Routine Chest Radiographs after Uncomplicated Thoracentesis

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The "Things We Do for No Reason" series reviews practices which have become common parts of hospital care, but which may provide little value to our patients. Practices reviewed in the TWDFNR series do not represent "black and white" conclusions or clinical practice standards, but are meant as a starting place for research and active discussions among hospitalists and patients. We invite you to be part of that discussion.

Bedside thoracentesis can cause serious complications, such as pneumothorax, re-expansion pulmonary edema, or hemorrhage. These rare complications have led many hospitalists to routinely order chest radiographs (CXRs) following thoracentesis. However, post-thoracentesis CXRs are usually not indicated and can lead to unnecessary radiation exposure and expense. Rather than obtaining routine CXRs, hospitalists should use postprocedural signs and symptoms to identify the occasional patients who require imaging. A risk-stratified approach is a safe and cost-effective way to avoid unnecessary radiographs.

CASE REPORT

A 52-year-old man with decompensated liver disease and hepatic hydrothorax is hospitalized for increasing dyspnea caused by a recurrent pleural effusion. Diuretics do not improve his dyspnea, and his hospitalist recommends a therapeutic thoracentesis for symptom relief. The patient does not have any significant procedural risk factors: He does not have preexisting pulmonary or pleural disease, his platelet count is 105,000 $\times$ $10^3/\mu l$, and his international normalized ratio is 1.3. Bedside sonography demonstrates a large, free-flowing, right-sided pleural effusion. The hospitalist performs an uncomplicated ultrasound-guided removal of 1.5 L of straw-colored fluid with a catheter-over-needle kit. The patient does not have any pain or increased shortness of breath during or after the procedure. The hospitalist reflexively orders a routine chest radiograph to assess for pneumothorax.

WHY YOU MIGHT THINK A CHEST RADIOGRAPH IS HELPFUL AFTER THORACENTESIS

Pleural effusions are newly diagnosed in more than 1.5 million Americans annually,[1] and hospitalists frequently care for patients requiring thoracentesis. Internal medicine residents traditionally learn to perform this procedure during residency, and thoracentesis remains a common task for both residents and hospitalists.[2] Patients typically tolerate thoracentesis well, but they can develop serious complications such as pneumothorax, re-expansion pulmonary edema, or hemothorax. Before the advent of bedside ultrasound, these complications occurred relatively commonly; a 2010 systematic review, for example, found that the rate of pneumothorax from thoracentesis performed without ultrasound was 9.3%.[3] Other studies have identified even higher rates of complications, including two case series in which investigators found a 14% rate of major complications[4] and a pneumothorax rate of nearly 30%.[5] Postprocedure radiographs became common practice because of the high rate of complications, and this practice has persisted for many practitioners despite the substantial safety improvements introduced by bedside ultrasonography.[6]

Hospitalists might think routine CXRs are helpful after ultrasound-guided thoracentesis for additional reasons. First, modern guidelines reflecting the low risk of complications after ultrasound-guided procedures have not been released by United States pulmonary medicine societies, and some clinicians may continue to follow practices acquired during the era of unguided thoracentesis. Second, performing postprocedure imaging has become ingrained as a standard part of some institutional procedure checklists[6] and some prominent textbooks continue to recommend the practice.[7] For some hospitalists, this testing reflex may be reinforced by other common procedures, such as placing a nasogastric tube or a central venous catheter, for which a postprocedure CXR is standard practice. Thus, ordering postprocedure imaging can become internalized as the safe, checklist-based final step of a procedure. Third, hospitalists may order a postprocedure CXR for reasons other than detecting procedural complications. The pleural effusion might be thought to obscure a parenchymal or endobronchial lesion for which a postprocedure CXR may reveal an important finding. Finally, a CXR also may also satisfy the clinician's curiosity regarding the completeness of drainage.

WHY A ROUTINE POSTPROCEDURE CHEST RADIOGRAPH IS NOT HELPFUL AFTER THORACENTESIS

A routine post-thoracentesis CXR is not necessary for three reasons. First, the use of ultrasound marking or guidance has substantially improved site selection and reduced the rate of complications for experienced operators. For example, a 2010 systematic review found an overall rate of pneumothorax of 4% for ultrasound-guided procedures performed between 1986 and 2006,[3] whereas more recently published data suggest the

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current rate of pneumothorax is closer to 1% when ultrasound marking or guidance is used.[8,9] One study of 462 consecutive patients with malignant pleural effusions, for example, showed that the rate of pneumothorax with ultrasound-guided needle-over-catheter thoracentesis was 0.97% (3/310 patients), compared with a rate of 8.89% (12/135 patients) when the procedure was performed without ultrasound.[9] Another prospective, randomized study of 160 patients with various causes of pleural effusion showed that the rate of pneumothorax with ultrasound-marked thoracentesis was 1.25% (1/80 patients), compared with 12.5% (10/80 patients) for procedures performed without ultrasound.[8] Hospitalists who competently use ultrasound guidance should act on modern estimates of complications and may also choose to incorporate postprocedure ultrasound into their practice. Indeed, the Society of Hospital Medicine recommends against routine chest radiography in asymptomatic patients when sliding lung is visualized on postprocedure ultrasound.[10]

