Clinician’s Ability to Accurately Determine Patient Angulation in Portable Chest Radiography With a More Quantitative Marker

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Disclosures

• Les Folio
  • Research agreement: Philips Healthcare
  • Patents (no royalties since NIH and military owned):
    • “Radiographic marker that displays upright angle on portable x-rays.” US Patent 9,541,822 B2
    • Interactive enterprise imaging personal health record (patient portal). Provisional USPTO docket 10110-403PV1
  • Author royalties, Springer

• Andrew Yen, Jeffrey Cook, Julie An, Kurt Lee
  • Nothing to disclose
Background and Objectives

• Traditional method of describing patient positioning in portable chest x-rays (pCXR) relies on imprecise radiopaque markers such as the triple BBs and subjective “upright/supine” marker
  • Accurate knowledge of patient angulation is highly relevant in assessing findings such as cardiac size, atelectasis, and pleural effusion among others
  • Lack of consensus on subjective angle ranges may lead to confusion and inaccurate readings

What is the approximate angle here, described as “upright”? 
Background and Objectives

• Goals:
  • to assess estimations of patient angle with traditional markers
  • to evaluate potential improved accuracy pCXR readings using a more quantitative marker (the x-clometer, available on NIH 3D print exchange)
Background and Objectives
Materials and methods

• X-clometer used to obtain patient positioning in pCXR for one week. Images retrospectively reviewed to identify those with CT exams within 24h of chest radiograph.

• Survey including 5 such cases was administered to physician volunteers (radiologists and non-radiologists). The survey included 2 tasks:
  • Estimating patient angle with traditional markers alone
  • Identifying findings first without and then with x-clometer angulation reading

• Responses then compared to findings from each case’s corresponding CT report
Materials and methods – case example
Results

• Estimation of patients’ position based on BB makers and technician labels alone was highly inaccurate
  • Respondents estimates were accurate (within +/- 15 degrees of true angle per x-clometer) only 23% of the time.
  • In one case, an image labeled “upright” was most commonly estimated at 90° while in fact the true angle was ~50°
Results Contd.

• Before being given x-clometer readings (i.e. traditional markers only), respondents identified the correct findings 66% percent of the time.

• After being given the x-clometer readings, respondents identified correct findings 59% of the time.

• Among attending radiologists, the accuracies were 73% and 70% respectively.
Discussion

• Traditional labels were highly unreliable and in some cases misleading in conveying accurate information about patient position
  • Subjective markers clearly inadequate, and a more precise method of communicating patient angulation, such as the x-clometer, is needed

• Respondents, especially radiologists, were relatively successful at identifying findings even before given angle information
  • Results potentially limited by small size of study (respondents + cases)