our website www.ejaypee.com, for detailed information on pharmacology books, visit our website www.ejaypee.com, for detailed information on pharmacology books, visit our website www.ejaypee.com

diginerve®
A Jaypee Initiative
• Video Lectures • Dr. Wise AI Chatbot
• Question Bank • Notes
Download App

Practical Manual of Pharmacology for Medical Students

As Per the Revised Competency-based Medical Education Curriculum 2024 (NMC)



4th Edition

Dinesh Badyal

JAYPEE

Contents

Section 1: Clinical Pharmacy

1. Terminologies in Pharmacology **3**
- Pharmacology 3
- Drug 3
- Branches of Pharmacology 4

2. Introduction to Clinical Pharmacy **6**
- Instruments 7

3. Weights, Measures, and Abbreviations **10**
- Metric System 10
- Pharmaceutical Calculations 11
- Abbreviations Used in Prescriptions 12
- Exercise 14

4. Labeling of Drugs **17**
- Commercial Preparations 17
- Exercises 22

5. Pharmacy Formulations **25**
- Exercise 1: To Prepare Oral Rehydration Solution from Oral Rehydration Salts Packet and Explain its use to a Subject/Standardized Patient 25
- Exercise 2: This Exercise is Related to Dilution of an Important Component Used Frequently (for MBBS/BDS Both) 28
- Exercise 3: To Prepare and Dispense Mouthwash Solution (for BDS) 29
- Exercise 4: To Prepare and Dispense 5 G of Tooth Powder (for BDS) 30
- Exercises 31

6. Common Dosage Forms and Routes of Drug Administration—I **33**
- Sources of Drugs 33
- Oral 34
- Factors Affecting Oral Route of Administration 37
- Oral-special Preparations 37
- Exercises 40

7. Common Dosage Forms and Routes of Drug Administration—II **41**
- Injections 41
- Parenteral—Intravenous 42
- Parenteral—Intramuscular 46
- Parenteral—Subcutaneous 48
- Parenteral—Intradermal Injection 49
- Parenteral—Sublingual 50
- Parenteral—Transdermal 50
- Demonstrate 52
- Exercise 1 52

- Exercise 2 52
- More Exercises 53

8. Common Dosage Forms and Routes of Drug Administration—III 56
- Local 56
- Local—Inhalation 62
- Local—Oral 64
- New Techniques for Drug Delivery 64
- Demonstrate 66
- Exercises 67

9. Calculation of Drug Doses and Dilutions 70
- Dose 70
- Loading Dose 71
- Maintenance Dose 71
- Fixed-Dose Combinations 71
- Ratio-Proportions 71
- Conversion within the Metric System 74
- Calculations of Drop Rate 74
- Liquids 75
- Exercises in Class 75

10. Drug Use in Special Population/Diseases/Physiological Conditions 79
- Children 79
- Elderly 81
- Pregnancy 82
- Lactation 84
- Hepatic Disease 85
- Renal Diseases 85
- Genetic Variations 87

Section 2: Simulation Based and Experimental Pharmacology

11. Introduction 93

12. Ethics and Animals 94
- Animal Toxicity Studies (Pre-Clinical Studies) 94
- Institutional Animal Ethics Committee 95

13. Alternatives to Animals Use 96
- Various Alternatives to Animal Use 97

14. Basics of Research 99
- Selecting Topic 99
- Aim and Objectives 100
- Materials and Methods 101
- Literature Searching 101
- Exercises 103

15. Ethics and Humans 106
- Patient Consent Form 108
- Examples 110

16. Technical Skills **111**
- Technical Skills 111
- Task Trainer 112
- Technical Skills in Pharmacology 112
- Example of Module 112
- Assessment 113
- Evaluation of the Module 115
- Advantages of Using Simulations for Technical Skills 115
- Exercise 115

17. Soft Skills **117**
- Communication 117
- Examples of Modules 119

18. Computer-assisted Learning **122**
- Use of Cal to Demonstrate Effects of Drugs in Humans 122

Section 3: Clinical Pharmacology

19. Introduction **129**

20. Pharmacokinetic Parameters and Calculations **130**
- Bioavailability 131
- First-Pass Metabolism 132
- Volume of Distribution 132
- Half-Life 134
- Clearance 134
- Exercises 135

