Purpose of the Study

To evaluate the knowledge and educational preparedness of advanced practice nurses (APNs) in the area of radiologic imaging.

Background

- Numerous studies acknowledge need for further physician education on radiological imaging
- Little to no research assessing APNs
Overuse

- Over 400 million radiology-imaging studies performed each year in the U.S.
- U.S. accounts for 4.5% of the world population, 50% of all nuclear medicine procedures
- Collective dose from medical imaging increased by 700% between 1980-2006

Pediatric Risks

- Exposed to more lifetime accumulated risks
- More sensitive to radiation exposure
- Pediatric Protocols - “Image Gently”

Costs

- 20% of U.S. GDP spent on health care (Neiman Report, 2012)
- $100 billion spent annually on diagnostic imaging in the U.S. (Otero, Rybicki, Greensberg, & Neumann, 2008)
Average Effective Radiation Doses

- Angiography of Chest (Coronary) = 1,231 chest x-rays.
- Angiography of chest (Pulmonary) = 1,154 chest x-rays.
- Myocardial perfusion imaging = 2,231 chest x-rays.
- Transjugular intrahepatic portosystemic shunt placement = 5,385.

Radiology Knowledge Survey

- Survey developed by investigator to evaluate perception of knowledge in the area of radiology.

Sample

- Met inclusion criteria: graduated from an accredited APN program.
- 107 different Universities identified and 20 different States.
- Median practice years: 11.48.
Clinical Questions

- Are APNs practicing in the state of Florida familiar with the ACR-AC?
- Are there differences between respondents based on their years of experience?
- Are there differences between respondents based on their educational preparation?

Familiarity with the ACR-AC

- Majority were not aware of the ACR-AC (n=681; 75.9%)
- Majority do not utilize ACR-AC in practice (n=692; 76.8%)

What is the ACR-AC?

- American College of Radiology Appropriateness Criteria
- Evidence-based guidelines developed and reviewed every two years by expert multidisciplinary panel
- Recommendations for appropriate imaging and treatment of specific conditions for radiologists and referring practitioners (ACR, 2013).
ACR - Website

http://www.acr.org/Quality-Safety/Appropriateness-Criteria

American College of Radiology – Appropriateness criteria


Mammography

Differences based on years in practice

- Statistically significant differences in ordering radiological imaging in the areas of pulmonary, vascular, gastrointestinal, breast, genitourinary, molecular, neurological studies, and head and neck

### Table 3.2 ANOVA: Confidence in ordering diagnostic imaging

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<th>Group</th>
<th>Sum of Squares</th>
<th>df</th>
<th>Mean Square</th>
<th>F</th>
<th>Sig.</th>
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</table>
Differences based on specialty

- Familiarity compared among primary and acute specialties
- T-test results show no statistically significant differences between groups
- Acute care reported greater perceived competency in ordering imaging studies within their specialty and use of contrast after graduation from APN program

Table 4.1: ANOVA: Perceived competency on program completion acute vs. primary care APNs

<table>
<thead>
<tr>
<th>Competency in</th>
<th>Between Groups</th>
<th>df</th>
<th>Mean Sq</th>
<th>F</th>
<th>Sig.</th>
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<tr>
<td>total</td>
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<td>competency in ordering contrast</td>
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<tr>
<td>within groups</td>
<td>723.601</td>
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<td>729.531</td>
<td>863</td>
<td></td>
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</table>

P <.05 in the areas of common conditions ordered in specialty, interpreting diagnostic reports, competency in ordering contrast.
Study Results Summary

- Estimated response rate of 12.69% (n=905)
- 75.9% (n = 684) had never heard of ACR-AC
- Experience increased perceived competency
- Acute care better perceived knowledge of:
  - interpretation of imaging results
  - ordering diagnostic imaging specific in their specialty
  - use of contrast agents

Results cont.

94.89% said they would like continuing education the area of radiology
92.3% said they would like to have had radiology incorporated into their educational program.
Assuming that imaging is clinically necessary

- Decide what to order
- Decide how to Order

Choosing a study

- Comparative studies
- Consensus
- Usefulness
- Do no harm
- Availability
- Expense
  - patient
  - system

Use your Radiologist

- Think of Radiologist as a consultant
- Invest time and effort
- Help them help you
- Summarize signs/symptoms/history
  - Tell them what you want to know
  - ICD9 (so they can bill)
Use of Clinical Decision Aides

- National Emergency X-Radiology Utilization Study (NEXUS), Canadian Cervical Spine Rule, Ottawa Foot and Ankle Rules, Pediatric head CT rule, and Pulmonary Embolism Rule-Out Criteria (PERC).

