The importance and ways of exploring the entire chest before and after cardiac surgery: Chest radiography, lung ultrasonography, and computed tomography

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Evaluation of the lungs and the entire chest is of crucial importance before and after cardiac surgery, particularly in terms of pulmonary diseases; relationships of the heart, aorta, and great vessels with other organs; and the extent and degree of calcifications.¹ In this issue of the *Journal*, den Harder and colleagues¹ evaluate the frequency of abnormalities on preoperative chest radiographs before cardiac surgery and explore their clinical implications. They demonstrate how chest radiography (CXR) usually does not affect the surgical planning; in some cases, however, abnormal findings may have important clinical consequences.

CXR is widely used for broad and fast evaluation of chest diseases, and it is routinely performed as the first imaging technique before and after cardiac surgery.^{1,2} Alternatives to CXR are gaining consensus, however, in both the preoperative and postoperative settings. Preoperatively, it has been suggested that CXR may be replaced by low-radiation dose computed tomography (CT).^{3,4} CT is the criterion standard for chest imaging; it allows accurate evaluation and quantification of calcifications and provides a 3-dimensional reconstruction of the heart, the great vessels, and their relationship in the chest.^{3,4} CT is expensive, however, and it carries risks related to transportation of patients in critical condition to the radiology department² and radiation exposure (particularly in children).² It has been proved for reoperative surgery that CT use for surgical planning may reduce intensive care unit stays, blood transfusions, and perioperative myocardial infarction.³ Whether CT should be limited to difficult cases or extended to all adult patients undergoing cardiac surgery, however,^{1,3,4} remains controversial.

In the postoperative period, CXR is routinely performed to evaluate drainage and catheter position and to monitor pulmonary complications. The excessive repetition of CXR examinations, however, has been criticized.^{1,2} In

Flow chart on use of chest radiography, CT, and chest ultrasonography in cardiac surgery.

Central Message

Chest radiography is a fundamental tool in cardiac surgery, but it may be replaced by CT preoperatively, at least in selected cases, and by LUS to monitor common postoperative pulmonary complications.

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this setting, the potential role of lung ultrasonography (LUS) merits attention. LUS is gaining consensus as an easy, accurate, fast, cheap, and radiation-free tool for the diagnosis of pulmonary diseases in acute settings.² LUS has proved its accuracy in diagnosis of all common pulmonary postoperative complications, including pleural effusion, atelectasis, pneumothorax, and pneumonia.² Relative to CXR, LUS has the capacity for differential diagnosis among these complications (eg, pleural effusion vs atelectasis or consolidation).¹ Furthermore, LUS has shown superior sensitivity and similar specificity to CXR for the detection of pneumothorax,⁵ and it was found to be superior to both CXR and CT in the classification of pneumothorax size.⁵ The use of LUS for the evaluation of lung water content has been extensively studied in adults with heart failure.^{6,7} Its application in cardiac surgery may help to modulate diuretic therapy and also provide prognostic information,^{8,9} although evidence remains limited. Chest ultrasonography (eg, the evaluation of the entire chest as well as the lungs) furthermore allows exploration of the retrosternal area, a zone often difficult to image with conventional echocardiography and one where postsurgical clots (even compressing the heart) may be detached.^{10,11}

In summary, CXR continues to hold a great diagnostic utility in cardiac surgery; however, low-radiation dose CT

FIGURE 1. A proposed flow chart for the potential use of chest radiography (*Chest-X-Ray*), computed tomography (*CT*), and chest ultrasonography before (A) and after (B) cardiac surgery.

scan (preoperatively) and chest ultrasonography (postoperatively) are valid complementary or alternative examinations (Figure 1).

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