Pediatric Sedation: Who Does or Should Provide This Service?

Jeana E. Havidich, MD, FAAP

Disclosures

Unfortunately, I have none

Jeana Havidich MD

Goals

- Discuss current pediatric sedation trends
- Present information on pediatric sedation published in non-anesthesia journals
- Provide examples of sedation models
- Discuss credentialing requirements for sedation providers
- Discuss role of Anesthesiologists in providing pediatric sedation

Demand for Pediatric Sedation Services

Does Your Facility Have a Pediatric Sedation Team? If Not, Why Not?

Carrie L. Davis, MSN, RN, MHA, CCRN, NE-BC

Authors and Disclosures

Posted: 10/21/2008; Pediatr Nurs. 2008;34(4):308-9, 318.

- Print This

Demand for Pediatric Sedation Services

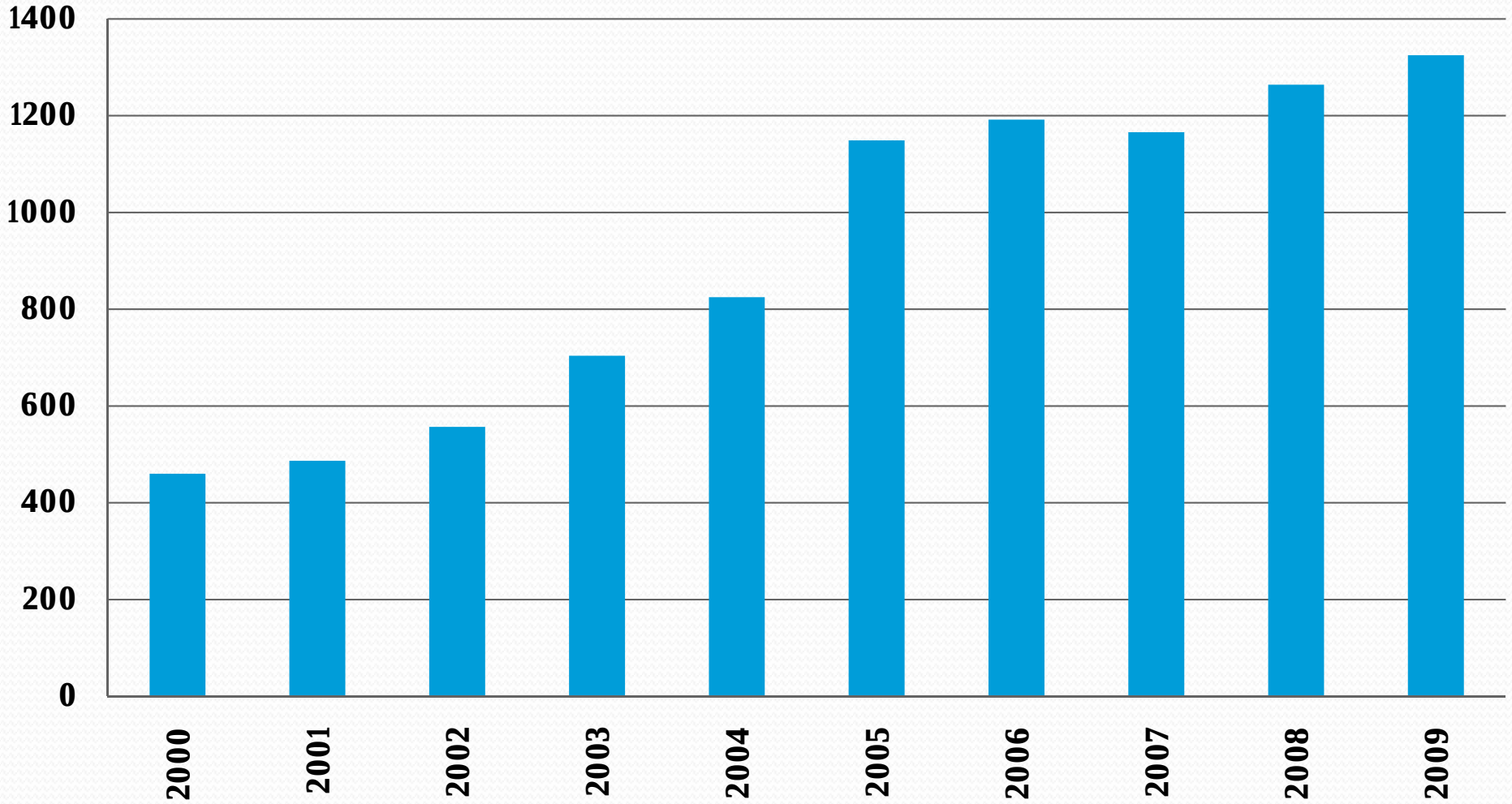
- Over the past decade, the demand for pediatric sedation has dramatically increased
  - Concept that children experience anxiety and pain
  - Advances in technology
  - Increase in the number of Non-Operating Room procedures (formerly performed in OR)
  - Economics
  - Parental, Patient, and Health Care Provider Expectations

What the Literature Reveals in 2009

- Literature Search: PEDIATRIC SEDATION
  - 14, 967 Citations
  - 13,344 Journal articles
  - 1771 Text Books
  - 106 Reference Works

