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The Practical Guide for Emergency Physicians

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Ask any of your colleagues, "Do you provide quality care?" The answer is, of course, but how do you know? It is because most of your patients seem to do OK? Quality in healthcare has been hard to define, and this task has baffled many. I remember the lecturer who spoke on quality in the emergency department at an ACEP conference about 20 or more years ago. He pulled out a Cross pen from his pocket and rhetorically asked the audience if they felt this was a quality writing instrument. Most of the audience nodded yes. Then he asked how the company determined that they made a quality product. Nobody could provide the answer. His answer was that the company developed specifications for the design of this pen and then monitored the assembly process to ensure compliance with these standards. This struck me as a simple but brilliant solution to the definition of quality in healthcare, and more importantly, a solution that could be implemented and monitored. Simply stated, quality in healthcare consists of deciding beforehand what is the right thing to do, and then doing it. The Hospital Quality Measures are like that; they are evidence-based and consensus-driven processes that, if done consistently, will improve patient outcome.

This issue of Emergency Medicine Reports *is devoted to increasing your understanding of these measures and the role they will play in your practice. And I want to thank Dr. Greg Henry for the anecdote I used in this introduction; I have remembered it all these years.*

—J. Stephan Stapczynski, MD, FACEP, AAEM, Editor

CMS/Joint Commission Hospital Quality Measures—Is It the Federal Grade for Quality?

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Introduction

Despite increasing expenditures and advances in medical technology, large gaps persist in the delivery of basic health care in the United States.[1] During the past 40 years, a number of converging influences have led to the current high-level focus on quality and transparency in U.S. healthcare and in closing these gaps. Increasing cost pressures, the rise of consumerism, organization of payor groups, application to healthcare of quality management methods borrowed from industry, and the maturation of health services research are but a few of the forces behind the present mandate for change. Accordingly, the landscape of performance measurement in healthcare has changed significantly during this time, most notably in the past decade. This period has introduced the use of standardized measures, compulsory reporting for accreditation, "voluntary" reporting to avoid reimbursement disincentives, other "pay-for-performance" (P4P) financial incentives for achieving quality targets, and public reporting of performance. Soon to follow will be additional hospital measures, the introduction of physician measures assessing individual and group performance, and measurement of patient perspectives on care, among other metrics and efforts.

These changes have already had a significant impact on routine medical practice. Certain measures specifically challenge emergency medicine and have led to questions as to the value of these measures, how they came to be, debates about the wisdom and usefulness of public reporting, and the future of these initiatives.[2] The issues of quality and performance measurement have certainly captured the attention of emergency physicians, striving to meet performance targets amidst the pressures of increased patient volume and limited capacity and resources. This experience has underscored the importance of engagement by emergency medicine organizations in setting the determinants by which performance is measured. Navigating the maze of numerous competing and collaborating agencies, the various proposed measures at different levels of care, and the broad initiatives that create incentives for reporting and performance can be puzzling even to those involved in the process.

In this issue of *Emergency Medicine Reports*, we present the current Centers for Medicare and Medicaid Services (CMS) and Joint Commission Hospital Quality Measures (a.k.a. "Core Measures"), outlining the changes and legislation leading to their development, reviewing fundamental aspects of these measures such as data collection, requirements of reporting, and public access, and attempt to place these measures into a larger framework to make them more understandable. We shine a light on the process of measure selection and development, and give a sense of future directions.

To understand how current conditions for measurement were selected and measures were chosen, it is important to have a sense of their history. The Hospital Quality Measures are a subset of existing measures at the Joint Commission (previously known as JCAHO) and CMS, and the story of their development is one of an evolution in the roles of these agencies and of changes in healthcare. This article will briefly review the evolution of quality efforts at CMS, beginning with utilization review and leading to the role of Quality Improvement Organizations who contract as CMS' agents in every state. Next, this article describes the role and progression of the Joint Commission from small consortium of medical societies to a ubiquitous accreditor, and the history of collaboration between these agencies. The recent changes in quality improvement and performance measurement in healthcare that have led to today's quality agenda and recent efforts to standardize measures in the absence of a centralized authority will be reviewed. The Hospital Quality Measures are presented, along with a description of the process of data collection and analysis, and public access to data. Finally, this issue discusses future plans of CMS and the Joint Commission in this arena, pay for performance initiatives, and what these mean for emergency medicine.

Performance Measurement at CMS and the Evolving Focus on Quality

The history of CMS' efforts in quality assurance begins with passage of Medicare in 1964. Initially designed to provide health insurance for people 65 and older, Medicare was expanded in 1970s to include those younger than 65 receiving social security

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disability benefits and to certain patients with end-stage renal disease. As the largest single purchaser of healthcare in the United States, Medicare's efforts in securing quality care for its beneficiaries affect quality standards nationally.

In the initial cost-based reimbursement scheme, Medicare's quality assurance efforts consisted primarily of utilization review, focusing on unnecessary services or overuse of services.[3] From 1970-1975 this was performed by Experimental Medical Care Review Organizations (EMCROs) provided for by this legislation and made up of voluntary groups of physicians. Neither specific review criteria nor authority for denial of payment were part of EMCROs' mandate, and they were ineffective in controlling the subsequent substantial cost increases. In the first few years after implementation, costs for Medicare doubled and those for Medicaid quadruped.[4-6]

Under an amendment to the Social Security Act in 1972, utilization review was contracted to Professional Standard Review Organizations (PRSOs). Headed by physicians within a given locality, PRSOs had a primarily regulatory role and were given the authority to recommend denial of payment on claims for inpatient services. Controversial from the outset, PRSOs were criticized by physician groups as government interference with medical practice promoting "cookbook medicine," and criticized by consumer groups on the other side who charged local review and self-policing as inherently ineffective and a conflict of interest. PRSOs did little to control healthcare costs and they, too, were ultimately replaced.[3,4,7]

HMOs and managed care plans became prevalent in response to rising costs, and under the Deficit Reduction Act of 1983 Medicare's reimbursement scheme shifted to a prospective payment system (PPS), introducing diagnosis-related groups (DRGs), and allowing for capitation for Medicare beneficiaries. Subsequent discussions about quality shifted to assuring appropriate services were provided to beneficiaries by these plans and utilization review focused on underuse.[3] While the government set minimum qualifications for the introduction of health plans, quality review of these plans was largely taken on by the JCAHO and the National Committee on Quality Assurance (NCQA), whose Health Plan Employer Data and Information Set (HEDIS) and Consumer Assessment of Healthcare Providers and Systems (CAHPS) measures became standards in evaluating health plans, and which have had numerous subsequent adaptations and applications.[3,4,7]

Passage of the Peer Review Improvement Act of 1982, as part of the Tax Equity and Fiscal Responsibility Act (TEFRA), replaced PRSOs with 54 Peer Review Organizations (PROs) (one per state and territory) that bid on contracts to provide reviewing and regulatory services. The focus of the PROs remained on cost control, but with time and each subsequent contract cycle or "scope of work" expanded to include quality oversight. Under the Omnibus Budget Reconciliation Act of 1986, the Federal Department of Health and Human Services contracted with the Institute of Medicine (IOM) to study of the impact of the PRO system on quality. Their 1990 report recommended that PROs be tasked primarily with quality improvement and not utilization review or cost control. This was codified to some degree in the 1993 fourth "scope of work" when the PROs were brought under the Health Care Quality Improvement Program (HCQIP) with a new focus on data collection, quality improvement efforts, and collaborations with providers.[3,4,7]

Under this program, PROs were charged with participating in quality improvement projects focusing on conditions prevalent in the Medicare population. One of the first projects under this program, the cardiac care coordination project, related to improving care in acute myocardial infarction (AMI) was felt to be a success. Working with the American College of Cardiology, the American Heart Association, and PROs in four states, measures were developed, refined, and piloted, with improvements in all four states over the pilot period. All participating states demonstrated significant improvement over the study period. These efforts set the stage for broader efforts. In 1999, HCQIP projects became national, and every PRO was required to demonstrate measurable statewide improvement in the areas of breast cancer, diabetes, heart failure, pneumonia, stroke, and AMI.[8]

To reflect their shift in focus, PROs underwent a name change between 1999 and 2002 to Quality Improvement Organizations (QIOs). Currently operating under the Eighth Scope of Work ("8th SoWz"), today there are 43 QIOs that contract with CMS for more than $400 million a year to provide service in the home health agencies, nursing homes, managed care plans, and physicians' offices.[9] QIOs retain utilization review and regulatory roles as well as those in quality improvement. Whether they are successful in improving quality and the potentially conflicting nature of their regulatory and quality improvement roles remain areas of contention and criticism, particularly by the IOM.

Performance Measurement at the Joint Commission

Before the existence of HCFA, the Joint Commission for Accreditation of Hospitals (JCAH), subsequently the Joint Commission for Accreditation of Healthcare Organizations (JCAHO), and currently the Joint Commission (as of January 8, 2007) had been established as the premier quality monitoring organization in healthcare. Established in 1951, the JCAH was formed by a partnering of the American and Canadian Medical Associations, the American College of Physicians, and the American Hospital Association with the American College of Surgeons (ACS). The ACS, influenced by surgeon Ernest Codman's focus on evaluation of outcomes, established "minimum standards for hospitals," and performed audits to assess whether these standards were met. The Joint Commission's mission of accreditation today supersedes mere compliance with "minimum standards" (now largely a function of credentialing federal agencies and licensing by State Departments of Public Health) to recognize "optimal achievable levels of quality."[10]

The Social Security Amendments of 1965 included a provision under its "Conditions of Participation," in essence requiring that hospitals be JCAHO-accredited (as then termed) to partici-

Table 1. Milestones in the History of CMS/Joint Commission Hospital Quality Measures

- **1965:** JCAHO (Joint Commission) accreditation mandatory for Medicare Reimbursement
- **1987:** JCAHO announces intention to require reporting of standardized performance measures. Later relents.
- **2001:** JCAHO announces initial set of performance measures for four conditions: acute myocardial infarction, heart failure, pneumonia, and pregnancy.
- **2002:** JCAHO requires data collection on 10 performance measures ("starter set") for accreditation.
- **2004:** CMS and JCAHO align performance measures around those already in use, with goal of making these identical where appropriate
- **2005:** CMS begins public reporting of hospital comparative data on 10 measures
- **2006:** CMS expands public reporting to 20 measures

Table 2. Key Components of the CMS Hospital Quality Initiative

- An ongoing regulatory role for CMS,
- Public disclosure of hospital quality information, including:
  Quality measures of hospital care derived from clinical data and
  Reporting on patient perspectives of their hospital care using the Hospital Patient Perspectives on Care Survey (HCAPS)
- The testing of rewards for superior performance on certain measures through the "pay for performance" program via the Premier Hospital Quality Incentive Demonstration,
- Continued quality improvement resources and collaboration through QIOs,
- Collaboration and partnerships with other quality organizations

pate in Medicare and Medicaid programs, sealing the latter agency's preeminence as a standard-setting organization and establishing a precedent for collaboration between the federal government and the Joint Commission. (*See Table 1.*) Today, more than 95% of acute care hospitals voluntarily report to the Joint Commission and undergo the accreditation process. Until the late 1970s, the JCAHO-accreditation (as then termed) process for hospitals did not focus on performance measurement at all, and as discussed further here, the accreditation process did not require reporting on performance until the 1990s.[11]

