Selected Best Practices and Suggestions for Improvement

PSI 06: Iatrogenic Pneumothorax

Why Focus on Iatrogenic Pneumothorax?

- Iatrogenic pneumothorax (IP) is a life-threatening complication seen in 3% of ICU patients.[1]
- IP occurs primarily due to barotrauma related to mechanical ventilation or as a postprocedural event. Due to the development of improved equipment and techniques, IP can be largely preventable.[1]
- Patients with accidental IP had an extra 4.4 days added to their LOS, $18,000 in additional charges, and had a 6% higher risk of hospital death.[2]
- At least part of this cost is likely to be shouldered by hospitals. In 2008 the Centers for Medicaid and Medicare Services (CMS) identified iatrogenic pneumothorax with venous catheterization as one of a number of conditions for which hospitals do not receive the higher payment for cases when the condition was acquired during hospitalization.[3]
- Starting in 2015, the iatrogenic pneumothorax PSI will be one of the measures used for Medicare's Hospital Value-Based Purchasing (as part of a composite indicator) that links quality to payment.[4]

This indicator is also reported on Medicare's Hospital COMPARE as part of the Hospital Inpatient Quality Reporting Program.[5]

Recommended Practice	Details of Recommended Practice
Identification of Patients at Risk	Develop a process to address common iatrogenic pneumothorax risk factors identified in the literature.[1]
Safe Insertion Techniques During Pleural Procedures	Standardize procedures and position techniques during pleural procedures, such as thoracentesis and chest tube insertion.[6-9]
Provider Training	Develop specified training components and criteria and establish a plan for continued competency[6,7]
Standardized Practices	Develop and standardize practices for site identification, marking, and procedural practice.[6,7,10-12]

Best Processes/Systems of Care

Introduction: Essential First Steps

- Engage key procedural personnel, including nurses, physicians and other providers, technicians, and representatives from the quality improvement department, to develop evidence-based protocols for care of the patient preprocedure, intraprocedure, and postprocedure to prevent iatrogenic pneumothorax.
- The above team:
    - Identifies the purpose, goals, and scope and defines the target population for this guideline.
    - Analyzes problems with guidelines compliance, identifies opportunities for improvement, and communicates best practices to frontline teams.

- Establishes measures to indicate if changes are leading to improvement; identifies process and outcome metrics, and tracks performance using these metrics based on a standard performance improvement methodology (e.g., FOCUS-PDSA).
- Determines appropriate facility resources for effective and permanent adoption of practices.

Recommended Practice: Identification of Patients at Risk

- Determine risk for iatrogenic pneumothorax during the history and physical.
- Consider the many factors identified in the literature that are associated with a higher risk of iatrogenic pneumothorax. These can be categorized as either patient related or procedure related.[2,13]

  Patient-related factors include:

  - Body habitus.
  - Effusion size.
  - Localized fluid.
  - Chronic obstructive pulmonary disease.
  - Diagnosis of cardiogenic pulmonary edema at admission.
  - Diagnosis of acute respiratory distress syndrome at admission.
  - Insertion during the first 24 hours of a central venous catheter or pulmonary artery catheter.
  - Use of vasoactive agents within 24 hours postprocedure.[1]
  - Cancer of kidney and renal pelvis (risk is likely due to the need for transthoracic needle aspiration, which is used for diagnostic purposes).

  Procedure-related factors include:

  - Transthoracic needle aspiration.
  - Thoracentesis.
  - Subclavian venipuncture.
  - Positive pressure ventilation.
  - Bronchoscopy.
  - Respiratory and mechanical ventilation.
  - Abdominal cavity operations.
  - Pleural biopsy.
  - Coughing during the procedure (patient).

Recommended Practice: Safe Insertion Techniques During Pleural Procedures

- Standardize procedures and equipment.[7]

  - Use of real-time ultrasound to identify and mark site and/or guidance for thoracentesis.[8,9,12,14-16]
  - Requirement of preprocedural verification of the correct patient using two identifiers.
  - Requirement of preprocedural verification of the intended procedure and the correct site selection.

- Use a lateral approach; avoid posterior approach if possible. A lateral approach minimizes risks of vessel laceration.[6,8]
- Use blunt dissection vs. trocar use for chest tube insertion.[6,9]

Recommended Practice: Provider Training

- Provide specified training, including three components:
    - Theoretical didactic training,
    - Simulated practice, and
    - Formal, supervised practice with minimum observation criteria.[6,7]
- Consider identifying a subset of practitioners (e.g., focus group) who receive specific training to perform the procedure (thoracentesis, chest tube insertion) regularly. Establish criteria for continued competency with minimum procedural number.[6,7]

Recommended Practice: Standardized Practices

- Appropriate site selection, including use of the ”safe triangle” (defined by the anterior border of the latissimus dorsi, the lateral border of the pectoralis major, and a horizontal line through the anatomical position of the ipsilateral nipple) as a default to reduce chances of visceral perforation. Consider using pleural ultrasound to provide real-time localization of pleural fluid.[6,10]
- Site marking performed immediately prior to the procedure to reduce the likelihood of fluid redistribution or tissue/organ movement secondary to patient repositioning.[6,11]
- Implementation of procedural guidelines (e.g., American College of Chest Physicians).

Educational Recommendation

- Plan and provide education on protocols to physicians and other providers, nursing, and all other staff involved in procedural cases. Education should occur upon hire, annually, and when this protocol is added to job responsibilities.

Effectiveness of Action Items

- Track compliance with elements of established protocol by using checklists, appropriate documentation, etc.
- Evaluate effectiveness of new processes, determine gaps, modify processes as needed, and reimplement practices.
- Mandate that all personnel follow the safety protocols developed by the team to prevent iatrogenic pneumothorax and develop a plan of action for staff in noncompliance.
- Provide feedback to all stakeholders (physicians and other providers, nursing, and ancillary staff; senior medical staff; and executive leadership) on the level of compliance with process.
- Conduct surveillance and determine prevalence to evaluate outcomes of new process.
- Monitor and evaluate performance regularly to sustain improvements achieved.

Additional Resources

Systems/Processes

- WHO Surgical Care at the District Hospital 2003, World Health Organization http://www.who.int/surgery/publications/Postoperativecare.pdf
- Baumann M, Strange C, Sahn S, et al. Management of spontaneous pneumothorax: an American College of Chest Physicians Delphi Consensus Statement. Chest. February 2001;119(2):590-602
- Henry M, Arnold T, Harvey J. BTS guidelines for the management of spontaneous pneumothorax. Thorax 2003;58 Suppl 2:ii39-ii52

Tools

- AHRQ Innovations Quality Tool: Problems and Prevention: Chest Tube Insertion https://innovations.ahrq.gov/qualitytools/problems-and-prevention-chest-tube-insertion
- NHS Chest Drain Protocol http://www.bsuh.nhs.uk/EasySiteWeb/GatewayLink.aspx?alId=383931

Staff Required

- Physicians and other providers
- Registered nurses
- Respiratory therapists

Equipment

- Computerized tomography (CT)
- Ultrasound

Communication

- Education on policy/protocol of monitoring and treatment of pneumothorax
- Communication system to escalate up the chain of command when provider not responding to diagnosis of pneumothorax or signs and symptoms of pneumothorax

Authority/Accountability

- Senior leaders such as chief/chairs of surgery and medicine, nursing leadership, and unit managers

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