- *Downloaded from www.Sciencedirect.com March 2009*

Number of Publications with "Pediatric Sedation" 2000-2009



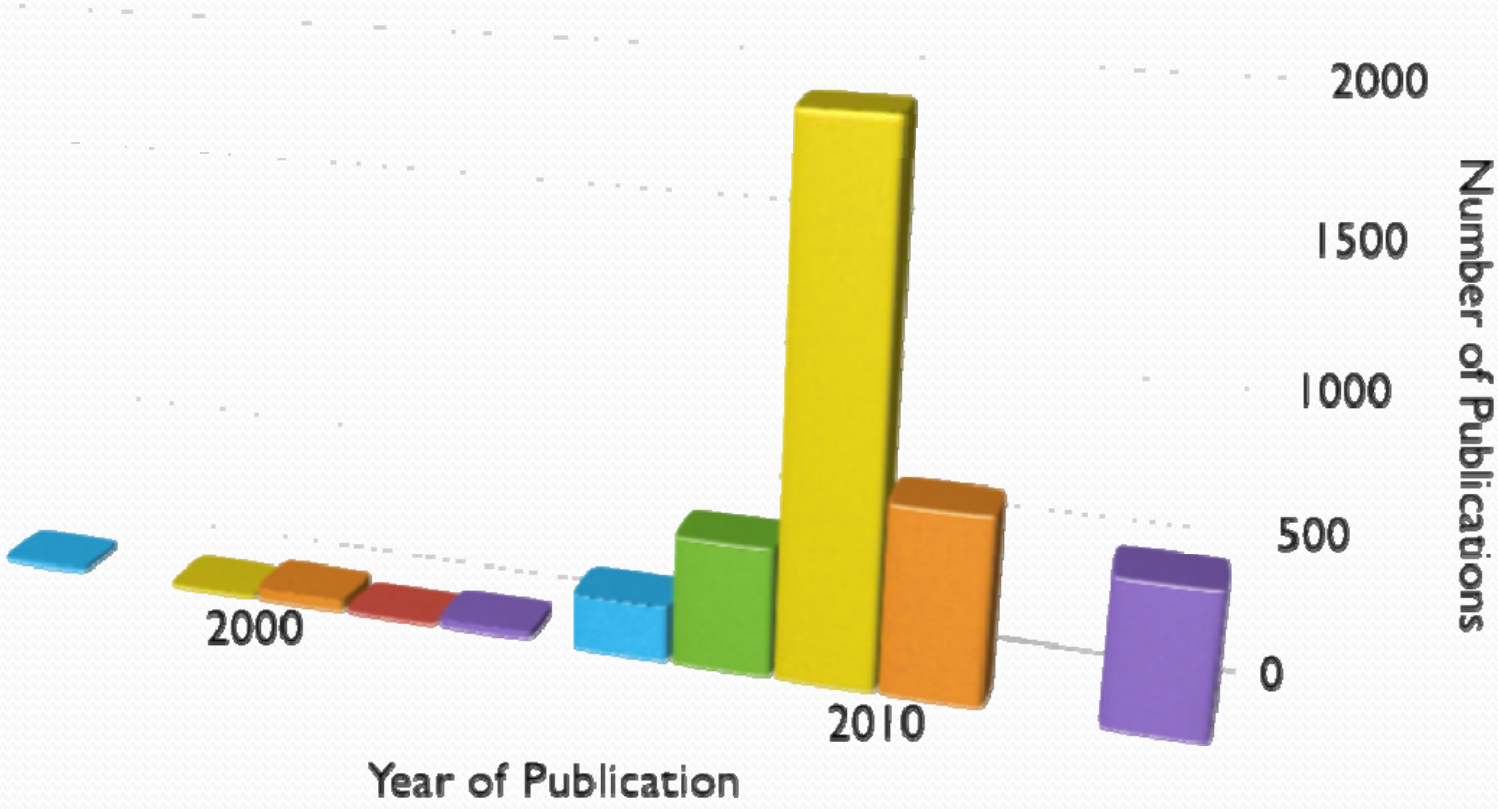
Top Ten Journals in 2000

- Clinical Pediatric Emergency Medicine (22)
- International Journal of Pediatric Otorhinolaryngology (14)
- Annals of Emergency Medicine (12)
- Pediatric Clinics of North America (11)
- Anesthesiology Clinics of North America (9)
- Emergency Medicine Clinics of North America (9)
- The Annals of Thoracic Surgery (8)
- Critical Care Clinics (7)
- Emergency Procedures for the Small Animal Veterinarian (7)
- Seminars in Anesthesia and Perioperative Medicine (7)

Top Ten Journals 2009

- Journal of Pediatric Surgery (960)
- Journal of Pediatrics (545)
- Annals of Emergency Medicine (478)
- Gastrointestinal Endoscopy (458)
- International Journal of Pediatric Otorhinolaryngology (232)
- Journal of Oral and Maxillofacial surgery (227)
- The American Journal of Cardiology (206)
- Journal of Clinical Anesthesia (197)
- The American Journal of Emergency Medicine (193)
- Pediatric Neurology (193)
- American Operating Room Nurses (190)

Publications by Specialty 2000 vs. 2009



Who Will Provide Sedation?

- Anesthesiology department is unable or unwilling to provide sedation services for all children
  - Manpower
  - Reluctance to provide sedation or anesthesia outside of the operating room
  - Not economically feasible
  - Risk
- Are Anesthesia Providers Really Necessary?

ORIGINAL ARTICLE

The Safe and Effective Use of Propofol Sedation in Children Undergoing Diagnostic and Therapeutic Procedures: Experience in a Pediatric ICU and a Review of the Literature

Derek S. Wheeler, MD,† Keith K. Vaux, MD,*‡ Michael L. Ponaman, MD,* and W. Bradley Poss, MD, CDR, MC, USNR**

Development of a nurse-led sedation service for paediatric magnetic resonance imaging

M R J Sury, D J Hatch, T Deeley, C Dicks-Mireaux, W K Chong

ELSEVIER

CLINICAL Pediatric Emergency Medicine

Emergency Department Based Sedation Services

Jay Pershad, MD,* Susanne Kost, MD†

Increased demand for procedural sedation in areas of the hospital outside the traditional emergency department and operating room settings has led to a growing trend of these services being rendered by pediatric emergency physicians. We will review the pros and cons of establishing an emergency department-based sedation service, discuss the scope of the service, review practical considerations in successfully implementing and administering this service, and highlight challenges and opportunities for reimbursement.
Clin Ped Emerg Med 8:253-261

KEYWORDS sedation service, procedural sedation, emergency services

PEDIATRIC HOSPITALIST

Guidelines to Practice

The Process of Planning and Implementing a Pediatric Sedation Program

Savithiri Ratnapalan, MBBS, MEd, MRCP, FRCPC, FAAP, and Suzan Schneeweiss, MD, MEd

CLINICAL–ALIMENTARY TRACT

Trained Registered Nurses/Endoscopy Teams Can Administer Propofol Safely for Endoscopy

DOUGLAS K. REX,* LUDWIG T. HEUSS,† JOHN A. WALKER,§ and RONG QI‖

*Division of Gastroenterology/Hepatology, Department of Medicine, Indiana University Hospital, Indianapolis, Indiana; †Division of Gastroenterology and Hepatology, University Hospital of Basel, Basel, Switzerland; §Gastroenterology Associates, Medford, Oregon; and ‖Department of Biostatistics, Indiana University School of Medicine, Indianapolis, Indiana

Expectations of Hospital Administration

- Provision of Excellent Patient Care
- High Patient and Parent Satisfaction
- Economically Sound
- Good Public Relations
- Patient Safety

Published Safety

Evaluation of a Pediatric-sedation Service for Common Diagnostic Procedures

Wendalyn K. King, MD, MPH, Jana A. Stockwell, MD, Michael A. DeGuzman, MPH, Harold K. Simon, MD, MBA, Naghma S. Khan, MD

Abstract

Background: Pediatric patients often require sedation for diagnostic procedures such as magnetic resonance imaging and computed tomography scanning. In October 2002, a dedicated sedation service was started at a tertiary care pediatric facility as a joint venture between pediatric emergency medicine and pediatric critical care medicine. Before this service, sedation was provided by the department of radiology by using a standard protocol, with high-risk patients and failed sedations referred for general anesthesia.

Objectives: To describe the initial experience with a dedicated pediatric-sedation service.

Methods: This was a retrospective analysis of quality-assurance data collected on all sedations in the radiology department for 23-month periods before and after sedation-service implementation. Study variables were number and reasons for canceled or incomplete procedures, rates of referral for general anesthesia, rates of hypoxia, prolonged sedation, need for assisted ventilation, apnea, emesis, and paradoxical reaction to medication. Results are reported in odds ratios (OR) with 95% confidence intervals (95% CI).

