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# Chest Radiographs in Surgical Intensive Care Patients: A Valuable "Routine"

H. Mathilda Horst, MD,\* Brian Fagan, MD,\* and Gordon H. Beute, MD†

*A total of 411 "routine" chest films were evaluated to determine their clinical value for surgical intensive care unit patients. There were 138 unexpected findings on 112 chest radiographs. These unexpected findings were equally divided between pulmonary problems (72) and device malposition (66). Of the unexpected findings, 30% were considered potentially life-threatening. On the basis of this study, we recommend "routine" chest films for monitoring in critically ill surgical intensive care patients. (Henry Ford Hosp Med J 1986;34:84-6)*

Patients receiving life support in intensive care units have a rapidly changing clinical and physiologic status. Multiple methods, including invasive tubes and lines, are used to support and monitor these critically ill patients. Portable chest radiographs have been recommended as a valuable monitoring modality and are obtained routinely on patients in the intensive care units (1-3). It has been suggested that portable chest films are valuable in identifying complications resulting from the primary disease or its treatment (4).

In the surgical intensive care unit at Henry Ford Hospital, there is a standing order for daily chest films on intubated patients. Concern of this policy promoting overutilization of bedside chest films prompted us to evaluate the clinical usefulness of these "routine" portable chest radiographs.

## Materials and Methods

The study population consisted of 262 consecutive patients admitted to a 15-bed surgical intensive care unit. Daily portable chest radiographs were obtained on these patients while they were intubated and at other times by physician order. The chest radiographs were interpreted with a staff radiologist and the intensive care unit team on a daily basis. Radiographic findings were compared to previous chest films and to clinical expectations. Data collection sheets were designed to include the following points: 1) indication for the chest radiograph, 2) endotracheal tube position, 3) central venous access position, 4) tube thoracostomy position, and 5) cardiopulmonary changes and/or disease. Findings were classified as unexpected if the changes were unanticipated by the clinician. All findings were recorded.

## Results

During the two-month study period 411 portable chest films were obtained on 262 patients (1.6 radiographs/patient). The most common indication for obtaining a chest radiograph was a postoperative film, while the least common indication was to check line or tube placement (Table 1). The changing clinical

condition of the patient was an infrequent reason for obtaining a chest film (5.6%). Only 65 chest radiographs (15.89%) showed multiple indications for obtaining the films.

There were 138 unanticipated problems recognized on a review of 133 (27%) of the 411 chest films (Table 2). These 138 problems represented 15% of the 893 abnormal radiographic findings identified in the study. The 138 unanticipated problems were almost equally divided between faulty tube or catheter position (48%) and pulmonary problems (52%) (Table 2).

A 12% incidence of malposition was discovered when monitoring the position of endotracheal and tracheostomy tubes, central venous catheters, chest tubes, and nasogastric tubes (Table 2). None of these positioning problems were anticipated. Abnormal endotracheal tube position was identified on 30 of 186 (16%) chest films on intubated patients. High placement of the endotracheal tube was seen on 12 films; the endotracheal tube was found to be placed too low on 17 films; and right main stem intubation was identified in one instance. Malposition of central venous catheters was seen on 24 of 271 radiographs (8.8%). These positional problems included finding the catheter to be in the proximal cava (6 patients), neck (4 patients), the opposite subclavian (2 patients), and the heart or inferior vena cava (4 patients), or the catheter was kinked and coiled (8 patients). Four of 31 (13%) chest tubes were found to be inappropriately placed, with two chest tubes kinked and two chest tubes with the last hole in the subcutaneous tissue outside the pleural cavity. Esophageal positioning of nasogastric tubes was identified on eight of 77 films (Table 2).

Atelectasis of varying degrees was present on 133 radiographs. In 17 of 133 (12.8%) of these chest films, the atelectasis was an unsuspected problem. Unexpected major lobar collapse

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**Table 1**  
Indications for 411 Routine Chest Films

Indications		Unexpected Findings
General	Postoperative	289
	Routine	78
	Use of ventilator	69
	Preoperative	5
	Subtotal	120
Specific	Clinical change	23
	Line position	9
	Intubation	2
	Chest tube	1
	Subtotal	18

was present on seven chest films (5%). Left lower lobe collapse was seen on four films, right middle lobe collapse on two films, and right lower lobe collapse on one film. Pleural effusion was an unexpected finding on 17 of 49 (35%) chest radiographs with effusion, but was minor in all instances. Clinically unsuspected infiltrates/pneumonia were identified on 12 of 56 (21.4%) radiographs. Congestive heart failure/pulmonary edema was present on 51 chest films and unsuspected in 11 cases (21.5%). Four of five pneumothoraces seen in this series were unsuspected (Table 2). Other unexpected problems were identified including gastric distension, apical hematoma, subcutaneous air, sternal dehiscence, pneumomediastinum, pneumopericardium, and mediastinal hematoma.

