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Review article

Should the lateral chest radiograph be routinely performed?

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ABSTRACT

Background: The chest x-ray is one of the most common plain film radiographic examinations performed. Inclusion of the lateral chest radiograph varies internationally and nationally across radiology departments and states in Australia.
Search strategy: A search strategy of the databases Cochrane Library, Ovid Medline/Medline, PubMed, Scopus and Science Direct was conducted. The results were restricted to those published between 1985 and 2013 and those published in English. The following search terms were used: 'lateral chest', 'radiograph', 'digital radiography', 'chest x-ray', 'plain film radiography', 'ionising radiation'. The results were restricted to publications with these terms in the title, abstract and/or keywords.
Main findings: There are few national or international guidelines pertaining to the inclusion of the lateral chest x-ray as routine. Primary concerns are the increased radiation dose associated with the additional chest view and reduction of medical imaging services cost. Modern digital imaging systems result in a lower radiation dose. The diagnostic yield of the lateral chest x-ray is highly dependent on the clinical indications of the patient. Further research into the routine inclusion of the lateral chest x-ray is recommended.
Conclusion: Review of the literature suggests that the lateral chest radiograph should not be performed routinely unless clinically indicated.

Introduction

The chest x-ray is the most common radiographic procedure performed in adult and paediatric patients.[1,2] Routine chest examinations are often confined to frontal (antero-posterior or postero-anterior) views with the lateral rarely requested during follow-up examinations.[3] The decline of the view has been attributed to the risks linked to radiation exposure and attempts to reduce the costs of medical imaging services.[3]

Recently computed tomography has replaced plain film chest radiography as the gold standard imaging test for some conditions.[3] Computed tomography has a higher sensitivity and specificity than plain film chest radiography in the detection of lung cancers, particularly in the early stage of the disease.[4] Consequently the lateral chest radiograph has been less thoroughly reviewed by radiographers, radiologists and other clinicians[3] This has resulted in a decrease in the diagnostic yield of plain film chest x-rays.[3] It is evident in research that some clinical indications benefit from a lateral view, while for others it is unnecessary, costly and time consuming.

The experience of undergraduate Medical Imaging and Radiation Science students on clinical placement in the state of Victoria, Australia suggests that there is variation in the application of the lateral chest x-ray in radiology departments. This may be due to a lack of clear guidelines available to medical imaging technologists and radiologists.

This literature review aims to answer the following questions; is it preferable to take advantage of the dose reduction provided by digital imaging systems and routinely acquire both views? Conversely, should the lateral view be treated as a supplementary projection depending on the clinical indications?

Risks and benefits of ionising radiation in medical imaging

A constant concern in medical imaging is the risks associated with the use of ionising radiation. Herrmann, Fauber, Gill, Hoffmann, Orth, Peterson et al. (2012)[5] state in an article that the amount of diagnostic radiation that Americans have been exposed to has increased six-fold since the 1980s. This increase in radiation dose has been attributed to the use of computed tomography (CT) and it is suggested that there is a possible link between CT and childhood cancers.[5] Lin (2010)[6] states that there is evidence of

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radiation induced effects above 100 mSv. However there is doubt as to the effects within the 10 mSv–100 mSv range in which many CT examinations fall.[6] Hermann et al. (2012) encourage adherence to the ALARA principle and for radiographers to avoid dose creep.[5]

A report from the United Nations in 2010[7] highlights the possible effects of radiation exposure and gaps in knowledge. Non-cancer diseases may occur at low doses, and this is still an area of active research.[7] Examples of these diseases include cataract formation and cardiovascular disease.[7] Due to the long delay between radiation exposure and presentation of disease and the high spontaneous occurrence of these, it is difficult to attribute specific cases to radiation exposure.[7]

It may also be difficult to determine the doses patients receive from examinations. According to Bond (1999),[8] there is great variation in the radiation dose given to patients receiving chest x-rays. Gaber, McGavin and Wells (2005)[1] state that the effective dose of a lateral chest x-ray is 0.05 mSv. However Feigin (2010)[3] states that CT examinations are associated with a significantly higher radiation dose than plain film radiography. Osei and Darko (2013)[9] state that the mean effective dose of the lateral chest x-ray and an adult chest CT are 0.11 mSv and 7.9 mSv respectively. For this reason Feigin suggests that the lateral view be considered after review of the frontal chest radiograph.[3]

Children are more sensitive to the risks of ionising radiation in comparison to adults since the probability of inducing malignancy is highest in the paediatric age range (0.6–15.6 years).[10] Willis and Slovis (2005)[11] argue that children receiving plain film radiographs are at greater risk of developing leukaemia and breast cancer and the approach should be that no level of radiation is without consequence. Similarly, women under 35 may develop breast cancer from medical radiation.[11,12] According to Mettler et al. (2008) The postero-anterior and lateral chest views have a combined average effective dose of 0.1 mSv, while the posteroanterior view alone has a dose of 0.02 mSv indicating that the lateral view contributes approximately four times the dose of the frontal view.[13] This dose is still a concern for prepubescent girls and Bossart et al. (1997)[12] recommend that the lateral chest view be eliminated for young women unless there are strong clinical indications for nodules.