Results: Data from 5,444 sedations were analyzed; 2,148 before and 3,296 after sedation-service activation. Incomplete studies secondary to inadequate sedation decreased, from 2.7% before the service was created to 0.8% in the post-sedation-service period (OR, 0.29; 95% CI = 0.18 to 0.47). There also were decreases in cancellations caused by patient illness (3.8% vs. 0.6%; OR, 0.16; 95% CI = 0.10 to 0.27) and rates of hypoxia (8.8% vs. 4.6%; OR, 0.50; 95% CI = 0.40 to 0.63). There were no significant differences between the groups in rates of apnea, need for assisted ventilation, emesis, or prolonged sedation. The implementation of the sedation service also was associated with a decrease in both the number of patients referred to general anesthesia without a trial of sedation (from 2.1% to 0.1%; OR, 0.33; 95% CI = 0.06 to 1.46) and the total number of general anesthesia cases in the radiology department (from 7.5% to 4.4% of all patients requiring either sedation or anesthesia; OR, 0.56; 95% CI = 0.45 to 0.71).

Conclusions: The implementation of a dedicated pediatric-sedation service resulted in fewer incomplete studies related to inadequate sedation, in fewer canceled studies secondary to patient illness, in fewer referrals for general anesthesia, and in fewer recorded instances of sedation-associated hypoxia. These findings have important implications in terms of patient safety and resource utilization.

ACADEMIC EMERGENCY MEDICINE 2006; 13:673–676 © 2006 by the Society for Academic Emergency Medicine

Keywords: conscious sedation, pediatrics

Society for Academic Emergency Medicine 2006

- Retrospective Analysis
- QA data collected 23 months prior to and after implementation of PSS (5444)
- Decreased failed sedations rates: 2.7% to 0.8%
- Decreased Cancellation rates 3.8% to 0.6%
- Decreased hypoxia 8.8% to 4.6%
- Decreased GETA cases 7.5% to 4.4%

Incidence and Nature of Adverse Events During Pediatric Sedation/Anesthesia for Procedures Outside the Operating Room: Report From the Pediatric Sedation Research Consortium

Joseph P. Cravero, MD[a,b], George T. Blike, MD[a], Michael Beach, MD[a], Susan M. Gallagher, BS[c], James H. Hartzog, MD[d], Jeana E. Havidich, MD[a], Barry Gelman, MD[e], and the Pediatric Sedation Research Consortium

- Anesthesiologists, Emergency Room Physicians, Critical Care specialists, Pediatricians, Sedation Nurses
- Total records submitted: 30, 037
- Complication rate: 5.3%
  - Serious adverse events were rare
    - No deaths
    - One cardiac arrest
- In highly motivated and organized sedation services, the adverse event rate is relatively low

Pediatric Sedation Models

- Anesthesia Provider/Care Team
- Pediatric Emergency Medicine
- Hospitalists
- Pediatricians
- Pediatric Intensivists
- Advanced Practice Nurses
- Specialist performing procedure and Sedation Nurse

Sedation Model: Anesthesiology

- Anesthesiologist or Anesthesia Care Team
- Advantage: We do it all
  - Diagnostic and Therapeutic Procedures
  - Efficiency
  - Safety
  - Low Procedural Failure Rate
- Disadvantage
  - Expensive
  - Availability
    - Manpower
    - Co-ordination with multiple services

A PEDIATRIC SEDATION/ANESTHESIA PROGRAM WITH DEDICATED CARE BY ANESTHESIOLOGISTS AND NURSES FOR PROCEDURES OUTSIDE THE OPERATING ROOM

David Gozal, MD, Benjamin Drenger, MD, Phillip D. Levin, MB BChir, Avishag Kadari, MD, and Yaacov Gozal, MD

- Observational study 8760 sedations
- Team: Anesthesiologists and PICU nurses
- Children were triaged
- PICU nurse would sedate children with oral chloral hydrate (1769)
- Pediatric Anesthesiologist was immediately available
- Nurse administered sedation failure rate was 6.5%
- Adverse event rate 1.7%

The Journal of Pediatrics July 2004

Pediatric Critical Care

Rainbow Babies and Children's Hospital Cleveland, Ohio

- Free Standing Pediatric Sedation Unit (PSU)
- Staff: Pediatric Critical Care, EM physician and one Hospitalist
- Performs approximately 3000 in-patient and outpatient sedations per year
- Medications used
  - Midazolam
  - Propofol
  - Dexmedetomidine
  - Ketamine
  - Etomidate

University Hospitals Rainbow Babies & Children's Hospital

Personal Communication

Pediatric Critical Care

Rainbow Babies and Children's Hospital
Cleveland, Ohio

- Hospital Credentialing Requirements
  - Intensivists are automatically credentialed for deep sedation
  - Others: Required reading with examination
    - Developed by the Department of Anesthesiology
  - Perform 10 sedations under the supervision of an Anesthesiologist or Physician who is credentialed to provide deep sedation
  - Must perform a minimum of 10 sedations per year

University Hospitals Rainbow Babies & Children's Hospital

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Pediatric Critical Care

Rainbow Babies and Children's Hospital
Cleveland, Ohio

- Referral to Department of Anesthesiology
  - Most ASA PS III and all ASA PS IV or greater
  - Obese children (> 150th percentile)
  - Severe URI
  - Obstructive Sleep Apnea
  - Pulmonary Hypertension
  - Severe Cardiac disease
- Successful working relationship with the Anesthesiology Department

University Hospitals
Rainbow Babies & Children's Hospital

Personal Communication

The Pediatric Sedation Unit: A Mechanism for Pediatric Sedation

Lia Lowrie, Anita H. Weiss and Cynthia Lacombe

Pediatrics 1998;102;e30
DOI: 10.1542/peds.102.3.e30

TABLE 4. Procedures for Which Patients Were Referred to the PSU and Average Sedation and Monitoring Time for Frequently Performed Procedures

Procedure	Number	Average Sedation Time (Min)	Average Monitoring Time (Min)
MRI	176	98	129
Computed tomography	77	52	84
Cardiac catheterization	41	199	247
Gastroesophagoduodenoscopy	20	31	62
Bone scan	19	111	135
Auditory evoked potentials	15	62	92
Cast manipulation	13	55	83
Burn care	13	22	38
Renal biopsy	12	45	110
Transesophageal echocardiography	9	47	133
Bronchoscopy	9	38	81
Broviac removal	8	7	28
Lumbar puncture	7	92	107
Visual evoked potentials	6	85	133
Exchange transfusion	6	64	96
Percutaneous central venous catheter line placement	6	57	88
Colonoscopy	6	64	100
Vaginal exam	5	22	68
Incision and drainage abscess	5	30	67
Transthoracic echocardiography	4		
Bone marrow aspiration/biopsy	4		
Liver biopsy	4		
Central line manipulation	4		
Joint aspiration/injection	3		
Angiography	3		
Pin placement	3		
Ph probe placement	3		
Electromyography	3		
Voiding cystourethrogram	3		
Ultrasound	3		
Anal manometry	3		
Rectal biopsy	2		
Halo traction manipulation	2		
Tube thoracostomy	2		
Foreign body removal	1		
Positron emission tomography	1		
Electroencephelography	1		
Dental exam	1		
Intravenous pyelogram	1		
Multiple studies per sedation episode	27	140	180