On the Menu:

- Plain Films
- Fluoroscopy
- Ultrasound
- CT (Computerized Tomography)
- MRI (Magnetic Resonance Imaging)
- Nuclear Medicine/PET CT
- Angiography

Plain Radiographs

- Includes:
  - CXR
  - Abdominal series
  - Musculoskeletal imaging etc
- Ordering basics involve what type of views you need
  - i.e. A knee series can be an AP only or as many as 5 views
Plain Films

- Economical
- Readily available
- Quick
- Informative
- Good place to start

Chest X-Ray

- Radiological investigation of a Chest problem should always start with a CXR
- Varieties: AP, PA & lateral, decubs
- PA & lateral: best quality
- AP: standby for immobile patients, portable studies
- Decubs: eval pleural effusion

Views

- Understand the view in which your xray is taken.
- AP vs PA/ lateral
KUB & Abd series

- **KUB**: supine abdominal film
  1. Evaluation for obstruction (Used primarily)
  2. Abnormal calcifications (kidney stones)
- **Abd series**: KUB, upright chest, +/- decubs
  1. Obstruction
  2. Calcifications
  3. Pneumoperitoneum
- Further eval: CT

Extremity Films

- Good for broken bones, lesions
- **Very limited Soft Tissue info**: effusions, sq emphysema, foreign bodies
- For better definition of bone: CT
- For better definition of soft tiss: MRI
- For foreign bodies: CT or US

Bone

- Plain films are more valuable than MRI for bone problems!
  
  (Known limitations: osteomyelitis, stress fractures, etc)
Fluoroscopy

• GI studies - Patient must be able to drink barium or gastrografin
• Esophagrams vs. Barium swallow
  – Barium enema
  – Pouchograms/fistulograms
• Orthopedic Surgery -
  – Guide fracture reduction
• Angiography –
  Leg, heart and cerebral vessels

Ultrasound

• Includes many different exams
  – Thyroid
  – HBP, Abdominal duplex
  – Gallbladder
  – Pelvic
  – Testicular
• Sometimes better than other studies, particularly for blood flow states
• Limitations: body habitus, bowel gas
  – Ie. we use acoustic windows

CT-computed tomography

• CT exams include
  – Head (w/ vs. w/o contrast)
  – Neck
  – Chest
  – Abdomen/pelvis
  – Musculoskeletal
• Type of contrast administration depends on what you are looking for.
Contrast

- Use contrast to assess vascular pathology, abscess or neoplasm (known or suspected) should be performed with IV contrast if possible.
- Contrast- Oral separates bowel from pathology
- IV gives enhancement to all perfused organs and vessels.

CT protocols

- Noncontrast:
  - Head CT
  - Renal stone protocol
  - Allergy to contrast
  - Low GFR
- Contrast:
  - Oral, separates bowel from pathology
  - IV, gives enhancement to all perfused organs as well as vessels

MRI-magnetic resonance imaging

- MRI includes
  - Neuro studies
  - Musculoskeletal studies
  - Vascular studies
  - Abdomen, pelvic floor
IV contrast Reactions

- Allergic
  - Hives, laryngeal edema, bronchospasm, pulmonary edema, bradycardia, HTN, seizures, hypoglycemia, cardiac arrest
- Renal failure
  - ATN

Nuclear Imaging

- Gamma ray imaging systems used to detect radiation emitted from the patient

Nuclear Imaging Common Uses

- Ventilation and Perfusion lung imaging for diagnosis of pulmonary embolism
- Hepatobiliary imaging
- Skeletal Imaging- Bone Scan metastatic lesion, osteomyelitis
- ACE inhibitor renal scan
- Myocardial Perfusion Imaging
Positive Emission Tomography

- Highly sensitive for small tumors that may be missed on MRI or CT scans.
- Neurologic-
  - Diagnosis of various brain disorders: dementia, depression, schizophrenia, epileptogenic foci
- Cardiac imaging
- Myocardial viability

Give clear clinical data

Poor example of an order for an abd/pelvis CT
- Diagnostic Question: R/O malignancy
- History: Constitutional Symptoms

Don’t use “Rule Outs”

- Take radiologist down the wrong path
- Make radiologists second-guess you
- Make Radiologists waffle (cannot prove a negative)
- Really bad NPV
  - Limitations of technique (search)
  - “The hardest thing to find is the one that’s not there”
  - Radiologist do not get paid with a rule out diagnosis.
General CT considerations

- Quick
- Available
- Relatively Affordable
- Problems:
  - Radiation (children, pregnancy)
  - Patient Size limit 450 lb
  - Patient Motion
  - Pt with ESRD

CT IV Contrast

- Benefits:
  - Better contrast in soft tissues
  - Better delineation of tissue types
  - Better sensitivity for tumors/abscesses
- Risks
  - Kidney damage (eGFR < 60)
  - Allergic reactions
  - Fluid overload

Allergic Reactions

- Hx of life-threatening reactions is an absolute contraindication for contrast
- Important to know if pt has had prior reaction to intravenous contrast- screen pt for allergies!
- True allergy- anaphylactic (Type I reactions) or mild (delayed Type 4).
- For mild reactions: premedicate
  - Call CT for protocol x8069
Terminology
Consolidation – Can be anything that's denser than the lung
- Cancer
- Fluid
- Atelectasis
- Pneumonia

Infiltrate
A nonspecific and imprecise term.
Any poorly defined opacity in the lung

What to do with results
- Understand when additional imaging is needed.
- Is surgery indicated?
- Antibiotics
- Specialty consultation?
Summary

• Radiological imaging has grown in its usefulness towards clinical diagnosis.
• Understanding how and what to order is complicated and APN’s need more educational preparation and awareness in this area.