21. Essential Medicines and Rational Drug Use **138**
- Rational Drug Use 138
- Essential Medicine Concept 139
- Objectives 142
- Formulations 143

22. Prescription Writing Through Problem-based Learning (Rational Prescribing) **145**
- Steps in Choosing a P-Drug 148
- P-Drugs and P-Treatment 149
- National Formulary of India 149
- Objectives 149
- Exercises in Class 150
- Examples of Prescriptions for Common Diseases: New Format 151
- Exercises in Class 194

23. Case-based Learning in Pharmacology **201**
- Case 201
- Role of Facilitator 202
- Actual Session (Initial Sessions) 202
- Learning Period 202
- Next Sessions 202
- Conduct of Session 203
- Case 1 203

- Case 1 205
- Case 2 205
- Case 3 205

24. Critical Evaluation of Prescriptions 206
- Common Errors in Prescription Writing 206
- Tips for Avoiding Prescribing Errors 207
- Parameters of Prescription Evaluation 207
- Tips for Writing a Good Prescription 208
- Exercises 208

25. Problem-based Drug Interactions 211
- Pharmaceutical 211
- Pharmacokinetic 212
- Pharmacodynamic 214
- Exercises in Class 215
- Examples of Problem-based Drug Interactions 215

26. Adverse Drug Reaction Monitoring 224
- What is an Adverse Drug Reaction? 224
- Special Need for ADR Monitoring in India 228
- Organization of ADR Monitoring System in India 229
- How to Recognize Adverse Drug Reactions? 229
- What should be Reported? 230
- How to Report Adverse Drug Reactions? 230
- Exercises in Class 231

27. Therapeutic Drug Monitoring 234
- Important Steps in Therapeutic Drug Monitoring 235
- Therapeutic Drug Monitoring Procedure at a Glance 237
- Exercises 238

28. Pharmacoeconomics 240
- Pharmacoeconomics 240
- Stakeholder's Perspectives 241
- Adherence to Drug Treatment 241
- Counseling the Patient 241
- Exercise 1 242
- Exercise 2 242
- Exercise 3 243

29. Critical Appraisal of Drug Promotional Literature 244
- Ethical Criteria for Drug Promotion 245
- Source of Drug Information 246
- Exercise 1 248
- Exercise 2 248
- Exercise 3 249

30. Therapeutic Follow-up Cases/Problems 252
- Clinical Pharmacology Exercise Form (Therapeutic Follow-up for Any Case) 252

31. New Drug Development 256
- Clinical Trials 257
- Good Clinical Practice 259

32. Evaluation of Drug Formulations **261**
- Objectives 262

33. Management of Some Common Poisonings **263**
- General Principles 263
- Supportive Care 264
- Terminating Exposure to Ingested Toxins 264
- Activated Charcoal (Who Essential Therapeutic Group) 264
- Poisoning with Drugs 265
- Management of Sting Bites 270

Section 4: Teaching-Learning and Assessment

34. Teaching-Learning Methods **273**
- Small-Group Teaching 273
- Self-directed Learning 275
- Demonstrate, Observe, Assist and Perform 277

35. Assessment Methods **278**
- Objective Structured Practical Examination 278
- Reflection and Grading 281
- Review of Logbooks 282
- Review of Practical Records 282
- Direct Observations 282
- Viva 282

36. Innovative Exercises in Pharmacology **283**
- Seminars 283
- Poster Making 283
- Quiz 283
- Debates 283
- Autobiography of Drugs 284
- Poetry Writing on Pharmacology 284
- Feedback Modules in Pharmacology 284

37. Assessment Blueprint and Plan **285**
- Formative Assessment 285
- Summative Assessment 285

Section 5: Appendices

Appendix 1: Revised Undergraduate Medical Curriculum 2024 **291**

Appendix 2: Adverse Drug Reaction Form **292**

Appendix 3: Adverse Event Reporting Form for Consumers **294**

Appendix 4: Alignment of Practicals/Skills with Theory Lectures in Pharmacology **296**

Appendix 5: Glimpses from National List of Essential Medicines 2022 (India) **297**

Index ***299***

CHAPTER 24

Critical Evaluation of Prescriptions

LEARNING OBJECTIVES

At the end of this unit, the students will be able to learn about:

- Enumerate WHO indicators for a good prescription.
- Illustrate steps in critical appraisal of a given prescription.
- Demonstrate ability to perform a critical appraisal of a given prescription.

