Contents lists available at ScienceDirect

Respiratory Investigation

journal homepage: www.elsevier.com/locate/resinv

Original article

Appropriateness and clinical outcome of chest computed tomography without intravenous contrast: A study conducted in Pakistan

Amjad Sattar[a], *Sohail Ahmed Khan*[a], *Nauman Al-Qamari*[a], *Hatem Adel*[a,*], *Syed Omair Adil*[b], *Kashif Shafique*[c,d]

[a]*Dow Institute of Radiology, Dow University of Health Sciences, Karachi, Pakistan*
[b]*Department of Research, Dow University of Health Sciences, Karachi, Pakistan*
[c]*School of Public Health, Dow University of Health Sciences, Karachi, Pakistan*
[d]*Institute of Health and Wellbeing, Public Health, University of Glasgow, Glasgow, United Kingdom*

ARTICLE INFO

Article history:
Received 29 May 2017
Received in revised form
7 February 2018
Accepted 28 February 2018

Keywords:
ACR appropriateness criteria
CT chest without IV contrast
Clinical indications
Outcome

ABSTRACT

Background: Chest computed tomography (CT), including high-resolution CT (HRCT), has become an integral part of modern healthcare. It enables the physician to arrive at a diagnosis using a noninvasive approach. Our practice has shown that various chest CT scans without intravenous (IV) contrast, including HRCT, have no proper clinical indication. For the same reason, we have assessed the appropriateness of chest CT without IV contrast based on the evidence-based American College of Radiology (ACR) appropriateness criteria.

Methods: Chest CT scans without IV contrast were reviewed to evaluate if the examination was based upon the evidence-based ACR appropriateness criteria. All clinical indications, positive physical examination findings, laboratory test findings, and radiological records submitted at the time of chest CT were reviewed.

Results: Of 1205 CT scans, 538 (44.6%) were considered "inappropriate," 367 (30.4%) were considered "appropriate," and 300 (24.8%) were considered "may be appropriate." CT scans were performed on 241 (20.0%) patients with no clinical history, whereas 148 (12.3%) examinations in patients aged < 40 years were performed with no positive physical finding. Positive results that affected the management were 4.43 times more likely to be considered appropriate than inappropriate (adjusted odds ratio, 4.43; 95% confidence interval, 1.81–10.87).

Conclusions: This study showed a high percentage of chest CT scans without IV contrast examinations not meeting the ACR appropriateness criteria. Chest CT is a valuable tool for evaluation of chest diseases only in the presence of adequate detailed history and physical examination.

Abbreviations: CT, computed tomography; HRCT, high-resolution CT; IV, intravenous; ACR, American College of Radiology; MRI, magnetic resonance imaging; OR, odds ratio; CI, confidence interval; ILD, interstitial lung disease

*Correspondence to: Dow Institute of Radiology, Dow University of Health Sciences, Gulzar-e-Hijri, Ojha Campus, Suparco Road, KDA Scheme-33, Karachi, Pakistan. Fax: +92 21 99215763.
E-mail address: hatemadil89@gmail.com (H. Adel).

https://doi.org/10.1016/j.resinv.2018.02.005
2212-5345/

Please cite this article as: Sattar A, et al. Appropriateness and clinical outcome of chest computed tomography without intravenous contrast: A study conducted in Pakistan. Respiratory Investigation (2018), https://doi.org/10.1016/j.resinv.2018.02.005

1. Introduction

Computed tomography (CT) and magnetic resonance imaging (MRI) have become an integral component of modern healthcare as they facilitate diagnosis using a noninvasive approach and have remarkably improved disease outcomes as well. However, a heavy reliance on imaging is straining the healthcare budget and harming the healthcare system's sustainability [1]. The appropriateness of indications for these examinations is controversial. Many researchers have worked on this subject, and many guidelines and criteria have been published [2–4].

High-resolution computed tomography (HRCT) has revolutionized chest imaging by utilizing thin cuts and image reformatting to yield accurate results. Its role is well-established in the diagnosis of many pulmonary pathologies and in guiding management [5–8]. Indications for chest HRCT have been well established [6,9–12]. HRCT together with appropriate clinical history can result in a highly specific diagnosis [13].