In 1987, shortly after Health Care Financing Administration (HCFA, the predecessor of CMS) announced its intent to release comparative reports on hospital mortality, JCAHO (as then termed) as part of the "Agenda for Change" announced its intention to require hospitals seeking accreditation to collect and submit data on six sets of standardized performance measures they had developed (perioperative care, obstetrical care, trauma care, oncology care, infection control, and medication use) using a standardized "Indicator Measurement System" to facilitate reporting. While both HCFA's and JCAHO's plans were met with strong objections from various quarters and were abandoned, these efforts set the stage for broader initiatives in the 1990s.[12]

In 1995, JCAHO (as then termed) named an Advisory Council on Performance Measurement to identify specific criteria as standards for use in accreditation and to develop the attributes of core performance measures. Their work established the initial evaluation framework and criteria used to review performance measurement systems and measures. This led to the 1997 launch of JCAHO's ORYX initiative, introducing performance measures as a condition of accreditation for hospitals, long-term care organizations, networks, home health agencies, and behavioral healthcare organizations.[13] ORYX allowed healthcare organizations to choose from a broad range of non-standardized measures to report, and to use various reporting systems for transmission of data. With more than 100 different measurement systems and more than 8000 measures available, however, meaningful analysis was limited, and the need for standardization was quickly apparent.[14]

In response to this, in 1999 JCAHO (as then termed) developed potential focus areas for standardized or "core" measures for hospitals, announcing the initial four measure sets of acute myocardial infarction (AMI), heart failure (HF), pneumonia (PN), and pregnancy and related conditions (PR) in May 2001. This process included input from stakeholders including clinicians, hospitals, consumers, state hospital associations, and medical societies about potential focus areas. Candidate measures were assessed using the Attributes of Core Performance Measures and Associated Evaluation Criteria, and advisory panels were convened to identify sets of measures to assess care provided in a given focus area. The potential core measures were posted on the JCAHO Web site for stakeholder feedback. After development of the initial specifications for the first sets of core measures, JCAHO pilot tested these at 16 facilities to evaluate feasibility, usefulness, reliability, and implementation costs.[14]

In 2002 JCAHO introduced these core measures into its performance requirements for hospitals. Hospitals seeking accreditation were required to submit data on three of five standardized measure sets (acute myocardial infarction, heart failure, pneumonia, pregnancy and related conditions, and surgical infection prevention). To a degree, reporting on non-standardized measures is still acceptable to obtain accreditation, but reporting on fewer standardized measures requires reporting on more non-standardized measures.[14]

Collaboration Between CMS, the Joint Commission, and the Hospital Quality Alliance

In 2001 the federal Department of Health and Human Services announced The Quality Initiative, "to assure quality health care for all Americans through accountability and public disclosure." This consisted of several components: the Hospital Quality Initiative (HQI, *see Table 2*), the Nursing Home Quality Initia-

Table 3. 2006 Hospital Quality Measures

MEASURE	DESCRIPTION	CONDITION
Aspirin on arrival	Percent of patients without contraindications who receive aspirin within 24 hours before or after hospital arrival.	**Acute myocardial infarction (AMI)**
Beta-blocker on arrival	Percent of patients without contraindications who received a beta-blocker within 24 hours after hospital arrival.	
Thrombolytic within 30 minutes of arrival	Percent of patients meeting criteria for thrombolytic therapy who were treated within a door-to-drug time of 30 minutes	
Primary Coronary Intervention (PCI or angioplasty) within 120 minutes of arrival	Percent of patients meeting criteria for PCI who were treated within a door-to-balloon time of 120 minutes	
Smoking cessation	Percent of patients who smoke that receive smoking cessation advice/counseling before leaving the hospital	
Aspirin at discharge	Percent of patients without contraindications who are prescribed aspirin at hospital discharge.	
Beta-blocker at discharge	Percent of patients without contraindications who are prescribed beta-blocker at hospital discharge.	
Angiotensin-converting enzyme inhibitor (ACEI) or angiotensin receptor blocker (ARB) for left ventricle systolic dysfunction	Percent of patients with left ventricular systolic dysfunction (LVSD) and without contraindications who are prescribed either an ACEI or ARB at hospital discharge. .	
Left ventricle function assessment	Percent of patients with documentation in the hospital record that left ventricular function (LVF) was assessed before arrival, during hospitalization, or planned for after discharge.	**Heart failure (HF)**
ACEI or ARB for LVSD	Percent of patients with left ventricular systolic dysfunction (LVSD) and without contraindications who are prescribed either an ACEI or ARB at hospital discharge.	
Smoking cessation	Percent of patients who smoke that receive smoking cessation advice/counseling before leaving the hospital	
Comprehensive discharge instructions	Percent of patients given comprehensive discharge instructions	
Oxygenation assessment	Percent of patients who had an assessment of arterial oxygenation within 24 hours after arrival to the hospital.	**Pneumonia**
Blood culture before first antibiotic	Percent of patients meeting criteria for blood culture who had specimen collected before initial antibiotic dose	

** Italics denote measures directly applicable to the emergency department.* *(continued on next page)*

Table 3. 2006 Hospital Quality Measures (continued)

MEASURE	DESCRIPTION	CONDITION
Initial antibiotic with 4 hours of arrival	Percent of patients who received their first dose of antibiotics within 4 hours after arrival at the hospital.	**Pneumonia**
Appropriate antibiotic selection	Percent of patients who received an appropriate initial antibiotic(s)	
Smoking cessation	Percent of patients who smoke that receive smoking cessation advice/counseling before leaving the hospital	
Pneumococcal vaccination	Percent of patients were screened for pneumococcal vaccine status and were administered the vaccine prior to discharge, if indicated.	
Prophylactic preoperative antibiotic(s)	Percent of patients who received prophylactic antibiotics within 1 hour prior to surgical incision, if indicated	**Surgical infection prevention**
Prophylactic postoperative antibiotic(s)	Percent of patient in who prophylactic antibiotics were discontinued within 24 hours after surgery end time	

** Italics denote measures directly applicable to the emergency department.*

tive, and the Home Health Quality Initiatives.

CMS contracted with the National Quality Forum (NQF) to propose a consensus-derived set of hospital quality measures appropriate for public reporting.[13] CMS chose 10 of 39 of the NQF consensus-derived measures for several quality improvement efforts and another 24 from this set for a quality incentive demonstration. Throughout this time, JCAHO and CMS had collaborated on the AMI, HF, and PN measures to align the specifications that were common to both and subsequently set out to make their measures sets identical, with common data dictionaries, information forms, and algorithms, including future measures common to both organizations.[13]

Under the banner of the Hospital Quality Alliance (HQA), CMS collaborated with the American Hospital Association, the Federation of American Hospitals, the Association of American Medical Colleges, and a broad array of stakeholders to develop a voluntary hospital reporting initiative linking a hospital's payment update under Medicare to the submission of data for a set of standardized measures from the JCAHO ORYX system. The HQA identified 20 standardized, NQF-endorsed measures in the areas of AMI, HF, pneumonia, and surgical infections that are referred to as "Hospital Quality Measures." Ten of these became the "starter set" of measures chosen for initial public disclosure. These measures were chosen because, "they are related to three serious medical conditions and prevention of surgical infections and it is possible for hospitals to submit information on for public reporting today."[15,16] These are also measures that were largely already known and that CMS could validate using existing systems through their QIOs. Since 2006, reporting on the full 20 measures is now required. (*See Table 3.*)

Table 4. ICD-9 Codes to Identify Patients for Hospital Quality Measure Analysis

MYOCARDIAL INFARCTION:

410.01, 410.11, 410.21, 410.31, 410.41, 410.51, 410.61, 410.71, 410.81, 410.91

HEART FAILURE:

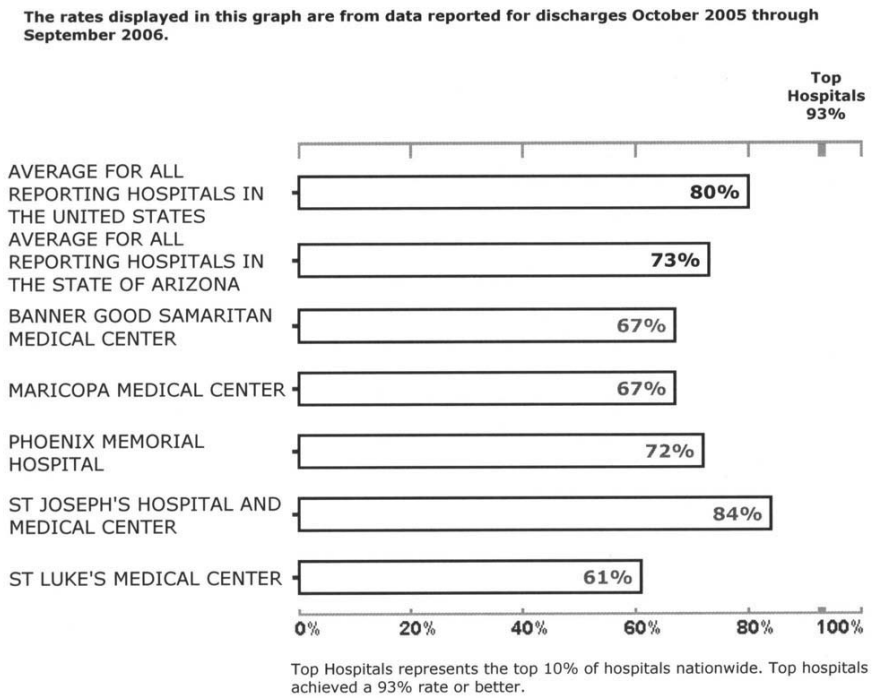
402.01, 402.11, 402.91, 404.01, 404.03, 404.11, 404.13, 404.91, 404.93, 428.0, 428.1, 428.20, 428.21, 428.22, 428.23, 428.30, 428.31, 428.32, 428.33, 428.40, 428.41, 428.42, 428.43, 428.9

PNEUMONIA:

481, 482.0, 482.1, 482.2, 482.31, 482.32, 482.39. 482.41, 482.49, 482.81, 482.83, 482.84, 482.89 , 483.0, 483.1, 483.8, 485, 486, 487.0

Although they had appeared in other forms previously under CMS and JCAHO initiatives, these measures were vetted by CMS through a process in April-June 2004 that included selection of measures and public "Listening Sessions" conducted in five U.S. cities, attended by healthcare consumers, payers, plans, providers, and purchasers. The stated objective of these meetings was to receive feedback and comments from interested parties and end-users "outside the beltway." In April 2005, CMS began publicly reporting hospital comparative data based on the HQA measures via its Web-based tool (see below) with the goal of identifying "a robust set of standardized and easy-to-understand hospital quality measures that would be used by all stakeholders in the healthcare system in order to improve quality of care and

Figure 1. Percent of Pneumonia Patients Given Initial Antibiotic(s) within 4 Hours after Arrival



the ability of consumers to make informed healthcare choices."[15]

Acceptance of the Hospital Quality Measures has not proceeded without controversy, and all measures have undergone revision, with the pneumonia measures receiving particular attention from emergency physicians. For example, the case of universal blood cultures before initial antibiotic treatment in patients with pneumonia was roundly challenged by emergency physicians on both clinical and epidemiologic grounds.[17] Shortly after publication of an editorial to this effect,[18] the description of this measure were revised to indicate that requiring a blood culture before the initial antibiotic dose applied only to patients with pneumonia being admitted to the intensive care unit (ICU) (a subpopulation for which there are reasonable supporting data for the utility of blood cultures) and those emergency department patients in whom blood culture was obtained anyway. The diagnostic criteria for pneumonia have been refined so that a patient is eligible for analysis only if the pneumonia diagnosis is confirmed by chest radiograph or computed tomography (July 2006) and is included in the emergency physician's diagnosis or impression (October 2006). The four-hour window for initial antibiotic administration for patients with pneumonia has been challenged and will be increased to six hours, effective for discharges after October 1, 2007.[19] These changes demonstrate some of the perils of accepting a "consensus-derived" measure particularly, as in the utility of blood cultures or the timing of initial antibiotic therapy in the management of pneumonia, without input from the specialties most affected and without considering the measure's full range of effects.

