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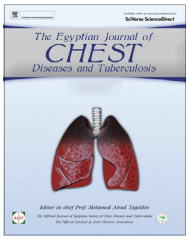

ORIGINAL ARTICLE

Evaluation of pulmonary function in renal transplant recipients and chronic renal failure patients undergoing maintenance hemodialysis

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KEYWORDS

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Abstract *Background:* Impaired pulmonary function in patients on hemodialysis may be caused by an underlying pulmonary disease, however the effects of hemodialysis treatment and kidney transplantation are not well understood.

Aim of the work: The aim of this study was to evaluate pulmonary function among patients with chronic renal failure (CRF) undergoing hemodialysis and patients with kidney transplant.

Patients and methods: This study was conducted on 60 subjects. They were classified into 3 groups: Hemodialysis group (HDG) included 20 patients with end stage renal disease (ESRD) on regular hemodialysis for at least six months and were clinically stable. Transplant group (TG) included 20 patients who had undergone kidney transplant at least six months earlier and were also clinically stable. Control group (CG) included 20 apparently healthy subjects. All subjects underwent pulmonary function testing; including resting spirometry included flow volume loop and Maximal Voluntary Ventilation (MVV), measurement of lung volumes and diffusing capacity for carbon monoxide (DLCO) using single breath technique, Six Minute Walking Test (6MWT) and arterial blood gases (ABG).

Results: There was a significant difference between HDG, TG and CG regarding FVC% of predicted, FEV1% of predicted, FEF 25–75% of predicted, PEFR% of predicted and MVV% of predicted. Also there was a statistically significant difference between HDG, TG and CG regarding RV% of predicted, TLC% of predicted and RV/TLC%. Although FVC% of predicted and FEV1% of predicted were within the normal range in the 3 studied groups, there was a statistically

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significant reduction in these spirometric parameters in HDG more than that in the TG and CG, also reduction in TG more than CG. FEF 25–75% of predicted was less than normal in HDG and was within the normal range in TG and CG, also RV% of predicted and TLC% of predicted were increased in HDG more than that in TG and CG. Regarding DLco% of predicted we found significant differences between the 3 studied groups. It was lower in HDG than in TG and CG. Also the same results we found regarding Dlco/VA% of predicted. There were statistically significant differences among the studied groups regarding 6MWT. Regarding ABG although all values were within normal levels, Pao2 in HDG was less than that in TG and CG.

Conclusion: There is impairment of lung function in patients with CRF undergoing hemodialysis. The main changes are small airway obstruction, reduction in carbon monoxide transfer and diminished 6MWT that were not completely improved in the kidney transplant patients.

Introduction

Chronic renal diseases are associated with a variety of respiratory manifestations. Pulmonary edema, pleural disease, pulmonary calcification, and sleep apnea syndrome have been documented in patients with chronic renal failure. Furthermore, treatment with hemodialysis also produces transient changes in pulmonary gas exchange [1]. Impaired pulmonary function in patients on hemodialysis may be caused by an underlying pulmonary disease, however, the impact of uremia and the effects of hemodialysis treatment are not well understood. Several mechanisms may impair pulmonary function and alter bronchial responsiveness in patients on long term regular hemodialysis treatment, some of which are trapping of neutrophils, increased extra-vascular lung water, left ventricular hypertrophy, metastatic lung calcification, and iron deposition [2,3]. On the other hand, hemodialysis can result in better respiratory function [4]. The muscles responsible for respiratory function, such as the diaphragm and intercostals, among others, are classified as skeletal muscles and may show decreases in muscle strength and endurance properties resulting from uremic myopathy. Some authors [5] who have studied the involvement of uremia in the diaphragm have concluded that loss of strength occurs through severe uremia. The ventilatory deficit due to this impairment in respiratory muscles, combined with other lung tissue impairments, compromises the functioning of this system, thereby contributing toward decreased lung capacity [6,7]. During hemodialysis, the majority of patients develop a reduction in arterial PO_2. The arterial PO_2 falls within a few minutes of initiation of dialysis by 10–15 mmHg, reaches a nadir after 30–60 min, and persists for the duration of the procedure [8–10].The severity of hypoxemia varies according to the type of dialysis membrane and the chemical nature of the dialysate buffer [11,12]. Several mechanisms have been proposed to explain the decrease in arterial PO_2: (1) a shift in the oxyhemoglobin dissociation curve caused by the increase in pH during the procedure, (2) depression of central respiratory output due to alkalosis, (3) oxygen diffusion impairment, (4) ventilation–perfusion mismatching due to stasis of leukocytes in small pulmonary vessels, and (5) hypoventilation due to carbon dioxide excretion via the dialysate. Some changes found in patients with CKF undergoing dialysis are also observed in transplant patients, even after restoration of kidney function. These changes can be partially attributed to immunosuppressive therapy, which commonly uses corticosteroids. This medication is associated with decreased synthesis and increased protein catabolism, which could hamper full return of the functions of kidney transplant patients [13].

The aim of the work

The aim of this study was to evaluate pulmonary function (including resting spirometry included flow volume loop and Maximal Voluntary Ventilation (MVV), measurement of lung volumes and diffusing capacity for carbon monoxide), 6MWT and ABG among patients with CRF undergoing hemodialysis and patients with kidney transplant.

Materials and methods

This study was conducted in King Fahd hospital in Almadinah Al Monawarah, Kingdom Saudi Arabia from December 2011 to December 2012 on a cohort of 60 subjects. The study protocol was approved by the local ethics committee. Informed consent was obtained from the patients. The subjects were classified into 3 groups:

Group I: hemodialysis group (HDG): included 20 patients with end stage renal disease (ESRD) on regular hemodialysis. They included (7 men and 13 women). These individuals had been undergoing hemodialysis regularly for at least six months. They were clinically stable, without anemia, and were under clinical follow-up. Group II: transplant group (TG): Included 20 patients (8 men and 12 women) who had undergone kidney transplant at least six months earlier. These patients were stable from a clinical and surgical point of view and were also under regular clinical follow-up. Group III: control group (CG): included 20 apparently healthy subjects (9 men and 11 women). These were of the same age and gender as the other two groups and fulfilled the same criteria for non-inclusion.

The exclusion criteria were history of respiratory diseases, and cardiac insufficiency, being a smoker or ex-smoker, current respiratory infections, musculoskeletal disorders, and those who were unable to cooperate.

All subjects were subjected to:

1. Thorough history taking and full clinical examination.
2. Chest X-ray picture was taken before each study, and if it was abnormal, the patient was eliminated from the study.