The Benefit of Lateral Radiographs in an Intensive Care Unit

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The portable anteroposterior (AP) radiograph (CXR) is an essential component of clinical management in the intensive care unit (ICU). In view of the immobility of patients, and overlying tubes, wires, and catheters, lateral (LAT) CXRs are infrequently ordered. We constructed a portable acrylic (Plexiglas) CXR cassette holder and were able to obtain reproducible quality LAT CXRs in the ICU. Of the 72 simultaneously obtained AP and LAT CXRs, 60 were technically acceptable for interpretation. We found an 11 percent incidence of either unexpected conditions or we were able to improve on the AP CXR interpretation. LAT CXRs should be obtained routinely in the ICU in select patients.

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Within the intensive care unit (ICU), the anteroposterior (AP) radiograph (CXR) is one of the most important diagnostic tools for the management of chest disorders. The technical quality of these CXRs varies, however, due to the restricted position of the patient, overlying tubes, wires, and catheters, the presence of other monitoring paraphernalia, and the difficulty in obtaining consistent film density. Accordingly, the value of the lateral (LAT) CXR in the ICU setting has not been meaningfully studied probably due to even greater technical difficulties in obtaining acceptable images. Indeed, we could find only two studies in the literature in which routine LAT CXRs were performed in either debilitated patients or children with an acute pulmonary illness.

In both reports, the LAT CXRs were taken in the radiology department where significant findings were found under specific clinical situations. This study, therefore, describes our experience in designing a cassette holder for LAT CXRs and whether our diagnostic and management capabilities were enhanced.

METHODS

Over a 4-month period (February 1, 1992 to May 30, 1992), we prospectively obtained 72 AP and LAT CXRs on 54 patients, aged 17 to 92 years (mean, 63 years). We utilized our medical ICU composed of ten beds.

Patient demographics for these CXRs can be found in Table 1 and included eight patients with chronic obstructive pulmonary disease, nine with pneumonia, ten with congestive heart failure, six in shock, nine postoperative, and three miscellaneous patients, which included drug overdose, pancreatitis, and trauma, with the adult respiratory distress syndrome.

The methods utilized to obtain the AP CXR were standard in the ICU routine. With the patient lying in the supine position, the radiograph would be taken from a distance of 60 cm using 90 kV. LAT CXRs were also taken from a distance of 60 cm using the same x-ray kV. The LAT CXRs were taken on the left (32) or right (40) side depending on the location of the area of disease.

Over a period of 7 months, we developed a cassette holder device that is acrylic (Plexiglas), portable, and lightweight. It is composed of a flat end (Fig 1, label A) that slides under the back of the patient and a perpendicular end (label B) that supports the upright cassette film extending along the chest wall. With the patient in the supine posture, the arms are extended and supported 90° from the side. If the patient is strong enough, and mobility of intravenous lines and wires permitted, the arms were extended over the head.

The development of the portable LAT CXR cassette holder allowed us not only to obtain the radiographs in a more utilitarian fashion, but also allowed standardized quality imaging. All radiographs were submitted the same day to the radiology department for interpretation by one of five radiologists. Feedback from the radiologist of the radiographic findings occurred in the usual fashion. At the end of the study, all radiographs were separately reviewed by a pulmonologist (B.D.B.) and a radiologist (A.C.C.). The AP radiographs were initially reviewed, and then the LAT radiographs. All interpretations were then correlated with the earlier independent readings.

RESULTS

Of the 72 simultaneously obtained AP and LAT CXRs, 60 LAT CXRs were technically acceptable for interpretation. Since portable radiographs are not phototimed, varying densities in 12 radiographs resulted.

On eight occasions (13 percent), the technically

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Lateral Roentgenograms in the ICU (Brandstetter et al)
below the nasogastric tube within the esophagus (respectively).

We were also able to determine on two patients that the presence of a unilateral haze and a bilateral haze as seen on an AP radiograph were, in fact, pleural effusions as determined by a LAT CXR.

A patient who had been seen in the ICU was admitted with severe abdominal pain. The AP radiograph of the chest demonstrated what appeared to be a large unusual-shaped gastric bubble. However, a LAT CXR was obtained that demonstrated that in fact, free air was under the left diaphragm indicating a ruptured viscus.

On two other separate occasions, retrocardiac densities were suspected as noted on AP CXR. On obtaining the LAT CXRs, infiltrates and atelectasis were found, dictating a change in clinical management.