How Are the Measures Analyzed and Reported?

The Hospital Quality Measures (HQM) are made up entirely of process measures and derived only from admitted patients with Medicare coverage. The specifications for these measures identify the numerator and denominator populations, and data are aggregated to present a rate of compliance with the standard. Performance is benchmarked against state and national average and top 10% performance. For Joint Commission accreditation, hospitals are required to submit data on a minimum of three measure sets and report on all measures within a given set. Reporting to both the Joint Commission and CMS is required and is done separately, but there are plans in process to unify the reporting mechanism.

Patients who are eligible for HQM analysis are identified by International Classification of Disease version 9 (ICD-9) codes generated upon hospital discharge. (*See Table 4.*) Data to calculate compliance with the individual HQM is abstracted from the medical record of appropriate patients by internal hospital employees or by vendors using standardized data collection instruments or worksheets. The data are aggregated and electronically submitted on a quarterly basis to a national clinical data repository via the Web tool, QualityNet Exchange, using either the CMS Abstraction and Reporting Tool (CART), JCAHO's ORYX Core Measure Performance Measurement System (PMS), or qualifying vendor software. CMS, through QIOs and local Clinical Data Abstraction Centers, validates this data by sampling hospital primary data and re-abstracting the clinical measures quarterly. QIOs are responsible for ensuring reliability, consistency, and for mediating appeals.

One of the goals in reporting is to standardize coding of quality measures and, when possible, to make this part of the administrative data set used for claims as opposed to reporting this through a separate system. Claims for emergency physician services utilize Current Procedural Terminology (CPT) codes developed and maintained by the AMA and adopted for use by the Health Care Procedure Coding System (HCPCS). These assign a five-digit numeric code for all services, procedures, and specific other items. For physician-level quality measures, CMS has defined a set of HCPCS codes (termed G-codes) to report data for the calculation of the quality measures. These new codes will supplement the usual claims data with clinical data that can be used to measure the quality of services rendered to beneficiaries. Separately, the AMA has also developed CPT II codes, which serve a similar function in providing a coding at the claims level for performance on a quality measure. The CPT II codes have modifiers that provide for exclusion, whereas G-codes include separate codes to indicate this. It is presently unclear whether G-codes or CPT II codes will become the standard for these measures.

Table 5. Physician Quality Reporting Initiatives Relevant to Emergency Medicine

- ECG performed for non-traumatic chest pain
- Aspirin on arrival for acute myocardial infarction
- ECG performed for syncope
- Vital signs obtained for community-acquired bacterial pneumonia
- Assessment of oxygen saturation for community-acquired bacterial pneumonia
- Assessment of mental status for community-acquired bacterial pneumonia
- Appropriate empiric antibiotic for community-acquired bacterial pneumonia

Table 6. Structure of CPT Category II Codes

- 0000F Composite Measures
- 0500F Patient Management
- 1000F Patient History
- 2000F Physical Examination
- 3000F Diagnostic Processes and Results
- 4000F Therapeutic, Preventative and Other Measures
- 5000F Follow-Up and Other Outcomes
- 6000F Patient Safety

Table 7. CPT Category II Codes Used for PQRI Emergency Medicine Relevant Measures

- ECG for non-traumatic chest pain: 3120F
- ASA for acute myocardial infarction: 4084F
- ECG for syncope: 3120F
- Vital signs assessment for community-acquired bacterial pneumonia: 2010F
- Oxygenation assessment for community-acquired bacterial pneumonia: 3028F
- Mental status assessment for community-acquired bacterial pneumonia: 2014F
- Appropriate empiric antibiotics for community-acquired bacterial pneumonia: 4045F

Public Access to the Results

Public access to results is considered a key component of the Quality Initiative and intended to provide transparency to consumers and purchasers. The extent to which public reporting is successful in achieving transparency and is being used by consumers remains to be seen. Newspapers and other media have occasionally published stories based on public access data, and some individual hospitals have cautiously used this information for self-promotion. The public has access to the results through www.hospitalcompare.hhs.gov or, for JCAHO publicly reported data, at www.qualitycheck.org. Data on the Hospital Compare Web site is updated quarterly and is typically six to nine months old. (*See Figure 1.*)

Pay for Performance ("P4P")

Despite the name "Pay for Performance," CMS' initial financial incentives or disincentives have focused not on performance per se, but first on encouraging voluntary reporting. For an eligible short-term acute care hospital to receive its full annual Medicare financial update under the inpatient prospective payment system, CMS requires hospitals to submit data on 10 quality measures for three medical conditions: AMI, HF, and pneumonia. These are also the same measures that form the starter set of the voluntary reporting effort established by the Hospital Quality Alliance (HQA). Hospitals failing to report these data by the established deadlines receive a 0.4 percentage point reduction in their annual Medicare payment update. Approximately 96% of all eligible hospitals received their full annual payment for FY 2006.

CMS, however, has also undertaken a number of experiments directed at rewarding high performance on achieving quality targets. The primary P4P program at the hospital level is the Premier Hospital Quality Incentive Demonstration, which provides financial awards of $8.85 million to hospitals that showed measurable improvements in care during the first year of the 3-year program in a number of areas of acute care. Hospitals receive bonuses based on overall score on quality measures for each of the following conditions (34 measures): AMI, HF, community-acquired pneumonia, coronary artery bypass graft (CABG), and hip and knee replacement. Additional P4P programs are being developed at the provider-level and other levels as well.[20]

Individual Physician Auditing and Reporting

Individual physician or physician group performance is one the aforementioned areas of focus in CMS' P4P initiative. Beginning January 1, 2006, interested physicians began to participate in a voluntary program of reporting on 36 performance measures. As originally implemented, the Physician Voluntary Reporting Program (PVRP) provided no additional payment or reward for reporting under the program, and participation is viewed as an opportunity to get a head start on implementing systems and practices for the reporting of future quality measures, as government and private payers head increasingly in this direction.

On December 20, 2006, the President signed into law the Tax Relief and Health Care Act of 2006 (TRHCA). Section 101 under Title I authorizes the establishment of a physician quality reporting system by CMS. This statutory program has been named the Physician Quality Reporting Initiative (PQRI), and CMS subsequently discontinued the PVRP and replaced it with PQRI. PQRI establishes a financial incentive for eligible professionals to participate in a voluntary quality-reporting program. Eligible professionals who successfully report a designated set of quality measures on claims for dates of service from July 1 to December 31, 2007, may earn a bonus payment, subject to a cap, of 1.5% of total allowed charges for covered Medicare physician fee schedule services, for the traditional Medicare fee-for-service program only. CMS is using 74 measures for PQRI, seven (7) of

Table 8. CPT Category II Code Modifiers

1P: EXCLUSION DUE TO MEDICAL REASONS

- Not indicated: absence of organ or limb, therapy or assessment already received or performed
- Contraindicated: patient allergic, potential adverse drug interactions, other

2P: EXCLUSION DUE TO PATIENT REASONS

- Patient declines
- Economic, social or religious reasons
- Other patient reasons

3P: EXCLUSION DUE TO SYSTEM REASONS

- Resources to perform services not available
- Insurance coverage or payer-related limitations
- Other reasons attributable to health care delivery system

which are most relevant for emergency medicine. (*See Table 5.*) The American College of Emergency Physicians has worked with CMS and other agencies to develop methodology to identify compliance with these PQRI measures.

Reporting compliance with PQRI measures requires that for each professional service, three codes be determined: a diagnosis (ICD-9 code), a professional service (CPT Evaluation and Management code), and compliance (CPT Category II code, with or without modifier). The CPT Category II codes were created to facilitate collection and reporting of evidence-based performance measures at the time of service. The CPT Category II codes were developed by the AMA Physician Consortium for Performance Improvement and NCQA, with input from more than 50 professional organizations. The codes have a hierarchal structure (*see Table 6*), with seven CPT Category II codes relevant to emergency medicine. (*See Table 7.*) An important aspect to CPT Category II codes is the modifiers that indicate compliance was not possible for specific reasons. (*See Table 8.*) Compliance with a PQRI measure calculated by the ratio of the numerator (determined by the CPT category II code) to the denominator (determined by a combination of the ICD-9 code, CPT Evaluation and Management code, and patient demographics). Reporting of these codes is to be done on the Medicare claim form submitted by the provider for reimbursement.

To be eligible for the PQRI bonus, CMS requires reporting of at least three measures, but is encouraging that providers report as many as possible. Quality data will be reported concurrently with the billing process as noted above. Successful involvement in the PQRI requires an 80% reporting rate in at least three measures. Successful reporting physicians may be eligible for a 1.5% bonus (subject to cap) for service provided to Medicare FFS beneficiaries between July 1 and December 31, 2007. CMS maintains that there are no plans to make PQRI mandatory. PQRI is a new initiative with evolving specifications; the most up-to-date information can be found on CMS and ACEP Web sites.