Pediatric Emergency Medicine

Pediatric Emergency Medicine Associates LLC, Atlanta Georgia

- Primary sedation providers for approximately 7000 cases per year
- Cases outside of the OR requiring moderate or deep sedation
- Medications administered
  - Propofol (primary)
  - Ketofol (Ketamine and Propofol)
  - Ketamine (used less now)
  - Fentanyl
  - Nitrous oxide

Personal Communication

Pediatric Emergency Medicine

Pediatric Emergency Medicine Associates LLC, Atlanta Georgia

- Credentialing
  - Physicians must be Board Eligible or Certified in Pediatric Emergency Medicine
  - Required to attend Airway Course or
  - One day in the OR with an Anesthesiologist
  - Review a Sedation Module
- Monitor the progress of newly hired physicians on their Sedation service

Personal Communication

Hospitalists

Children's Hospital of Philadelphia

- Sedation service is composed of pediatricians, advanced practice nurses, and sedation nurses (RNs)
- Physician or Physician-nurse team provides sedation (depending on what level is required)
  - 10 physicians (6.5 FTEs)
  - 25-30 Registered nurses
- Perform approximately 8500 sedations per year

Personal Communication

Hospitalists

Children's Hospital of Philadelphia

- Credentialing Requirements
  - Credentialing course created in conjunction with the Department of Anesthesiology
    - Hospitalist spend 10 days in the OR
    - Three weeks on sedation service observing experienced sedationist
    - PALS and ACLS certified
    - Complete a didactic curriculum

Personal Communication

Hospitalists

Children's Hospital of Philadelphia

- Patient Selection
  - Outpatient: phone triage
  - Majority of Patients: ASA PS I or II
- Referrals to the Department of Anesthesiology
  - ASA PS III or greater
  - Congenital Heart Disease
  - Severe Respiratory Disease
  - Syndromes

Personal Communication

Pediatricians

Los Angeles Children's Hospital

- Pediatricians trained in EM or Critical Care perform 2000-3000 sedations per year
  - A NP screens patients to determine ASA PS
  - Sedations by pediatricians are limited to ASA PS I and II patients for radiological procedures
- Practice under the auspices of the Department of Anesthesia
  - QA
  - Morbidity and Mortality Conference

Personal Communication

USC UNIVERSITY OF SOUTHERN CALIFORNIA

Pediatricians

Los Angeles Children's Hospital

- Medications:
  - Premedicate with midazolam when required
  - Propofol
  - Ketamine
  - *Not* credentialed to use combination of drugs
- Credentialing
  - Total of 40 hours of training
    - 20 hours of didactics
    - 20 hours of preceptorship with anesthesiologist or credentialed sedationist
- Model has been in existence for 8 years
- No critical events

USC
UNIVERSITY
OF SOUTHERN
CALIFORNIA

Successful Sedation Service

- Good working relationship with the Department of Anesthesiology
- Development of Guidelines
- Educational Support
- Development of Hospital Standards for the care of children receiving deep sedation
- Open forum and dialogue with the Department of Anesthesiology

Comparing and Contrasting Models

- Similarities
  - Highly motivated organized sedation teams
  - Collaborated with Department of Anesthesia
  - Triage system
- Differences
  - Free Standing vs. Members of the Anesthesia Department
  - Credentialing requirements
  - Educational Background
  - Drug Administration
  - Documentation of continued practice

What's happening in the Adult world?

- Sedation Model: Physician providing the service will medically direct the sedation nurse (RN) during the administration of sedatives and/or analgesics for deep sedation
- Propofol
- Ketamine
- Methohexital
- Combination of narcotic (fentanyl) and anxiolytic (midazolam)

Nurse-Administered Propofol Sedation Without Anesthesia Specialists in 9152 Endoscopic Cases in an Ambulatory Surgery Center

John A. Walker, M.D., Robert D. McIntyre, M.D., Paul F. Schleinitz, M.D., Kris N. Jacobson, M.D., Anthony A. Haulk, M.D., Peter Adesman, M.D., Shelley Tolleson, R.N., Robyn Parent, R.N., Rosie Donnelly, R.N., and Douglas K. Rex, M.D.

Departments of Anesthesiology and Gastroenterology, Surgery Center Of Southern Oregon, Medford, Oregon; and Division Of Gastroenterology, Department Of Medicine, Indiana University School of Medicine, Indianapolis, Indiana

The American Journal of Gastroenterology 2003

- Prospective , observation study in private practice setting
- ASA PS I and II patients for EGD, colonoscopy, liver biopsies
- Propofol bolused 30-50 mg and titrated to effect (10-20 mg boluses)
- 7 cases of respiratory compromise
- Mean discharge time: 18 minutes after completion of procedure
- Reported high safety, patient and physician satisfaction

Endoscopist-Directed Administration of Propofol: A Worldwide Safety Experience

DOUGLAS K. REX,* VIJU P. DEENADAYALU,* EMELY EID,* THOMAS F. IMPERIALE,*,‡ JOHN A. WALKER,§ KULDIP SANDHU,‖ ANTHONY C. CLARKE,‖ LYBUS C. HILLMAN,¶ AKIRA HORIUCHI,# LAWRENCE B. COHEN,** LUDWIG T. HEUSS,‡‡ SHAJAN PETER,‡‡ CHRISTOPH BEGLINGER,‡‡ JAMES A. SINNOTT,§§ THOMAS WELTON,‖‖ MAGDY ROFAIL,¶¶ IYAD SUBEI,## RODGER SLEVEN,*** PAUL JORDAN,††† JOHN GOFF,§§§ PATRICK D. GERSTENBERGER,‖‖‖ HAROLD MUNNINGS,¶¶¶ MARTIN TAGLE,### BRIAN W. SIPE,**** TILL WEHRMANN,†††† JACK A. DI PALMA,§§§§ KAITLIN E. OCCHIPINTI,§§§§ EGIDIO BARBI,‖‖‖‖ ANDREA RIPHAUS,¶¶¶¶ STEPHEN T. AMANN,#### GEN TOHDA,***** TIMOTHY MCCLELLAN,‡‡‡‡‡ CHARLES THUESON,‡‡‡‡‡ JOHN MORSE,§§§§§ and NIZAM MEAH‖‖‖‖‖

- Total of 646,080 cases
  - 0.1 % required mask ventilation
  - 11 intubations
  - 4 deaths
- Conclusion: Death rate for EDP is 1 in 161,515
  - EDP has lower mortality rate when propofol is used compared to BZD and narcotics
  - Comparable safety rating compare d to GETA

    (Mortality rate 1 in 10,000 to 1 in 50,000)