PH10.4: Describe parts of a correct, rational and legible prescription and write rational prescriptions for the provided condition. (Examples of conditions to be used are given with other relevant competencies).
PH10.5: Identify and apply the legal and ethical regulation of prescribing drugs especially when prescribing for controlled drugs, off-label medicines, and prescribing for self, close family and friends.
PH10.6: Perform a critical appraisal of a given prescription and suggest ways to improve it.

Irrational prescribing is seen everywhere (developing and developed countries), at all levels (senior consultants and junior students) and in all categories (specialists, superspecialists). As drug treatment is the essence of therapeutics, it become extremely important to audit prescriptions. Wrong prescriptions can be fatal. With Consumer Protection Act (CPA) in force, you need to be careful when writing prescriptions.

COMMON ERRORS IN PRESCRIPTION WRITING

- **Dosage form:** The prefix before drug like tablets, capsule, and injection missing, hence difficult to dispense. Sometimes pharmacist/patient decides own about the dosage form. Suppose patient is prescribed an injection for a serious infection, but he takes only tablets or a patient is prescribed tablet to decrease his blood pressure (BP), but he takes injection.
- **Quantity:** This is very common. You reach a pharmacist/chemist, give him prescription, but he asks which one you want 250 mg or 500 mg. Missing quantity can play havoc with lives of patients. Similar error in dose when prescribing to children can lead to serious adverse effects. Sometimes you will find a prescription for an amount that does not exist. Do not assume anything, always write on prescription.
- **Length of therapy:** This is a common error with most of the prescriptions. The result is that most of patients decide on their own when to stop or when to restart. This leads to irrational use especially with antimicrobials. With antimicrobials you need to be very specific about duration.
- **Patient allergies:** Usually missing part on prescriptions.
- **Date:** Very important to track back when medication was started, how much time has passed and when to refill prescription.
- **Signature:** Missing on prescriptions. This mistake is now increasing, may be because of CPA.
- **Registration number:** Again a serious omission.
- **Directions:** A busy physician will not explain or explain in such a hurry that the patient does not understand or understand in incorrect way, e.g., a lady took methotrexate daily which was to be taken weekly. She died because of severe bone marrow suppression.

JAYPEE BROTHERS

- An error in reading the prescription by the pharmacist so that the wrong drug or dose is dispensed, e.g., cotrimoxazole-clotrimazole.
- **Substitution:** Usually, physician does not write substitution in case drug is not available. It is only when you go back and tell them that a particular drug is not available then he/she will write substitution.
- Bad handwriting leading to confusion of drug name, such as similar names, e.g., acetazolamide and acetohexamide.
- Not writing generic names.
- Drugs may be administered incorrectly. A drug may be given to the wrong patient, at the wrong time or by the wrong route. Certain drugs must be given slowly when given intravenous (IV), and some drugs cannot be given simultaneously.
- Use of expired/outdated drugs is common. For some drugs (e.g., aspirin, tetracycline), risk of harm is great when outdated drug is used.
- Most commonly, drug error results from a patient's confusion about how to take drugs.

TIPS FOR AVOIDING PRESCRIBING ERRORS

- Keep all blank prescription pads in a safe place
- Minimizing the number of prescription pads in use
- Write in ink
- Write out the amount prescribed in addition to the numerical number
- Avoid large quantities
- Only use prescription pads for prescriptions
- Do not sign prescriptions in advance
- Put only one prescription on a blank prescription form.

