

**Routine Chest Radiographs  
EVIDENCE TABLE**

Reference	Study Type	Patients/ Events	Study Objective (Purpose of Study)	Study Results	Strength of Evidence
1. Graat ME, Choi G, Wolthuis EK, et al. The clinical value of daily routine chest radiographs in a mixed medical-surgical intensive care unit is low. <i>Crit Care</i> 2006; 10(1):R11.	10	754 patients 2,457 CXRs	Prospective observational study to determine if daily routine chest radiographs (CXRs) reveal unexpected, clinically relevant abnormalities and whether it helps intensive care unit (ICU) patients.	Daily routine CXRs rarely reveal abnormalities and should not be used in ICU patients. Study proposes this examination be abandoned in ICU patients.	2
2. Krivopal M, Shlobin OA, Schwartzstein RM. Utility of daily routine portable chest radiographs in mechanically ventilated patients in the medical ICU. <i>Chest</i> 2003; 123(5):1607-1614.	8	Routine: 43 patients 293 CXRs Non-routine: 51 patients 226 CXRs	Prospective randomized observational study to determine whether any differences exist in diagnostic, therapeutic, and outcome efficacy between protocols utilizing daily routine CXRs and those utilizing clinically indicated- non routine CXRs in mechanically ventilated patients.	<ul style="list-style-type: none"> <li>• CXRs with new findings was significantly larger in the non-routine CXR group (53.1%; 120 CXRs) compared to routine CXR group (33.4%; 98 CXRs; odds ratio, 1.59; 95% CI, 1.16 to 2.18; P=0.004).</li> <li>• CXRs with new findings that led to interventions was significantly larger in the non-routine CXR group (26.5%; 60 CXRs) compared to routine CXR group (13.3%; 39 CXRs; OR, 2.0; 95% CI, 1.29 to 3.08; P=0.002).</li> <li>• No difference in mean duration of mechanical ventilation (routine CXR arm, 7.93 days; non-routine CXR arm, 6.76 days; P=0.2606), length of ICU stay (routine CXR arm, 11.93 days; non-routine CXR arm, 9.55 days; P=0.1936), and total length of hospital stay (routine CXR arm, 19.34 days; non- routine CXR arm, 16.45 days; P=0.2199) between two groups.</li> <li>• For mechanically ventilated patients, no additional benefit was realized by a strategy that required daily CXRs in comparison to one that mandated only clinically indicated CXRs.</li> </ul>	1
3. Hendrikse KA, Gratama JW, Hove W, Rommes JH, Schultz MJ, Spronk PE. Low value of routine chest radiographs in a mixed medical-surgical ICU. <i>Chest</i> 2007; 132(3):823-828.	10	Part 1: 559 admissions/ 1,780 CXRs Part 2: 274 admissions/ 433 CXRs	Prospective controlled trial to determine the diagnostic and therapeutic value of daily routine CXRs, and to determine the effect of abandoning this CXR from daily practice on total CXR volume, ICU length of stay, readmission rate, and ICU mortality.	Low diagnostic and therapeutic value of the daily routine CXR. CXRs can be abandoned in the ICU.	1

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4. Brainsky A, Fletcher RH, Glick HA, Lanken PN, Williams SV, Kundel HL. Routine portable chest radiographs in the medical intensive care unit: effects and costs. <i>Crit Care Med</i> 1997; 25(5):801-805.	10	80 patients 221 CXRs	Prospective, cohort survey to determine the effects and net costs of routine CXR in ICU.	<ul style="list-style-type: none"> <li>72 (33%) of 221 routine radiographs (95% CI: 25% to 39%) had findings, of which 44 (61%) were important, and 18 (8%, 95% CI: 5% to 12%) prompted actions.</li> <li>Experts predicted that each action averted, on average, 2.1 +/- 1.7 days in the medical ICU.</li> <li>Mean savings per routine radiograph was \$98.</li> <li>Concludes that routine CXR in the medical ICU is effective and results in net savings.</li> </ul>	2
5. Marik PE, Janower ML. The impact of routine chest radiography on ICU management decisions: an observational study. <i>Am J Crit Care</i> 1997; 6(2):95-98.	10	200 patients 47 CXRs	Observational study to determine the impact of routine CXR on ICU treatment decisions.	<ul style="list-style-type: none"> <li>At least one change in therapy was made for 91 (66%) of the 138 intubated patients but for only 14 (23%) of the 62 non-intubated patients; this difference was significant.</li> <li>Concludes that routine CXR may be justified in critically ill patients in a medical ICU because most of these patients have management decisions based on information obtained from CXR.</li> </ul>	2
6. Hall JB, White SR, Karrison T. Efficacy of daily routine chest radiographs in intubated, mechanically ventilated patients. <i>Crit Care Med</i> 1991; 19(5):689-693.	10	74 patients 538 CXRs	Prospective blinded study to determine efficacy of daily routine CXRs in intubated, mechanically ventilated patients.	<ul style="list-style-type: none"> <li>354 of 538 CXRs did not disclose either new major or new minor findings as defined.</li> <li>163 radiographs disclosed only new minor findings, 40.5% of which were anticipated by bedside assessment.</li> <li>In 13 (17.6%, 95% CI 9% to 26%) of 74 patients, new major findings were discovered only by CXR.</li> <li>Findings support use of daily CXRs in critically ill patients.</li> </ul>	1