Gastroenterology
October 2009

Endoscopist-Directed Administration of Propofol: A Worldwide Safety Experience

DOUGLAS K. REX,* VIJU P. DEENADAYALU,* EMELY EID,* THOMAS F. IMPERIALE,*,‡ JOHN A. WALKER,§ KULDIP SANDHU,‖ ANTHONY C. CLARKE,‖ LYBUS C. HILLMAN,¶ AKIRA HORIUCHI,# LAWRENCE B. COHEN,** LUDWIG T. HEUSS,‡‡ SHAJAN PETER,‡‡ CHRISTOPH BEGLINGER,‡‡ JAMES A. SINNOTT,§§ THOMAS WELTON,‖‖ MAGDY ROFAIL,¶¶ IYAD SUBEI,## RODGER SLEVEN,*** PAUL JORDAN,††† JOHN GOFF,§§§ PATRICK D. GERSTENBERGER,‖‖‖ HAROLD MUNNINGS,¶¶¶ MARTIN TAGLE,### BRIAN W. SIPE,**** TILL WEHRMANN,‡‡‡‡ JACK A. DI PALMA,§§§§ KAITLIN E. OCCHIPINTI,§§§§ EGIDIO BARBI,‖‖‖‖ ANDREA RIPHAUS,¶¶¶¶ STEPHEN T. AMANN,#### GEN TOHDA,***** TIMOTHY MCCLELLAN,‡‡‡‡‡ CHARLES THUESON,‡‡‡‡‡ JOHN MORSE,§§§§§ and NIZAM MEAH‖‖‖‖‖

Economics

- Estimated cost per life-year saved to substitute anesthesia specialists was $5.3 million
- Estimated cost per case for anesthesia provider: $298
- ‘Back of the Envelope analysis’
  - Assumption all four deaths would have been prevented
  - Life expectancy (maximum of 85 years)
  - No other deaths occurred

Ref :http://www.youtube.com/watch?v=FGmOxu9L1d4

Role of Anesthesiologists

- Actively Involved
- Define “Safety”
  - What is an acceptable rate of adverse events?
- Develop Standard Definitions of Adverse Events
- Develop Objective Tools to Monitor and Measure the severity and rate of adverse events
  - Eliminate self reporting
- Conduct Research
  - Safety and economics

Role of Anesthesiologists

- Leadership role in credentialing providers that administer deep sedation
  - Educational requirements
  - Participation and oversight in Credentialing, QA and Peer Review Committees
  - Competency Standards
  - Standard of Care

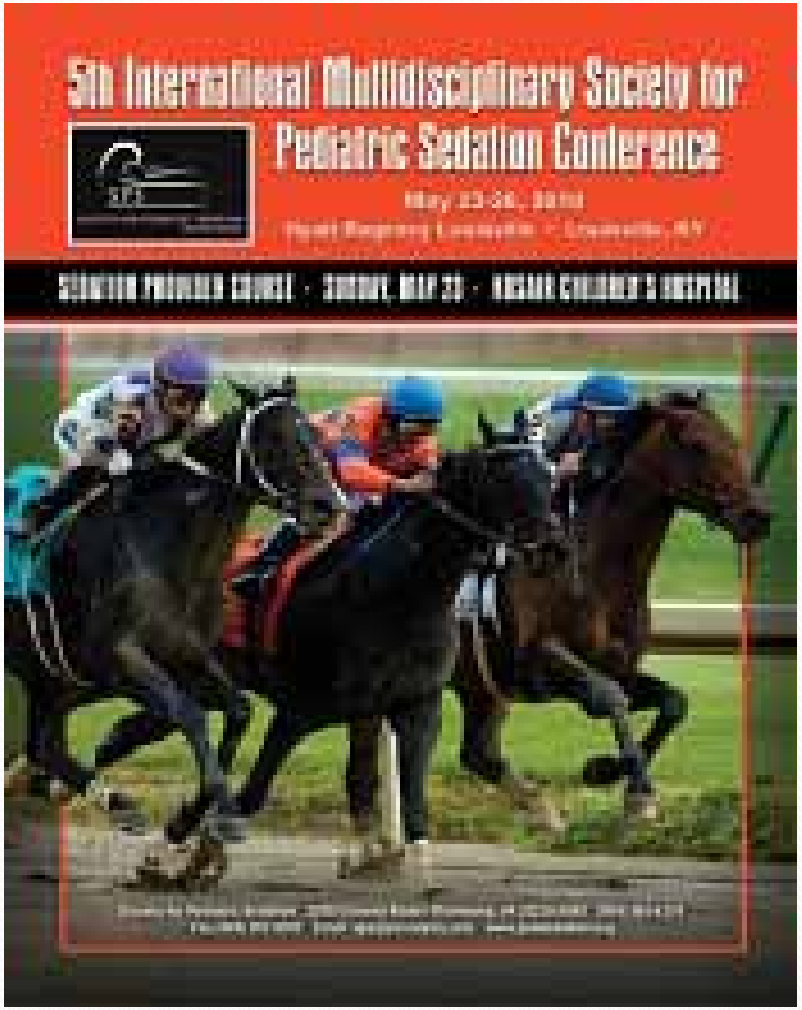
Role of Anesthesiologists

- Educational Responsibilities
  - Advisory capacity
  - Educational opportunities
    - Medical School
    - Residency Programs
    - Hospital Programs
- Actively engage with Hospital Administration
- Patient advocacy

5th International Multidisciplinary Society for Pediatric Sedation Conference

May 23-26, 2010
Hyatt Regency
Louisville, KY

www.pedsedation.org



Thank you!

Pediatric Sedation Research Consortium

- Multi-disciplinary group of medical professionals dedicated to improve the quality of care to pediatric patients receiving sedation
- First organized meeting May 2003
- Development of a web based data collection tool
- Publications of pediatric sedation quality assurance issues

Development of Pediatric Sedation Services

- Anesthesiologists
- Intensivists
- Emergency Room Physicians
- Hospitalists
- Physicians medically directing RNs (NAPS)
  - Gastroenterologists
  - Radiologists
  - Cardiologists
  - Pediatricians

ORIGINAL ARTICLES

Propofol Versus Midazolam/Fentanyl for Outpatient Colonoscopy: Administration by Nurses Supervised by Endoscopists

BRIAN J. ULMER, JONATHAN J. HANSEN, CHRISTINE A. OVERLEY, MICHELLE R. SYMMS, VIDYASREE CHADALAWADA, SUTHAT LIANGPUNSAKUL, ELOISE STRAHL, APRIL M. MENDEL, and DOUGLAS K. REX

Division of Gastroenterology and Hepatology, Department of Medicine, Indiana University Hospital, Indianapolis, Indiana

Background & Aims: Propofol is under evaluation as a sedative for endoscopic procedures. We compared nurse-administered propofol to midazolam plus fentanyl for outpatient colonoscopy. ***Methods:*** One hundred outpatients undergoing colonoscopy were randomized to receive propofol or midazolam plus fentanyl, administered by a registered nurse and supervised only by an endoscopist. Endpoints were patient satisfaction, procedure and recovery times, neuropsychologic function, and complications. ***Results:*** The mean dose of propofol administered was 277 mg; mean doses of midazolam and fentanyl were 7.2 mg and 117 μg, respectively. Mean time to sedation was faster with propofol (2.1 vs. 6.1 min; $P < 0.0001$), and depth of sedation was greater ($P < 0.0001$). Patients receiving propofol reached full recovery sooner (16.5 vs. 27.5 min; $P = 0.0001$) and were discharged sooner (36.5 vs. 46.1 min; $P = 0.01$). After recovery, the propofol group scored better on tests reflective of learning, memory, working memory span, and mental speed. Six minor complications occurred in the propofol group: 4 episodes of hypotension, 1 episode of bradycardia, and 1 rash. Five complications occurred with the use of midazolam and fentanyl: one episode of oxygen desaturation requiring mask ventilation and 4 episodes of hypotension. Patients in the propofol vs. midazolam and fentanyl groups reported similar degrees of overall satisfaction using a 10-cm visual analog scale (9.3 vs. 9.4, $P > 0.5$). ***Conclusions:*** Nurse-administered propofol resulted in several advantages for outpatient colonoscopy compared with midazolam plus fentanyl, but did not improve patient satisfaction.