Table 9. Important Attributes of Performance Measures (The Joint Commission)

- Should target improvement in the health of populations
- Should be precisely defined and specified
- Should be reliable
- Should be valid
- Should be interpretable
- Should be risk-adjusted or stratified
- Should be evaluated for the burden of data collection
- Should be useful in the accreditation process
- Should be under provider control
- Should be publicly available

Standardization and Standard-Setting Bodies

It has been clear for more than a decade that redundant and non-standardized measures present an enormous burden of data collection and reporting for providers and institutions, and wasting of resources that could be better utilized in quality improvement efforts. It is also clear that data and measures serve many stakeholders and are used for a variety of purposes, and that the existing uncoordinated efforts remain inadequate to this task.[12]

In 1998 the President's Advisory Commission on Consumer Protection and Quality in the Health Care Industry recommended creating an agency to identify national aims for improvement and to report on progress, and a forum to define plans for implementation of quality measurement, data collection, reporting standards, identification and updating of core sets of quality measures, and standardized reporting methods. The latter agency took form in the National Quality Forum (NQF), a not-for-profit organization with a membership across the spectrum of stakeholders whose function remains primarily that of endorsement of measures: "To improve American healthcare through endorsement of consensus-based national standards for measurement and public reporting of healthcare performance data that provide meaningful information about whether care is safe, timely, beneficial, patient-centered, equitable and efficient."[21]

Perhaps because the former of these two agencies, a centralized standard-setting body, was never established by Congress, performance measurement efforts have often continued in an uncoordinated, fractionated manner. However, a number of groups such as the Joint Commission, CMS, the AMA, the NQF, and the NCQA have made considerable gains in both standardizing hospital measures and aligning initial efforts at creating physician-specific measures. In 2000, the landmark IOM report "To Err is Human" underscored the importance of building quality systems to avoid medical error resulting in patient deaths.[22] The follow-up report "Crossing the Quality Chasm" outlined a number of quality goals for systems to build toward.[23] These reports have solidified support for more attention to quality and to a proposal by the IOM for a central, independent, National Quality Coordination Board to coordinate the diverse efforts in a usable way.

Future Changes

A number of changes will continue in the near future to expand the mandate of the Quality Initiative and to move toward standardization in reporting. Hospitals currently report on the 20 HQA-approved measures. The HQA anticipates adding new measures in 2007-2008: 30-day mortality for AMI, HF, and pneumonia, influenza vaccination for pneumonia, and two measures concerning venous thromboembolism prophylaxis in surgical patients. It is highly likely that the number of mandatory hospital quality measures is likely to increase in the next few years, so it is important that new measures be selected to serve their intended purpose while minimizing unintended negative consequences. (*See Table 9.*)

The Joint Commission will replace non-core measures by 2010 and will adopt NQF-endorsed measures for non-hospital areas. Physician-level measures will be developed as described above. With adoption of an electronic health record (spurred on by federal and state reimbursement requirements), emphasis will then focus on patients' experience within and across delivery sites. It is proposed that measures collected by human abstraction of paper records will eventually be retired with only randomized data collection from electronic records for surveillance purposes.

Conclusion

The drive for determinants of quality and the derivation of measures in healthcare continues to increase. Initial steps have focused on securing reporting, standardizing measures, and beginning public reporting of results. It is a recognized phenomenon that the introduction of imperfect measures stirs passions and results in increased engagement in quality improvement and development of better measures. In the drive to apply this science to healthcare, however, it is important that the focus is on measuring and encouraging quality rather than simply measuring and encouraging documentation. To assure that measures and conditions are high priority, evidence-based, and appropriate, it is critical that practicing emergency physicians not only sit at the table when metrics are proposed and vetted, but also that they be engaged in and take control of this process as it relates to their field of expertise. Failure to do so results in assuming a reactionary role, and presents a missed opportunity to demonstrate leadership in an area that is bound to expand in medicine.[24,25]

For the practicing emergency physician, the bottom line is this: Somebody is starting to watch your practice. The methodology may be imprecise, but that somebody is big, powerful, and has the ability to hurt your hospital and affect your career. Your hospital CEO cares about these measures, and so must you. You should know which measures are applicable to your practice in the emergency department and develop techniques and processes to facilitate compliance with both utilization and documentation. Develop protocols or pathways, use pre-printed or computerized order sets, and document with templated screens or forms that incorporate relevant quality measures. In addition, it is important to have a physician champion to represent your interests. This individual knows who is collecting the data on compliance with these measures, knows the methods of the individuals, can audit their performance and correct inaccuracies, and hopefully, review data before submission to the quality. If you and your group can achieve this, you will not only be making your hospital CEO happy, but improving the quality of care for your patients as well.

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Physician CME Questions

51. Which of the following statements concerning Medicare is *not* true?
    A. It was originally designed to cover those citizens older than 65 years of age.
    B. It is currently the largest single purchaser of healthcare in the United States.
    C. Medicare is primarily concerned with overuse (fraud and abuse) and not quality.
    D. Quality activities for Medicare are defined in the Scope of Work.

52. Which of the following statements best describes the Joint Commission (JCAHO)?
    A. Joint Commission accreditation is not required to receive Medicare payments.
    B. Quality performance reporting is required for Joint Commission accreditation.
    C. The Joint Commission is a Federal government agency.
    D. The Joint Commission specifies "minimum standards" for accreditation.

53. Which of the following conditions was covered in the initial set ("starter set") of CMS Hospital Quality Measures?
    A. Acute myocardial infarction, heart failure, pneumonia
    B. Acute myocardial infarction, heart failure, surgical site infections
    C. Acute myocardial infarction, heart failure, obstetrical care
    D. Acute myocardial infarction, pneumonia, surgical site infections

54. How many Hospital Quality Measures are required by CMS for periodic reporting?
    A. 10
    B. 14
    C. 16
    D. 20

55. Which of the following statements best describes the Hospital Quality

Emergency Medicine Reports
CME Objectives

To help physicians:

- quickly recognize or increase index of suspicion for specific conditions;
- understand the epidemiology, etiology, pathophysiology, and clinical features of the entity discussed;
- apply state-of-the-art diagnostic and therapeutic techniques (including the implications of pharmaceutical therapy discussed) to patients with the particular medical problems discussed;
- understand the differential diagnosis of the entity discussed;
- understand both likely and rare complications that may occur.

CME Instructions

Physicians participate in this continuing medical education program by reading the article, using the provided references for further research, and studying the questions at the end of the article. Participants should select what they believe to be the correct answers, then refer to the list of correct answers to evaluate their knowledge. To clarify confusion surrounding any questions answered incorrectly, please consult the source material. *After completing this activity, you must complete the evaluation form that will be provided at the end of the semester and return it in the reply envelope provided to receive a certificate of completion.* When your evaluation is received, a certificate will be mailed to you.

Measures?

A. They measure compliance with process, not outcome.
B. They are all evidence-based with supporting data.
C. Both inpatients and outpatients are used for analysis.
D. They apply to all patients regardless of insurance coverage or payor source.

56. How are patients identified for Hospital Quality Measure compliance analysis?
    A. By admitting diagnosis
    B. By ancillary test results (e.g., ECG or chest radiograph)
    C. By utilization managers during inpatient stay
    D. By discharge diagnosis

57. Which of the following best describes public access to Hospital Quality Measure information?
    A. It is specific for hospital, condition, and measure.
    B. It only reports aggregate data for an individual hospital.
    C. It is up-to-date.
    D. It requires a signed request form.

58. Which of the following statements best describes the effect of Hospital Quality Measures reporting on Medicare reimbursement?
    A. It has no effect on Medicare hospital reimbursement.
    B. Hospitals not reporting on the 10 measures of the starter-set had a reduction in Medicare reimbursement.
    C. Hospital Medicare reimbursement is tied to compliance with the Hospital Quality Measures.
    D. Compliance with Hospital Quality Measures affects physician Medicare reimbursement.

59. Which of the following statements best describes the current status of individual physician Medicare quality auditing?
    A. It is required, not voluntary.
    B. It is voluntary, but not tied to reimbursement.
    C. It requires a separate form to document compliance with quality measures.
    D. It can apply to both inpatients and outpatients.

60. Which of the following organizations is the centralized standard creating agency established by Congress to medical care quality?
    A. The Centers for Medicare and Medicaid Services (CMS)
    B. The Joint Commission
    C. No such agency was ever established.
    D. The National Quality Forum (NQF)

CME Answer Key

51. C
52. B
53. A
54. D
55. A
56. D
57. A
58. B
59. D
60. C

In Future Issues: **Acute Infectious Diarrhea**

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CMS/Joint Commission Hospital Quality Measures

2006 Hospital Quality Measures

MEASURE	DESCRIPTION	CONDITION
Aspirin on arrival	Percent of patients without contraindications who receive aspirin within 24 hours before or after hospital arrival.	**Acute myocardial infarction (AMI)**
Beta-blocker on arrival	Percent of patients without contraindications who received a beta-blocker within 24 hours after hospital arrival.	
Thrombolytic within 30 minutes of arrival	Percent of patients meeting criteria for thrombolytic therapy who were treated within a door-to-drug time of 30 minutes	
Primary Coronary Intervention (PCI or angioplasty) within 120 minutes of arrival	Percent of patients meeting criteria for PCI who were treated within a door-to-balloon time of 120 minutes	
Smoking cessation	Percent of patients who smoke that receive smoking cessation advice/counseling before leaving the hospital	
Aspirin at discharge	Percent of patients without contraindications who are prescribed aspirin at hospital discharge.	
Beta-blocker at discharge	Percent of patients without contraindications who are prescribed beta-blocker at hospital discharge.	
Angiotensin-converting enzyme inhibitor (ACEI) or angiotensin receptor blocker (ARB) for left ventricle systolic dysfunction	Percent of patients with left ventricular systolic dysfunction (LVSD) and without contraindications who are prescribed either an ACEI or ARB at hospital discharge. .	
Left ventricle function assessment	Percent of patients with documentation in the hospital record that left ventricular function (LVF) was assessed before arrival, during hospitalization, or planned for after discharge.	**Heart failure (HF)**
ACEI or ARB for LVSD	Percent of patients with left ventricular systolic dysfunction (LVSD) and without contraindications who are prescribed either an ACEI or ARB at hospital discharge.	
Smoking cessation	Percent of patients who smoke that receive smoking cessation advice/counseling before leaving the hospital	
Comprehensive discharge instructions	Percent of patients given comprehensive discharge instructions	
Oxygenation assessment	Percent of patients who had an assessment of arterial oxygenation within 24 hours after arrival to the hospital.	**Pneumonia**
Blood culture before first antibiotic	Percent of patients meeting criteria for blood culture who had specimen collected before initial antibiotic dose	
Initial antibiotic with 4 hours of arrival	Percent of patients who received their first dose of antibiotics within 4 hours after arrival at the hospital.	**Pneumonia**
Appropriate antibiotic selection	Percent of patients who received an appropriate initial antibiotic(s)	
Smoking cessation	Percent of patients who smoke that receive smoking cessation advice/counseling before leaving the hospital	
Pneumococcal vaccination	Percent of patients were screened for pneumococcal vaccine status and were administered the vaccine prior to discharge, if indicated.	
Prophylactic preoperative antibiotic(s)	Percent of patients who received prophylactic antibiotics within 1 hour prior to surgical incision, if indicated	**Surgical infection prevention**
Prophylactic postoperative antibiotic(s)	Percent of patient in who prophylactic antibiotics were discontinued within 24 hours after surgery end time	

