Incentive spirometry decreased pulmonary complications in sickle cell diseases


Objective
To evaluate the efficacy of incentive spirometry in preventing acute pulmonary complications in sickle cell diseases.

Design
Randomised controlled trial with follow-up to hospital discharge.

Setting
A sickle cell centre at a children's hospital in Ohio, USA.

Patients
29 patients (52% boys) between ages 8 and 21 years with sickle cell diseases who had 38 episodes of acute chest or back pain above the diaphragm and who were admitted to the hospital. 23 patients had homozygous sickle cell anaemia, 3 had sickle cell-haemoglobin C disease, 2 had sickle cell-B\(^+\) thalasemia, and 1 had sickle cell-haemoglobin D disease.

Intervention
Each episode of pain was considered to be an independent event. At each hospitalisation, patients were assigned to incentive spirometry (n = 19 episodes), 10 maximal inspirations every 2 hours between 8 and 22 h and while they were awake at night until chest pain subsided, or to a nonspirometry control group (n = 19 episodes).

Main Outcome Measures
Pulmonary complications (atelectasis or infiltrates) assessed by radiography and thoracic bone infarction assessed by bone scanning. All chest radiographs were interpreted by radiologists who were unaware of the treatment allocation.

Main Results
Incentive spirometry led to fewer pulmonary complications than did nonspirometry (5% vs 42%, \(P = 0.019\)). Assuming episodes are independent, this absolute risk reduction of 37% means that 3 episodes of pain would need to be treated to prevent 1 pulmonary complication, 95% CI 2 to 9; the relative risk reduction was 88%, CI 35% to 98%. The incidence of thoracic bone infarction was 39.5%, 15 of 38 hospitalisations (CI 24% to 55%). Among patients with thoracic bone infarction, no pulmonary complications developed in those assigned to incentive spirometry during 7 hospitalisations (0%) compared with 5 of 8 hospitalisations (62.5%) in the nonspirometry control group (\(P = 0.025\)).

Conclusion
Incentive spirometry decreased the incidence of pulmonary complications (atelectasis or infiltrates) in patients with sickle cell diseases who were hospitalized with acute chest or back pain above the diaphragm.

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*Numbers calculated from data in article.

Commentary

The study by Bellet and colleagues makes a valuable contribution because it addresses for the first time in a randomised trial whether the risk for pulmonary complications in sickle cell crises can be decreased by administering incentive spirometry. Although the number of patients is relatively small, the authors find a significant decrease in atelectasis and infiltrates (review of chest radiography) in the spirometry group compared with the nonspirometry group. The concept of rib and sternal infarction that causes hypoventilation and pulmonary complications was first described by Rucknagel and colleagues (1) and Ballas and Park (2). Application of incentive spirometry in routine clinical practice requires motivation and discipline from patients, nursing staff, and respiratory physiotherapists. Measuring the treatment response, however, could be simplified because neither chest radiography nor bone scanning would be advisable or necessary in all patients. Finally, future studies on the prevention of pulmonary complications in sickle cell diseases should include the evaluation of noninvasive positive pressure ventilation in patients with established hypoxia and evolving chest radiograph changes.

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