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7. Strain DS, Kinasewitz GT, Vereen LE, George RB. Value of routine daily chest x-rays in the medical intensive care unit. <i>Crit Care Med</i> 1985; 13(7):534-536.	10	94 patients 507 CXRs	Prospective study to determine the value of the daily routine CXR in the medical ICU.	<ul style="list-style-type: none"> <li>• 76 (15%) of 507 CXRs revealed an unsuspected abnormality, 71 (93%) of which led to a management change.</li> <li>• There was significantly (<math>p&lt;.02</math>) more unsuspected abnormalities and management changes in the pulmonary and unstable cardiac patients, independent of ventilator status.</li> <li>• Patients with two or more catheters and/or tubes visible on the CXR also had significantly more management changes (51/312 vs 11/150, <math>p&lt;.05</math>).</li> <li>• Concludes that while CXR affect the management of pulmonary and unstable cardiac patients in the ICU, routine films rarely influence management of uncomplicated cardiac patients and those without heart or lung disease, and are not needed in this group.</li> </ul>	2
8. O'Brien W, Karski JM, Cheng D, Carroll-Munro J, Peniston C, Sandler A. Routine chest roentgenography on admission to intensive care unit after heart operations: is it of any value? <i>J Thorac Cardiovasc Surg</i> 1997; 113(1):130-133.	10	404	To determine the value of routine CXR on admission to intensive care unit after heart operations.	18 (4.5%) of 404 required intervention because of abnormalities detected by CXR but not predicted by the initial physical and laboratory assessment. Concludes that CXR is recommended if clinical and laboratory assessment indicates the possibility of underlying pathologic conditions that can only be confirmed or diagnosed by CXR.	2
9. Graham RJ, Meziane MA, Rice TW, et al. Postoperative portable chest radiographs: optimum use in thoracic surgery. <i>J Thorac Cardiovasc Surg</i> 1998; 115(1):45-50; discussion 50-42.	10	99 patients 769 CXRs	Prospective review to assess the efficacy and cost of routine daily portable CXR and determine the optimum use of postoperative radiograph studies.	Radiography findings altered management in 43 of 769 CXRs (5.6%): in 33 routine (4.5%), in 10 nonroutine (26.3%), in 13 A (2.3%), in 22 B (37.3%), and in 8 C (17.4%). Results show routine daily portable CXR studies have a minimal impact on management.	2