Precautions for Controlled (e.g., Morphine) or Unscheduled Medications

- Put the patient's diagnosis or the purpose of therapy on the prescription
- Print
- Include the patient's age and weight if relevant on the prescription
- Use the metric system unless dealing with units
- Avoid uncommon abbreviations
- Be consistent
- Sign your own prescriptions
- Inform patient about medications
- Never leave a decimal point naked.

Prescription audit is part of medical audit. Medical audit is an objective and systematic way of evaluating the quality of care provided by physicians. It is conducted mainly in the hospitals, assesses only the technical aspects of medical care, and often falls short in its objectives.

PARAMETERS OF PRESCRIPTION EVALUATION

- **Format of the prescription:** Superscription, inscription, subscription, transcription—complete/incomplete
- Whether the diagnosis is recorded? Final or provisional.
- Number of drugs prescribed.
- Whether drugs prescribed are by official/pharmacological or brand names.
- **Choice of drugs for the given condition:** First choice/second choice/third choice/placebo.
- Unnecessary/irrational/hazardous drugs:
  - *Unnecessary drug or injection:* Means a category of drugs or formulations not recommended for that particular condition in the standard textbooks. However, rational alternatives should not be considered unnecessary.
  - *Irrational drug or drug combinations*: A drug or drug combination not recommended in the standard textbooks of pharmacology or other reputed scientific medical literature.
  - *Hazardous drugs:* Drugs listed under the heading "banned and bannable drugs".

JAYPEE BROTHERS

- **Dose regimen:** Dosage form, dose, frequency, and duration of treatment.
- Prescription cost is calculated using the prevailing prices of drugs given in the latest volumes of Indian Drug Review, Monthly Index of Medical Specialties (MIMS), Current Index of Medical Specialties (CIMS) or Drug Index.
- **Status of the prescription:** Rational/semirational/irrational.
- Date
- Signature of doctor, registration number.
- Patient's particulars are right.

TIPS FOR WRITING A GOOD PRESCRIPTION

- Write or print the prescription *legibly*. If the physician has poor writing, preprinted or typed prescriptions may help.
- Spell the name(s) of the drug(s) correctly, especially in view of the number of "look-alikes" and "sound-alikes".
- Write generic names in capital letters.
- Write the prescription in proper E
- nglish grammar. Latin abbreviations, such as qid may be interpreted as qd or od and are no longer recommended. Avoid phrases, such as "as directed" or "as needed". Specify exact times to be taken: daytime hours, around the clock, and relationship to meals.
- Careful use of decimal points to avoid ambiguity:
  - Avoid unnecessary decimal points: 5 mL instead of 5.0 mL to avoid possible misinterpretation of 5.0 = 50
  - Always zero prefix decimals, e.g., 0.5 instead of .5 to avoid misinterpretation with .5 = 5
  - Never have trailing zeros on decimals, e.g., use 0.5 instead of .50 to avoid misinterpretation with .50 = 50
  - Avoid decimals altogether by changing the units: 0.5 g = 500 mg.
- Directions should be written out in full in English.
- Quantities can be given directly or implied by the frequency and duration of the directions.
- Where the directions are "as needed" the quantity should always be specified.
- Where possible, usage directions should specify times (7 AM, 3 PM, 11 PM) rather than simply frequency (three times a day) and especially relationship to meals for orally consumed medication.
- Avoid unspecified abbreviations like prn (Latin "pro re nata"—meaning "as needed") instructions—limits and indicators should be provided, e.g., "every 3 hours prn pain".
- For refills, minimum duration between repeats and number of repeats should be specified.
- Provide the indication for all prescriptions even when obvious to the prescriber so that the pharmacist may identify possible errors.
- Avoid nonstandardized units, such as "teaspoons" or "tablespoons".
- Write out numbers as words and numerals ["dispense #30 (thirty)"] as in a bank draft or cheque.

EXERCISES

Critically analyze following prescription and rewrite the correct prescription:

Example 1

R_x

- Injection L-dopa 10 mg IV stat
- Tablet B complex 1 tablet twice daily
- Tablet benzhexol hydrochloride 2–5 mg initially and then dose increased to 300 mg daily in divided doses.