Second, procedural factors and postprocedural symptoms (new chest pain, dyspnea, or persistent cough) reliably identify patients with high risk of clinically meaningful complications. On one hand, only 1%-2% of asymptomatic patients have a postprocedure pneumothorax, and clinical monitoring does not lead to chest tube placement in almost all of these cases.[11] On the other hand, 67%-72% of symptomatic patients are found to have complications.[12] Doyle et al[13] showed that the use of symptoms and procedure-specific factors (such as the aspiration of air, difficult procedure, multiple needle passes, or high operator suspicion of pneumothorax) could obviate the need for routine CXRs in approximately 60% of their procedures without any serious consequences.

Third, postprocedural CXRs very rarely reveal new or unexpected findings. For example, in one series,[12] only 3.8% of postdrainage radiographs uncovered new findings, none of which clarified the underlying diagnosis or changed management. To assess the utility of an initial thoracentesis and decide about repeat procedures, begin by asking the patient about symptoms and perform a physical exam.

WHY POSTPROCEDURAL CHEST RADIOGRAPHS MIGHT BE HELPFUL IN CERTAIN CIRCUMSTANCES

CXRs might be helpful in certain scenarios, even when a complication is not suspected. For example, a postprocedure CXR to detect nonexpandable lung or evaluate the rate of recurrence may guide definitive management of patients with recurrent or malignant pleural effusion. Determining completeness of drainage may also assist with planning for palliative measures such as pleurodesis or indwelling pleural catheter placement. A postprocedure CXR is also helpful in patients with a technically difficult procedure or in those with symptoms during or immediately after the procedure. This recommendation is consistent with the 2010 British Thoracic Society guidelines, which recommend CXRs for procedures where air was withdrawn, the procedure was difficult, multiple needle passes were required, or the patient became symptomatic.[14] The Society of Hospital Medicine's recent Position Statement concurs with these guidelines and recommends against routine chest radiography in asymptomatic patients when sliding lung is visualized by postprocedure ultrasound.[10]

WHAT YOU SHOULD DO INSTEAD

Hospitalists should not routinely obtain post-thoracentesis CXRs in asymptomatic patients. Clinical monitoring with subsequent symptom-guided evaluation lowers costs, avoids unnecessary radiation exposure, and has been shown to be successful in a large case series of more than 9,300 patients.[15] Some coughing should be expected with all large-volume thoracenteses as a normal response to re-expansion of atelectatic lung. The coughing should not persist past the immediate postprocedure period. If symptoms arise or if a complication is expected, the test of choice is either CXR or, if the hospitalist is a competent sonographer, bedside sonography. Bedside sonography is a low-cost, noninvasive method and has been well studied in the diagnosis of post-thoracentesis pneumothorax.[16] CXRs may still be needed to confirm findings by sonography, to investigate postprocedural symptoms in those with pleural adhesions or other lung/pleural diseases (because ultrasonography is less reliable in these patients), or if reexpansion pulmonary edema or other complications are suspected. A robust quality improvement strategy to reduce unnecessary post-thoracentesis CXRs could result in cost savings and spare patients from radiation exposure, because a recent study of almost 1,000 thoracenteses performed at an academic medical center demonstrated that internal medicine residents, pulmonologists, and interventional radiologists order a CXR following 95% of thoracenteses.[17] For a hypothetical hospital that orders 100 unnecessary post-thoracentesis CXRs annually, hospitalists could avoid approximately $7,000 in wasted expense per year.[18]

RECOMMENDATIONS

- Do not routinely order post-thoracentesis CXRs.
- Order a post-thoracentesis CXR if (1) the patient had new chest pain, dyspnea, or persistent cough during or after the procedure; (2) procedural features suggest increased risk of a complication (multiple needle passes, aspiration of air, difficulty obtaining fluid); or (3) a definitive palliative procedure will be arranged based on lung expansion.
- If qualified, use bedside sonography as a first step in the diagnosis of pneumothorax, reserving CXRs for those patients in whom accurate sonography is not possible, an alternative diagnosis is suspected, or when sonography findings are equivocal.

CONCLUSION

Following the uncomplicated thoracentesis, the hospitalist reconsidered the initial decision to order a CXR and rapidly assessed the patient's risk of complications. Because the procedure required only one needle pass, air was not aspirated, and the patient did not experience prolonged coughing or pain, the CXR order was canceled. The patient recovered uneventfully and was spared the cost and radiation associated with the proposed CXR.

Do you think this is a low-value practice? Is this truly a "Thing We Do for No Reason?" Share what you do in your practice and join in the conversation online by retweeting it on Twitter (#TWDFNR) and liking it on Facebook. We invite you to propose ideas for other "Things We Do for No Reason" topics by emailing TWDFNR@hospitalmedicine.org.

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