A lumbar MRI costs our patients $998, which is expensive for a screening test. MRI should be reserved as a definitive test in selected patients. If the cost is not known, the test may be ordered inappropriately.

Because health-care costs are important, studies of new drugs and techniques must include and reveal costs. An increase (or decrease) in costs may be as significant as an improvement in effectiveness as resources become scarce. The practice of anesthesiology requires allocating these limited resources among competing needs. Especially in an era of fixed revenue, buying expensive drugs or services may preclude other desirable therapies or programs. Intelligent choices require knowing the costs of each alternative. We would prefer to know total differential costs, but knowing just the costs of each drug studied helps place findings in perspective. Authors should add an appendix listing pertinent costs when the information is not contained within their study. The economic realities of health care and anesthesia require the inclusion of costs when considering any benefits found in a scientific study.

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References

1. White PF, Watcha MF: Are new drugs cost-effective for patients undergoing ambulatory surgery? ANESTHESIOLOGY 78:2–5, 1993
2. Saidman LJ: The role of desflurane in the practice of anesthesia. ANESTHESIOLOGY 74:399–401, 1991
3. Brown BW: An application of health services research to anesthesiology. ANESTHESIOLOGY 76:1–2, 1992
4. Wong HY, Carpenter RL, Kopacz DJ, Fragen RJ, Thompson G, Maneatis TJ, Bynum LJ: A randomized, double-blind evaluation of ketorolac tromethamine for postoperative analgesia in ambulatory surgery patients. ANESTHESIOLOGY 78:6–14, 1993
5. Scuderi P, Wetchler B, Sung Y-F, Mingus M, DuPen S, Claybon L, Leslie J, Talke P, Apfelbaum J, Sharifi-Azad S, Williams MF: Treatment of postoperative nausea and vomiting after outpatient surgery with the 5-HT_3 antagonist ondansetron. ANESTHESIOLOGY 78:15–20, 1993
6. McKenzie R, Kovac A, O'Connor T, Duncalf D, Angel J, Gratz I, Tolpin E, McLeskey C, Joslyn A: Comparison of ondansetron *versus* placebo to prevent postoperative nausea and vomiting in women undergoing ambulatory gynecologic surgery. ANESTHESIOLOGY 78:21–28, 1993
7. Hickey C, Gugino LD, Aglio LS, Mark JB, Son SL, Maddi R: Intraoperative somatosensory evoked potential monitoring predicts peripheral nerve injury during cardiac surgery. ANESTHESIOLOGY 78: 29–35, 1993
8. Mamourian AC, Dickman CA, Drayer BP, Sonntag VKH: Spinal epidural abscess: Three cases following spinal epidural injection demonstrated with magnetic resonance imaging. ANESTHESIOLOGY 78: 204–207, 1993

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In Reply:—The Letter to the editor by Johnstone and Martinec is timely and appropriate although not rationally applicable to the studies with ondansetron.[1,2] However, any speculation on the cost of ondansetron for postoperative nausea and vomiting, at this time, is premature and unreliable.

The cost of developing new medications is related to numerous factors, many of which are not yet available to the authors. One important factor is the size of the estimated market, which is directly related to the condition treated. For ondansetron, the available pool of patients has been those undergoing chemotherapy or radiation therapy—a relatively small pool. The standard treatment regimen consumes most of the 40-mg vial. Development costs had to include potential sales estimates. In contrast, the pool for either the prevention or treatment of postoperative nausea and vomiting is much larger because, in the United States alone, more than 20 million anesthesias are given annually. The most effective dose of ondansetron seems to be 4 mg intravenously or, in Europe, 8 mg orally three times a day.[3] At current prices, as quoted by Johnstone and Martinec, the 4-mg intravenous dose would cost $17.29. However, packaging and pricing of ondansetron for the prevention and treatment of postoperative nausea and vomiting, to my knowledge, is not available.

There are factors other than cost to consider. A significant finding in our paper was the 95% incidence of nausea in history of postoperative nausea and vomiting. Ondansetron reduced this incidence to 54%.[2] Droperidol may or may not do the same.

Ondansetron in a single dose, when compared with placebo, provides a 24-h protection from emesis for ambulatory patients who did not vomit in the recovery room.[2] Droperidol may or may not last as long.

The side effect profile of ondansetron to date has been benign, whereas extrapyramidal symptoms, including restlessness, akathisia, and torticollis, have been reported even with low-dose droperidol.[4,5]

Only one publication to date has compared metoclopramide, droperidol, and ondansetron.[6] The percentage of patients vomiting were 54%, 45%, and 13%, respectively.

The cost-effectiveness of this promising new antiemetic will be decided soon, when ondansetron takes its place in competition with other antiemetic agents.

