



TO ASSESS THE CRITERIA OF CHOICE OF ANTIMICROBIALS PRESCRIBED IN VARIOUS CLINICAL DEPARTMENTS OF GOVT DOON HOSPITAL

Pharmacology

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ABSTRACT

Background: The choice of antibiotic depends on antibiotic susceptibility of the causative organism. There are some infections which can be treated by one or several drugs. The choice is based on most effective, least toxic with rapid action and good pharmacokinetics and with least cost, for the precise duration of time to cure or prevent infection. Also, the diagnostic tests & culture sensitivity detect an infection and the causative organism involved. **Materials&Methods:** The study was carried out in various clinical departments (Medicine, Surgery, Gynecs&Obstetrics, Orthopedics, Pediatrics, ENT, ICU) in Govt Doon Hospital situated in Patel Nagar, Dehradun for a period of four months from January to April 2022. The data from 200 prescriptions was entered and tabulated regarding name of disease, treatment and dose, criteria of choice of antimicrobials, in a departmentwise manner. **Results:** The criteria of choice as efficacy and availability were 100% & cost was important in case of medicine dept. Safety was the criteria in case of antitubercular drugs and tolerability in case of pediatrics while giving metronidazole to children as in gastroenteritis because of its adverse effects. Broad spectrum drugs are prescribed in empirical therapy and narrow spectrum after culture sensitivity and diagnostic tests. A stepped up approach is used giving higher antibiotics in case of sepsis. Prophylactic therapy is given in cases of communicable diseases and as surgical preoperative prophylaxis. **Conclusion :** The criteria of choices are important factors for laying guidelines for antibiotic prescribing in a hospital setup. They prevent the indiscriminate injudicious use of antimicrobials. Designing an antibiogram by our hospital lab will help define local susceptibility trends and resistance patterns.

KEYWORDS

Empirical, broad spectrum, narrow spectrum, diagnostic tests, culture, antimicrobials, infection

INTRODUCTION

Treatment of infection with antibiotics need an appropriate diagnosis first. Initial therapy for infection is empirical guided by clinical presentation. It covers multiple possible pathogens --usually based on the most likely causative organism. The microbiological samples eg (blood cultures, urine and sputum) should be taken prior to commencing treatment, to guide targeted switches to alternatives that are better tolerated and more effective against the pathogen involved. Switching to narrow spectrum drugs reduces the cost and toxicity and prevents the emergence of antimicrobial resistance in the community. Identifying the causative organism is of paramount importance to determine the best course of treatment. Signs and symptoms can be misleading since most viral infections present similarly to bacterial infections. High inflammatory marker like procalcitonin indicate severe bacterial infection whereas PCT is less likely to be raised in response to viral infections, autoimmune conditions. Infections are marked by increased leucocyte count, increased platelets, increased C reactive protein, increased ESR, increased serum creatinine, liver function tests. Danger signals as high temperature, hypotension, rapid pulse rate, high/low respiratory rate and altered mental state can indicate sepsis. The microbiological tests used to confirm source of infection are presence of organism, microscopy, culture, serology, polymerase chain reaction, antibiotic susceptibility testing. CSF & urine microscopy are also used to detect infection. In addition to treating infections, antimicrobials can be used for long term prophylaxis eg in recurrent UTI, surgical prophylaxis and as adjuvant prophylaxis eg with some chemotherapeutic agents. Patients at extremes of age (very young and very old), immunocompromised patients and patients with serious long-term conditions such as chronic kidney disease or liver failure, are at higher risk of serious infections and are more likely to need antimicrobial treatment. The choice of antimicrobials involves several factors like causative organism, infection severity, local resistance patterns, drug interactions, patient factors such as previous history of drug allergy, body weight and hepatorenal function, local sensitivity patterns. In critically ill patients as in septic shock, febrile neutropenia and bacterial meningitis, empirical therapy should be started immediately after collection of diagnostic specimens. Patients who are stable and frequently ill for a period of several days or weeks (eg subacute bacterial endocarditis and vertebral osteomyelitis /diskitis) before presentation, antibiotic therapy should be withheld until multiple sets of blood cultures or disk space aspirate /or bone biopsy have been obtained.

