



Survival of Patients With Kyphoscoliosis Receiving Mechanical Ventilation or Oxygen at Home*

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Background: Home mechanical ventilation (HMV) and long-term oxygen therapy (LTOT) are the two treatment alternatives when treating respiratory insufficiency in patients with kyphoscoliosis. We aimed to study the effect on survival with regard to HMV or LTOT alone in patients with respiratory insufficiency due to kyphoscoliosis.

Methods: Swedish patients with nonparalytic kyphoscoliosis (*ie*, scoliosis not related to neuromuscular disorders) who started LTOT or HMV between 1996 and 2004 were followed up prospectively until February 14, 2006, with death as the primary outcome. Treatment modality, arterial blood gas levels, the presence of concomitant respiratory diseases, and age were recorded at the onset of treatment. No patient was lost to follow-up.

Results: One hundred patients received HMV, and 144 patients received oxygen therapy alone. Patients treated with HMV experienced better survival, even when adjusting for age, gender, concomitant respiratory diseases, and blood gas levels, with a hazard ratio of 0.30 (95% confidence interval, 0.18 to 0.51).

Conclusion: The survival of patients with kyphoscoliosis receiving HMV was better than that of patients treated with LTOT alone. We suggest HMV and not oxygen therapy alone as the primary therapy for patients with respiratory failure due to kyphoscoliosis, regardless of gender, age, and the occurrence of concomitant respiratory diseases. (CHEST 2006; 130:1828–1833)

Key words: kyphoscoliosis; long-term oxygen therapy; mechanical ventilation; respiratory failure; survival; Swedevox; treatment

Abbreviations: CI = confidence interval; HMV = home mechanical ventilation; HR = hazard ratio; LTOT = long-term oxygen therapy

Patients with severe kyphoscoliosis run the risk of chronic respiratory failure and early death because of alveolar hypoventilation.^{1,2} The treatment alternatives for these patients include home mechanical ventilation (HMV) during sleep and oxygen

therapy during the day and night. HMV is often recommended, as it improves spontaneous blood gas levels during the daytime, which is not the case with oxygen therapy.^{3–10} Dyspnea, headache, impaired sleep quality, and drowsiness are common symptoms

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of hypoventilation, and they are reduced by treatment with mechanical ventilation but not during oxygen therapy.^{6,11} We aimed to study whether patients who were treated with HMV experience better survival than patients treated with oxygen therapy alone in a nationwide prospective study of patients with respiratory insufficiency due to kyphoscoliosis.

MATERIALS AND METHODS

All Swedish men and women with respiratory failure due to nonparalytic kyphoscoliosis (*ie*, scoliosis not related to neuromuscular disorders) who commenced long-term oxygen therapy (LTOT) or HMV from January 1, 1996, to December 31, 2004, were eligible for inclusion in the study. All of the departments of respiratory medicine and all other medical units prescribing oxygen or HMV in all 24 Swedish counties agreed on the inclusion criteria and prospectively to register all patients who started treatment from January 1, 1996, with survival as a primary outcome. This register is now called Swedex and is run by the Swedish Society of Chest Medicine.¹²⁻¹⁴

Arterial blood gas tensions when breathing air, the presence of a concomitant respiratory disease, and personal identification numbers were registered at the start of treatment. The vital status until February 14, 2006, and the dates of death were obtained from the Swedish Population Register.

Every regional ethics committee in Sweden, the National Board of Health and Welfare, and the Data Inspection Board approved the study. All of the patients gave their written informed consent.

Statistical Analysis

Baseline characteristics were analyzed using the χ^2 test for categorical data and analysis of variance for continuous data. The values are presented as the mean \pm SD. A *p* value of < 0.05 was considered to be significant. A Cox proportional hazards regression model was used to assess the effect of treatment on survival. In the multivariate survival analyses, we included age, gender, blood gas values, and concomitant respiratory disease as potential confounders. A cutoff point of 70 years of age was used in the analysis of age, since age had no effect on survival below 70 years of age.

RESULTS

The study group comprised 244 patients with kyphoscoliosis who were starting treatment with HMV or oxygen in Sweden during the study period. Their mean age was 69 ± 11 years; 167 were women and 77 were men. One hundred patients received HMV, and 27 of them also received supplementary oxygen therapy. Three patients were ventilated via tracheostomy, and the rest by nasal or oronasal masks. Mechanical ventilation was prescribed during sleep (*ie*, for < 8 h) to 75% of the patients and for > 12 h to only 2% of patients. One hundred forty-four patients received oxygen therapy alone. All of them were prescribed to receive oxygen for 16 to

24 h a day. Five patients who started with oxygen therapy alone and later received supplementary mechanical ventilation are grouped according to the initial treatment. Baseline characteristics are presented in Table 1. The annual number of patients starting HMV or LTOT is given in Figure 1. No patient was lost to follow-up.

Thirty-two of the 100 patients (32%) receiving HMV and 110 of the 144 patients (76%) receiving oxygen therapy alone were dead at follow-up. Age > 70 years old, the presence of a concomitant respiratory disease, low PaO₂, and low PaCO₂ were related to an increased risk of early death in the univariate analysis (Table 2). Patients treated with HMV experienced better survival than patients who were treated with oxygen alone, even when adjusting for age, gender, concomitant respiratory diseases, and blood gas levels, with an adjusted hazard ratio (HR) of 0.30 (95% confidence interval [CI], 0.18 to 0.51) [Fig 2, Table 3].

Subjects receiving oxygen therapy alone were older and more frequently had a concomitant respiratory disorder (Table 1). Despite this, survival was still better in patients with a concomitant disease receiving mechanical ventilation than in patients without a concomitant respiratory disease who were receiving oxygen therapy (*p* = 0.03) [Fig 3].

DISCUSSION

Survival in patients who were treated with HMV was three times higher than that in patients who were treated with oxygen alone, even when adjusting for age, gender, concomitant respiratory diseases, and blood gas levels, in the present cohort of patients with respiratory insufficiency due to kyphoscoliosis. Survival was influenced by age and treatment modality but not by gender, concomitant respiratory disease, or the degree of hypoxia or hypercapnia before the onset of treatment.

Domiciliary mechanical ventilation using tracheostomy was reported as a successful therapy for

Table 1—Baseline Characteristics Among Patients With Kyphoscoliosis*

| Characteristics | HMV (n = 100) | LTOT Alone (n = 144) | <i>p</i> Value |
|------------------------------------|------------------|-------------------------|----------------|
| Age, yr | 62.4 \pm 12.7 | 73.5 \pm 8.9 | < 0.001 |
| Female gender, % | 68 | 69 | 0.95 |
| Concomitant respiratory disease, % | 33 | 65 | < 0.001 |
| PaO ₂ , mm Hg | 56 \pm 13 | 48 \pm 7 | < 0.001 |
| PaCO ₂ , mm Hg | 57 \pm 9 | 52 \pm 10 | 0.002 |

*Values are given as the mean \pm SD, unless otherwise indicated.

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