R-SCAN Pilot Project
CT for Minor Pediatric Head Injury

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WHAT IS R-SCAN

Clinical practice improvement activity
- Brings radiologists and referring clinicians together
- Reduce avoidable imaging & streamline image ordering

R-SCAN gives clinicians
- Access to Web-based tools & clinical decision support (CDS) technology
- Optimize imaging care & reduce unnecessary imaging
- Lower the cost of care
WHY R-SCAN

Focuses on highly relevant imaging studies to improve utilization

- Radiologists and referring clinicians collaborate
- To improve image ordering
- Reduce unnecessary imaging
- Based on Choosing Wisely® topics
- Endorsed by multiple medical societies
HOW IT STARTED

- A collaborative team at Northwest Medical Center was formed
  - To improve image ordering
  - Use R-SCAN

- Several Choosing Wisely topics on the R-SCAN website were reviewed

- Participants included members of the Radiology and Emergency Medicine Departments
TEAM MEMBERS

- Dr. Gittleman & Dr. Doan – Department of Radiology

- Dr. Whitman & Dr. Font – Department of Emergency Medicine
Minor head injuries occur commonly in children.

CT scans are performed in ~50% of children who present to the ED with a head injury.

Many of these may be unnecessary:
- Radiation exposure poses a danger to children.
- Undue costs on the health care system.

Clinical observation prior to CT decision making for children with minor head injuries is an effective approach.
CT for Minor Pediatric Head Injury

- CT scans are not necessary in the immediate evaluation of minor head injuries
- Clinical Observation / Pediatric Emergency Care Applied Research Network Criteria (PECARN) should be used to determine whether imaging is indicated
  - Measure #416: Emergency Medicine: Emergency Department Utilization of CT for Minor Blunt Head Trauma for Patients Aged 2 through 17 Years – National Quality Strategy Domain: Efficiency and Cost Reduction
This project was chosen for many reasons:

- Many CT scans ordered for ED pediatric patients may be unnecessary
  - Do not meet the Clinical Observation / PECARN criteria
  - To determine when imaging is indicated
- Great impact on patients and resources
R-SCAN Pilot Project at NWMC

- Wanted to partner with interested group of clinicians
  - ED chief is a champion of Image Gently Alliance
  - Strong interest in CDS technology to optimize imaging care and receptive to R-SCAN

- LOS resources & metrics
  - Reduce CTs ordered for minor pediatric head trauma
  - Requires more observation time in ED & possible admits to floor
The Image Gently Alliance

- A coalition of health care organizations dedicated to providing safe, high quality pediatric imaging worldwide
- The Image Gently Alliance began as a committee within the Society for Pediatric Radiology in late 2006
- The goal of this Alliance is to alter clinical practice:
  - Raise awareness of ways to lower radiation exposure in the imaging of children
- Chose to focus first on computed tomography (CT) scans
  - Dramatic increase in the number of pediatric CT scans performed in the United States over the past decade
  - Rapid evolution, change, and availability of CT technology and equipment
One Size **Does Not** Fit All...

There’s no question – CT helps us save kids’ lives! But... radiation matters! So, when we image, let’s image gently.

More is often not better. When CT is the right thing to do:

- Child size the kVp and mA
- One scan (single phase) is often enough
- Scan only the indicated area

Visit www.imagegently.com
PECARN Head injury Prediction Rules

Between 1995 – 2005, CT use in children more than **doubled**

~20-60% of children assessed for head trauma in North American emergency departments undergo CT

- Great variability in practice among ED departments

< **10%** of CT scans in children with minor head trauma (defined by GCS score of 14-15) show traumatic brain injury (TBI)

**Only 0.1-0.2%** of injuries need neurosurgery in children with GCS 14-15

PECARN Head Injury Prediction Rules

- 43,904 children from 25 US hospitals with minor head trauma (defined as GCS 14-15) were reported on in a prospective study.
  - Kupermann et al, Lancet 2009

- Validated prediction rules identifying children at very low risk of TBI after head trauma for whom CT is unnecessary.