After starting, an antimicrobial should be reviewed within 48-72 hours to ensure that the initial diagnosis is still valid and the chosen antimicrobial remains appropriate. Response to the antimicrobials should also be monitored by checking patient's temperature,

inflammatory markers and general wellbeing. If the antimicrobial is to be continued, regular reviews every 48 to 72 hours should be undertaken to continue treatment, stop or change the antimicrobial and clearly documented. The patient must be switched from IV to oral therapy when he is afebrile for more than 24 hours, clinically improving -signs and symptoms of infection and inflammatory markers trending down towards normal, eating and drinking well, not suffering from certain deep seated risk infections such as (liver abscess, osteomyelitis, septic arthritis, meningitis, endocarditis).

Due to emerging antibiotic resistance due to irrational prescribing pattern, there was felt a need to conduct a study in Govt Doon Hospital to assess the criteria of choice of antimicrobials prescribed by clinicians in different departments of the hospital. A questionnaire based on different criteria of choosing an antibiotic, was designed for the clinicians to easily choose among the options. Also, some general questions were framed to assess the antibiotic prescribing practice guidelines in the hospital. The criteria of choice were P drug criteria -efficacy, safety, tolerability, cost of treatment, patient factors--age, comorbidity, previous allergy to a drug, sensitivity to an organism, broad spectrum or narrow spectrum, empirical, prophylactic or definitive therapy, diagnostic tests--hematology, X ray, urine microscopy, CSF, blood/urine culture. Also the results were tabulated based on different criteria in all clinical departments¹⁻⁹

MATERIAL METHODS

The study was carried out in various clinical departments (Medicine, Surgery, Gynecs&Obstetrics, Orthopedics, Pediatrics, ENT, ICU) in Govt Doon Hospital situated in Patel Nagar, Dehradun, affiliated to Doon Medical College, for a period of four months from January to April 2022. The two intern students were instructed to collect nearly 200 prescriptions from IPD from different clinical departments like -Medicine, Surgery, Gynecs, Pediatrics, ENT, Orthopedics, ICU. Nearly all the important cases prescriptions were covered in which antibiotics were prescribed. The consultants were given questionnaires of 21 questions (Appendix 1) to answer appropriately the criteria of choosing antimicrobials in a particular scenario. Some general questions about the prescribing trend in the follow up in IPD were also put in the questionnaire. Any doubts regarding antibiotic use, were cleared by discussions with the consultants. The data was compiled by the students and tabulated. The permission for conducting the study was taken by the Institutional ethical committee.

RESULTS

The criteria of choice as efficacy and availability was 100% & cost was important in case of medicine dept.

Table 1

DEPARTMENT	No. of Cases
Medicine	40
Surgery	40

Obs & Gyn	40
Orthopedics	40
ENT	20
Pediatrics	20
Total	200

Table2:Medicine

Case	Cause/ Causative Organism	Treatment	No. of Cases	Antibiotics Prescribed on what basis
Acute Gastroenteritis	Viral, Entero-toxigenic & Entero-pathogenic E. coli S. aureus, B. cereus, C. botulinum	Inj Ceftriaxone 1 gm IV BD Inj Metronidazole 100ml IV TDS	10	Broad spectrum
Biliary tract infection/Jaundice	Enterobacteriaceae (E.coli, Klebsiella sp.)	Inj hepamerz or udliv	4	Diagnostic tests –hematology
Community acquired Pneumonia	S. pneumoniae,	Inj Amoxyclav 1.2gm IV BD	9	-Diagnostic tests –x ray,hematology -Efficacy of drug
Typhoid	Salmonella Typhi	Inj Cefuroxime 1.5gm IV BD or cefixime 200mg bd or azithromycin 500mg od x 5 days	3	--Against specific pathogen --hematology –widal test
UTI	Escherichia coli, Klebsiella pneumonia, Proteus mirabilis, Pseudomonas, Enterococcus sp.	Inj Piperacillin+Ta zobactam 4.5gm TDS after that 2.25gm TDS	3	Diagnostic tests --- hematology,urine microscopy ,Urine culture ,
Liver Abscess	Polymicrobial	Inj Ciprofloxacin 500mg BD Inj Metronidazole 100ml IV TDS	2	-Tolerability of drug Diagnostic tests –hematology Blood culture
Pulmonary Tb	M. tuberculi	HRZE	3	-bactericidal and bacteriostatic action -Efficacy of drug -Safety of drug Diagnostic tests –X ray,hematology
Acute Bacterial Meningitis	S. pneumoniaeH.influenzae, Neisseria meningitidis	Inj Ceftriaxone 2 g IV 12hourly Dexamethasone 4 mg BD.	2	-Based on bacterial or viral etiology -CSF culture Diagnostic tests—CSF,Hematology
Acute bacterial exacerbation of COPD	S. pneumoniae H. influenzae M. catarrhalis	Amoxyclav 1.2gm IV BD	5	Broad spectrum -
Total			40	