** Italics denote measures directly applicable to the emergency department.*

Milestones in the History of CMS/Joint Commission Hospital Quality Measures

- **1965:** JCAHO (Joint Commission) accreditation mandatory for Medicare Reimbursement
- **1987:** JCAHO announces intention to require reporting of standardized performance measures. Later relents.
- **2001:** JCAHO announces initial set of performance measures for four conditions: acute myocardial infarction, heart failure, pneumonia, and pregnancy.
- **2002:** JCAHO requires data collection on 10 performance measures ("starter set") for accreditation.
- **2004:** CMS and JCAHO align performance measures around those already in use, with goal of making these identical where appropriate
- **2005:** CMS begins public reporting of hospital comparative data on 10 measures
- **2006:** CMS expands public reporting to 20 measures

Physician Quality Reporting Initiatives Relevant to Emergency Medicine

- ECG performed for non-traumatic chest pain
- Aspirin on arrival for acute myocardial infarction
- ECG performed for syncope
- Vital signs obtained for community-acquired bacterial pneumonia
- Assessment of oxygen saturation for community-acquired bacterial pneumonia
- Assessment of mental status for community-acquired bacterial pneumonia
- Appropriate empiric antibiotic for community-acquired bacterial pneumonia

Key Components of the CMS Hospital Quality Initiative

- An ongoing regulatory role for CMS,
- Public disclosure of hospital quality information, including:
  - Quality measures of hospital care derived from clinical data and
  - Reporting on patient perspectives of their hospital care using the Hospital Patient Perspectives on Care Survey (HCAPS)
- The testing of rewards for superior performance on certain measures through the "pay for performance" program via the Premier Hospital Quality Incentive Demonstration,
- Continued quality improvement resources and collaboration through QIOs,
- Collaboration and partnerships with other quality organizations

ICD-9 Codes to Identify Patients for Hospital Quality Measure Analysis

MYOCARDIAL INFARCTION:
410.01, 410.11, 410.21, 410.31, 410.41, 410.51, 410.61, 410.71, 410.81, 410.91

HEART FAILURE:
402.01, 402.11, 402.91, 404.01, 404.03, 404.11, 404.13, 404.91, 404.93, 428.0, 428.1, 428.20, 428.21, 428.22, 428.23, 428.30, 428.31, 428.32, 428.33, 428.40, 428.41, 428.42, 428.43, 428.9

PNEUMONIA:
481, 482.0, 482.1, 482.2, 482.31, 482.32, 482.39. 482.41, 482.49, 482.81, 482.83, 482.84, 482.89 , 483.0, 483.1, 483.8, 485, 486, 487.0

CPT Category II Code Modifiers

1P: EXCLUSION DUE TO MEDICAL REASONS

- Not indicated: absence of organ or limb, therapy or assessment already received or performed
- Contraindicated: patient allergic, potential adverse drug interactions, other

2P: EXCLUSION DUE TO PATIENT REASONS

- Patient declines
- Economic, social or religious reasons
- Other patient reasons

3P: EXCLUSION DUE TO SYSTEM REASONS

- Resources to perform services not available
- Insurance coverage or payer-related limitations
- Other reasons attributable to health care delivery system

Structure of CPT Category II Codes

- 0000F Composite Measures
- 0500F Patient Management
- 1000F Patient History
- 2000F Physical Examination
- 3000F Diagnostic Processes and Results
- 4000F Therapeutic, Preventative and Other Measures
- 5000F Follow-Up and Other Outcomes
- 6000F Patient Safety

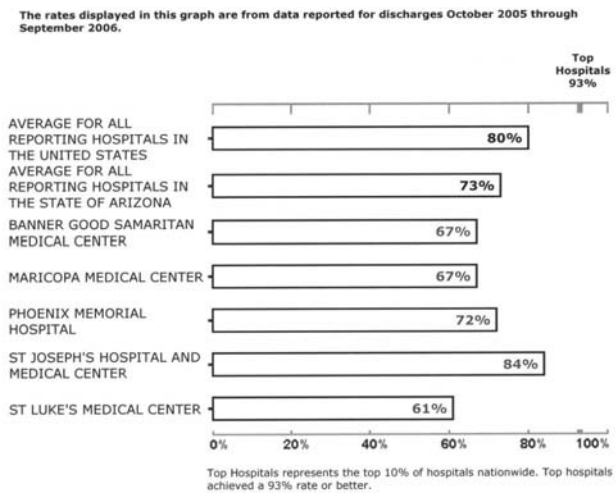
CPT Category II Codes Used for PQRI Emergency Medicine Relevant Measures

- ECG for non-traumatic chest pain: 3120F
- ASA for acute myocardial infarction: 4084F
- ECG for syncope: 3120F
- Vital signs assessment for community-acquired bacterial pneumonia: 2010F
- Oxygenation assessment for community-acquired bacterial pneumonia: 3028F
- Mental status assessment for community-acquired bacterial pneumonia: 2014F
- Appropriate empiric antibiotics for community-acquired bacterial pneumonia: 4045F

Important Attributes of Performance Measures (The Joint Commission)

- Should target improvement in the health of populations
- Should be precisely defined and specified
- Should be reliable
- Should be valid
- Should be interpretable
- Should be risk-adjusted or stratified
- Should be evaluated for the burden of data collection
- Should be useful in the accreditation process
- Should be under provider control
- Should be publicly available

Percent of Pneumonia Patients Given Initial Antibiotic(s) within 4 Hours after Arrival



Supplement to *Emergency Medicine Reports*, September 3, 2007: "CMS/Joint Commission Hospital Quality Measures—Is It the Federal Grade for Quality?" *Authors:* **Richard T. Griffey, MD, MPH**, Assistant Professor of Emergency Medicine, Washington University School of Medicine, St. Louis, MO; and **Joshua M. Kosowsky, MD**, Assistant Professor, Harvard Medical School, Clinical Director, Department of Emergency Medicine, Brigham and Women's Hospital, Boston, MA .

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Enclosed in this issue: CME/CME Evaluation

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September/October 2007

Abstract: Abdominal trauma is the most frequently initially missed fatal injury in pediatrics. A high degree of suspicion is critical and early diagnosis is essential to minimize the morbidity and mortality associated with these injuries. The clinician must understand the mechanisms of injury that place the child at risk and the subtle physical examination findings, and develop an algorithmic approach to the diagnosis. The authors review the unique features and injury patterns associated with pediatric abdominal trauma.

— *The Editor*

Pediatric Abdominal Trauma

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Introduction

Trauma remains the number one cause of disability and death for children. Abdominal trauma is a major cause of severe injury in children and also is the most common cause of initially missed fatal injury.[1,2] This article will discuss the epidemiology of pediatric abdominal trauma, the differences between abdominal injury in adults and children, and the specific patterns of abdominal injury seen in children. Specific organ system injuries and their management will be systematically presented.

Background/ Epidemiology

Unintentional injury is the number one cause of death in the United States for children and adults ages 1-44. Use of the term "unintentional injury" as opposed to "accident" began two decades ago. Referring to something as an "accident" implies that the injury occurred without a cause. The term "unintentional injury" is now used to emphasize that many injuries can be prevented either by physical safety equipment, such as bicycle helmets and seat belts, or by regulations, such as slower speed limits. It is sobering to note that homicide and suicide, often carried out by traumatic mechanisms, remain the second and third most common causes of death in our society for young people ages 15-34.

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Dr. Dietrich (editor in chief), Drs. Wang and Blankenburg (authors), and Stafford (peer reviewer), Ms. Finerty (nurse reviewer), and Ms. Neff (nurse reviewer) report no relationships with companies related to this field of study.

While traumatic injury is common in children, the mechanism of injury depends upon the chronologic and developmental age of the child. Toddlers usually suffer from submersion injuries as well as falls. School age children more often experience pedestrian and bicycle injuries. Pedestrian injuries are the second most common cause of abdominal injury in children after motor vehicle collision (MVC). Morbidity in these cases is related to the degree of multiple injury, with the majority of deaths caused by head trauma.[3]

Adolescents incur injuries secondary to increased risk taking behavior, coupled with the ability to drive legally. Injuries in adolescents result from organized sports, firearms, recreational equipment, and motorized vehicles. Adolescents sustain the largest burden of injury mortality, with 48.5% of these deaths occurring between the ages of 15 and 19.[4] MVCs are the major cause of fatal injuries in adolescents, as well as the majority of serious injuries and death in the pediatric population. Although young adults ages 15-20 make up only 7% of licensed drivers, this group makes up 15% of all drivers killed in fatal crashes.[4] Per Loiselle, "the fatality per distance traveled is 4 times higher in this age group than all other ages combined."[4]

All terrain vehicles (ATVs) deserve special mention. Despite regulations developed in the 1980s mandating that children younger than age 16 cannot use ATVs without a helmet or adult supervision, there continue to be more than 20,000 injuries annually caused by ATVs, with more than 200 deaths per year.[5] Rollovers account for almost one-half of injuries, while falls and collisions account for the rest. Abdominal trauma accounts for 25% of injuries and 19% of deaths.[5,6]

Abuse is responsible for less than 4% of children with abdominal trauma cared for in urban EDs and accounts for less than 1% of children admitted to urban hospitals for abdominal trauma.[7,8] The children with abdominal trauma secondary to abuse are younger than a majority of trauma patients (mean age, 2-3 years) but they have more severe injuries than children who were injured by other mechanisms of abdominal trauma.[9] Up to 50% of mortality in abdominal trauma is due to delays in presentation (mean time to presentation, 13 hours) and extent of injuries.[7,8]

Abdominal injury in children is mainly due to blunt trauma, with more than 90% of pediatric injuries caused by blunt trauma such as MVCs.[10,11] Penetrating injuries such as gunshots and stab wounds account for only 1.5% of all trauma admissions nationwide; however, they account for 15% of children with abdominal trauma who are admitted to urban trauma centers.[9] These children are older and account for a disproportionate number of trauma-related deaths.

Differences Between Adult and Pediatric Abdominal Trauma: Children are not Small Adults

Unique developmental, anatomic, and physiologic factors in children compared to adults lead to differences in the type of injury and the management and outcome of abdominal trauma. In regard to overall injury management, since children often sustain head trauma or are unable to communicate accurately secondary to their level of development or fear, a history of the incident may be unavailable. Abdominal distention, which occurs from swallowing air when crying, can make the physical examination less reliable. A compliant rib cage may allow for internal injury without external evidence of these injuries.

Infants and young children are more prone to abdominal injury than adults. Since the solid abdominal organs are relatively larger, the abdominal musculature is less mature, the abdominal wall and internal organs have less fat than those in adults, and the internal organs are suspended by more elastic structures (especially the kidneys), the abdominal organs have an increased risk of direct injury and are more vulnerable to blunt injury.[12] The pediatric kidney retains fetal lobulations that might lead to easier separation and fracture.[12] In children, the splenic and hepatic capsules are tougher than those in adults, which is postulated to account for the ability to contain bleeding and manage injuries nonoperatively.[13,14] Because of a child's smaller size, a given force is applied over a relatively larger area, causing increased susceptibility to multi-organ injury.[12] In children, the compliant ribcage does not protect the liver and spleen from injury as it does in adults, and the bladder is an intraabdominal organ. Thus, the child's abdomen begins at the level of the nipples.

