

RATIONAL PRESCRIBING & PRESCRIPTION WRITING: ROLE OF CLINICAL PHARMACOLOGIST TO IMPROVE THE PATIENT QUALITY OF CARE

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INTRODUCTION

Once a patient with a clinical problem has been evaluated and a diagnosis has been reached, the practitioner can often select from a variety of therapeutic approaches. Medication, surgery, psychiatric treatment, radiation, physical therapy, health education, counseling, further consultation, and no therapy are some of the options available. Of these options, drug therapy is by far the one most frequently chosen. In most cases, this requires the writing of a prescription. A written prescription is the prescriber's order to prepare or dispense a specific treatment—usually medication—for a specific patient. When a patient comes for an office visit, the physician or other authorized health professional prescribes medications 67% of the time and an average of one prescription per office visit are written because more than one prescription may be written at a single visit. The treatment of diseases by the use of essential drugs, prescribed by their generic names, has been emphasized by the WHO and the National Health Policy of India. We conclude that the prescription monitoring studies provide a bridge between areas like rational use of drugs, pharmacovigilance and evidence based medicine, pharmacoeconomics, pharmacogenetics and eco pharmacovigilance. In India, this is the need of the hour to utilize the data generated by so many prescription pattern monitoring studies done in every state and on every drug, so that the main aim of promoting rational use of drugs is fulfilled.¹

By estimating the concentration, time curves, and plasma concentration Vs effect curves we can interpret the drug response/drug effect, so that we can adjust the dose/change the drug in order to improve the patient quality of care and also to prevent antimicrobial resistance/AMS-antimicrobial stewardship. The physical form of the prescription, common prescribing errors, and legal requirements that govern various features of the prescribing process are reviewed. Finally, some of the social and economic factors involved in prescribing and drug use are explained.

CASE STUDY

A 35-year-old woman presents with complaints of symmetric joint stiffness, pain, and

inflammation that are worse in the morning. There is no history of joint injury or infection. She has attempted to self-medicate with aspirin and acetaminophen but is not satisfied with the results. Should you write a prescription for her? If so, what steps should you take? These questions are answered in the discussion that follows.

Rational Prescribing

Like any other process in health care, writing a prescription should be based on a series of rational steps.

1. **Make a specific diagnosis:** Prescriptions based merely on a desire to satisfy the patient's psychological need for some type of therapy are often unsatisfactory and may result in adverse effects. A specific diagnosis, even if it is tentative, is required to move to the next step. For example, in the patient described in the case study, a diagnosis of rheumatoid arthritis would be considered. This diagnosis and the reasoning underlying it should be shared with the patient.
2. **Consider the pathophysiologic implications of the diagnosis:** If the disorder is well understood, the prescriber is in a much better position to offer effective therapy. For example, increasing knowledge about the mediators of inflammation makes possible more effective use of non steroidal anti-inflammatory drugs (NSAIDs) and other agents used in rheumatoid arthritis. The patient should be provided with the appropriate level and amount of information about the pathophysiology. Many pharmacies and disease-oriented public and private agencies (e.g., American Heart Association, American Cancer Society and Arthritis Foundation) provide information sheets suitable for patients.
3. **Select a specific therapeutic objective (as a part of evidence based medicine):** A therapeutic objective should be chosen for each of the pathophysiologic processes defined in the preceding step. In a patient with rheumatoid arthritis, relief of pain by reduction of the inflammatory process is one of the major therapeutic goals that identify the drug groups that will be considered. Arresting the course of the disease process in rheumatoid arthritis is a

different therapeutic goal, which might lead to consideration of other drug groups and prescriptions.

4. **Select a drug of choice/p-drug concept (preferred drug or physician's choice):** One or more drug groups will be suggested by each of the therapeutic goals specified in the preceding step. Selection of a drug of choice from among these groups follows from a consideration of the specific characteristics of the patient and the clinical presentation. For certain drugs, characteristics such as age, other diseases, and other drugs being taken are extremely important in determining the most suitable drug for management of the present complaint. In the example of the patient with probable rheumatoid arthritis, it would be important to know whether the patient has a history of aspirin intolerance or ulcer disease, whether the cost of medication is an especially important factor and the nature of the patient's insurance coverage, and whether there is a need for once-daily dosing. Based on this information, a drug would probably be selected from the NSAID group. If the patient is intolerant of aspirin and does not have ulcer disease but does have a need for low-cost treatment, ibuprofen or naproxen would be a rational choice. Physician should prefer for the prescription of generic drugs which are cost effective (pharmacoeconomics). Poly pharmacy in which the number of drugs/encounter was < 2.5 was minimal, but that a large proportion of the prescriptions contained two or more drugs could result in adverse drug-drug interactions. The most frequently prescribed drugs were anti-infectives and analgesics accounting for over 76% in HCs and 82% in HSs and in most cases they are probably prescribed with little justification.²
5. **Determine the appropriate dosing regimen depending up on patient condition:** The dosing regimen is determined primarily by the pharmacokinetics of the drug in that patient. If the patient is known to have disease of the organs required for elimination of the drug selected, adjustment of the average regimen is needed. For a drug such as ibuprofen, which is eliminated mainly by the kidneys, renal function should be assessed. If renal function is normal, the half-life of ibuprofen (about 2 hours) requires administration three or four times daily. The dose suggested in drug handbooks, and the manufacturer's literature is 400–800 mg four times daily.
6. **Devise a plan for monitoring the drug's action (drug safety surveillance) and determine an end point for therapy:** The prescriber should be able to describe to the patient the kinds of drug