Table3-ENT

Case	Causative organism/ Cause	Treatment	No. of Cases	Antibiotics Prescribed on what basis
Chronic Otitis Media	S. pneumoniae H. influenzae Morexella catarrhalis	Amoxyclav 1gm IV BD For Pre and Post op care- Inj Ceftriaxone 1gm IV BD	5	Diagnostic tests –hematology
Chronic Mastoiditis	Polymicrobial	Inj Piptaz 4.5gm IV TDS Inj Meropenem 1gm IV TDS	4	-Blood culture -Diagnostic tests –X ray,hematology
Neck Swelling with abscess	Polymicrobial	Draining of abscess and pus Prophylactic antimicrobial therapy- Inj Ceftriaxone 1gm IV BD	3	Diagnostic tests –X ray,hematology Blood culture
ENT Pre&Post op Antimicrobial Therapy		Inj Ceftriaxone 1gm IV BD Inj Metronidazole 100ml IV TDS	8	-Diagnostic tests –X ray, hematology, urine microscopy
Total			20	

Table4:Obs/Gyn

Case	Causative organism/ Cause	Treatment	No. of Cases	Antibiotics Prescribed on what basis
Obstetric Sepsis during and after pregnancy	Group A beta- haemolytic Streptococcus; E.coli, anaerobes. S. pyogenes, E. coli, S. aureus, S.pneumoniae, Methicillin-resistant S.aureus (MRSA), C.septicum & Morganella morgani	Inj Ceftriaxone 1gm IV BD Inj Metronidazole 500mg IV TDS	10	Broad spectrum before starting definitive therapy Cost &availability Send c/s always Diagnostic tests ---X ray,hematology
Septic abortion	Bacteroides, Prevotella biviuis, Group B, Group A	Inj Ceftriaxone 1gm IV BD	2	Broad spectrum, c/s in sepsis always Diagnostic tests –hematology, urine microscopy

	Streptococcus, Enterobacteriaceae, C.trachomatis, Clostridium perfringens.	Inj Metronidazole 500mg IV TDS Clindamycin in ICU		Metronidazole & clindamycin --Efficacy for anaerobes
Surgical Obstetric Antimicrobial Prophylaxis (LSCS)		Inj Ceftriaxone 1gm IV BD Inj Metronidazole 100ml IV TDS Inj Amikacin 500mg IV BD	8	Broad spectrum Diagnostic tests --Urine microscopy, hematology -Efficacy of drug -Safety of drug -Tolerability of drug -Cost of treatment
Surgical Gynecological Antimicrobial Prophylaxis(TAH, LTO, TO)		Inj Ceftriaxone 1gm IV BD Inj Metronidazole 100ml IV TDS Inj Amikacin 500mg IV BD	5	Broad spectrum Diagnostic tests --hematology, urine microscopy
Pelvic Inflammatory Disease*	S. aureus, Enterobacteriaceae, gonococci, gardenella	Kit 6(Tab Cefixime 400mg 1tab Tab Metronidazole 400mg-BD for 14 days Tab Doxycycline 1gm-BD for 14 days)	9	Syndrome management –kits according to syndromes
Vaginal Discharge(Vaginitis)*	Polymicrobial	Kit 2(Tab Secnidazole 2gm Tab Fluconazole 150mg) Clindamycin vaginal tablets for anaerobes	6	Syndrome management Pap smear cultures
Skin infections after vaginal hysterectomy ,surgical infections and chest infections		Augumetin oral and IV	2	Efficacy
Premature rupture of membranes	Azithromycin or erythromycin	Azithromycin or erythromycin	2	Efficacy
Total			40	