Dr ABC

Reg. no. 456

Comments

- Format of prescription is not proper, i.e., superscription is not given. Further the duration of drugs is not specified.
- **In the inscription:** Route and dose of L-dopa mentioned is wrong.

JAYPEE BROTHERS

- Pyridoxine which is present in B complex tablet is DOPA decarboxylase enzyme stimulator, so that very little amount of dopamine will reach the brain, further deteriorating the clinical condition.
- Tablet benzhexol is increased to only 10–50 mg/day and also in divided doses. Such high doses can lead to toxic anticholinergic side effects.

Example 2

Comment on the following prescription:

Name: Mr Kulwant Singh Age: 47 Sex: M Diagnosis: Status asthmaticus R_x ❖ Tablet cetirizine 10 mg stat ❖ Injection pethidine 10 mg IM 6 hourly ❖ Tablet salbutamol 20 mg TDS ❖ Injection adrenaline hydrochloride 1:1,000 IV, SOS	Date: Occupation: Business executive Address: Mahim (Bombay)

Example 3 (Fig. 24.1)

Comment on the following prescription:

.....

.....

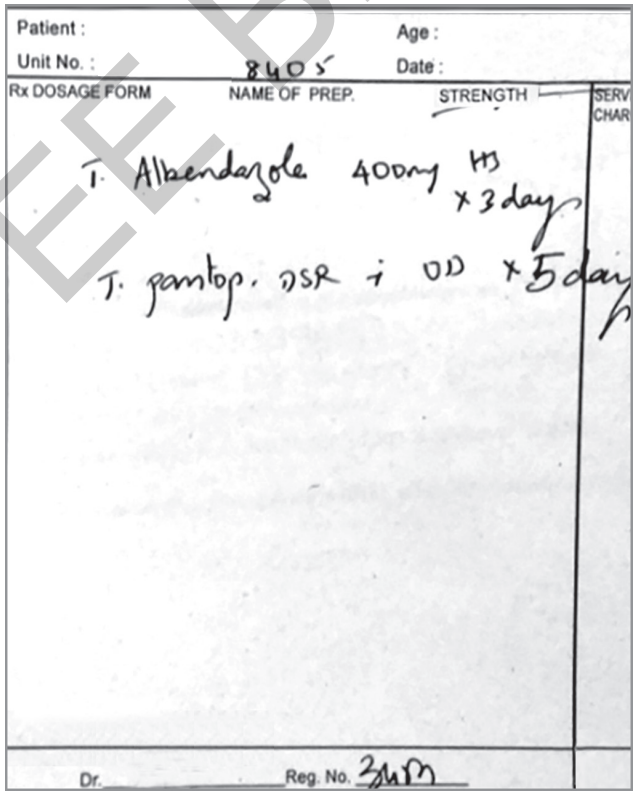

Fig. 24.1: Real prescription.

JAYPEE BROTHERS

Example 4 (Fig. 24.2)

Comment of the following prescription:

