 5ml of pus transfer to a leak proof sterile container. In other cases ,cotton wool swab is used to collect a sample from infected siteImerse the swab in a container of transport medium When mycetoma is suspected ,obtain a specimen from the drainage sinus tract using a sterile hypodermics needle to uplift the crusty surface over sinus opening.

Label the specimen, as soon as possible and deliver it with request form to the laboratory. An **Ideal antibiotic** would be cheap, easy to produce, stable in a low-volume solution, available and effective in oral, intravenous and topical preparations, be bactericidal against Gram positive and negative rods and bacilli, spirochetes and anaerobes, have a wide therapeutic range with minimal side-effects, be non-allergenic and resilient to the development of bacterial resistance.

In our study augmentin (Co-amoxiclav) showed better results than klaricid (clarithromycin) against staphylococcus aureus , being the most common organism cultured in pus. Mixed growth of pseudomonas & staph aureus was not sensitive to most of antibiotics except tienem (imipenem) and tazocin (piperacillin & tazobactum). It is highly recommended that urinary catheter must be removed as soon as possible to prevent the colonisation of pseudomonas.

Proteus is common and mostly resistant to routine antibiotics.

Erytromycine, Cephradine and ciprofloxacin are not effective against most of the micro organism cultured .Bacteria may be naturally resistant to antibiotics, or may acquire immunity by a number of mechanisms. What is clear, however, is that antibiotic resistance is increasing: species that were formerly sensitive to certain antibiotics have mutated into resistant forms. Examples include methicillin (i.e. penicillin) – resistant *Staphylococcus aureus* (MRSA) and vancomycin-resistant enterococcus (VRE). The development of antibacterial resistance is primarily due to the indiscriminate use of current antibiotics, such that inadequate doses of broad-spectrum antibiotics are being administered for an inadequate time period.

Natural bacterial resistance may occur due to:

- Natural impermeability to antibiotic molecules
- Lack of target binding sites
- Lack of a target metabolic pathway
- The production of antibiotic destroying enzymes (e. g beta lactamases).

Acquired resistance may result from

- alteration in cell wall/membrane permeability
- Alteration in target binding site (e.g. penicillin resistant *S pneumoniae*
- Alteration in metabolic pathway (e.g. trimethoprim resistance)
- Gene activation to produce antibiotic destroying enzymes (e.g. amino glycoside resistance)
- New gene acquisition to produce antibiotic destroying enzymes

Long term use of resistant antibiotic may also suppress host bacteria or increase growth of pathogens that may result in further complications.

Limitations:

1. The inability to culture anaerobic organisms found in surgical wounds such as carbuncles and gas gangrene because of unavailability of anaerobe culture and the proper sample collection techniques.
2. Although Staph. aureus is the most common organism found in all the specimen but methicillin resistant staph aureus (MRSA) could not be documented either because of lack of targeted search for it or improper sampling and culture techniques.

Conclusion & recommendations:

Resistant of micro organisms in our wards against commonly used antibiotics is fast growing. It is need of hour that surgeons and doctors from all other department combine hands with microbiologist to find out the prevalence of organism and their sensitivities and resistance. Injudicious use of antibiotics must be avoided in order to prevent the development of resistance.

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