*These cases were taken from Gynaecology OPD

Table5:Pediatrics

Dosage of all antibiotics given to children are calculated on basis of their weight

Cases	Causative Organisms/Causes	Treatment	No. of Cases	Antibiotics Prescribed on what basis
Pneumonia	S. pneumoniae, H.influenzae, Legionella, E.coli, Klebsiella sp., S.aureus	-Child above 2 months- Cefotaxime 100mg/kg /ceftriaxone /day x 5 days After 48 hrs Gentamycin 7.5mg/kg /dose hours if no improvement we give meropenem or vancomycin	7	-Age -Efficacy of drug -tolerability due to adverse effects Diagnostic tests –X ray, hematology
Acute Gastroenteritis with Diarrhoea + Vomiting	Less than 5 years –rota virus –no antibiotic E. coli Salmonella	Tab cefixime In adolescents – inj ceftriaxone & amikacin	6	Associated with blood and mucus -antibiotic against strain specific
Rheumatic Fever	Group A Streptococcus	Inj Benzathine Penicillin G20,000IU /dose If Penicillin allergy give Inj Amoxycylav Or Oral Azithromycin	1	-Against specific pathogen till 18 years Diagnostic tests –hematology
Bacterial Meningitis	At birth –hemophilus influenzae ,Ecoli 2 months -2 years S. pneumoniae	Inj Ceftriaxone 100mg/kg /day x 14 days	2	Against specific pathogen Blood culture Diagnostic tests –CSF, hematology
Epiglottitis	H.influenzae , S.pyogenes, S.pneumoniae, S.aureus, viral	Inj Ceftriaxone Or Inj Cefotaxime	1	Against specific pathogen Diagnostic tests –X ray ,hematology
Typhoid	Salmonella sps	Inj Ceftriaxone- once fever resolves start oral Cefixime	3	Against specific pathogen Diagnostic test –Widal
Total			20	

Table6:Surgery

Case	Causative Organism/ Cause	Treatment	No. of Cases	Antibiotics Prescribed on what basis
Appendicitis	E.coli, K.pneumoniae, Streptococcus, Enterococcus, P.aeruginosa	Inj ceftriaxone 1 g BD +metronidazole 100ml 8 hrly	4	--Efficacy of drug -Safety of drug -Tolerability of drug Diagnostic tests—X ray,hematology
Cholecystitis	Enterobacteriaceae (E.coli, Klebsiella sp.)	Inj Cefuroxime 1.5 gm IV BD In Acute cases Inj Meropenem 1gm IV TDS	3	Prophylactic Efficacy Diagnostic tests—X ray,hematology
Peritonitis/ GI perforations	Enterobacteriaceae (E.coli, Klebsiella sp.), Bacteroides (colonic perforation), Anaerobes	Inj Piptaz 4.5gm IV TDS+metrogyl or Inj Meropenem(2nd line drug) 1gm IV TDS+metrogyl	4	Against gram negative & anaerobes Diagnostic tests—X ray,hematology
Mastitis	S. aureus	Inj Amoxyclav 1.2gm IV TDS + Inj Metronidazole 100ml IV TDS	2	Against gram positive organisms Diagnostic tests –hematology
Cellulitis	Strep.pyogenes, S.aureus	Inj Amoxyclav 1.2 g iv BD		Blood culture Diagnostic tests –hematology
Burns	Strep pyogenes, Enterobacter sp., S. aureus, S. epidermidis, Pseudomonas, fungi (rare)	Amoxyclav 1.2gm IV TDS And dressing with Silver sulfadiazine	3	To cover gram positive organisms Blood culture Diagnostic tests --- hematology,urine microscopy
Ulcers		Amoxyclav & amikacin		For gram positive and gram negative organisms Diagnostic tests—hematology
Necrotising Fascitis	Streptococcus pyogenes, S. aureus, anaerobes, Enterobacteriaceae (polymicrobial)	Inj Piptaz 4.5gm IV 6hrly + Inj Clindamycin 600mg IV TDS	2	-for gram positive Diagnostic tests –hematology Blood culture
Surgical Pre and Post op Antimicrobial Prophylaxis (Hernia, Cholecystectomy)		Inj cefuroxime or ceftriaxone	16	-broad spectrum Diagnostic tests –X ray,hematology
Liver abscess		Metronidazole		Against amoebic liver abscess due to anaerobes In bacterial abscess – against gram negative E.coli
UTI		Nitrofurantoin or Ciplox /norflox In refractory cases Tab Rifagut 200 mf BD X 5 days.		Sensitivity to organisms
Total			40	