- Prediction rule accuracy for low-risk group in validation sample (>50% of patients, accounting for 25% of CTs):
  - <2yo: NPV 100%, Sensitivity 100%
  - ≥2yo: NPV 99.95%, Sensitivity 96.8%

PECARN clinical decision rule consists of 2 age specific rules:
- For children < 2 years of age
- For children ≥ 2 years of age
PECARN & ACEP

- California ACEP has developed a toolkit to facilitate adoption of the PECARN algorithm
- Toolkit specifically addresses “shared decision making” as a vital part of PECARN
- *Observation can be a safe alternative to CT scanning in low-risk patients*
PECARN Head Injury Prediction Rules

How to use the rules for children < 2 yo

- **High Risk of TBI (4.4%)**: GCS =14, palpable skull fracture, or altered mental status (AMS) → **CT indicated**

- **Intermediate Risk of TBI (0.9%)**: occipital or parietal scalp hematoma, LOC > 5 seconds, severe mechanism of injury, or acting different per parent → **Observation vs CT, shared decision-making**

- **Low Risk of TBI (<0.02%)**: none of the PECARN predictors → **Observe in ED; CT not recommended**
PECARN Head Injury Prediction Rules

How to use the rules for children $\geq 2$ yo.

High Risk of TBI (4.3%): GCS = 14, signs of basilar skull fracture, or AMS $\rightarrow$ **CT indicated**

Intermediate Risk (0.8%): LOC, history of vomiting, severe HA, or severe mechanism of injury $\rightarrow$ **Observation vs CT, shared decision-making**

Low Risk of TBI (<0.05%): none of the PECARN predictors $\rightarrow$ **Observe in ED; CT not recommended**
Shared Decision Making

Based on:

- Physician experience
- Parental preference
- Multiple vs. isolated findings
- Age < 3 months

**Worsening signs or symptoms after initial period of observation is an indication for CT scan**
Severe Mechanism of Injury

- Motor vehicle crash with patient ejection
- Death of another passenger
- Rollover MVC
- Pedestrian or bicyclist without helmet struck by motor vehicle
- Fall > 5 ft (if >2 y.o.) or > 3 ft (if <2 y.o)
- Head struck by high-impact object (golf ball, baseball, golf club, horse hoof, etc.)
Pediatric Head Trauma CT Decision Guide

Children younger than 2 years

GCS < 15
Palpable skull fracture
AMS (agitation, somnolence, slow response, repetitive questioning)

High Risk--4.4% risk of ci-TBI*
Yes to any

No

Scalp hematoma (excluding frontal)
LOC >5 seconds
Not acting normally per parent
Severe mechanism of injury
-Fall >3 ft
-MVA w/ ejection, rollover, or fatality
-Bike/ped vs. vehicle w/o helmet
-Struck by high-impact object

Intermediate Risk--0.9%
Yes to any

Observation vs. CT using shared decision-making

Clinical factors used to guide decision-making:
- Multiple vs. isolated factors
- Worsening findings during observation (AMS, headache, vomiting)
- Physician experience
- Parental preference
- <3 months old

No
Low risk-- < 0.02%

CT not indicated, Observe

*ci-TBI: risk of clinically important TBI needing acute intervention, based on PECARN validated prediction rules
Pediatric Head Trauma CT Decision Guide

Children 2 years and older

GCS < 15
Signs of basilar skull fracture
AMS (agitation, somnolence, slow response, repetitive questions)

Yes to any → CT

High Risk -- 4.3% risk of ci-TBI*

Intermediate Risk -- 0.8%
Clinical factors used to guide decision-making:
- Multiple vs. isolated factors
- Worsening findings during observation (AMS, headache, vomiting)
- Physician experience
- Parental preference

Vomiting
LOC
Severe headache
Severe mechanism of injury
- Fall > 5 ft
- MVA w/ ejection, rollover, or fatality
- Bike/ped vs. vehicle w/o helmet
- Struck by high-impact object

Yes to any → Observation vs. CT using shared decision-making

Low risk -- < 0.05%
CT not indicated, Observe

*ci-TBI: risk of clinically important TBI needing acute intervention, based on PECARN validated prediction rules
Explaining the Rationale