In a developing country like Pakistan, chest diseases are significantly prevalent [14]. In particular, tuberculosis accounts for a major proportion of chest diseases in this cohort [15]. Our university hospital is located in one of the densely populated cities and has a specialized chest institute comprising of approximately 200 beds. This institute provides free treatment to all chest disease patients and was declared as the center of excellence for tuberculosis by the World Health Organization. However, subsidized charges for diagnostic studies are obtained from the patients. Undergoing a CT examination in a low-income country is a privilege, and health insurance is not covered by the government.

In this study, most of the general physicians and chest physicians recommend chest CT without IV contrast, more specifically plain chest HRCT to reach the early diagnosis based on disease suspicion without any preliminary chest X-ray or laboratory investigation. Moreover, many CT scans are prescribed without any clinical indications. Each clinical indication, when provided, is usually assessed by a radiologist. In cases when clinical indication is not provided or there is any ambiguity in the diagnostic investigation, clarity is established after taking the patient's detailed history and talking to a primary physician for patients admitted in our institute. However, it is difficult on cases coming from various parts of the city/country as it takes a lot of time to contact the primary care physician. The unnecessary use of chest CT without IV contrast and plain HRCT does not only increase the risk of exposure to high amounts of radiation but also creates a large financial burden on the patients of low- and middle-income countries. Studies have reported that most of the patients in a developing country belong to families with low socioeconomic status [16–18]. For the same reason, appropriate use of chest CT is highly recommended particularly in developing countries.

The American College of Radiology (ACR) appropriateness criteria are evidence-based guidelines that assist primary care physicians in determining the appropriate imaging technique for a specific clinical condition. Utilization of these guidelines can lead to effective use of radiology services and improve the quality of patient care. Therefore, this study aimed to assess the appropriateness and outcomes of chest CT examinations without IV contrast according to the ACR appropriateness criteria in a developing country.

2. Patients and methods

A retrospective review of medical records from January 1, 2015 to December 31, 2015 was carried out. The electronic medical records of patients who had undergone chest CT, chest CT without IV contrast, and plain chest CT were reviewed. The ACR appropriateness criteria [19–21] that included the radiological procedure “chest CT without IV contrast” was used to assess if each examination met the appropriateness criteria based upon the clinical indication provided by the primary care physician (Table 1). The radiology results were reviewed to identify potential clinical indications or presenting complaints of the patient. Any available clinical detail, positive physical examination finding, laboratory test finding, or the radiological record before the scan date was also reviewed. A senior radiologist applied the appropriateness criteria on the reviewed records within 1 year of 2015. Based on the available information, these records were categorized as appropriate, may be appropriate, and inappropriate according to the ACR appropriateness criteria.

After the initial analysis of clinical indications, the radiology reports and medical records related to that particular examination were reviewed and analyzed. The final diagnosis was noted from the radiology report or available medical record. Based on those diagnoses, the records were grouped into four categories: positive results that affected management (active infection, acute or chronic infection, bronchogenic carcinoma, chronic obstructive pulmonary disease with or without exacerbation, pulmonary metastasis, occupational lung disease, and foreign body), positive results that did not have role in management (changes of previously healed lung infection), positive findings that were unrelated to the clinical indications (incidental findings and cardiac- and vascular-related abnormalities), and negative findings (normal scans or nonspecific findings that did not fit into a single clinical spectrum such as calcified lymph nodes or calcified granulomas). This study was approved by an institutional review board (IRB-814/DUHS/Approval/2016/32; dated: January 21, 2017). The requirement for signed informed consent was waived as data were retrospectively collected from the electronic medical records.

For the purpose of statistical analysis, first, frequencies and percentages were calculated for the variables like gender, clinical indications, outcome, and ACR appropriateness. Chi-square test was applied to determine the differences in the outcomes of the examinations (positive and affected management, positive and did not affect management, positive and unrelated to management, and negative) with its corresponding appropriateness levels (appropriate/may be appropriate/inappropriate). Second, a multinomial logistic regression was applied to estimate the odds ratio (OR) and two-tailed 95% confidence interval (CI). Inappropriate level was taken as a reference category.

Please cite this article as: Sattar A, et al. Appropriateness and clinical outcome of chest computed tomography without intravenous contrast: A study conducted in Pakistan. Respiratory Investigation (2018), https://doi.org/10.1016/j.resinv.2018.02.005