Table6:Orthopedics

Surgical Antimicrobial Prophylaxis

Surgery	Medication	Antibiotics Prescribed on what basis
Orthopedic Surgery	Inj Cefuroxime Inj Metronidazole 100ml IV TDS Inj Amikacin 500mg IV BD	Broad spectrum P drug concept -Efficacy of drug against specific pathogen depending on c/s -Safety of drug -Cost of treatment Diagnostic ---X ray,hematology,urine microscopy Patient factor --hepatorenal function Pregnancy –avoid surgery, sent to gynecs to give safe medicine .
Total	37	

Case	Causative organism	Treatment	No. of cases	Antibiotics Prescribed on what Basis
Acute osteomyelitis	S.aureus, Streptococcus pyogenes, Enterobacteriaceae	Inj Ceftriaxone 1gm IV BD + Piptaz 4.5gm IV TDS	3	-against gram positive staphylo infection Also gram negative bacteria on rise Pseudomonas and Ecoli also Diagnostic tests –X ray,hematology

Table7: Antibiotic Resistant Cases

Out of 200 cases above some of the cases were antibiotic resistant for which higher antimicrobials were given

Case	Resistance	Treatment	No. of Cases
Osteomyelitis	VRSA (Vancomycin Resistance)	Inj Linezolid 600mg IV BD	1
Ulcer (Bed Sores)	Ampicillin, Amoxyclav, Imipenem, Cefoperazone, Meropenem, Ceftriaxone, Cefotaxime, Gentamycin	Inj Amikacin 500mg IV BD	1

DISCUSSION

The broad spectrum antibiotics prescribed were generally ceftriaxone, cefuroxime, cefixime, cefoperazone and narrow spectrum antibiotics prescribed based on culture sensitivity were ciprofloxacin, norfloxacin, metronidazole, gentamycin. The higher antibiotics prescribed in case of sepsis were meropenem, piperacillin tazobactam---both (against gram positive bacteria, gram negative bacteria, common anaerobes), vancomycin in methicillin resistant staphylococcus aureus. Metronidazole & Clindamycin are administered for anaerobes. The clinicians comply with the standard treatment guidelines. Efficacy & availability is the criteria in all cases.

Criteria of choice in Medicine Deptt- Based on diagnostic tests like –X ray, hematology reports, Blood culture, CSF –the antimicrobials are prescribed. Safety is also a criteria while administering anti Tubercular drugs as Anti TB drugs are associated with liver enzymes elevation, vestibular toxicity,retrobulbar neuritis. The doctors switch to alternative drugs in case of toxicity with any anti T.B drug.

