

Overall Cost Comparison of Gastrointestinal Endoscopic Procedures With Endoscopist- or Anesthesia-Supported Sedation by Activity-Based Costing Techniques

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Abstract

Objective: Endoscopic/colonoscopic procedures are either done with gastroenterologist-administered conscious sedation or with anesthesia-administered sedation with propofol. There are potential benefits to anesthesia-administered sedation, but the concern has been the associated increased cost.

Methods: To perform this study, we used the time-derived activity-based costing (TDABC) technique to accurately assess the true cost of gastrointestinal procedures done with gastroenterologist-administered conscious sedation vs anesthesia-administered sedation in 2 areas of our practice that use predominantly conscious sedation or anesthesia-administered sedation. This type of study has never been reported using such an integrated approach. This study was performed on 2 different days in June 2015.

Results: The true cost associated with anesthesia-administered sedation in our practice was associated with only 9% to 24% greater cost when the TDABC technique was applied.

Conclusion: Gastrointestinal procedures with anesthesia-administered sedation are not as costly when all factors are considered. Using novel approaches to cost measurement, such as the TDABC, allows a total cost measurement approach across an episode of care that existing cost measurements in health care are incapable of.

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Conscious sedation has been used to improve the patient experience in endoscopic procedures for more than 30 years. An increasing trend seen in endoscopic practices has been the utilization of propofol, administered by either anesthesiologists or certified nurse anesthetists (CRNAs), and this trend has impacted how endoscopists and patients view endoscopic sedation. During the past 15 years, propofol has become the drug of choice among many endoscopists due to its favorable pharmaceutical properties and safety profile.¹⁻³ Propofol has hypnotic, antiemetic, and amnestic properties with the advantage of a rapid onset of action and a short recovery period. The depth of sedation increases in a dose-dependent manner.⁴ Emergence from sedation is also

rapid because of its fast redistribution into peripheral tissues. Recovery from propofol will occur within 10 to 20 minutes after discontinuation. Studies demonstrate significantly shorter recovery times and faster recovery of cognitive function with propofol compared with traditional sedation.^{5,6} A recent Cochrane review found that the use of propofol for sedation during colonoscopy can lead to faster recovery after the procedure and higher patient satisfaction, without any increase in adverse effects as compared with the use of drugs traditionally used (narcotics and/or benzodiazepines) for endoscopic procedure sedation.⁷ Polyp detection during colonoscopy does not appear to be improved by deeper sedation, although one study suggested a higher rate of detection of advanced lesions with deep

sedation,⁸⁻¹¹ and speculation suggests that this is a result of the endoscopist being able to better focus on the examination rather than on the comfort and safety of the patient.

Importantly, titrating propofol to achieve conscious sedation without inducing general anesthesia requires significant clinical expertise.¹² Although controversial, it is generally accepted that propofol-based sedation should be administered by appropriately trained anesthesiology personnel. There has been an increasing use of propofol and/or anesthesiology services in colonoscopy practice. Studies report a rise in the use of anesthesiology assistance from 11.0% in 2000 to 23.4% in 2006 in a Medicare cohort and from 13.6% to 35.5% in 2009 in a commercially insured group.¹³ It has been estimated that a nationwide conversion to monitored anesthesia care could result in as much as \$5 billion per year in new US health care costs for gastrointestinal (GI) procedures and that the estimated cost per life-year saved to substitute anesthesia specialists in endoscopic procedures is approximately \$5 million.^{14,15}

Recently, a provider-perspective economic model assessed the ability of rapid recovery agents (propofol and a closely related drug fospropofol) to increase practice efficiency.¹⁶ In the time to complete 1 colonoscopy with midazolam/meperidine, 1.76 colonoscopies can be completed with propofol and 1.91 colonoscopies can be completed with fospropofol.¹⁶ In addition to this time saving, we believed that the Mayo Clinic model of anesthesia care teams of anesthesiologists and CRNAs would lower total costs of using propofol relative to those reported by similar studies at other institutions.

The goal of this study was to compare the true overall cost difference between endoscopic procedures performed with conventional sedation and those performed with propofol. Although the use of propofol requires additional resources for anesthesia support, it offers cost-saving benefits from reduced procedure times for clinicians and staff. We used time-driven activity-based costing (TDABC) technique to measure accurately the costs of endoscopies under the 2 sedation regimens. The TDABC technique combines process mapping from industrial engineering and activity-based costing from accounting.¹⁷ Clinical teams direct and develop the process mapping by

identifying the high-level events in a procedure or care cycle and then drill down into the process steps that occur within each event; in parallel, the finance staff develops the cost component by constructing a dollar-per-minute capacity cost rate for each clinical resource.¹⁴ By mapping processes and measuring the costs of the resources involved in clinical processes, health care organizations can better compare the true cost of providing care under alternative treatment regimens, such as traditional sedation vs propofol.¹⁸

METHODS

Our goal was to work collaboratively with the departments of gastroenterology and anesthesiology to ascertain as accurately as possible the true costs to the institution of procedures done under the 2 types of sedation for GI endoscopy. We determined that the TDABC technique, a modern approach for accurate/transparent patient-level costing, offered the best way to measure the true cost of the procedure(s). We identified 2 geographically separate areas within the Mayo Clinic Rochester practice of endoscopy: one that uses only sedation with versed/fentanyl directed by an endoscopist and a second that uses predominantly sedation with propofol administered by a CRNA with staff anesthesiologist support. Over the same time period, we studied all patients in both clinical areas. The clinical processes and monitoring methods and standard monitoring techniques were not changed at any time during the study period. This study is not a randomized clinical trial; we studied consecutive patients who underwent procedures in 2 geographically separate areas that used these different practices.

We met with the clinical leaders and the administrative and finance staff of the gastroenterology and anesthesia departments and enlisted their support to objectively study the costs of endoscopies in the 2 different areas. In each location, 10 consecutive colonoscopy patients and 10 consecutive endoscopy patients (40 total patients) were studied. These studies were performed on 2 days (separated by 48 hours) in June 2015. In each location, the costs of both colonoscopies and upper GI tract endoscopies (esophagogastroduodenoscopy [EGD]) were measured. All groups

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