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10. Gray P, Sullivan G, Ostryzniuk P, McEwen TA, Rigby M, Roberts DE. Value of postprocedural chest radiographs in the adult intensive care unit. <i>Crit Care Med</i> 1992; 20(11):1513-1518.	10	316	Prospective controlled study to evaluate the necessity for post-procedural CXR after catheterization of central veins, insertion of pulmonary artery catheters (PAC), and placement of endotracheal tubes (ETT).	<ul style="list-style-type: none"> <li>• Ability to predict the absence of complications after cordis catheter insertions via the subclavian vein or internal jugular vein (151/152; <math>p &lt; .001</math>) and ability to predict uncomplicated pulmonary artery catheterization (110/111; <math>p &lt; .001</math>) were high.</li> <li>• Unsuspected complications were more frequent with central vein multilumen catheter insertions (3/24; <math>p &lt; .001</math>).</li> <li>• Physicians were unable to predict the majority of complications associated with endotracheal intubations (28/32; <math>p &gt; .50</math>).</li> </ul>	1
11. Silverstein DS, Livingston DH, Elcavage J, Kovar L, Kelly KM. The utility of routine daily chest radiography in the surgical intensive care unit. <i>J Trauma</i> 1993; 35(4):643-646.	10	Univ center: 256 patients Suburban hospital: 269 patients 525 CXRs	Prospective study to assess the impact of routine daily CXR in the surgical ICU.	<ul style="list-style-type: none"> <li>• 1,028 medical devices were evaluated. 55 (5.4%) were considered to be in a minor incorrect position and 13 (1.3%) required repositioning.</li> <li>• 78 CXRs were normal. There were 775 cardiopulmonary findings on the remaining 477 CXRs. When compared with previous CXRs, only 12% (89 of 775) of the findings were considered new, 65% were unchanged, 14% were improved, and 15% demonstrated worsening of a known finding.</li> <li>• Of the 89 new cardiopulmonary findings, only 3 had any potential clinical impact (pneumothorax in two, effusion in one).</li> <li>• Study concludes that routine daily CXR should be abandoned and need for a morning CXR be based on clinical necessity.</li> </ul>	2
12. Henschke CI, Pasternack GS, Schroeder S, Hart KK, Herman PG. Bedside chest radiography: diagnostic efficacy. <i>Radiology</i> 1983; 149(1):23-26.	10	140 patients 1,132 CXRs	Prospective study to evaluate the efficacy of a bedside CXR in patients admitted to the surgical and medical ICU.	<ul style="list-style-type: none"> <li>• Endotracheal or tracheostomy tubes were present in 54% of exams; 12% were malpositioned.</li> <li>• Central venous catheters were present in 47%; 9% were malpositioned.</li> <li>• Interval changes (cardiopulmonary findings) were present in 44% of the radiographs.</li> <li>• 65% of the radiographs had findings or changes affecting the patient's management. Recommends use of bedside radiography.</li> </ul>	2

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13. Horst HM, Fagan B, Beute GH. Chest radiographs in surgical intensive care patients: a valuable "routine". <i>Henry Ford Hosp Med J</i> 1986; 34(2):84-86.	9	262 patients 411 CXRs	Evaluation of CXR to determine their clinical value for surgical ICU patients. Radiographic findings, previous CXR and clinical expectations were compared.	<ul style="list-style-type: none"> <li>• 138 unexpected findings on 112 CXR.</li> <li>• The unexpected findings were equally divided between pulmonary problems (72) and device malposition (66).</li> <li>• 30 % of unexpected findings were considered potentially life threatening.</li> <li>• Study recommends routine CXR for monitoring surgical ICU patients.</li> </ul>	2
14. Brunel W, Coleman DL, Schwartz DE, Peper E, Cohen NH. Assessment of routine chest roentgenograms and the physical examination to confirm endotracheal tube position. <i>Chest</i> 1989; 96(5):1043-1045.	10	219	Prospective study to evaluate the accuracy of the physical examination in assessing ETT position and the appropriateness of taking routine CXR after intubation in the ICU.	Techniques to minimize risk of tube malposition were not completely reliable. Study confirms unreliability of the physical examination to assess ETT position. CXRs after intubation are recommended to verify tube position, particularly after emergency intubations.	2
15. Bekemeyer WB, Crapo RO, Calhoun S, Cannon CY, Clayton PD. Efficacy of chest radiography in a respiratory intensive care unit. A prospective study. <i>Chest</i> 1985; 88(5):691-696.	10	167 patients 1,354 CXRs	Prospective study to determine diagnostic and therapeutic efficacy of CXR in a respiratory ICU.	<ul style="list-style-type: none"> <li>• In a respiratory ICU, routine morning radiographic examination frequently demonstrates unexpected or changing abnormalities.</li> <li>• Post-procedure radiographic examination uncommonly demonstrates complications related to the procedure, but frequently demonstrates abnormalities of tube or catheter placement.</li> </ul>	2
16. Bhagwanjee S, Muckart DJ. Routine daily chest radiography is not indicated for ventilated patients in a surgical ICU. <i>Intensive Care Med</i> 1996; 22(12):1335-1338.	9	34 patients 164 CXRs	To determine whether clinical examination can accurately predict radiological change and if routine CXR is effective in ventilated patients in a surgical ICU.	<ul style="list-style-type: none"> <li>• Two significant radiographically changes were missed on clinical examination: catheter malposition and pneumothorax, representing a yield from radiography of 1%.</li> <li>• Study concludes that clinical examination can effectively predict the need for radiography and therefore CXR is not recommended for ventilated patients.</li> </ul>	3

