PROCESS IMPROVEMENT: HOW CAN WE REDUCE RADIATION EXPOSURE TO THE FEMALE BREAST DURING ROUTINE CT EXAMINATIONS OF THE ABDOMEN AND PELVIS?

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PURPOSE

• To determine the number of examinations that included breast tissue on routine CT abdomen and pelvis examinations for quality improvement purposes.

• The scan range of a standard CT exam of the abdomen and pelvis extends from the dome of the diaphragm to below the ischial tuberosities.
  • However, this varies by technologist and the lower chest may be included in the examination.
  • This poses a problem, as glandular breast tissue is particularly sensitive to the effects of ionizing radiation.

• As proponents of ALARA, we must ensure the CT tomogram is used to reduce scanning coverage, thereby resulting in CT dose reduction, especially to the radiosensitive breast.
**PDSA CYCLE**

**PLAN**
- Determine the number of exams that include the breast tissue on routine CT abdomen and pelvis
- Devise inclusion and exclusion criteria

**DO**
- Retrospective review
- Images reviewed on PACS workstations
- Apply inclusion/exclusion criteria
- Data collection into spreadsheet

**STUDY**
- Determine number of exams that included the breast in FOV
- Exclude exams that could not avoid breast tissue
- Calculate number of exams by hospital site and shift

**METHODS**

**Inclusion Criteria**
- Female
- Age 12-50
- Routine CT exam of abdomen and pelvis
- Study between December 2017 – January 2018
- Re-study in September 2018 following intervention

**Retrospective review**
- PACS Search Filters
- Images reviewed on PACS workstations

**Data Collection**
- Exam date
- Patient age
- Breast in FOV?
- If yes, was it preventable?
- Hospital site
- Shift
- Accession number
- Indication
- DLP (mGy*cm)
RESULTS, PART 1

n = 100 exams

Hospital A
n = 52
- Day shift: 9 exams (34.6%)
- Evening shift: 11 exams (42.3%)
- Night shift: 6 exams (23.1%)

Breast in FOV:
- 26 exams (50%)

Hospital B
n = 48
- Day shift: 16 exams (41.0%)
- Evening shift: 17 exams (43.6%)
- Night shift: 6 exams (19.4%)

Breast in FOV:
- 39 exams (81.2%)

CAUSE-AND-EFFECT DIAGRAM

People
- Tech forgot
- Tech doesn’t know

Policies & Practice
- Standard CT protocol scan range
- Dose reduction policies
- Teaching environment
- Supervision policies
- Feedback policies

Materials & Technology
- Appropriateness of study
- Repeat studies performed

Workflow
- Tech busy
- Tech distracted

Breast in scanned FOV (increased CT dose)

Adapted from: Kruskal JB et al. Quality Improvement in Radiology: Basic Principles and Tools Required to Achieve Success.
TECHNOLOGIST EDUCATION: COLLIMATION EXAMPLES

<table>
<thead>
<tr>
<th>Collimation</th>
<th>Topogram</th>
<th>Coronal plane</th>
<th>Axial plane</th>
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<tbody>
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RESULTS, PART 2

- **n = 100 exams after intervention**
  - **Hospital A**
    - Day shift: 4 exams (28.6%)
    - Evening shift: 7 exams (50%)
    - Night shift: 3 exams (21.4%)
    - Breast in FOV: 14 exams (25.9%)
  - **Hospital B**
    - Day shift: 7 exams (21.9%)
    - Evening shift: 16 exams (50%)
    - Night shift: 9 exams (28.1%)
  - Breast in FOV: 32 exams (69.6%)
CONCLUSION

• From our preliminary data, CT technologists overnight did better at scan collimation than their counterparts during the day and evening shifts.

• Following technologist education, there was an overall decrease in cases including the breasts within the FOV at both hospitals.

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<th>Hospital A</th>
<th>Hospital B</th>
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<td>Prior to intervention</td>
<td>26 (50%)</td>
<td>39 (81.2%)</td>
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<tr>
<td>Following intervention</td>
<td>14 (25.9%)</td>
<td>32 (69.6%)</td>
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<td>% change</td>
<td>46.1%</td>
<td>17.9%</td>
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• In conclusion, the principles of ALARA, continuous QI, technologist education and routine surveillance can help to decrease radiation dose to the female breast.

REFERENCES