The majority of patients in the United States prefer to be sedated during colonoscopy.[1] The most widely used form of sedation is the combination of a benzodiazepine, which has amnesic, anxiolytic, and sedative properties, and an opioid, which provides analgesia, synergistic sedation with benzodiazepines, and additional amnesia.[2] Although the use of a benzodiazepine and opioid is used routinely for colonoscopy, the combination is associated with several undesirable effects, including a delay of several minutes from the time of injection before the drugs exert their effects,[3] delay of discharge after completion of the procedure owing to lingering effects of the medications,[4] and risk for respiratory depression.[5]

Propofol is being investigated as a sedative for endoscopic procedures.[6–17] Propofol has a favorable pharmacokinetic profile that is superior to benzodiazepines and narcotics with regard to onset of action[18] and recovery time.[6,7,10] Although concern about respiratory depression results in restriction of its use to anesthetists in some institutions, it has been our experience[19] and the experience of others[20] that registered nurse–endoscopist administered propofol is safe when patients are selected and appropriate safety measures are taken. In a prospective study of 80 patients, we showed that propofol was associated with a faster time to sedation, faster recovery and discharge times, faster recovery of neuropsychologic function, and higher overall patient satisfaction when compared with midazolam and meperidine for outpatient colonoscopy.[6] When used in combination with midazolam, fentanyl has been associated with faster recovery times for upper[21] and lower[22] endoscopy compared with meperidine. Because the use of fentanyl as a substitute for meperidine in endoscopic procedures is expanding, we performed a controlled, randomized study of propofol vs. midazolam and fentanyl as sedation for outpatient colonoscopy. Importantly, all medications were admin-

Abbreviations used in this paper: ASA, American Society of Anesthesiology; P, propofol; M/F, midazolam and fentanyl.

1542-3565/03/$30.00
PII: 10.1053/S1542-3565(03)00226-X

List of Participating Institutions

Alfred I Dupont Children's Hospital	Wilmington, DE
Avera Mckennan Hospital	Sioux Falls, SD
Cape Fear Valley Medical Center	Fayetteville, NC
Children's Healthcare of Atlanta Egleston Campus	Atlanta, GA
Children's Healthcare of Atlanta Scottish Rite Campus	Atlanta, GA
Children's Hospital of Philadelphia	Philadelphia, PA
Children's Hospital Omaha	Omaha, NE
Children's Mercy Hospital	Kansas City, MO
Chris Evert Childrens Hospital	Fort Lauderdale, FL
Columbus Children's Hospital	Columbus, OH
Dartmouth Hitchcock Medical Center	Lebanon, NH
Denver Children's Hospital	Denver, CO
DeVos Children's Hospital	Grand Rapids, MI
Eastern Maine Medical Center	Bangor, ME
Gundersen Lutheran	LaCrosse, WI
Jackson Memorial Hospital, University of Miami School of Medicine	Miami, FL
Kosair Children's Hospital, University of Louisville	Louisville, KY
LeBonheur Childrens Medical Center	Memphis, TN
Medical University of South Carolina	Charleston, SC
New York University School of Medicine	New York, NY
Rainbow Babies and Children's Hospital	Cleveland, OH
Tod Children's Hospital	Youngstown, OH
UMass Memorial Medical Center	Worcester, MA
University of Florida	Gainesville, FL
University of Virginia	Charlottesville, VA
Yale New Haven Children's Hospital	New Haven, CT

Closed claims review of anesthesia for procedures operating room

Reinette Robbertze, Karen L. Posner and Karen B. Domino

Purpose of review

The demand for anesthesia services is increasing due to more complex procedures being performed outside the operating room. We reviewed the literature and closed malpractice claims in the American Society of Anesthesiologists' Closed Claims database to assess liability and injury associated with anesthesia for procedures outside the operating room (nonoperating-room anesthesia, $n = 24$) compared with intra-operative surgical anesthesia (operating room, $n = 1927$) claims.

Recent findings

A higher proportion of patients in nonoperating-room anesthesia claims underwent monitored anesthesia care (58 vs. 6%, $P < 0.001$) and were at the extremes of age (50 vs. 19%, $P = 0.003$) than in operating room claims. Half of the nonoperating-room anesthesia claims occurred in the

Abbreviations

ASA	American Society of Anesthesiol
ERCG	endoscopic retrograde cholangio
MAC	monitored anesthesia care
MRI	Magnetic resonance imaging
NORA	nonoperating-room anesthesia

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Introduction

Anesthesia for procedures ou
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Adverse Events and Risk Factors Associated wi Sedation of Children by Nonanesthesiologists

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After implementation of hospital-wide monitoring standards, a quality assurance (QA) tool was prospectively completed for 1140 children (aged 2.96 ± 3.7 yr) sedated for procedures by nonanesthesiologists. The tool captured data regarding demographics, medications used, adequacy of sedation, monitoring, adverse events, and requirement for escalated care. The medical records of children who experienced adverse events were reviewed. Most (99%) children were monitored with pulse oximetry. Chloral hydrate was the most frequently used sedative (74.9% of cases). Of the children, 239 (20.1%) experienced adverse events related to sedation, including inadequate sedation in 150 (13.2%) and decrease in oxygen saturation in 63 (5.5%). Five of these children experienced airway obstruction and two became apneic. No adverse event resulted in long-term sequelae. Of the 854 children who re- oxygen saturation (≥90% of ba enced desaturation after the use received the recommended dose 83 mg/kg). ASA physical status were predictors of increased risk verse events. These data unders propriate monitoring that includ mit early detection of adverse ev quality assurance study highlig with the sedation of children an tance of appropriate monitorin Children with underlying medi who are very young are at in events, which indicates that a gr may be required in these patient

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Pediatric sedation in North American children hospitals: a survey of anesthesia providers

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Summary

Background: Information about the existence and organizatio pediatric sedation services in North America is not available conducted a survey to collect this information from anesthes at pediatric institutions and to identify factors perceived as l the development of sedation services.

Method: We electronically mailed a confidential survey abou ric sedation practice to an attending anesthesiologist involve pediatric sedation at 116 children's hospitals in the United St Canada. We identified the institutions using Internet resourc Electronic mailing addresses were obtained from departmen

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CLINICAL–ALIMENTARY TRACT

Trained Registered Nurses/Endoscopy Teams Can Administer Propofol Safely for Endoscopy

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See editorial on page 1781.