The routine lateral chest view may be associated with a higher repeat rate than the frontal view. A study by Foos, Sehnert, Reiner, Siegel, Segal and Waldman (2009)[14] found a link between examinations with relatively long exposure times and an increased repeat rate. The authors used the lateral chest radiograph as an example of this.[14]

The diagnostic yield of the lateral chest radiograph

A reduction in the use of the lateral chest radiograph has raised some doubt to the diagnostic yield of the lateral chest view. Some journal authors claim that the view provides additional diagnostic information to the frontal view and may in some cases eliminate the need for a CT examination.[3,15] Raoof, Feigin, Sung, Raoof, Irugulpati and Rosenow (2012)[16] state that chest radiographs provide a diagnosis of the patient's condition in 46% of cases. Raoof et al. (2012)[16] also claim that the dose effects of CT examinations will not be fully understood for some time yet.

Similarly, Robinson (1998)[15] considers orthogonal views to be important in chest imaging. Feigin (2010)[3] claims that many abnormalities are shaped and located in a manner that is more prominent on the lateral view and that interpretation of the film should not take longer than the frontal view. Goodman (1999)[17] claims that the lateral view is useful in localising structures in the mediastinum and visualising the retrosternal space. Additionally the author states that the lateral view is more sensitive in the detection of small fluid levels than the frontal view.[17]

There are mixed opinions of the use of the lateral view in the diagnosis of pneumonia. Rigsby, Strife, Johnson, Atherton, Pommersheim and Kotagal (2004)[2] state that inclusion of the view increases the sensitivity and specificity of a chest examination by up to 6% and 2% respectively (from 85% and 98% respectively for the frontal view). The lateral view is not needed for confluent lobar pneumonia but is required for paediatric, nonconfluent types.[2] Manson (2003) suggests that in paediatric patients this view can provide additional information besides pneumonia.[18] A study by Ojutiku, Haramati, Rakoff and Sprayregen (2005)[19] found that pneumonia, when present, was seen on the PA view only in 22% of cases, the lateral view only in 20% of cases and both views in 57% of cases. This evidence suggests that the lateral view can improve the diagnosis of pneumonia.

While computed tomography is ideal for demonstrating free intraperitoneal air, it is not always practical or cost effective. Woodring and Heiser (1995)[20] found that the inclusion of the lateral chest x-ray in the diagnosis of pneumoperitoneum significantly increased the sensitivity of the test. The results of the study found that the lateral view demonstrated free air in 98% of cases while the PA view showed free air in 80% of the cases. In 20% of cases only the lateral view showed pneumoperitoneum.[20] According to Markowitz and Ziter (1986),[21] pneumoperitoneum may present atypically, with free air trapped anterior to the stomach and liver and not beneath the domes of the diaphragm. In these instances the free air will only be seen in the lateral view, whereas the air will be projected over the upper abdomen in the postero-anterior view.[21]

Brenden, Wallis, Owens, Ridout and Dinwiddie (2005)[10] describe a test called the modified Chrispin Norman scoring system which can be used to stage the severity of cystic fibrosis. The original scoring system required both a frontal and lateral view of the chest, which were then analysed for cystic fibrosis markers. The authors claim that the reliability of the modified test can negate the need for a lateral chest projection.[10]

Lynch, Gouin, Larson and Patenaude (2003)[22] state that in paediatric patients forty additional lateral chest x-rays are required for one extra case of pneumonia to be diagnosed. In 2004, a study by the same authors determined that the view did not improve the sensitivity or specificity of pneumonia diagnoses in children, or affect the management of the condition.[23] In addition, the lateral chest radiograph is associated with an increased radiation dose, increased expense, longer examination time and possibly a higher repeat rate.[23]

A study by Bossart, Brunsdale, Hughes, Manster, Doyle, Murray et al. (1997)[12] found that in only 0.9% of cases involved in the study would a diagnosis be missed as a result of omitting the lateral chest view. Additionally, 97% of pneumothoraces could have been diagnosed with a frontal view alone. Bossart et al. (1997)[12] posit that the lateral chest view, like the lordotic and oblique views, should not be considered routine. A more recent study of the diagnostic yield of the lateral view for pneumothoraces would be beneficial.

There is evidence that the diagnostic yield of the view is not sufficient to warrant its inclusion in the routine chest examination.

The clinical indications for a lateral chest radiograph

Several authors have described conditions in which diagnosis is aided or unaffected by the lateral chest view.

Sonnex and Coulden (2010)[24] state that plain chest radiographs provide a two-dimensional view of three-dimensional objects. When the position of a ventricular lead tip of a dual chamber permanent pacemaker needs to be identified, an additional lateral