All of the problems identified in this study required active intervention. Of the 138 unexpected problems, 44 were considered potentially life-threatening. These potentially life-threatening problems included four pneumothoraces, seven collapsed lobes, one right main stem intubation, 12 high-positioned endotracheal tubes, three pneumonias, 11 unsuspected congestive heart failures/pulmonary edemas, and one sternal dehiscence.

### Discussion

Bedside (portable) chest radiographs are an important tool for the evaluation of critically ill patients in the intensive care units (5-8). For patients on life-support systems, frequent portable chest films have been recommended to identify unexpected cardiopulmonary problems and to monitor invasive catheter or tube position (1-3). Portable chest films are expensive in terms of dollars, labor, and time. Excessive use of these films can increase the cost of intensive care (2,3). Because of the expense and the difficulty of defining the benefit, the value of "routine" portable chest radiographs for intensive care unit patients has been questioned (2,3,9).

The majority of the portable chest films in this study were taken for routine reasons such as preoperative or postoperative status or ventilator use (Table 1). The remaining films were obtained for specific reasons such as changing clinical condition or following line or tube placement. It is of interest that 120 of 138 (87%) unexpected findings were identified on "routine" chest films, while radiographs obtained for specific indications had only 18 unexpected findings. Our 27% overall incidence of un-

**Table 2**  
Unexpected Findings on 411 Routine Chest Films

		Total Findings	Unexpected Findings	
Pulmonary	Atelectasis	133	18 (14%)	
	Infiltrate/pneumonia	68	12 (18%)	
	Congestive heart failure/pulmonary edema	51	11 (22%)	
	Effusion	49	17 (35%)	
	Pneumothorax	5	4 (80%)	
	Other	15	10 (67%)	
	Subtotal	321	72 (22%)	
	Lines	Endotracheal tubes	186	30 (16%)
		Central lines	189	15 (8%)
		Pulmonary arterial catheters	89	9 (10%)
Nasogastric tubes		77	8 (10%)	
Chest tubes		31	4 (13%)	
Subtotal		572	66 (12%)	
Total		893	138 (15%)	

anticipated findings is similar to the report by Greenbaum and Marschall (2). The patients monitored in this study had short intensive care unit stays which may have biased the results. The effectiveness of daily chest films on patients with longer periods of intubation or intensive care unit stay was not addressed in this study.

Pulmonary complications, a common cause of postoperative mortality, were the most frequent abnormal chest radiographic findings in our study (Table 2). Pulmonary problems are difficult to evaluate because clinical examination of the intensive care unit patient is hampered by patient position, bandages, drainage tubes, and transmission of ventilator noise to the chest wall. When chest radiographs are used to monitor the pulmonary parenchyma, the reported incidence of new, unanticipated, or worsening pulmonary problems documented by bedside chest films is 43% (2,3). Our study was limited to documenting unanticipated pulmonary problems, which explains the lower incidence (22%) of pulmonary problems encountered.

The impact of unexpected pulmonary problems is difficult to assess. In this study all instances required intervention. Certainly, an unrecognized pneumothorax is a life-threatening situation, and the four unexpected pneumothoraces identified in our study required chest tube drainage. The seven cases of lobar collapse were potentially life-threatening and required bronchoscopy. The identified cases of congestive heart failure/pulmonary edema also required therapeutic intervention.

Device malposition is an iatrogenic problem with potentially serious consequences (4,6,10). The 12% incidence of malposition reported in this study is similar to the incidence reported in the literature (3). The position of all invasive lines and tubes should be checked by a radiograph.

In summary, this study documents that the overwhelming majority of unexpected problems are identified on "routine" portable chest films and that 27% of films obtained on surgical intensive care unit patients identify unanticipated findings, some of which may be life-threatening. Based on these results, we support the use of bedside chest films as a valuable monitor-

ing routine for critically ill patients and advise the use of the "routine" films to help reduce morbidity and mortality.

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