Physiologically, children can maintain normal vital signs even in the setting of significant blood loss. As much as one quarter of the blood volume can be lost prior to the onset of hypotension.[15,16] Clinical identification of hypovolemia is difficult. Heart rate varies with age, pain, temperature, and stress, and persistent tachycardia can be secondary either to these factors or to blood loss. Capillary

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Table 1. Mechanisms and Patterns of Injury Suggesting Increased Risk of Intra-abdominal Injury*

FALL

- Major factors in injuries incurred as a result of a fall:
  - — Height of fall
  - — Body position on impact
  - — Nature of contact surface
  - — Body orientation on impact
  - — Body mass
  - — Victims age
- Children younger than age 3 have less serious injuries than older children who fall the same distance (increased fat and cartilage and less muscle mass help younger children dissipate energy from the fall).[40,41]
- Mortality increases with falls from > 6 meters.

MVC

- Position in vehicle and use of seatbelts have an effect on seriousness of MVC injuries.
- Compared with unrestrained occupants, restrained occupants of MVCs may be at comparable risk for solid-organ intra-abdominal injury and greater risk for hollow viscous injury.[42,43]
- MVC with restraints and steering wheel deformity have increased risk of small bowel injury and pancreatic injury.
- Injury of thoracic cage and rib fractures should heighten suspicion for hepatic and splenic injury.[44,45]

* Adapted from: Potoka DA, Saladino RA. Blunt abdominal trauma in the pediatric patient. *Clin Ped Emerg* Med 2005;6:23-31.

refill, which often is cited as a useful predictor of blood loss, is unreliable given inter-observer variation, fluctuations with environmental temperature, and variability in technique.[17-20] A larger relative surface area in children younger than age 2 can promote hypothermia and complicate shock. Given that the diaphragm is a major muscle of respiration, abdominal injury or distention can cause severe respiratory distress, exacerbating other injuries.

Patterns of Pediatric Abdominal Injury

Children with an abdominal injury often have other associated injuries, depending on the mechanism of injury. Falls usually cause head and extremity injuries with a very small percentage of significant abdominal trauma.[9,12,15,21] Pedestrian injuries in toddlers are usually caused by low-speed cars backing into children and result in crush injuries to the trunk and head.[22,23] Pedestrian injuries in school age children who are struck crossing the street often cause multiple injuries, including injuries to the head (44%) and extremities (32%) as well as abdominal injuries (10%).[3] Bicycle injuries usually cause extremity and neck fractures; abdominal injuries in this instance are less common and more difficult to diagnose.

Waddell's triad refers to the pattern of a lower limb injury, left sided abdominal or chest injury, and head injury occurring as a motor vehicle hits a child who is running across a street. The vehicle hits the lower extremity first. Then the child's left chest/abdomen is impacted by the front of the car. After the child is thrown over the car, the head strikes the pavement, causing a closed head injury.[12,24]

Children in MVCs using restraints tend to have less massive head, thoracic, solid organ, and extremity injury than those who do not use restraints. Although the incidence of abdominal trauma may be more common among those who use restraints, overall mortality and morbidity are significantly lower.[12,25,26]

Lap belt complex injuries typically occur` in young children who wear seat belts improperly positioned over immature iliac crests. The restraint migrates onto the abdomen during rapid deceleration of the car.[12,27] Abdominal injuries (small bowel contusions and lacerations) and lumbar injuries can occur. Chance fracture is a flexion injury of the lumbar spine with distraction of posterior elements and anterior compression fractures. Chance fracture results from rapid deceleration with hyperflexion around a poorly fitted lap seatbelt.[12,27]

The seatbelt sign, or contusion of the abdomen secondary to the lap belt, is known to be a possible harbinger of more serious abdominal injury. However, in one study, only 45% of children with visceral injury had abdominal wall ecchymoses;[28] therefore, lack of a seatbelt sign cannot be used to rule out serious injury.

With the advent of airbags in cars, children are at risk of airbag injury. Airbags can deploy at speeds of 150 mph, causing significant injury to children. Both infants in rear-facing car seats and children sitting inappropriately in a seat with airbags can suffer serious injury, including death, head injury, C-spine injury, abrasions, and burns from the airbag deployment mechanism.[29-35] The middle back seat is, thus, the safest for children.

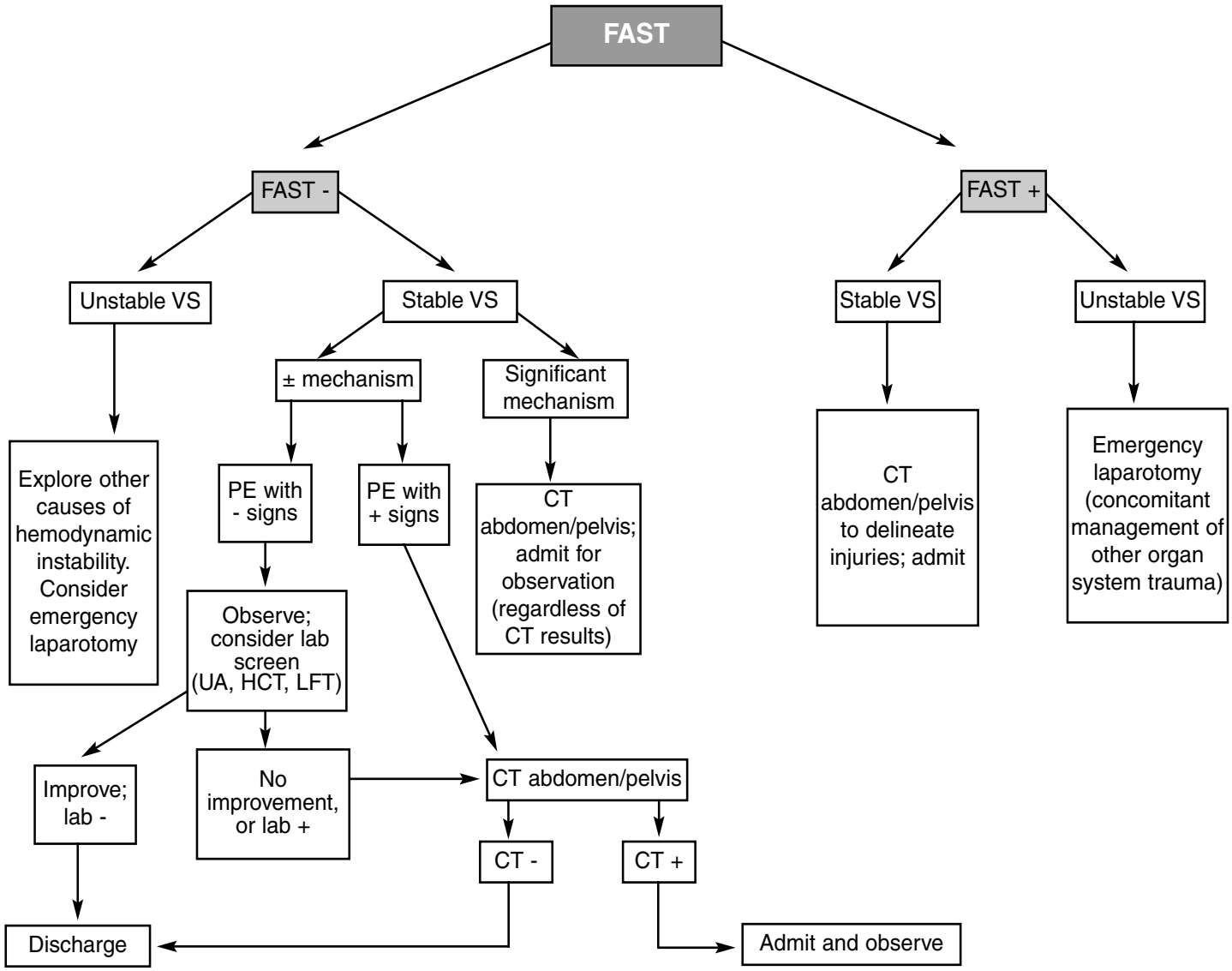
Handlebar injuries are not uncommon in children riding bicycles.[36-38] After a sudden stop, the child falls over the front of the bicycle and the handlebars hit the child's abdomen. The trauma in this instance can be considered trivial and the symptoms may initially be mild. The mean delay before injury diagnosis is approximately 23 hours.[39] Traumatic pancreatitis is the most common injury (33%) in these cases. Other handlebar injuries include renal and splenic trauma (17%), duodenal hematoma (13%), and bowel perforation (10%).[39]

Initial Management

Initial management of the child with trauma always begins with attention to the ABC's (airway, breathing, and circulation). It is important to always remember that the main cause of cardiac arrest in children is respiratory arrest. Oxygenation and ventilation must be the first priorities in pediatric trauma management. When assessing circulatory status, heart rate and end organ perfusion are important. While tachycardia can have many etiologies in a trauma situation, it also is a child's earliest response to hypovolemia. Blood pressure is not a reliable indicator of circulatory status. In regard to abdominal injury, the most important factor indicating the need for laparotomy in a child with trauma is hemodynamic instability.

Diagnosis. Diagnosis depends on understanding the mechanism of the injury, thorough physical examination and appropri-

Figure 1. Algorithm for Abdominal Imaging in Pediatric Trauma



Key: VS = vital signs; UA = urinalysis; HCT = hematocrit; LFT = liver function test

ate laboratory and imaging tests. Table 1 lists mechanisms that suggest an increased risk of intraabdominal injury.

Physical Examination. Physical exam of the child's abdomen in trauma has been generally considered an unreliable and inaccurate indicator of injury and has led to missed injuries.[2,46] Stage of development and inability to communicate verbally can impede the physical exam. Also, children with severe trauma have an increased incidence of concomitant brain injury compared to adults, which decreases the sensitivity of the physical exam.[12] Since abdominal trauma also is the most common cause of initially unrecognized fatal injury in the pediatric population,[1,2] children with serious mechanisms of abdominal injury usually undergo some imaging modality to identify these injuries.

Diagnostic Modalities. *CT Scan.* CT scan has become a valuable tool in the evaluation of abdominal and pelvic injury.[47-51] However, concerns about increased risk of cancer from radiation exposure in children have raised questions about possible overuse of CT imaging.[52-55] Overall, children are more radiosensitive than adults. A child also receives a larger radiation dose than an adult for a given procedure, and the use of helical CT is increasing faster in children than in adults.[55] Frush and colleagues estimated a risk of developing a fatal cancer secondary to radiation to be approximately 1/1000 pediatric CT scan examinations.[56] The recent literature has shown that children with mild and moderate trauma undergo more abdominal imaging for similar injuries than adults,[57] and that 67-75% of pediatric abdominal CT scans obtained are normal.[48,51,58]

Table 2. Grading of Splenic Injury: American Association for the Surgery of Trauma (AAST) Splenic Injury Scale[10]

GRADE 1

Subcapsular hematoma < 10% of surface area or capsular tear < 1 cm in depth.