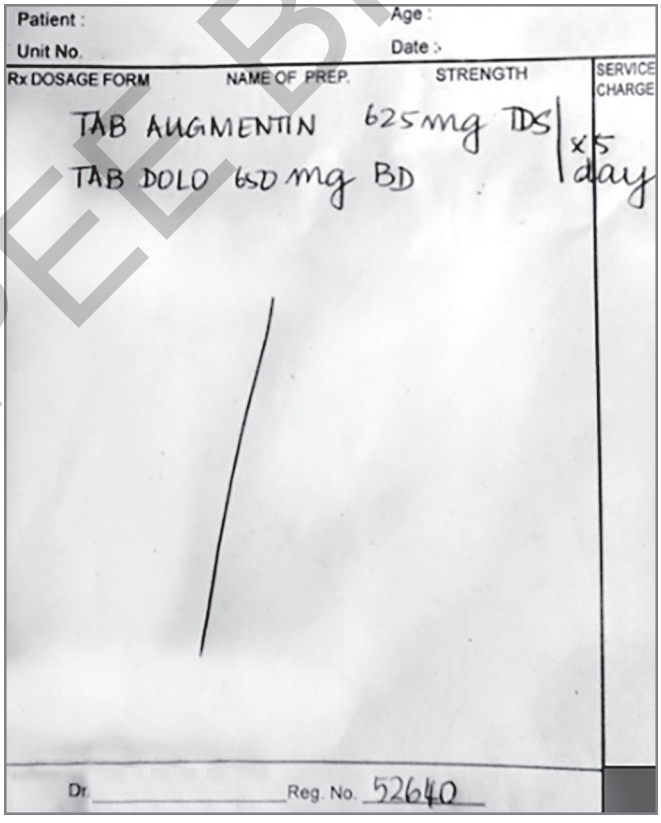

Fig. 24.2: Real prescription.

JAYPEE BROTHERS

tailed information on pharmacology books, visit our website www.ejaypee.com, for detailed information on pharmacology books, visit our website www.ejaypee.com, for detailed information on pha

Practical Manual of Pharmacology for Medical Students

Practical Manual of Pharmacology for Medical Students has been developed in alignment with the updated pharmacology competencies as per CBME 2024 curriculum, incorporating contemporary approaches to teaching–learning and assessment. The manual comprehensively addresses newly introduced curricular elements and scenario-based exercises that promote experiential learning. All certifiable competencies are systematically included along with structured formats for documentation and completion. Students can directly use it as manual and add their observations and inferences at the end of chapters in the workbook exercises pages. The emphasis has been placed on psychomotor competencies, supplemented with relevant cognitive, attitudinal, and communication domains essential for holistic skill development. The manual also features a wide range of application-oriented exercises to strengthen understanding of clinical pharmacology in real-world contexts.

Updated chapters cover key areas, such as communication, technical and procedural skills, simulation, pharmacoeconomics, rational prescribing, emerging teaching methodologies, and modern assessment strategies. In addition, the content integrates the latest national standard treatment guidelines, recent advances in drug formulations, updated regulations concerning drugs and clinical trials, and ethical considerations.

Designed to meet the needs of undergraduate medical students, the manual is equally valuable for dental students and postgraduate learners in pharmacology. It serves as a versatile resource—functioning as a practical manual, a teaching aid, a reference text, and a useful guide for assessment stations.

Dinesh Badyal MD (PGI) MHPE (UK) Fellow FAIMER (USA) FNAMS Diploma in Clinical Research, International Diplomas in Bioethics & Health Laws has expertise in Pharmacology and Medical Education. He is Professor and Head, Department of Pharmacology; Vice Principal (Medical Education); and Professor, Department of Medical Education, Christian Medical College (CMC), Ludhiana, Punjab. He is Convener of National Medical Commission (NMC), Nodal Centre; National Convener, NMC Advance Course in Medical Education; and Director of CMCL-FAIMER Regional Institute at CMC, Ludhiana. He contributed to new competency-based MBBS curriculum and MD Pharmacology curriculum (Chairman, Pharmacology expert group, NMC MBBS CBME 2024 curriculum, Convener, NMC Expert group for MD Pharmacology Curriculum 2022). He has published more than 210 papers, written research modules for Open University, UK, and authored four books/chapters in books. He is a recipient of many awards including APJ Kalam Memorial Oration; Rajiv Gandhi Gold Medal Award; Prof G Achari Oration; Dr Rita Sood Memorial Oration; Shri Ganni Satyanarayana Memorial Oration; ML Gupta Award; visiting fellowship by Rector Clinical Skills and Simulation Center, Jefferson University, Philadelphia; scholarship by German Academic Exchange Service and Best Paper in International Conference for his work in Pharmacology and Medical Education. He is Editor-in-Chief, National Journal of Pharmacology and Therapeutics. He is on the editorial board of several journals and has conducted a number of sessions on clinical trials, pharmacovigilance, ethics, research methodology, paper writing, kinetics, and medical education in national and international conferences and workshops. His areas of interest include clinical pharmacology, faculty development training, and development of low-resource intensive simulations in South-East Asia and competency-based curriculum.

Buy from ejaypee

JAYPEE BROTHERS

Shelving Recommendation
PHARMACOLOGY

ISBN 978-93-7937-477-6