effects that will be monitored and in what way, including laboratory tests (LFT- for Mtx) and signs and symptoms that the patient should report. For conditions that call for a limited course of therapy (e.g., most infections), the duration of therapy should be made clear so that the patient does not stop taking the drug prematurely and understands why the prescription probably need not be renewed. For the patient with rheumatoid arthritis, the need for prolonged—perhaps indefinite—therapy should be explained. The prescriber should also specify any changes in the patient's condition that would call for changes in therapy. In patients with rheumatoid arthritis, development of gastrointestinal bleeding would require an immediate change in drug therapy and a prompt workup of the bleeding. Major toxicities that require immediate attention should be explained clearly to the patient

7. **Plan a program of patient education:** The prescriber and other members of the health team should be prepared to repeat, extend, and reinforce the information transmitted to the patient as often as necessary. The more toxic the drug prescribed, the greater the importance of this educational program. The importance of informing and involving the patient in each of the above steps must be recognized.
8. **Improving the patient compliance/adherence to the treatment:** Provide and encourage use of medication counseling, use mechanical compliance aids as needed (compliance packaging, colour coding, use appropriate dosage forms and schedules for each individual patient.

THE PRESCRIPTION

Although a prescription can be written on any piece of paper (as long as all of the legal elements are present), it usually takes a specific form. All prescriptions must include the following information:

Prescriber Name, with contact details (perhaps incorporated as header/footer of prescription); Date of prescription; Patient Name and/or registration number (R/N), Date of Birth and/or Age. Approved medicine name (avoid abbreviations, prefer generic name) Dosage strength (with appropriate units); Route of administration or dosage form e.g. tablet; Frequency of administration or dosing interval e.g. three times a day or every 6 hours; Duration of therapy or duration of supply; Signature and initials of prescriber.

For practical purposes, the following approximate conversions are useful:

1 grain (gr) = 0.065 grams (g), often rounded to 60 milligrams (mg)

15 gr = 1 g

1 ounce (oz) by volume = 30 milliliters (mL)

1 teaspoonful (tsp) = 5 mL

1 tablespoonful (tbsp) = 15 mL

1 quart (qt) = 1000 mL

1 minim = 1 drop (gtt)

20 drops = 1 mL

2.2 pounds (lb) = 1 kilogram (kg).

Indicators of prescribing quality (WHO CORE INDICATORS)

Average no. of medicines per encounter, percentage of medications prescribed by generic name, percentage of encounters in which antibiotics/injection is prescribed, percentage of medicines prescribed from EML (essential medicines list in formulary), average consultation time, prescription in accordance with STGs (standard treatment guidelines), percentage of patients treated without medication, percentage of the patients satisfied with the care that they received.

Prescribing Errors: Frequent use of antibiotics, irrational fixed dose combinations and preparations of uncertain efficacy, inadequate labeling of dispensed drugs and lack of access to standard tools for rational drug use such as locally adapted essential drugs list, formularies and standard treatment guidelines were some of the problematic prescribing and dispensing trends³. All prescription orders should be legible, unambiguous, dated (and timed in the case of a chart order), and signed clearly for optimal communication between prescriber, pharmacist, and nurse. Furthermore, a good prescription or chart order should contain sufficient information to permit the pharmacist or nurse to discover possible errors before the drug is dispensed or administered.

Several types of prescribing errors are particularly common. These include:

Omission of Information: Errors of omission are common in hospital orders and may include instructions to "resume pre-op meds," which assumes that a full and accurate record of the "pre-op meds" is available; "continue present IV fluids," which fails to state exactly what fluids are to be given, in what volume, and over what time period; or "continue eye drops," which omits mention of which eye is to be treated as well as the drug, concentration, and frequency of administration. Chart orders may also fail to discontinue a prior medication when a new one is begun; may fail to state whether a regular or long-acting form is to be used; may fail to specify a strength or notation for long-acting forms; or may

authorize "as needed" (prn) use that fails to state what conditions will justify the need.