Background & Aims: Propofol has advantages as a sedative for endoscopic procedures. Its administration by anesthesia specialists is associated with high cost. Administration by nonanesthesiologists is controversial because of concerns about safety, particularly respiratory depression. *Methods:* Three endoscopy units developed programs to train registered nurses supervised only by endoscopists in the administration of propofol for endoscopic procedures. The rate of adverse respiratory events was tracked from the inception of the programs. To estimate whether training nurses to give propofol on a widespread basis might be effective, we evaluated the individual safety records of all nurses and endoscopists involved in propofol delivery at the 3 centers. *Results:* Among a total of 36,743 cases of nurse-administered propofol sedation (NAPS) at the 3 centers, there were no cases requiring endotracheal intubation or resulting in death, neurologic sequelae, or other permanent injury. The rate of respiratory events requiring assisted ventilation was not significantly different among the 3 centers and ranged from just <1 per 500 cases to just <1 per 1000 cases among the 3 centers. There was no individual nurse or physician for whom the rate of respiratory events requiring assisted ventilation differed from the overall rate of events at the respective centers. *Conclusions:* Trained nurses and endoscopists can administer propofol safely for endoscopic procedures. Nurse-administered propofol sedation is one potential solution to the high cost associated with anesthetist-delivered sedation for endoscopy.

States. A recent analysis estimated that 6.47 million colonoscopies were performed in 2003 in the United States.[3] Most endoscopic procedures in the United States are performed with sedation, which improves patient comfort and increases willingness to undergo repeat procedures.[4] The delivery of sedation is considered by the Center for Medicare and Medicaid Services and many private insurers to be part of the performance of the procedure, that is, separate billing for the performance of sedation by the provider performing the endoscopy is not a covered service. Currently, there is a rapidly increasing tendency for endoscopists to employ or associate with anesthesia specialists who commonly sedate patients with propofol or propofol-based regimens for endoscopy.[7] Anesthetists typically submit separate charges for delivery of sedation, thereby substantially increasing the total charges for endoscopic procedures. In a survey reported in 2004, 17% of US gastroenterologists were using propofol and 43% planned to begin using propofol in the next year.[7] Nearly all of this propofol administration is or will be done by anesthesia specialists.

Propofol has certain advantages for endoscopy. Patients can be sedated more quickly, resulting in improved efficiency.[8,9] Patients recover neuropsychological function more quickly after sedation with propofol compared with traditional endoscopic sedation regimens that typically include midazolam and a narcotic,[8,9] because propofol has a very short half-life. Patient satisfaction after colonoscopy using propofol was higher than after sedation using meperidine and midazolam,[8] although there was no difference when propofol was compared with midazolam and fentanyl.[9] Physician satisfaction is

EDITORIALS

Nurse-Assisted Propofol Sedation: The Jury Is In!

See article on page 1384.

The propofol wave, which seemed at one point to be about to break over gastrointestinal (GI) endoscopy in the United States like a tsunami, has yet to reach the shore. When we wrote about propofol (2,6-diisopropyl phenol) and its potential as an agent for endoscopic sedation 3 years ago,[1] the principal concerns were cost and the unknown risks of administration by nonspecialists (ie, non-anesthesiologists). We were castigated by Australian colleagues for suggesting that the "jury was still out."[2] In their opinion, the case for propofol was already proven. A number of endoscopy centers in the United States began experimenting with propofol sedation provided by anethesiologists. Endoscopists working in these centers were delighted with the rapidity of onset and recovery, and the quality of sedation. They and their patients were uniformly pleased with the results, but medical insurers often balked at the cost. A colleague of ours whose family member was promised "professional courtesy" for esophagogastroduodenoscopy (EGD) at a center using propofol for endoscopic procedures was taken aback to receive a bill exceeding $1000 for the anesthesiology services provided. Clearly, expensive anesthesia for routine endoscopic procedures is a recipe for insurance denials. In this issue of GASTROENTEROLOGY, Rex et al[3] describe a huge experience of propofol administration by trained endoscopy nurses in 3 centers (Indianapolis, Indiana; Basel, Switzerland; and Medford, Oregon). Data from 36,743 cases of nurse-administered propofol sedation (NAPS) were reviewed: impressively, no case required endotracheal intubation, and no adverse event resulted in death, neurologic damage, or other permanent sequelae. The rate of respiratory events requiring assisted ventilation ranged from 1 in 500 to just under 1 in 1000 cases. The authors concluded that NAPS is a potential solution to the high cost associated with anesthesia-delivered sedation. They opine that "trained nurses and endoscopists can administer propofol safely for endoscopic procedures."

The propofol wave is certainly coming: the authors However, currently almost all of this propofol sedation is done by anesthesiologists or their "extenders." In most centers, the reluctance to start NAPS reflects safety concerns. The centers in the study by Rex et al[3] developed programs centered around physicians and nurses who had received specific training in propofol administration from anesthesiologists and/or certified registered nurse anesthesiologists (CRNAs) (or their European equivalent). All participants were required to have Advanced Cardiac Life Support (ACLS) certification. This has not been a uniform requirement for conscious (moderate) sedation providers in the past, but fairly soon it will be. The Joint Commission on Accreditation of Healthcare Organizations (JCAHO) mandates that hospital-based practitioners who provide conscious sedation should be credentialed by the facility in which they practice. Increasingly, this takes the form of ACLS training and certification. In each of the 3 centers in the Rex study,[3] monitoring consists of continuous display of oxygen saturation, electrocardiography, and heart rate and intermittent blood pressure checks. Each center had experience of capnography (measurement of continuous end-expiratory carbon dioxide concentration) but none relied on capnography primarily. It is the authors' contention that capnography—touted in certain quarters as essential for monitoring propofol-sedated patients—may be unnecessary in this setting. Adverse "events" (eg, need for assisted ventilation) were recorded and identified by individual practitioner. The results were reassuringly uniform between centers and between practitioners (physicians and nurses) within individual centers. The overall "event" rate ranged from 0.09 to 0.19. Interestingly, adverse events were commoner in each center during sedation for EGD than during colonoscopy, which is typically a procedure of longer duration. There were no clinically significant cardiac arrythmias during procedures or recovery from them other than bradycardia, which was successfully treated with atropine in all cases. The authors did not collect data on 30-day morbidity or mortality, so this study does not identify potential increased risk of, say, postprocedural respiratory infections from aspiration during sedation. Respiratory compromise is the most

Evaluation of a Pediatric-sedation Service for Common Diagnostic Procedures

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Harold K. Simon, MD, MBA, Naghma S. Khan, MD

Abstract

Background: Pediatric patients often require sedation for diagnostic procedures such as magnetic resonance imaging and computed tomography scanning. In October 2002, a dedicated sedation service was started at a tertiary care pediatric facility as a joint venture between pediatric emergency medicine and pediatric critical care medicine. Before this service, sedation was provided by the department of radiology by using a standard protocol, with high-risk patients and failed sedations referred for general anesthesia.

Objectives: To describe the initial experience with a dedicated pediatric-sedation service.

Methods: This was a retrospective analysis of quality-assurance data collected on all sedations in the radiology department for 23-month periods before and after sedation-service implementation. Study variables were number and reasons for canceled or incomplete procedures, rates of referral for general anesthesia, rates of hypoxia, prolonged sedation, need for assisted ventilation, apnea, emesis, and paradoxical reaction to medication. Results are reported in odds ratios (OR) with 95% confidence intervals (95% CI).

