partum period in a health centre, by establishing a system of coordinated care by a field-level health worker.[8] A new group of community-based functionaries called Accredited Social Health Activist (ASHA) has been identified as change agents for health in villages.[9] With these concerted efforts, the proportion of institutional deliveries and immunization coverage is likely to increase. With this increase, the proportion of neonates who are administered BCG vaccine at birth would also increase. The existing 78% coverage of BCG vaccination[10] would improve further. Protection from the development of asthma would be an added possible benefit for these immunized children.

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Chest radiographs in the ICU: Routine or on demand?

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SUMMARY

This study aimed to determine whether obtaining chest radiographs (CXR) in patients admitted to intensive care units on a 'demand' basis was a more effective and efficient method compared with routine daily CXR (which is as per the present American Roentgen Association guidelines).

Twenty-one intensive care units (ICUs) from 18 hospitals in France participated in the study. Each ICU enrolled 20 patients, who at the time of enrolment were on mechanical ventilation. The period of study extended till the time of discharge of the patient or up to 30 days of ventilation. Patients undergoing ventilation for <72 hours were excluded from the analysis.

In the first treatment period, the 21 ICUs were randomly allocated to use either a 'routine' or 'demand' strategy to order CXR. After a washout period of 1 week, the second strategy was used. Since in most ICUs worldwide all medical staff in a given unit use the same strategy to decide when to do a CXR, randomization was done at the level of the ICU (cluster-randomized design) rather than at the patient level.

In the 'routine' strategy, all mechanically ventilated patients had a daily CXR, regardless of their clinical status. In the 'on-demand' strategy, mechanically ventilated patients had a CXR done if warranted by the clinical findings on the morning rounds. In both strategies additional unscheduled CXRs were allowed, if necessary.

The primary outcome measure was the mean number of CXRs per patient-day of mechanical ventilation; the key secondary outcome measures were days of mechanical ventilation, length of stay in the ICU and mortality of patients during their stay in the ICU.

Acute respiratory failure with or without pulmonary oedema, septic shock and acute renal failure were among the most common causes of admission to the ICU. Overall, 425 patients were assigned to have CXR by a 'routine' and 424 by an 'on-demand' strategy. A total of 7755 CXRs were done during both treatment periods under both strategies.

The mean number of CXRs per patient-day of ventilation was 32% lower with the on-demand strategy than with the routine strategy (95% CI 25–38; p<0.0001). However, the difference in the total number of routine and on-demand CXRs was not significant when the analysis was restricted to CXRs with new findings that led to diagnostic/therapeutic interventions (728 routine CXRs contributed/led to 824 procedures in 264 patients, whereas 729 'on-demand' CXRs led to 834 interventions; p=0.77). The 'on-demand' strategy was associated with a large and significant decrease in CXRs during the morning hours and with a small and non-significant increase in unscheduled CXRs. There was no significant difference between the secondary outcomes in both strategies (days of mechanical ventilation, duration of ICU stay and mortality).

COMMENT

The issue of whether CXRs in mechanically ventilated patients in the ICU should be done on a 'routine' basis or only 'on demand' has been intensely debated in the past 2 decades. Routine CXRs are done in the majority of ICUs worldwide. The ostensible reason has been the high prevalence of findings on CXRs of ICU patients.

A postal survey questionnaire covering 41 ICUs in the Netherlands reported that 63% practised a daily routine strategy.[1] This survey also found that university-affiliated (teaching) ICUs and larger ICUs (with >20 beds) were less likely to use the 'routine' strategy. In a web-based questionnaire involving 82 intensivists from 32 ICUs, Hejblum *et al*.[2] found that although there was a consensus on routine CXRs for some specific situations, the majority did not support daily CXRs for intubated patients.

How useful are CXRs? Strain *et al*. evaluated 507 'routine' CXRs and found that 15% showed abnormalities; of these, 93% required a change in management.[3] In a study on mechanically ventilated patients randomly assigned to a 'routine' or 'on-demand' strategy for CXRs, Krivopal *et al*.[4] reported an incidence of 26% of new findings and found no difference in diagnostic, therapeutic and outcome efficacy. In contrast, Diaz-Fuentes *et al*.[5] reported a much lower incidence of new findings (15%). A later study by Graat *et al*. also found that the majority of 'routine' CXRs (94.2%) did not reveal new and/or unexpected predefined abnormality. This study, conducted in a 28-bed ICU of a single hospital, found new abnormalities in only 5.8% of CXRs (accounting for 14.3% of patients). Of these, 6.4% required a change in management.[6]

Apart from the low possibility of finding clinically significant changes, CXRs have been seen to have limited diagnostic utility for pulmonary congestion, pleural effusions, cardiogenic oedema and pneumothorax. Further, lung findings depend on the state of inflation of the lung. Positive end-expiratory pressure (PEEP) may give an erroneous impression of lung inflation. Although all these studies agree that routine CXRs have a limited value, they support the post-procedural use of CXR. Diaz-Fuentes *et al.*[5] found that 13% and 8% of post-procedure CXRs in the control and study groups, respectively, revealed misplacement of invasive devices that could be life-threatening. A review by Adesanya[7] listed 20 studies on the efficacy of daily routine CXR. They reported that although incidence rates of CXR abnormalities were high, the incidence of clinically important findings requiring treatment was low.

The results of this study are similar to those published by Kröner *et al*.[8] In a retrospective study done over 10 months in a university-affiliated ICU, they found that elimination of daily routine CXR resulted in a decrease from 1.1 (03) to 0.6 (04) CXRs per patient-day ($p<0.05$). Elimination of 'routine' CXR did not affect the duration of stay in the ICU or mortality; the numbers of CTs and ultrasounds obtained before and after the change in practice were similar.[8]

Only a few studies have compared both strategies of obtaining CXR in ICU patients. One study was in children by Price *et al*., which found that apart from a positive financial impact, there was no significant change in duration of mechanical ventilation or ICU stay.[9]

Mets and colleagues[10] found that in patients undergoing cardiothoracic surgery, the elimination of routine CXR led to a decrease in the total number of CXRs per patient per day; in the post-ICU phase, slightly more abnormalities were found in the on-demand CXRs.

Thus, the present study confirms that routine CXRs in ICUs have no benefit and obtaining them on 'demand' is cost-effective. However, post-procedural CXRs may still have to be done 'routinely' as they reveal a high incidence of findings requiring intervention.

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