Poor Prescription Writing: Poor prescription writing is traditionally exemplified by illegible handwriting. However, other types of poor writing are common and often more dangerous. One of the most important is the misplaced or ambiguous decimal point. Thus ".1" is easily misread as "1," a tenfold overdose, if the decimal point is not unmistakably clear. This danger is easily avoided by always preceding the decimal point with a zero. On the other hand, appending an unnecessary zero after a decimal point increases the risk of a tenfold overdose, because "1.0 mg" is easily misread as "10 mg," whereas "1 mg" is not. The slash or virgule ("/") was traditionally used as a substitute for a decimal point. This should be abandoned because it is too easily misread as the numeral "1." Similarly, the abbreviation "U" for units should never be used because "10U" is easily misread as "100"; the word "units" should *always* be written out. Doses in micrograms should *always* have this unit written out because the abbreviated form ("g") is very easily misread as "mg," a 1000-fold overdose! Orders for drugs specifying only the number of dosage units and not the total dose required should not be filled if more than one size dosage unit exists for that drug. For example, ordering "one ampule of furosemide" is unacceptable because furosemide is available in ampules that contain 20, 40, or 100 mg of the drug. The abbreviation "OD" should be used (if at all) only to mean "the right eye"; it has been used for "every day" and has caused inappropriate administration of drugs into the eye. Similarly, "Q.D." or "QD" should not be used because it is often read as "QID," resulting in four daily doses instead of one. Acronyms and abbreviations such as "ASA" (aspirin), "5-ASA" (5-aminosalicylic acid), "6MP" (6-mercaptopurine), etc, should not be used; drug names should be written out. Unclear handwriting can be lethal when drugs with similar names but very different effects are available, e.g., acetazolamide and acetohepamide, methotrexate and metolazone. In this situation, errors are best avoided by noting the indication for the drug in the body of the prescription, e.g., "acetazolamide, for glaucoma."

Inappropriate Drug Prescriptions: Prescribing an inappropriate drug for a particular patient results from failure to recognize contraindications imposed by other diseases the patient may have, failure to obtain information about other drugs the patient is taking (including over-the-counter drugs), or failure to recognize possible physicochemical incompatibilities between drugs that may react with each other. The manufacturer's package insert usually contains similar information. Physicians should

realize that the pregnancy categories by themselves provide little guidance for the physician treating pregnant women. For example, angiotensin-converting enzyme (ACE) inhibitors such as captopril cause developmental toxicity (Category X) only after the first trimester. Physicians' primary responsibility remains treating the pregnant patient. However, the risks of withholding treatment to the mother because of possible risks to the fetus have to be considered as well. Physicochemical incompatibilities are of particular concern when parenteral administration is planned. For example, certain insulin preparations should not be mixed. Similarly, the simultaneous administration of antacids or products high in metal content may compromise the absorption of many drugs in the intestine, e.g., tetracyclines.

By doing prescription audits (both outpatient, inpatient and in ICU) regularly in the primary, secondary and tertiary health care facilities and in govt. medical colleges and hospitals by clinical pharmacologist can give some inputs to the prescribing doctors/physicians so that together by team work we can improve the patient quality of life and also the quality of care. TDM (therapeutic drug monitoring) if the patient is not responding to the appropriate dose of antimicrobial agents or anti-convulsants. By doing TDM we can check the serum plasma concentration levels so that we can adjust the dose. In some of the individuals we can see the genetic polymorphism (altered response to the particular group of drug-can be due to genetic mutations in the specific enzyme.eg. NAT (N- acetyl transfers enzyme for metabolizing INH) can be seen. This can be seen with antipsychotics or antidepressants and also with warfarin.

Pediatric Dosage Forms & Compliance:

Suspensions contain undissolved particles of drug that must be distributed throughout the vehicle by shaking. If shaking is not thorough each time a dose is given, the first doses from the bottle may contain less drug than the last doses, with the result that less than the expected plasma concentration or effect of the drug may be achieved early in the course of therapy. Conversely, toxicity may occur late in the course of therapy, when it is not expected. This uneven distribution is a potential cause of inefficacy or toxicity in children taking phenytoin suspensions. It is thus essential that the prescriber know the form in which the drug will be dispensed and provide proper instructions to the pharmacist and patient or parent.

