Role of Case Studies in Evaluating Medical Problem Solving

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Studies of problem solving by experienced clinicians have identified four steps in the process of defining patients' problems: cue acquisition, hypothesis generation, cue interpretation, and hypothesis evaluation.[1] Physicians gather and interpret information (cues) from various sources (charts, colleagues, patients, families, laboratories) to generate and evaluate possible explanations (hypotheses) for the problems of patients. Clearly, defining patients' problems is only the first step toward solving the problems; however, medical students and residents must master this first step before they can help patients achieve satisfactory resolutions of their problems.

Various approaches to case studies provide opportunities to assess trainees' performance of problem definition.[2-6] Four case study approaches have been developed to evaluate a course in medical decision making for preclinical students, but may be useful in other settings where assessment of problem solving is desired.

Four Case Study Approaches

Case Formulations

The case formulations approach includes the subjective and objective parts of a typical SOAP (subjective, objective, assessment, plans) note for an outpatient encounter. The assessment, or formulation, part of the note is a paragraph discussing the cues used in defining the problems, the hypotheses generated to explain the patient's presenting complaints, the way in which the cues were interpreted in relation to the hypotheses under consideration, and a statement about the final, working diagnosis. The case formulations used in the decision-making course intentionally contain five errors common in defining problems: failure to acquire relevant cues, failure to generate relevant competing hypotheses, ignoring unreliability of cues, failure to interpret acquired cues, and misinterpreting cues in relation to hypotheses.[1] The student is asked to identify problem-solving errors in the case formulations after reading a handout discussing the steps in problem solving and the errors common at each step. (The latest group of students taking the course identified a mean of 2.7 of the five errors.)

Case Write-up

The case write-up approach is similar to the usual write-up with regard to the subjective and objective evidence parts of a SOAP note. However, the student is asked to expand the assessment to include a ranking of the hypotheses under consideration from a most likely to a least likely explanation for the presenting complaints. The assessment should also include a discussion of how cues were used to develop the initial list of hypotheses, to eliminate hypotheses, and to discriminate among the remaining hypotheses. The plan part of the case write-up contains the student's diagnostic, therapeutic, and patient education recommendations. Through expansion of the assessment part of the write-up, the logic of the student's problem solving can be examined in detail and common errors noted.

Written Case

In this approach, the history and physical examination parts of a case write-up are presented and followed by three questions: What pieces of the above information would you use in evaluating the patient's problem? What diagnostic possibilities

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Azo Gantrisin®
Each tablet contains 0.5 Gm sulfisoxazole/Roche and 50 mg phenazopyridine HCl.

Before prescribing, please consult complete product information, a summary of which follows:

INDICATIONS: Initial treatment of uncomplicated urinary tract infections caused by susceptible strains of *Escherichia coli, Klebsiella* species, *Enterobacter* species, *Proteus mirabilis, Proteus vulgaris* and *Staphylococcus aureus* when relief of pain, burning or urgency is needed during first 2 days of therapy. Azo Gantrisin treatment not to exceed 2 days. Evidence lacking that sulfisoxazole plus phenazopyridine HCl better than sulfisoxazole alone after 2 days. Treatment beyond 2 days should only be continued with Gantrisin (sulfisoxazole/Roche). (See DOSAGE AND ADMINISTRATION.) *Important Note:* Coordinate *in vitro* sulfonamide sensitivity tests with bacteriologic and clinical response. With ongoing therapy, add aminobenzoic acid to culture media. Increasing resistance of organisms may limit sulfonamide usefulness. As identical doses produce wide variations, measure blood levels in patients receiving sulfonamides for serious infections: 12 to 15 mg/100 ml is optimal; adverse reactions are more frequent above 20 mg/100 ml.

CONTRAINDICATIONS: Children under 12; known sensitivity to either component; pregnancy at term and during nursing period; in glomerulonephritis, severe hepatitis, uremia and pyelonephritis of pregnancy with gastrointestinal disturbances.

WARNINGS: Sulfonamides are bacteriostatic; organisms causing common infections are often resistant. Sulfas won't eradicate group A streptococci or prevent sequelae like rheumatic fever and glomerulonephritis. Deaths from hypersensitivity reactions, hepatocellular necrosis, agranulocytosis, aplastic anemia and other blood dyscrasias have been reported. Sore throat, fever, pallor, purpura or jaundice may be early signs of serious blood disorders. Perform blood counts and renal function tests.