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17. Kollef MH, Legare EJ, Damiano M. Endotracheal tube misplacement: incidence, risk factors, and impact of a quality improvement program. <i>South Med J</i> 1994; 87(2):248-254.	15	Retrospective review: 278 patients Prospective: 246 patients	Comparative study in an adult ICU to assess the impact of a quality improvement program on the occurrence of serious complications related to ETT misplacement and to identify risk factors.	<ul style="list-style-type: none"> <li>• 113 (46%) of 246 patients were identified as having at least one ETT misplacement requiring immediate repositioning.</li> <li>• The incidence of serious complications related to ETT misplacement was significantly less during the implementation of the quality improvement program (0 of 246 patients) than during the retrospective period (5 of 278 patients).</li> <li>• Multivariate analysis showed that a longer duration of endotracheal intubation, the lack of chemical paralysis, and the occurrence of cardiac arrest were independently predictive of ETT misplacement.</li> <li>• Results suggest a specific ICU quality improvement program can have a favorable impact on patient outcome.</li> </ul>	2
18. Sise MJ, Hollingsworth P, Brimm JE, Peters RM, Virgilio RW, Shackford SR. Complications of the flow-directed pulmonary artery catheter: A prospective analysis in 219 patients. <i>Crit Care Med</i> 1981; 9(4):315-318.	4	219 patients 320 catheters	Prospective study to determine and analyze the complications of the flow-directed PAC.	Major complications occurred in 3% of catheterizations. Findings suggest that, when indicated in the care of critically ill patients, the properly placed and maintained PAC has an acceptably low morbidity and mortality rate, particularly when used for 72 hours or less.	2
19. Kassner EG, Baumstark A, Balsam D, Haller JO. Passage of feeding catheters into the pleural space: a radiographic sign of trauma to the pharynx and esophagus in the newborn. <i>AJR</i> 1977; 128(1):19-22.	14	4	Description of premature infants with clinically unsuspected retroesophageal false passages incidentally discovered on CXR.	Differentiation of pseudodiverticula from spontaneous rupture of the middle or distal esophagus can be achieved by careful inspection of the course of the feeding catheter in frontal and lateral projections and by partial withdrawal of the catheter to permit injection of the retroesophageal false passage with a small volume of water-soluble contrast material.	4
20. Hand RW, Kempster M, Levy JH, Rogol PR, Spirn P. Inadvertent transbronchial insertion of narrow-bore feeding tubes into the pleural space. <i>JAMA</i> 1984; 251(18):2396-2397.	14	4	To describe complications of soft, narrow-bore feeding tubes passed transbronchially into the pleural space.	Alternate methods of inserting tubes in patients with altered airway and swallowing reflexes is needed. Radiographic confirmation of the tube's position is important before starting tube feedings.	4

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21. Balogh GJ, Adler SJ, VanderWoude J, Glazer HS, Roper C, Weyman PJ. Pneumothorax as a complication of feeding tube placement. <i>AJR</i> 1983; 141(6):1275-1277.	14	3	To examine pneumothorax as a complication of feeding tube placement.	In one patient, pneumothorax developed after removal of the misplaced feeding tube, in the other two patients the pneumothorax was present on the initial CXR that showed abnormal tube position. The resulting pneumothorax required thoracostomy drainage in all 3 patients.	4
22. Dorsey JS, Cogordan J. Nasotracheal intubation and pulmonary parenchymal perforation. An unusual complication of naso-enteral feeding with small-diameter feeding tubes. <i>Chest</i> 1985; 87(1):131-132.	14	2	To present case reports on tracheal intubation and subsequent pulmonary complications.	Rigid guide wire used in small-diameter feeding tubes increases the probability of nasotracheal intubation. Wire introducer should not be advanced beyond the nasopharynx, and radiographic verification of catheter location should be mandatory in order to prevent pulmonary complications.	4

## Evidence Table Key

### Study Type Key

*Numbers 1-7 are for studies of therapies while numbers 8-15 are used to describe studies of diagnostics.*

1. Randomized Controlled Trial — Treatment
2. Controlled Trial
3. Observation Study
  - a. Cohort
  - b. Cross-sectional
  - c. Case-control
4. Clinical Series
5. Case reviews
6. Anecdotes
7. Reviews
  
8. Randomized Controlled Trial — Diagnostic
9. Comparative Assessment
10. Clinical Assessment
11. Quantitative Review
12. Qualitative Review
13. Descriptive Study
14. Case Report
15. Other (Described in text)

### Strength of Evidence Key

- Category 1 - The conclusions of the study are valid and strongly supported by study design, analysis and results.
- Category 2 - The conclusions of the study are likely valid, but study design does not permit certainty.
- Category 3 - The conclusions of the study may be valid but the evidence supporting the conclusions is inconclusive or equivocal.
- Category 4 - The conclusions of the study may not be valid because the evidence may not be reliable given the study design or analysis.