Compliance may be more difficult to achieve in pediatric practice than otherwise, since it involves not only the parent's conscientious effort to follow directions but also such practical matters as measuring errors, spilling, and spitting out. For

example, the measured volume of "teaspoons" ranges from 2.5 to 7.8 ml. The parents should obtain a calibrated medicine spoon or syringe from the pharmacy. These devices improve the accuracy of dose measurements and simplify administration of drugs to children.

When evaluating compliance, it is often helpful to ask if an attempt has been made to give a further dose after the child has spilled half of what was offered. The parents may not always be able to say with confidence how much of a dose the child actually received. The parents must be told whether or not to wake the infant for its every-6-hour dose day or night. These matters should be discussed and made clear, and no assumptions should be made about what the parents may or may not do. Noncompliance frequently occurs when antibiotics are prescribed to treat otitis media or urinary tract infections and the child feels well after 4 or 5 days of therapy. The parents may not feel there is any reason to continue giving the medicine even though it was prescribed for 10 or 14 days. This common situation should be anticipated so the parents can be told why it is important to continue giving the medicine for the prescribed period even if the child seems to be "cured."

Pediatric Drug Dosage: Because of differences in pharmacokinetics in infants and children, simple proportionate reduction in the adult dose may not be adequate to determine a safe and effective pediatric dose. The most reliable pediatric dose information is usually that provided by the manufacturer in the package insert. However, such information is not available for the majority of products, even when studies have been published in the medical literature, reflecting the reluctance of manufacturers to label their products for children. Recently, the FDA has moved toward more explicit expectations that manufacturers test their new products in infants and children. Still, most drugs in the common formularies, e.g., *Physicians' Desk Reference*, are not specifically approved for children, in part because manufacturers often lack the economic incentive to evaluate drugs for use in the pediatric market. Most drugs approved for use in children have recommended pediatric doses, generally stated as milligrams per kilogram or per pound. In the absence of explicit pediatric dose recommendations, an approximation can be made by any of several methods based on age, weight, or surface area. These rules are not precise and should not be used if the manufacturer provides a pediatric dose. When pediatric doses are calculated (either from one of the methods set forth below or from a manufacturer's dose), the pediatric dose should never exceed the adult dose. Interventions to rectify over prescription of antibiotics and syrup formulations, inadequate labeling of drugs and lack of access to an essential

drugs list are necessary to further improve rational drug use.⁴

Special Pharmacodynamic Features in the Neonate: The appropriate use of drugs has made possible the survival of neonates with severe abnormalities who would otherwise die within days or weeks after birth. For example, administration of indomethacin causes the rapid closure of a patent ductus arteriosus, which would otherwise require surgical closure in an infant with a normal heart. Infusion of prostaglandin E₁ analogues (alprostadil), on the other hand, causes the ductus to remain open, which can be lifesaving in an infant with transposition of the great vessels or tetralogy of Fallot. An unexpected effect of such infusion has been described. The drug caused antral hyperplasia with gastric outlet obstruction as a clinical manifestation in 6 of 74 infants who received it. This phenomenon appears to be dose-dependent. Neonates are also more sensitive to the central depressant effects of opioids than are older children and adults, necessitating extra caution when they are exposed to some narcotics (e.g., codeine) through breast milk. Physiologic processes that influence pharmacokinetic variables in the infant change significantly in the first year of life, particularly during the first few months. Therefore, special attention must be paid to pharmacokinetics in this age group.

Electronic Prescribing: The era of e-prescribing has begun. Its implementation is still expensive, but the subsequent benefits to patients and savings in personnel costs, along with its integration with electronic medical records, drug inventory control, and billing, point to the wide use of e-prescribing in the future. Computerized prescription ordering eliminates some of the subjective features of prescribing. Thus, if the proper information is entered correctly in the electronic system, medication errors due to illegible handwriting, incorrect dose, incorrect medication for medical condition, and drug interactions can be reduced, because each prescription can be linked to high-quality drug databases that check that the information on the prescription is appropriate for the patient (e.g., age, weight, gender, condition, lab values, disease being treated, concurrent medications) and that known warnings and potential problems are brought to the attention of the physician, pharmacist, and patient. Such systems must not be used as a substitute for personal attention to the individual patient by healthcare workers but, rather, as an adjunct measure that ensures safe, high-quality, efficient care.

CONCLUSION

The ultimate goals of studying and intervening in medicines use practice include:

Improving the quality of healthcare through effective and safe use of pharmaceuticals and improving cost effectiveness of health care through economic and efficient use of pharmaceuticals. Strategies to improve rational prescribing can be characterized as targeted or system oriented approaches. Programs to ensure rational use of medicines should be an integral part of health and medical care services. The responsibility for promoting rational use of medicines belongs to decision maker, administrators and clinicians as well as health care professionals, consumers, educators and pharmaceutical companies.

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