A patient who was suspected of aspirating nasogastric tube feedings required an AP radiograph to determine the position of the tube. On the AP view, no abnormality was noted; however, on obtaining the LAT CXR, we were able to demonstrate a critical bend in the nasogastric tube within the stomach that was not apparent on the AP radiograph.

**DISCUSSION**

The portable CXR is an essential component of clinical patient treatment in the ICU. Anteroposterior images have been the exclusive portable technique utilized. The routine use of such CXRs has led to improved diagnostic interpretations over the years. In addition, unexpected cardiopulmonary abnormalities have been detected frequently, and malposition or complications of intravascular devices and endotracheal thoracostomy or nasogastric tubes have also commonly been found.

We believe that our preliminary study demonstrates the importance of the LAT CXR in select patients and/or under certain circumstances (Table 2). Although our 13 percent incidence of LAT CXR findings is lower than the 35 percent incidence of AP CXR abnormalities as reported by Bekemeyer et al, we believe that this procedure is indicated for the same reasons as reported for noncritically ill patients. Certainly the value of the LAT CXR has been shown in children with acute pulmonary illness.

Within the ICU, atelectasis is probably the most common cause of lung opacification on CXR. The left lower lobe may be involved more than 60 percent of the time. In two of our patients, a LAT CXR confirmed the presence of a left lower lobe consolidative process suggested by AP CXR. In view of the fact that a significant portion of the lower lobes lie below the diaphragmatic domes, it seems that a LAT CXR is reasonable when a disorder is suspected, in particular since computed tomography has been recommended in ICU patients for such conditions.

Our study demonstrates that a LAT CXR will localize the position of the distal tip of the SGC as previously reported. On both AP CXRs, it was not possible to determine whether the SGC tip was in West zone 3. In one of our patients, repositioning the SGC resulted in a change in the location of the catheter from a zone 2 to the appropriate zone 3 position.

In the ICU, the CXR should be monitored for the accumulation of fluid. A previous study has demonstrated the value of a supine cross-table LAT CXR for the detection of pericardial effusions in suspected patients, but these views were taken outside of an ICU setting. In our study, on two occasions a uniform haze either unilaterally or bilaterally was noted, with the LAT radiographs definitely demonstrating the effusions.

Clinical assessment of nasogastric tube position is usually inadequate and a radiograph is necessary for this purpose. The most frequent misplacements are incomplete insertion and tube coiling within the esophagus. Anteroposterior CXRs have been used almost exclusively to confirm the location of such feeding tubes. We detected, however, on LAT CXR a malpositioned bent nasogastric feeding tube in the stomach not detected on

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<th>Table 1 — Patient Demographics*</th>
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<td><strong>Age, yr</strong></td>
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<td>Male</td>
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*Miscellaneous = drug overdose, asthma, pancreatitis, trauma, ARDS. CHF = congestive heart failure.

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<th>Table 2 — Value of Lateral Radiograph*</th>
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<td><strong>Reason for AP CXR</strong></td>
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<tr>
<td>(2) Position of SGC</td>
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<tr>
<td>(2) Retrocardiac density</td>
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<tr>
<td>bilateral haze/unilateral haze</td>
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<tr>
<td>Position of N/G tube in stomach</td>
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<td>Possible free air under diaphragm</td>
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*N/G = nasogastric tube; SGC = Swan-Ganz catheter; LLL = left lower lobe; AP = anteroposterior; LAT = lateral.
the AP radiograph. Seven other feeding tubes were assessed during the study by LAT CXR and all were of normal contour, without bends or disfigurement.

The final value demonstrated the worth of the LAT CXR in the ICU, was the detection of free air in the abdomen. As part of our study, the LAT CXR disclosed air under the anterior abdominal wall not demonstrated on the AP radiograph.

We believe it is possible that the LAT CXR can demonstrate other unexpected cardiopulmonary disorders that are suggested by or escape the AP CXR in the ICU. Pneumothorax and lung abscess may be easier to detect with a LAT CXR in an immobilized supine patient within the ICU. Furthermore, the route of catheters, wires, and tubes may be better defined when a LAT CXR is added to the routine AP radiograph.7

In conclusion, we believe that there is a role for the routine use of LAT CXRs in the ICU, in selected patients. Patients should not have to be transported out of the ICU for more sophisticated studies of the thorax when a LAT CXR may suffice.36 Although perfecting a method to obtain quality, reproducible LAT CXRs may be difficult, it can and should be done by the radiology departments. The cooperation of all of the integral health team members should be obtained as only in this fashion can the ICU patient have the maximal investigational benefit of portable chest radiography.

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