PRECAUTIONS: *General:* Use with caution in patients with impaired renal or hepatic function, severe allergy, bronchial asthma. Hemolysis may occur in glucose-6-phosphate dehydrogenase-deficient individuals.
The more soluble sulfonamides are associated with fewer renal complications. Maintain adequate fluid intake to prevent crystalluria and stone formation.
Information for Patients: Maintain adequate fluid intake; urine will turn reddish-orange.
Laboratory Tests: Perform urinalysis with careful microscopic examination at least once a week and regular blood counts after 2 weeks therapy; measure blood levels in patients with serious infection (see INDICATIONS). *Drug Interactions:* Sulfonamides may displace oral anticoagulants from plasma protein binding sites, increasing anticoagulant effect. Can also displace methotrexate. *Drug Laboratory Test Interactions:* May affect liver function tests in hepatitis.
Carcinogenesis, Mutagenesis, Impairment of Fertility: Carcinogenesis: Azo Gantrisin has not undergone adequate trials relating to carcinogenicity; each component, however, has been evaluated separately. Rats appear especially susceptible to goitrogenic effects of sulfonamides; long-term administration has resulted in thyroid malignancies in this species. Long-term administration of phenazopyridine HCl has induced neoplasia in rats (large intestine) and mice (liver). No association between phenazopyridine HCl and human neoplasia reported; adequate epidemiological studies have not been conducted. *Mutagenesis:* No studies available. *Impairment of Fertility:* The components of Azo Gantrisin have been evaluated in animal reproduction studies. In rats given 800 mg/kg/day sulfisoxazole, there were no effects on mating behavior, conception rate or fertility index. Fertility was not affected in a two-litter study of rats given 50 mg/kg/day phenazopyridine.
Pregnancy: Teratogenic Effects: Pregnancy Category C. The components of Azo Gantrisin have been evaluated. At 800 mg/kg/day sulfisoxazole was nonteratogenic in rats and rabbits, with no perinatal or postnatal effects in rats. In two other studies, cleft palates developed in rats and mice after 500 to 1000 mg/kg/day sulfisoxazole. No congenital malformations developed in rats given 50 mg/kg/day phenazopyridine. As there are no satisfactory animal or human studies, it is not known whether Azo Gantrisin can cause fetal harm or affect reproduction capacity. Use during pregnancy only if the potential benefit justifies the potential risk to the fetus. *Nonteratogenic Effects, Nursing Mothers and Pediatric Use:* See CONTRAINDICATIONS.

ADVERSE REACTIONS: *Allergic:* Anaphylaxis, generalized allergic reactions, angioneurotic edema, arteritis and vasculitis, myocarditis, serum sickness, conjunctival and scleral injection, periarteritis nodosa, systemic lupus erythematosus. *Cardiovascular:* Tachycardia, palpitations, syncope, cyanosis. *Dermatologic:* Rash, urticaria, pruritus, erythema multiforme, Stevens-Johnson syndrome, toxic epidermal necrolysis, exfoliative dermatitis, photosensitivity. *Endocrine:* Goiter production, diuresis, hypoglycemia. Cross-sensitivity with some goitrogens, diuretics (acetazolamide and the thiazides) and oral hypoglycemic agents may exist. *Gastrointestinal:* Nausea, emesis, abdominal pain, anorexia, diarrhea, glossitis, stomatitis, flatulence, salivary gland enlargement, G.I. hemorrhage, pseudomembranous enterocolitis, melena, pancreatitis, hepatic dysfunction, jaundice, hepatocellular necrosis. *Genitourinary:* Crystalluria, hematuria, BUN and creatinine elevation, nephritis and toxic nephrosis with oliguria and anuria, acute renal failure, urinary retention. *Hematologic:* Leukopenia, agranulocytosis, aplastic anemia, thrombocytopenia, purpura, hemolytic anemia, anemia, eosinophilia, clotting disorders including hypoprothrombinemia and hypofibrinogenemia, sulfhemoglobinemia, methemoglobinemia. *Musculoskeletal:* Arthralgia, chest pain, myalgia. *Neurologic:* Headache, dizziness, peripheral neuritis, paresthesia, convulsions, tinnitus, vertigo, ataxia, intracranial hypertension. *Psychiatric:* Psychosis, hallucinations, disorientation, depression, anxiety. *Miscellaneous:* Edema (including periorbital), pyrexia, drowsiness, weakness, fatigue, lassitude, rigors, flushing, hearing loss, insomnia, pneumonitis.

OVERDOSAGE: *Signs:* Anorexia, colic, nausea, vomiting, dizziness, drowsiness, unconsciousness; possibly pyrexia, hematuria, crystalluria. Blood dyscrasias and jaundice may occur later. *Treatment:* Institute gastric lavage or emesis; force oral fluids; administer intravenous fluids if urine output is low with normal renal function. Monitor blood counts and appropriate blood chemistries, including electrolytes. In cyanosis, consider methemoglobinemia and treat with intravenous 1% methylene blue. Institute specific therapy for blood dyscrasias or jaundice.

