How Valid is the AHRQ Patient Safety Indicator "Postoperative Hemorrhage or Hematoma"?

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BACKGROUND: Postoperative hemorrhage or hematoma (PHH), an Agency for Healthcare Research and Quality Patient Safety Indicator, uses administrative data to detect cases of potentially preventable postsurgical bleeding requiring a reparative procedure. How accurately it identifies true events is unknown. We therefore determined PHH's positive predictive value.

STUDY DESIGN: Using Patient Safety Indicator software (v.3.1a) and fiscal year 2003–2007 discharge data from 28 Veterans Health Administration hospitals, we identified 112 possible cases of PHH. Based on medical record abstraction, we characterized cases as true (TPs) or false positives (FPs), calculated positive predictive value, and analyzed FPs to ascertain reasons for incorrect identification and TPs to determine PHH-associated clinical consequences and risk factors.

RESULTS: Eighty-four cases were TPs (positive predictive value, 75%; 95% CI, 66−83%); 63% had a hematoma diagnosis, 30% had a hemorrhage diagnosis, 7% had both. Reasons for FPs included events present on admission (29%); hemorrhage/hematoma identified and controlled during the original procedure rather than postoperatively (21%); or postoperative hemorrhage/hematoma that did not require a procedure (18%). Most TPs (82%) returned to the operating room for hemorrhage/hematoma management; 64% required blood products and 7% died in-hospital. The most common index procedures resulting in postoperative hemorrhage/hematoma were vascular (38%); 56% were performed by a physician-in-training (under supervision). We found no substantial association between physician training status or perioperative anticoagulant use and bleeding risk.

CONCLUSIONS: PHH's accuracy could be improved by coding enhancements, such as adopting present on admission codes or associating a timing factor with codes dealing with bleeding control. The ability of PHH to identify events representing quality of care problems requires additional evaluation. (J Am Coll Surg 2011;212:946–953. © 2011 by the American College of Surgeons)

The Agency for Healthcare Research and Quality (AHRQ) Patient Safety Indicators (PSIs) were developed in response to demand for easily applied measures that could guide quality-improvement initiatives and monitor trends in patient safety.[1] Because they use hospital administrative discharge abstracts, they were originally intended as screens for potentially preventable inpatient complications, highlighting areas where quality of care should be investigated rather than being definitive measures. However, the National Quality Forum recently endorsed several PSIs as hospital performance measures, and the Centers for Medicare and Medicaid Services (CMS) are adding 4 individual PSIs and a composite PSI to measures tracked by their hospital reporting initiative.[2-4] Underperforming or nonreporting hospitals will receive reduced payments.

The increasing use of PSIs as a measure of quality and safety requires users to understand their strengths and lim-

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Abbreviations and Acronyms

AHRQ = Agency for Healthcare Research and Quality
CMS = Centers for Medicare and Medicaid Services
EMR = electronic medical record
FP = False positive
OR = operating room
PHH = postoperative hemorrhage or hematoma
PPV = positive predictive value
PSI = Patient Safety Indicator
TP = true positive
VHA = Veterans Health Administration

itations, including whether they identify true events or preventable events. The current study focuses on PSI 9, ie, postoperative hemorrhage or hematoma (PHH), a component of the CMS-tracked composite measure. Although some blood loss is expected with most operations, this PSI is designed to capture bleeding after a surgical procedure that is presumably serious enough to require a subsequent reparative procedure. As such, the numerator requires both a diagnosis code of hemorrhage or hematoma and a procedure code for hemorrhage control or hematoma drainage.[5]

Like other PSIs, this indicator was developed using a consensus panel of clinical experts.[1] Additional work showed that hospital-level rates of this PSI were positively associated with rates of other PSIs representing postoperative complications,[6] and occurrence of this PSI was associated with excess hospitalization days, hospital costs, and in-hospital deaths.[7,8] However, relatively little is known about how well this indicator identifies true complications (ie, its criterion validity or agreement with medical record review). An earlier related indicator, "postprocedural hemorrhage or hematoma," from the Complications Screening Program had a moderate confirmation rate by chart review.[9] Complications Screening Program investigators also found frequently associated process of care problems, suggesting potential use of the current PSI as a quality of care measure.[10] Such use would be unwarranted if flagged cases do not identify true cases experiencing an event. Therefore, we examined the positive predictive value (PPV) of this indicator in the Veterans Health Administration (VHA). To better understand the type of events detected by this indicator and their potential preventability, we also examined circumstances surrounding this complication and associated risk factors.

METHODS

Study design

This was a retrospective cross-sectional study using VHA administrative and electronic medical record (EMR) data from fiscal year 2003 through 2007 (October 1, 2002 to September 30, 2007). We obtained Institutional Review Board approvals from the Bedford VA Medical Center and the VA Boston Healthcare System.

Data sources

We used hospital discharge information (ie, demographics, ICD-9-CM–coded diagnoses and procedures, and discharge status) from the VHA's National Patient Care Database Patient Treatment File.[11] Per earlier PSI work, we eliminated nonacute care (eg, long-term care).[7,12] We accessed VHA EMR data using VistaWeb, a program enabling centralized access to EMR data from all VHA facilities.[13]

PHH definition

The indicator is defined as "cases of hematoma or hemorrhage requiring a procedure per 1,000 surgical discharges with an operating room (OR) procedure."[6] The numerator requires both a secondary diagnosis code for hemorrhage or hematoma complicating a procedure and a procedure code for hemorrhage control or hematoma drainage. The denominator excludes discharges where the condition was present on admission, or the hemorrhage control or hematoma drainage procedure occurred before the first OR procedure, was the only OR procedure, or was part of the initial operative procedure (see Appendix 1, available online only, for the full PHH definition including ICD-9-CM codes).[5,6]

Study population

Hospital sampling

We applied the PSI software (v. 3.1a) to the inpatient database to obtain individual PSI counts and composite scores (ie, a combined measure that includes 11 PSIs).[14,15] From 158 acute care hospitals, we selected a representative sample of 28 hospitals based on individual PSI counts, composite rates, and geographic distribution (see Appendix 2, available online only, for sampling strategy and hospital characteristics). The observed PHH rate among sample hospitals was 3.8 per 1,000 (n = 614 cases), compared with a national VHA rate of 3.9 per 1,000 discharges at risk (n = 1,998 cases).

Case identification

We randomly selected 4 software-flagged cases of PHH per hospital. This total of 112 cases was based on power calculations using earlier reported PPVs and selected to ensure reasonably narrow confidence intervals (ie, 10% to 20%).[9]

Medical record abstraction

Two trained nurse-abstractors (KH, SM) conducted EMR reviews using a standardized data abstraction instrument