Criteria of choice in Surgery department- Broad spectrum drugs with bactericidal activity and concentration dependent killing were preferred. In Operation theatre, culture sensitivity (c/s) is sent & drugs with pharmacokinetic profile of time dependent killing drugs were given. In pregnancy Amoxycillin was preferred. The Fixed dose combinations mostly chosen were piperacillin and tazobactam and Amoxyclav and Norflox TZ. The antibiotics were provided definitely for dirty contaminated wounds and mostly in high-risk situations. Both pre-and postoperative prophylaxis for surgical site infection were given. Metronidazole 100 ml 8 hrly was prescribed for anaerobic organisms and Augmentin 1.2 g IV TDS for skin infections against staphylococcus organisms. Cefepazone and sulbactam combination - 1.5 gm IV B.D was given in hepatobiliary surgeries.

Criteria of choice in Orthopedics- Broad spectrum antibiotics were given in road traffic accidents and metronidazole infusion in farm injuries. Also, in operation theatre & all infective orthopedic conditions like osteomyelitis c/s is done to find the antibiotic sensitivity. In old age where there is hepatorenal dysfunction ---cefepazone 1 g IV adult dose is given and 500 mg IV in children.

Criteria of choice in Gynecs Obstetrics- The antibiotics are given stepping up from lower to higher antibiotics depending on the severity of infection. First ceftriaxone & metronidazole are prescribed based on broad spectrum & efficacy. If it is not cured, the doctors switch to Inj amoxiclav and gentamycin and metronidazole –Triple antibiotic therapy. In case of sepsis, stepping up to Injs Meropenem or Piptaz (Tazobactam +Piperacillin) is done. In case of surgical site infections – depending on results of microbiology test reports of culture sensitivity of organisms, in case of suspecting any drug resistance, antibiotics are given. Urine culture is done in early pregnancy UTI, prolonged Foleys catheterisation. In case of Pelvic inflammatory disease & vaginitis ---syndrome approach is applied giving treatment kits. In case of skin infections, the antimicrobial treatment depends on the site of infection. In antenatal cases, the safer drugs to be used are Inj ceftriaxone and metronidazole.

Criteria of choice in Pediatrics- Broad spectrum drugs were prescribed in case of children instead of waiting for culture sensitivity. Generally Inj Ceftriaxone/Amoxycillin were given. Vancomycin was contraindicated in acute kidney injury. The cephalosporins were avoided in cases with history of drug allergy. Also Amoxyclav was substituted for penicillins in case of allergy. Also sensitivity of the organism to the antibiotic also criteria to treat in pediatrics diseases like in typhoid, meningitis.

Antibiotic prescribing pattern- The prescribers documented in the medical record, the dose, duration and indication for all antibiotic prescriptions. The appropriateness of all antibiotics was approved 48 hours after the initial orders. There was change from IV to oral therapy in appropriate situations and while discharging. The dose adjustment was done in case of renal dysfunction eg piperacillin tazobactam, meropenem dose were halved. Also, dose optimization was done to optimize the treatment of organisms with reduced susceptibility. Eg topical use of drugs in skin infection. Time sensitive stop orders for specific antibiotics were given like metronidazole for 5 days only, rest antibiotics for 7 days, no antibiotics in acute pancreatitis with normal total leucocyte count. Also there are educational trainings provided to clinicians through seminars, Medical education unit, pharmacovigilance meetings, to improve their antibiotic prescribing. There is no current antibiogram distributed to prescribers at this facility. Also, the facility does not monitor antibiotic consumption or antibiotic expenditure.

CONCLUSION

The correct criteria of choice of antimicrobials and antibiotic prescribing pattern help the hospital doctors in designing an antibiotic stewardship programme. The hospital antibiogram should be designed by the microbiology lab to give a periodic summary of antimicrobial susceptibilities of local bacterial isolates. Antibiograms should be used by clinicians to assess local susceptibility rates, as an

aid in selecting empirical antibiotic therapy, and in monitoring resistance trends over time within an institution. Antibiograms can also be used to compare susceptibility rates across institutions and track resistance trends. The clinicians should be given training how to read & interpret an antibiogram. Also the antibiotic consumption and expenditure should be recorded in the hospital. All practicing physicians should be able to use antimicrobial agents in a responsible manner that is beneficial to the individual patient and the community.

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