GRADE 2

Subcapsular hematoma of 10-50% of surface area, intraparenchymal hematoma of < 5 cm in diameter or laceration of 1-3 cm in depth and not involving trabecular vessels.

GRADE 3

Subcapsular hematoma > 50% of surface area or expanding and ruptured subcapsular or parenchymal hematoma, intraparenchymal hematoma of > 5 cm or expanding, or laceration > 3 cm in depth or involving trabecular vessels.

GRADE 4

Laceration involving segmental or hilar vessels with devascularization of > 25% of the spleen.

GRADE 5

Shattered spleen or hilar vascular injury.

Reproduced with permission from: Potoka DA, Saladino RA. Blunt abdominal trauma in the pediatric patient. *Clin Ped Emerg Med* 2005;6:23-31

Focused Abdominal Sonography for Trauma (FAST). FAST has gained popularity in the adult trauma patient as an initial screening tool for identifying patients who are in need of immediate laparotomy. FAST is portable, easy, quick, and non-invasive. The specificity of FAST in children is cited at 95-100% for hemoperitoneum.[59-63] However, in the hemodynamically stable pediatric patient with blunt abdominal trauma, the sensitivity of FAST is 42-88%.[62,63] Solid organ injuries without free intraperitoneal fluid, delayed bleeds, as well as intestinal injuries that do not cause a large accumulation of fluid would not be picked up by FAST. A consensus conference on ultrasound in trauma developed the following practice paradigm:[64] positive FAST in a hemodynamically unstable patient should indicate immediate laparotomy while negative FAST in the same patient would warrant examination for an extraabdominal source of bleeding. Positive FAST in a hemodynamically stable patient should be followed by abdominal CT scan to better define injury. Negative FAST in the same patient should be followed with serial exams for six hours and then follow-up FAST or CT scan, depending on the clinical scenario.

In children, the use of FAST is controversial. A positive FAST exam in a hemodynamically unstable child would indicate the need for an emergent laparotomy.[65,66] Rose suggests that FAST exam can offer information about the timing and urgency of head CT, abdominal CT, and laparotomy in children with concomitant head and abdominal trauma.[67] He also suggests that FAST exam may be sufficient to obviate a CT exam in a child who has a low likelihood of intraabdominal injury.[63,67] However, a FAST exam, whether positive or negative, does not provide the same information as a CT scan. It is argued that many pediatric patients with traumatic injury do not have free fluid, and CT imaging is necessary to stage and identify these injuries to appropriately manage these patients.[65,68,69] Other work suggests using ultrasound in conjunction with physical examination and laboratory values to determine the need for further imaging studies.[58,60,62] *(See Figure 1.)*

Diagnostic Peritoneal Lavage. Diagnostic peritoneal lavage (DPL) historically has been used to identify intraabdominal injury in patients, including children who are too unstable to go to the CT scanner. Since the advent of FAST, which serves a similar diagnostic role, with the advantages of being quicker and non-invasive, the use of DPL has decreased in trauma.

Laboratory Tests. Aside from urinalysis, routine "trauma panels" are not sensitive or specific for identifying intraabdominal injury in children.[70-72] However, children with equivocal physical exam and low mechanism of injury can be screened with laboratory tests. Serial hematocrits are standard to monitor possible bleeding. Several studies found that elevation of aspartate aminotransferase (AST) and alanine aminotransferase (ALT) are predictive of internal abdominal injury.[73-76]

Summary. In summary, the physical exam in pediatric abdominal trauma is not considered reliable. With high risk mechanisms of injury and abnormal physical exam, imaging is necessary to characterize injuries and develop a management plan. Although CT scan is very sensitive and specific, increasing awareness of the trade-off with radiation risks raises questions about appropriate imaging algorithms utilizing combination of physical exam, FAST, CT scan and laboratory tests. It also must be remembered that although helical CTs are increasing in quality, there are some injuries that can be missed by CT scan. Observation at a tertiary trauma center is the only intervention proven to decrease the risk of missed traumatic injury.[77]

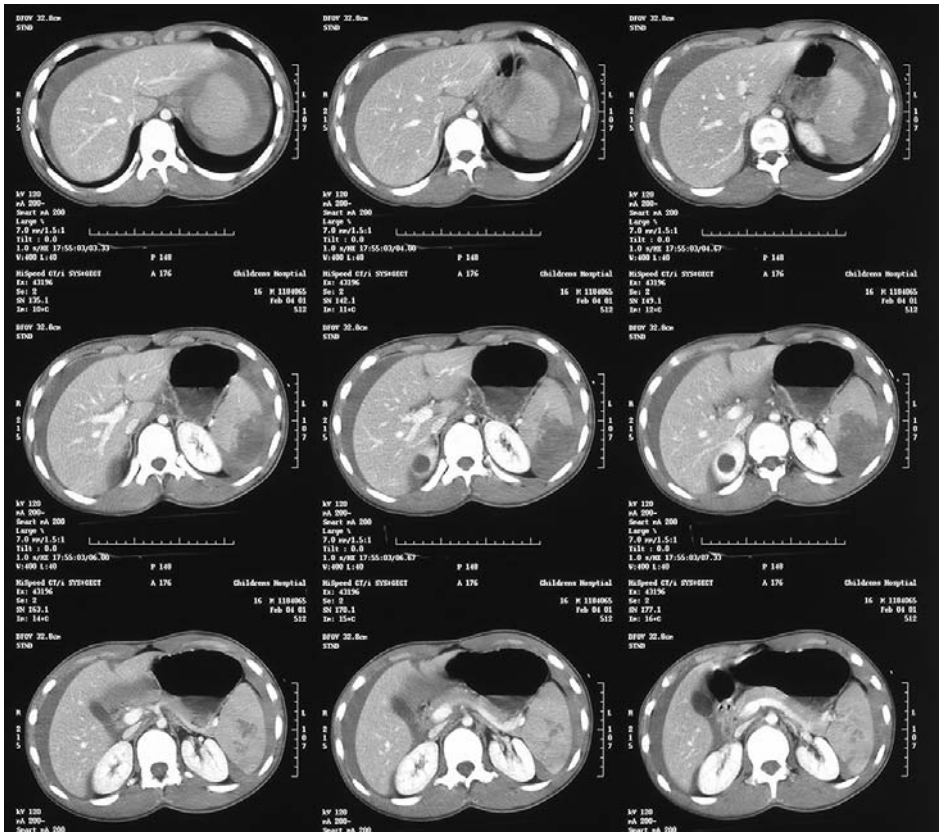
Splenic Injuries

Pediatric splenic injuries are the most common intraabdominal organ injury following blunt trauma. *(See Figure 2.)* They should be suspected in any child with significant mechanism of injury, abdominal pain, abdominal tenderness on exam (particularly in the left upper quadrant), left upper quadrant abdominal ecchymoses or contusions, or left rib fractures.

Diagnosis. In hemodynamically stable patients, abdominal CT scan is the best method for diagnosing and grading splenic injuries. *(See Figure 3.)* If contrast blush is seen on CT scan, this indicates active bleeding and a greater likelihood that surgical intervention will be necessary. In hemodynamically unstable patients, diagnosis should be made at laparotomy.[10] *(See Table 2.)*

Management. The current standard of care in pediatric splenic injury is that the spleen should be preserved whenever possible. Nonoperative management and splenic preservation techniques, including partial splenectomy and splenorrhaphy, have become the mainstay of splenic injury management. The presence of hemodynamic instability in a child with an irreparably damaged spleen does remain an absolute indication for

Figure 2. Splenic Trauma



splenectomy. Hemodynamically stable patients may be followed with serial abdominal exams and serial hematocrits, and do not need repeat imaging studies unless they remain symptomatic.

Nonoperative management should be attempted in any hemodynamically stable child with blunt splenic injury, regardless of grade, unless another intraabdominal injury necessitates exploratory laparotomy. Nonoperative management of pediatric splenic injuries leads to full recovery in 90-98% of patients. Nonoperative management has been associated with a decreased number of blood transfusions compared to operative management, and no increased risk of missing other intraabdominal injuries.[78-83] Splenic preservation prevents overwhelming postsplenectomy infection; this may occur in 2-11% of children following post-traumatic splenectomy, with a mortality rate of up to 50%.[84] It also has been shown to result in longer quality-adjusted life expectancy.[85]

A recent retrospective study by Stylianos and colleagues comparing operative rates for 3,232 patients with blunt splenic trauma at both trauma and non-trauma centers found that patients treated at trauma centers had a significantly lower rate of operation than those at non-trauma centers (15.3% vs. 19.3%, $p < 0.001$, for multiply injured patients, and 9.2% vs. 18.5%, $p < 0.0001$, for isolated injury). But rates at both types of centers exceed published American Pediatric Surgical Association benchmarks for all children with spleen injury (5-11%) and the subset with isolated splenic injury (0-3%).[86] Thus, although trauma centers do a better job of having reduced operation rates for splenic injuries, they still have rates 1.5 to 3 times higher than those set by the American Pediatric Surgical Association.

Figure 3. Spleen Fracture

Hepatic Injuries

Pediatric liver injuries *(see Figure 4)* are the second most common intraabdominal organ injury following blunt trauma. They should be suspected in any child with significant mechanism of injury, abdominal pain, abdominal tenderness on exam, right upper quadrant abdominal ecchymoses or contusions, or right rib fractures.

Paddock and co-workers retrospectively reviewed a multi-institutional pediatric trauma registry and found that hepatic injuries represent a higher mortality risk (2.5%) than splenic injuries (0.7%), and though rare, hepatosplenic injuries have the highest risk of mortality (8.6%).[87]

Diagnosis. In hemodynamically stable patients, abdominal CT scan with IV contrast is the best method for diagnosing and grading liver injuries. In unstable patients, diagnosis should be made at laparotomy.

Several studies have shown that AST (aspartate aminotransferase) greater than 400 IU/L or ALT (alanine aminotransferase) greater than 250 IU/L is predictive of hepatic injury.[73-76] Cotton et al used multiple logistic regression analysis in a study of 353 children to show that increased ALT was the only laboratory finding predictive of intraabdominal injury; in fact, ALT of

Figure 4. Liver Laceration

greater than 131 IU/L and the presence of abdominal trauma were indicative of intraabdominal injury with 100% sensitivity.[88] Thus, in cases in which no clear indication exists for imaging following initial assessment, measurement of hepatic enzymes may provide additional information. *(See Table 3.)*

Management. The hemodynamic status of the child should guide management. Hemodynamically stable patients can be managed nonoperatively by following serial abdominal exams, serial hematocrits, and if abnormal, serial liver enzymes. If a child is hemodynamically unstable despite fluid resuscitation or requiring blood transfusion, then an exploratory laparotomy may be required.

