Chest Radiography for Children with Pneumonia: A Century of Folly?

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When Roentgen reported his discovery of a new form of radiation in 1895(1), the excitement was immediate, and a radiology handbook was published within a year(2). Screening of apparently healthy people was being recommended by 1928(3), and the US Army and Navy screened approximately 10 million personnel during World War II(4). In 1980 alone an estimated 30 million routine admission chest x-rays were taken in the United States, costing consumers $1.5 billion(5). The development of the scientific basis for the use of chest radiography has however received little attention. Recognition of inter-observer variation took almost 50 years(6), and widespread acceptance even longer(7). In the centennial of Roentgen's discovery, a prestigious radiological journal published a paper stating that, "As the most common radiographic examination, the chest radiographic examination rose to this position not on the basis of medical science but faith that technology in any form would aid in the care of patients"(8).

The use of chest radiography in the initial assessment of acute lower respiratory infection rests on the assumptions that; (*i*) clinical assessment plus radiography results in a more accurate diagnosis than clinical assessment alone; (*ii*) this leads to changes in clinical management; and (*iii*) the changes benefit the patient. Any such benefits must be weighed against the costs and potential adverse effects of the procedure, which include the effects of false positive and false negative findings, and exposure to ionising radiation. Costs of radiography include the cost of the radiograph itself and the time spent waiting for radiography and to be seen again by a clinician. If travel to another facility for radiography is necessary, the cost is further increased. The resource implications are perhaps most acute in middle income countries, where chest radiography is potentially affordable but with many priorities competing for resources. In this situation it is particularly important to know whether chest radiography has clinical benefit and, if so, by how much and at what cost.

The diagnostic accuracy of chest radiography is difficult to study because of the lack of a credible reference standard for pneumonia (other than biopsy or autopsy). When microbiological findings have been used as reference standards for the etiology of pneumonia, chest radiography has been found to be of little use in distinguishing bacterial from viral pneumonia in both adults(9) and children(10,11). The poor agreement between different observers assessing the same films, or even when later assessing the same films themselves(12,13), casts further doubt on diagnostic accuracy, although training has been found to increase the agreement from "poor" to "moderate"(14).

There is little evidence to support a beneficial impact of a radiograph when used to follow up radiological pneumonia(15), or in screening for tuberculosis children with clinical pneumonia in a high prevalence population(16). In this issue of *Indian Pediatrics*, Bharti, *et al*.(17) suggest that chest radiography also has limited value in predicting clinical improvement in children hospitalized with severe pneumonia.

The most direct way to assess clinical benefit is to compare the effect on clinical outcome of management using a chest radiograph with that without its use, by means of a randomized controlled trial. A recent careful search has identified two such

trials(18). One was performed in adults presenting for the first time to a US emergency room or walk-in clinic with a cough for less than one month(19), and the other in ambulatory children presenting to a primary-level outpatient department in a South African children's hospital(20). Neither found clinical benefit, despite higher antibiotic use in the radiograph group in the study of children.

Given the poor observer agreement, the lack of benefit in less severely affected children, and the potential harms and costs of the procedure, carefully planned randomized controlled trials in more severely affected children with pneumonia appear to be ethically justified, if not mandated.

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