Results: Data from 5,444 sedations were analyzed; 2,148 before and 3,296 after sedation-service activation. Incomplete studies secondary to inadequate sedation decreased, from 2.7% before the service was created to 0.8% in the post–sedation-service period (OR, 0.29; 95% CI = 0.18 to 0.47). There also were decreases in cancellations caused by patient illness (3.8% vs. 0.6%; OR, 0.16; 95% CI = 0.10 to 0.27) and rates of hypoxia (8.8% vs. 4.6%; OR, 0.50; 95% CI = 0.40 to 0.63). There were no significant differences between the groups in rates of apnea, need for assisted ventilation, emesis, or prolonged sedation. The implementation of the sedation service also was associated with a decrease in both the number of patients referred to general anesthesia without a trial of sedation (from 2.1% to 0.1%; OR, 0.33; 95% CI = 0.06 to 1.46) and the total number of general anesthesia cases in the radiology department (from 7.5% to 4.4% of all patients requiring either sedation or anesthesia; OR, 0.56; 95% CI = 0.45 to 0.71).

Conclusions: The implementation of a dedicated pediatric-sedation service resulted in fewer incomplete studies related to inadequate sedation, in fewer canceled studies secondary to patient illness, in fewer referrals for general anesthesia, and in fewer recorded instances of sedation-associated hypoxia. These

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Initiating a Hospital-Wide Pediatric Sedation Service Provided by Emergency Physicians

Loren G. Yamamoto

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Guidelines to Practice

The Process of Planning and Implementing a Pediatric Sedation Program

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Objective: Pediatric sedation practices vary among institutions and even within the same institution depending on providers and location. We planned to implement a pediatric procedural sedation program for a tertiary care pediatric emergency department to standardize sedation practices among emergency physicians.

Methods: An interactive contextual planning model was adapted, and several tasks were initiated simultaneously. The director of pediatric emergency medicine and clinical director of the institution approved the proposal for the sedation program. Needs assessment surveys and focus group interviews were conducted to identify educational needs of the target audience and infuse a sense of ownership. A grant was obtained from the institution because the budget exceeded available divisional funds. Other pediatric sedation guidelines and published literature were used to produce a sedation handbook and pocket card. Interim approval was obtained from the Drugs and Therapeutics Committee and the Patient Care Committee.

Results: The program was successfully implemented after all physicians and nurses working in the emergency department attended a half-day sedation course and completed a multiple-choice examination. Random chart audits verify that the emergency physicians are performing almost all procedural sedations now as per protocol.

Conclusions: Implementing a structured program facilitates guideline adherence. Adapting a flexible contextual planning model was successful in translating guidelines to practice where resources were limited, and the target audience was highly trained adult learners.

Key Words: medical education, clinical guidelines, program planning, practice implementation, pediatric sedation

Pain management in children is often inadequate, and procedural pain is not an exception.[1] Although all painful procedures in the operating room are performed under anesthesia or sedation, pain management and sedation practices for procedures performed outside the operating room are often inconsistent. Many painful procedures in children are successfully conducted outside operating rooms under sedation.[2] Practices in sedations outside the operating rooms vary and are performed by anesthesiologists and nonanesthesiologists.[3] Over the past decade, there are increasing numbers of pediatric sedations being safely performed by nonanesthesiologists.[4,5] The American Society of Anesthesiology, the American Academy of Pediatrics, and the American College of Emergency Physicians have published guidelines for pediatric sedation by the nonanesthesiologist.[6–8] Many institutions have implemented their own pediatric sedation programs based on these guidelines.

In the past, most moderate procedural sedations for fracture reductions in the emergency department at our hospital were performed by anesthesiologists, and there was increasing difficulty in obtaining anesthesiologist coverage in a timely manner. The emergency physicians had no standardized institutional guidelines for emergency procedural sedations and practices varied. It was difficult to evaluate the sedations performed by emergency physicians because there were no mandated sedation records as those used by anesthesiologists. Thus, standardized pediatric sedation guidelines had to be implemented in order for emergency physicians to sedate pediatric patients for procedures in the emergency department.

Guidelines do not automatically translate into change of practice as shown by practice audits.[9] The existence of multiple guidelines does not make guideline implementation any easier, as the lack of established evidence-based practice in pediatric sedation complicates these efforts. Published guidelines to successful program implementation often require extensive planning, education, and continuous evaluation.[10,11]

Institutional program planning can be on a short- or long-term basis or a combination of both short- and long-term goals.[12] Prescription planning is a short-term planning model adapted to rapidly fix a problem and usually has little flexibility to incorporate any long-term objectives. Rational planning or long-range planning, strategic planning, and contextual planning are the main models of planning used in higher education over the years.[13] Planners usually adopt or adapt a model that suits their need and is able to achieve the program goals. Table 1 summarizes some of the characteristics of these models. Although a strategic planning model may have suited our purpose, contextual planning was a better fit because it is a flexible interactive model where simultaneous tasks are carried out to achieve the goal of the program.[12–14]

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Development of a nurse-led sedation service for paediatric magnetic resonance imaging

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Summary

Background Children generally lie still enough for magnetic resonance imaging (MRI) only if they are asleep, either under sedation, which is deeper than conscious sedation, or under anaesthesia. Anaesthesia resources, however, are limited, and non-anaesthetists must use sedation frequently. Demand for MRI has increased and the failure of our sedation regimen led to an impractical demand for anaesthesia and unacceptable waiting times for scanning. We have therefore developed a nurse-led sedation service in a designated unit next to the scanner. This study assessed the safety and efficacy of this approach.

Methods Children who required MRI were sedated in the unit by designated sedationist nurses, who used an oral drug regimen (according to weight and age from conception: weight <5 kg, 50 mg/kg chloral hydrate; 5–10 kg, 100 mg/kg chloral hydrate; 10–20 kg, 1 mg/kg temazepam plus pinching the nose, could open their mouths to maintain their airway.

Interpretation This study suggests that it is possible to have a nurse-led sedation service for MRI of children that is both successful and safe.

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Introduction

Magnetic resonance imaging (MRI) requires the patient to be immobile in a noisy and enclosed space for at least 20 min. Although small infants may sleep naturally after a feed, and older children can be sufficiently cooperative, most children will lie still for the required time only if they are made to sleep by sedation or anaesthesia.[1–3] At the present time, anaesthesia resources are limited and demand for sedation is increasing with increasing use of MRI.

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Initiating a Hospital-Wide Pediatric Sedation Service Provided by Emergency Physicians

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Advanced diagnostic procedures, imaging studies, and therapeutic procedures have combined to substantially increase the need for pediatric sedation. The objective of this study is to describe the initiation of a hospital-wide (nonemergency department) pediatric deep sedation service provided by pediatric emergency physicians. This article describes a consecutive cohort of pediatric patients undergoing deep sedation provided by a new hospital sedation service (excluding the emergency department). The results of 133 pediatric deep sedations are described. Propofol was used for most sedations. Mean infusion times were 55 minutes for MRI scans and 13 minutes for heme-oncology procedures. The risk of adverse events was low. This case series of pediatric deep sedation patients describes the initiation of a hospital-wide pediatric sedation service utilizing pediatric emergency physicians, which has resulted in improved patient care, and improved financial performance of several hospital units. The risk of adverse events is low if proper precautions are taken.

Keywords: sedation; emergency physicians; propofol; ketamine