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References

1. Scuderi P, Wetchler B, Sung Y-F, Mingus M, DuPen S, Claybon L, Leslie J, Talke P, Apfelbaum J, Sharifi-Azad S, Williams MF: Treatment of postoperative nausea and vomiting after outpatient surgery with the 5-HT_3 antagonist ondansetron. ANESTHESIOLOGY 78:15–20, 1993

2. McKenzie R, Kovac A, O'Connor T, Duncalf D, Angel J, Gratz I, Tolpin E, McLeskey C, Joslyn A: Comparison of ondansetron *versus* placebo to prevent postoperative nausea and vomiting in women undergoing ambulatory gynecologic surgery. ANESTHESIOLOGY 78:21–28, 1993

3. Kenny GNC, Oates JDL, Leeser J, Rowbotham DJ, Lip H, Rust M, Saur P, Onsrud M, Haigh CG: Efficacy of orally administered ondansetron in the prevention of postoperative nausea and vomiting: A dose ranging study. Br J Anaesth 68:466–470, 1992

4. Melnick BM: Extrapyramidal reactions to low dose droperidol. ANESTHESIOLOGY 69:424–426, 1988

5. Melnick BM, Sawyer R, Karambelkar D, Phitayakorn P, Uy NTL, Patel R: Delayed side effects of droperidol after general anesthesia. Anesth Analg 69:748–751, 1989

6. Alon E, Himmelsehr S: Ondansetron in the treatment of postoperative vomiting: A randomized double-blind comparison with droperidol and metaclopramide. Anesth Analg 75:561–565, 1992

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In Reply:—Johnstone and Martinec point out once again the need for cost-benefit studies in medicine. In the 1990s, this will become more important as the federal government attempts, through legislative and other means, to curb the ever rising health-care costs plaguing our economy. It is not appropriate, however, to insist that every clinical trial be conducted as a cost-benefit study. Changes in the way medicine is practiced, regardless of the specialty or subspecialty in question, occur as a result of collection, publication, and analysis of many kinds of scientific data. Many questions must be answered before a new therapy or intervention can supplant older, previously established practices. In addition to cost-effectiveness, questions of safety and efficacy are of primary concern. Our recent multicenter study of ondansetron as a possible treatment for postoperative nausea and vomiting[1] sought to answer some of these questions. Earlier single-center studies[2,3] indicated that ondansetron appeared effective, when compared to placebo, as a treatment for postoperative nausea and vomiting. The dosages of ondansetron used in these and other earlier studies were based on the clinical experience compiled during the studies of ondansetron as an antiemetic for chemotherapy-induced emesis. Our study was designed to determine whether doses smaller than 8 mg would be effective in treating postoperative nausea and vomiting. In addition, we evaluated the safety of ondansetron in our study population (*i.e.,* patients undergoing outpatient surgery). At the time of our study, ondansetron was not approved by the Food and Drug Administration for the indication in question. This study was conducted as part of the approval process. Since the drug was not approved as a treatment for postoperative nausea and vomiting when our study was conducted, no pricing or packaging information applicable to this indication was available.

If ondansetron is to become part of the accepted treatment of postoperative nausea and vomiting, further studies comparing it to other accepted treatments should be performed. These studies should include data necessary to make appropriate cost-benefit analyses. This will not be as easy as it sounds. Pharmacoeconomic studies must define in specific dollar amounts not only the cost of the intervention but a quantifiable benefit. Though cost of a drug appears to be straightforward, one must remember that, as noted by Johnstone and Martinec, the cost to the patient differs from the wholesale cost to the hospital. Various fees are associated with dispensing and administering medications, often resulting in a cost to the patient many times greater than the hospital's cost of the drug. Consequently, generic medications can result in substantial patient cost, even when the hospital cost may be trivial. It may be more difficult to quantitate benefit. Some measures of benefit lend themselves to simple analysis (*e.g.,* increased or decreased recovery room stay, time lost from work, unanticipated hospitalization). Other measures may be difficult to assess. For instance, some complications associated with postoperative nausea and vomiting may occur infrequently but have serious or even catastrophic results when they do occur (*e.g.,* bleeding under a flap graft, evisceration of ocular contents after an open eye procedure). It becomes difficult to attach precise dollar figures to quality-of-life issues such as the psychologic impact on the patient of prolonged postoperative nausea and vomiting. Indeed, though data from pharmacoeconomic and quality-of-life studies should be included as part of the decision-making process when considering changes to customary practices, they should not be the primary focus during initial safety and efficacy studies.

It is imperative, however, that every practicing physician be aware of the patient cost of the tests and therapies before they are ordered. Finding the most economic approaches to patient care is the responsibility of every health-care professional. It should be an integral part of each institution's quality-improvement process. It is not acceptable medical practice to prescribe medications, order therapies, or perform laboratory tests without a knowledge of the cost *versus* the presumed benefit.

Our study was designed to answer specific questions about the potential suitability of ondansetron as a treatment for postoperative nausea and vomiting. Our aim was to present data on the safety, efficacy, and dose of ondansetron when used as a treatment for postoperative nausea and vomiting. The study was not designed to determine whether ondansetron is superior in efficacy or cost-effectiveness to other available treatments. Further studies are needed to answer these and other questions.

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