The majority of children (85-90%) with blunt hepatic and splenic injuries have relatively low-grade (grade 1-3) injuries and can be managed nonoperatively. In the management of higher-grade solid organ injuries, angiographic embolization is gaining acceptance.[88] Asensio and colleagues reported a significant reduction in liver-related mortality in patients with grades 4 and 5 liver injuries when using angiography and embolization in the initial evaluation and management (from 40-80% down to 8-22%).[89]

Pancreatic Injuries

Compared with other solid organ injury, pancreatic injury is relatively uncommon, occurring in 3-12% of patients with abdominal trauma. It is almost always caused by blunt trauma, and often is caused by compression of the pancreas against the lumbar vertebral column.[10]

Of patients with pancreatic injury, children are more likely than adults to have isolated pancreatic injury. In one series of patients with pancreatic injury, 62.5% of children had isolated pancreatic injuries following blunt abdominal trauma, compared with 15.3% of adults.[90] Bicycle handlebar injuries are a particularly common mechanism of pancreatic injury.

Table 3. Grading of Hepatic Injury: American Association for the Surgery of Trauma (AAST) Liver Injury Scale

GRADE 1
Subcapsular hematoma < 1 cm in maximal thickness; capsular avulsion; superficial parenchymal laceration < 1 cm deep; and isolated periportal blood tracking.

GRADE 2
Parenchymal laceration 1-3 cm deep and parenchymal/subcapsular hematomas 1-3 cm thick.

GRADE 3
Parenchymal laceration > 3 cm deep and parenchymal or subcapsular hematoma > 3 cm in diameter.

GRADE 4
Parenchymal/subcapsular hematoma > 10 cm in diameter, lobar destruction, or devascularization.

GRADE 5
Global destruction or devascularization of liver.

GRADE 6
Hepatic avulsion (CT scan grade, not AAST grade).

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Diagnosis. Pancreatic injuries may be difficult to diagnose due to the retroperitoneal location of the pancreas. Clinical signs and laboratory markers may be subtle and require time to evolve, as pancreatic secretions become activated and pancreatic and peripancreatic inflammation begins. Thus, it is prudent to be suspicious for possible pancreatic injury based on mechanism of injury and clinical signs.

Serum amylase and lipase are rarely helpful in the early post-injury period, but can be followed. Abdominal CT scans are the primary imaging modality, but 1) the sensitivity varies widely, ranging from 28 to 85%; 2) they tend to underestimate the severity of pancreatic injury; and 3) the sensitivity for pancreatic ductal injury is particularly low (42.9-54.5%).[91-96]

Management. Nonoperative management of pancreatic injury is being increasingly proposed, and several series have shown that nonoperative management of pancreatic injuries without ductal disruption can result in low morbidity.

However, compared to other solid organ injuries, pancreatic injury is the most likely to fail nonoperative management. Holmes and coworkers' retrospective study of 1818 pediatric patients with solid organ injury showed an overall nonoperative management failure rate of 5%.[97] The failure rates for isolated organ injuries were: kidney 3%, liver 3%, spleen 4%, and pancreas 18%. Of mechanisms of injury, only bicycle accidents demonstrated a significantly increased risk of failing nonoperative management. A summary Abbreviated Injury Scale (AIS) score of greater than 4, isolated pancreatic injury, and more than

one injured organ were significantly associated with nonoperative management failure.[97]

Intestinal Injuries

Small intestine and colon injuries occur less frequently in children than solid organ injuries, but their findings can be more subtle. They should be suspected in any child with significant mechanism of injury, abdominal pain, abdominal tenderness on exam, ecchymoses or contusions, and particularly in children involved in motor vehicle accidents who are found to have seat-belt signs. One should be highly suspicious if the initial exam demonstrates peritonitis or hemodynamic instability (due to mesenteric bleeding).

Three distinct mechanisms of injury have been described: 1) in burst injuries a compressive force ruptures a transiently distended segment of bowel; 2) shear injuries occur when the rapid deceleration of the bowel is resisted by a fixed point such as the ligament of Treitz or terminal ileum; and 3) crush injuries are seen when the bowel is compressed against the spine.

Diagnosis. These injuries are often subtle in their workup as well as in their initial presentation, and the lack of significant findings on routine trauma imaging and laboratory studies does not imply the absence of injury, particularly in the early post-injury period.

FAST scans have low sensitivity for intestinal injuries. Abdominal CT scan with IV contrast is preferred; specific CT scan findings that suggest surgical exploration include evidence of extraluminal air, extraluminal contrast material, or a moderate to large amount of free fluid without evidence of solid-organ injury (seen on 4 or more consecutive CT scan sections).[98]

Management. In hemodynamically stable patients with no clear signs of intestinal injury, diagnosis requires serial exams, serial laboratory tests, and repeat imaging studies. Any child with initial or evolving peritonitis or intestinal injuries on imaging should undergo an exploratory laparotomy.

Renal Injuries

If the posterior abdomen and retroperitoneum are included in the definition of blunt abdominal trauma, then the kidney is the most commonly injured solid organ in pediatrics.[99] Renal injuries should be suspected in any child with significant mechanism of injury, abdominal or flank pain, abdominal or flank tenderness on exam, back ecchymoses or contusions, or posterior rib fractures.

Diagnosis. Urinalyses are frequently obtained in children with abdominal trauma, and both gross and microscopic hematuria have been associated with intraabdominal injury in children. Gross hematuria is defined as being visible to the naked eye. Microscopic hematuria has been defined differently by different authors, as greater than 5 red blood cells per high power field (RBCs/hpf), more than 20 RBCs/hpf, or more than 50 RBCs/hpf.[72,74,99-101]

How well microscopic hematuria predicts renal injury and the amount of workup that is needed in patients with microscopic hematuria remains controversial (partly due to differing definitions of how many red blood cells per high power field constitute microscopic hematuria). In Stein and coworkers' retrospective study of abdominal CT scans in 412 children following abdominal trauma, it was found that all significant renal injuries presented with hematuria (48 had renal injuries documented by abdominal CT; 25 of which had significant injuries and 23 had insignificant renal injuries). Of those with significant renal injuries, 68% (17/25) had microscopic hematuria, and 32% (8/25) had gross hematuria.[102]

In Stalker and colleagues' retrospective chart review of 256 children with blunt abdominal trauma, they found that hematuria has a sensitivity of 33% (35/106) for predicting renal injury. However, they also noted that having a normal blood pressure and less than 50 RBCs/hpf had a negative predictive value of 100%.[101]

Santucci and associates retrospective review of 720 pediatric trauma patients with hematuria found that all patients with significant renal injuries had either gross hematuria, shock, or significant deceleration injury.[103]

Management. Hemodynamically stable children with gross hematuria or other concerning symptoms should undergo an abdominal CT scan with IV contrast to diagnose and grade kidney injuries. It remains controversial whether hemodynamically stable patients with asymptomatic microscopic hematuria need to undergo abdominal CT. In unstable patients, diagnosis should be made at laparotomy.

The standard of care is renal preservation. A recent retrospective study from a single institution's 25-years of experience reported a less than 1% nephrectomy rate.[104]

Conclusion

Abdominal injury in children is a major cause of severe injury and also is the most common cause of initially missed fatal injury in children.[1,2] It usually is caused by blunt injury due to MVC. An understanding of how abdominal injury presents in children as compared to adults, as well as a knowledge of the different patterns of injury can aid in diagnosing pediatric abdominal injury. Although management of many pediatric abdominal injuries is non-operative, use of appropriate imaging modalities to diagnose intraabdominal pathology is essential to the care of these patients.

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CME/CNE Questions

1. Which of the following is true regarding pediatric abdominal trauma?
   A. Mainly due to penetrating trauma
   B. Children with abdominal trauma secondary to abuse are younger than the majority of trauma patients and have more severe injuries
   C. Only 5% of the mortality in abdominal trauma is due to delays in presentation
   D. Penetrating injuries account for 60% of all trauma admissions nationwide

2. Which of the following is true regarding pediatric anatomy?
   A. Pediatric solid abdominal organs are smaller
   B. A compliant rib cage may allow for underlying injury without external evidence of injury
   C. Abdominal wall and internal organs have more fat than adults
   D. The pediatric internal organs are suspended by less elastic structures than adults

3. A child presents with a seatbelt sign. Which of the following is true?
   A. The child may have serious internal injury
   B. The child may have a Chance fracture
   C. The child may have a small bowel injury
   D. All of the above

4. Which of the following is true regarding a child who has a handlebar mark to the abdomen?
   A. The trauma may be considered trivial and initially symptoms may be mild
   B. The mean delay before diagnosis is approximately 23 hours
   C. Traumatic pancreatitis is the most common injury
   D. All of the above

5. CT scan has become a valuable tool in the evaluation of abdominal and pelvic injuries.
   A. True
   B. False

6. Which of the following is *false* regarding the use of ultrasound in a pediatric trauma patient?
   A. FAST is easy, portable, quick, and noninvasive.

CNE/CME Instructions

Physicians and nurses participate in this continuing medical education/continuing education program by reading the article, using the provided references for further research, and studying the questions at the end of the article. Participants should select what they believe to be the correct answers, then refer to the list of correct answers to test their knowledge. To clarify confusion surrounding any questions answered incorrectly, please consult the source material. **After completing this activity, you must complete the evaluation form provided and return it in the reply envelope provided in order to receive a letter of credit.** When your evaluation is received, a letter of credit will be mailed to you.

CNE/CME Objectives

Upon completing this program, the participants will be able to:

a.) discuss conditions that should increase suspicion for traumatic injuries;
b.) describe the various modalities used to identify different traumatic conditions;
c.) cite methods of quickly stabilizing and managing patients; and
d.) identify possible complications that may occur with traumatic injuries.

B. The specificity of FAST for hemoperitoneum in children is 95-100%.
C. In the hemodynamically stable patient the sensitivity of FAST is 100%.
D. The FAST exam does not detect solid organ injuries without free intraperitoneal fluid.

7. The current standard of care for pediatric splenic injury is that the spleen should be preserved whenever possible.
   A. True
   B. False

8. Regarding hepatic injury, which of the following is true?
   A. Hepatic injury is the most common intraabdominal injury following blunt trauma.
   B. In hemodynamically unstable patients, CT scan is the imaging modality of choice.
   C. The majority of children with hepatic injury have low-grade injuries and can be managed nonoperatively.
   D. In unstable patients, CT scan should be performed immediately.

9. Which of the following is true regarding pancreatic injury?
   A. Pancreatic injury is common.
   B. It usually occurs following penetrating injury.
   C. Children are more likely than adults to have isolated pancreatic injury.
   D. Pancreatic injuries are easy to diagnose.

10. FAST scans have a high sensitivity for intestinal injuries.
   A. True
   B. False

Answers: 1. B; 2. B; 3. D; 4. D; 5. A; 6. C; 7. A; 8. C; 9. C; 10. B

In Future Issues:

Pitfalls in Trauma Management

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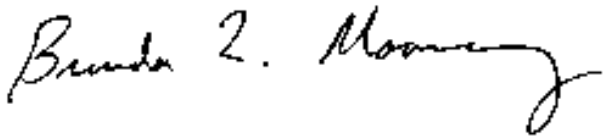

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