DOSAGE AND ADMINISTRATION: Azo Gantrisin is intended for the acute, painful phase of urinary tract infections. The recommended dosage in adults is 4 to 6 tablets initially, followed by 2 tablets four times daily for up to 2 days. Treatment with Azo Gantrisin should not exceed 2 days. Treatment beyond 2 days should only be continued with Gantrisin (sulfisoxazole/Roche).

HOW SUPPLIED: Tablets, each containing 0.5 Gm sulfisoxazole/Roche and 50 mg phenazopyridine HCl—bottles of 100 and 500.

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volved, this team approach is not fragmentary, for most members act simply as internal consultants to those who provide direct patient-family contact, thus actually facilitating a coherent, unified approach.[3] Hospice involvement can make possible truly comprehensive care while helping to avoid "burnout" of the physician, home care nurse, or any member of the care team.

As with any change in medical delivery systems, particularly one that makes expanded use of nonphysician personnel, there has been resistance on the part of some physicians. Nevertheless, in the five years that I have been working with hospice programs, I have repeatedly seen such resistance evaporate once physicians understand that the hospice enhances their ability to provide high-quality care and that families are deeply appreciative of such care.

Beyond a continued involvement with patients through their terminal illnesses and cooperative interaction with the local hospice, there are leadership roles to be played by family physicians in supporting hospice programs on local, regional, and national levels. Family medicine and hospice share similar basic orientations: Both view the patient within the family as the appropriate unit of care,[4-6] both emphasize education as a means of fostering compliance and self-reliance,[2] and both see growth as a longitudinal process that continues beyond the dying of an individual family member.[2,4,6] These are some of the same features that originally attracted many family physicians to family practice. Unlike that in other specialties, residency training in this field is designed to strengthen and expand these orientations, which become valued as areas of emphasis reflected in the daily practice of family physicians.

On a local level each hospice functions through a multidisciplinary team, one member of which is a physician—termed either *medical director* or *medical consultant*. Although many family physicians may be unaccustomed to thinking of themselves as consultants, they are, in my opinion, best suited to fill this role. Broad specialty training and practice exposure provides familiarity with the age groups (from pediatric to geriatric) and the many diseases and therapeutic modalities that are regularly encountered by the hospice team. Working knowledge of pharmacology and metabolic medicine and

experience in dealing with problems of bowel and bladder function, skin and mouth care, as well as familiarity with such resources as rehabilitation therapies (physical and occupational), equip the family physician to help manage the multiple mundane complications often seen. This help in turn enhances the comfort and functional status of the patient during the terminal phase. In addition, the family physician's understanding of family and interpersonal dynamics and experience in counseling and anxiety management enable a comprehensive approach to care.

During the brief history of the American hospice movement, the medical direction or consultant position has fallen largely to medical oncologists, primarily because cancer remains the most common diagnosis of the hospice patient. However, even those oncologists who have been most successful in their hospice role tend to agree that their subspecialty training and experience are ill-suited to so broad an area. Their strength lies in the treatment of neoplastic disease—often an unfathomably difficult job, which they heroically perform—but the emphasis in hospice is on total care of the person (family): relieving symptoms, supporting maximal function and independence, and encouraging growth. The skills and expertise required are as broad as the specialty of family practice. Though no consultant will have immediate answers to every question or problem, the interested family physician is well equipped through training, experience, and general approach to care to make invaluable contributions to the local hospice team.

On a national level hospice represents a rapidly expanding, vital trend in American medicine, at once leading and reflecting a general movement toward home-centered, patient-family–directed, and cost-effective care.[7-9] Here, too, family practice has important contributions to make. I suggest that the American Academy of Family Physicians open an ongoing dialogue with the National Hospice Organization and the newly formed Association of Hospice Physicians for the purpose of exploring areas of fruitful collaboration. Possibilities appear to be limitless, though they might specifically include the following:

1. Jointly sponsored continuing medical education conferences that touch on some of the more technical aspects of modern palliative care and home care while presenting in depth the hospice team approach to managing terminal illness
2. Introduction of palliative care and terminal care topics into the recommended family practice residency curriculum
3. Exploration of various models for affiliation of academic departments of family practice with existing (or developing) hospices (One affiliation I helped form provides for a motivated senior family practice resident to serve, with a staff oncologist, as medical co-director of a hospice serving a primarily indigent population. This has proved to be of benefit to the teaching program and hospice alike and of inestimable value for the resident medical co-directors.)
4. Development of research methodologies relevant to palliative care and home care of terminal illness
5. Sponsorship by the AAFP (or, perhaps, the Family Health Foundation) of several formal family practice fellowships in the area of palliative care and hospice medicine

The time would seem ripe both to increase the general knowledge base of graduating residents and practicing physicians and to expand the number of true experts in this important, progressive field. Family practice has unique contributions to make toward the maturing of hospice care in America. The potential for leadership is there; the time to begin realizing this potential is at hand.

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