• **Low risk** = Concussion
  • Concussion is a *clinical* dx based on symptoms
  • Risks of CT outweigh benefits

• **Intermediate risk**
  • Intermediate risk symptoms warrant observation before deciding whether to perform head CT
  • No increase in adverse outcome with this strategy
WEIGHING THE RISKS IN “INTERMEDIATE” PATIENTS

Give more consideration to CT scan if:

- Child is < 3 months of age
- Home observation is unreliable
- Child has more than one “intermediate” risk factor, for example:
  - Vomiting AND headache
  - Headache AND LOC
  - High-risk mechanism AND parietal hematoma
WEIGHING THE RISK FACTORS

- If patient has worsening signs and symptoms during observation → **get CT**
- Experts recommend observation period of:
  - ~2 hours post-injury in low-risk patients
  - ~4 hours post-injury in intermediate-risk patients
- Some of observation period can happen at **home** if there is a reliable observer
R-SCAN PILOT PROJECT

:: Collaboration with IT department:
  - Over 50 CT Brain studies performed in the ED over the past 6 months were retrospectively reviewed

:: Dr. Whitman reviewed the ED provider’s documentation
  - Determine why necessary to perform CT
  - Identify if PECARN criteria were utilized
The team classified studies based on the following criteria:

- Either met PECARN criteria, *then CT necessary*
- If didn’t meet PECARN criteria, *then CT unnecessary*
## Baseline Case Data Summary

- **Number of exams entered**: 55
- **Average exam value rating**: 4.62
- **Exams ordered rated: >= 7**: 25 (45%)
- **Exams ordered rated: 4, 5 and 6**: 0 (0%)
- **Exams ordered rated: < 3**: 30 (55%)
- **Reasons recorded for why lower rating value exams were ordered**
  - **Contractual**: 0 (0%)
  - **Patient Preference**: 0 (0%)
  - **Physician Preference**: 0 (0%)
  - **Unknown**: 0 (0%)
  - **Other**: 30 (100%)
- **Total**: 30 (100%)

### R-SCAN REPORT

**Baseline (%)**
- High value: 25
- Medium value: 0
- Low value: 30

**Post-Education (%)**
- High value: 15
- Medium value: 0
- Low value: 25

*Medium to lower value = ACR appropriateness criteria ratings 1-6*

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BASELINE DATA RESULTS

Total CTs for Pediatric Head Trauma During 6 months
N = 55

CTs Deemed Appropriate
Appropriateness criteria >=7
N = 25 (45%)

CTs Deemed Inappropriate
Appropriateness criteria <=3
N = 30 (55%)
PILOT PROJECT RESULTS

Evaluation of the baseline data demonstrated
- 45% cases showed appropriate imaging
- 55% cases showed inappropriate imaging

Team was concerned many CT scans ordered for
- ED pediatric patients were deemed inappropriate
- Did not meet the Clinical Observation / PECARN criteria
- To determine if imaging was indicated

Note, was retrospective chart review of baseline data
CONDUCT EDUCATIONAL ACTIVITIES

Propose & hold collaborative educational programs
- With ER and Radiology physicians and staff
- To guide improved image ordering

Plan to begin with overview of the pilot project
- Followed by discussion of cases and examples
  - Consisting of presentation of the study results
  - Presentation of the Choosing Wisely® campaign
  - Educational tools
CONDUCT EDUCATIONAL ACTIVITIES

 Obtain educational tools from R-SCAN site
  - For both the Emergency and Radiology Departments
    - Journal articles
    - Podcasts
    - ACR Appropriateness criteria
    - Patient educational materials
    - Instructional Videos
CONDUCT EDUCATIONAL ACTIVITIES

R-SCAN website

Journal Articles
CONDUCT EDUCATIONAL ACTIVITIES

Educational Materials

ACR Appropriateness Criteria®
FUTURE: ASSESS IMPROVEMENT

- After the educational program component
  - Collaborative Team will evaluate new set of data
  - Same number of cases from same Choosing Wisely Topic

- Compare appropriateness scores to baseline
  - Determine overall improvement in image ordering
  - Goal of inappropriate use of imaging tests decrease