

# SUBCLINICAL PULMONARY CONGESTION IN NEPHROTIC SYNDROME

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## Introduction

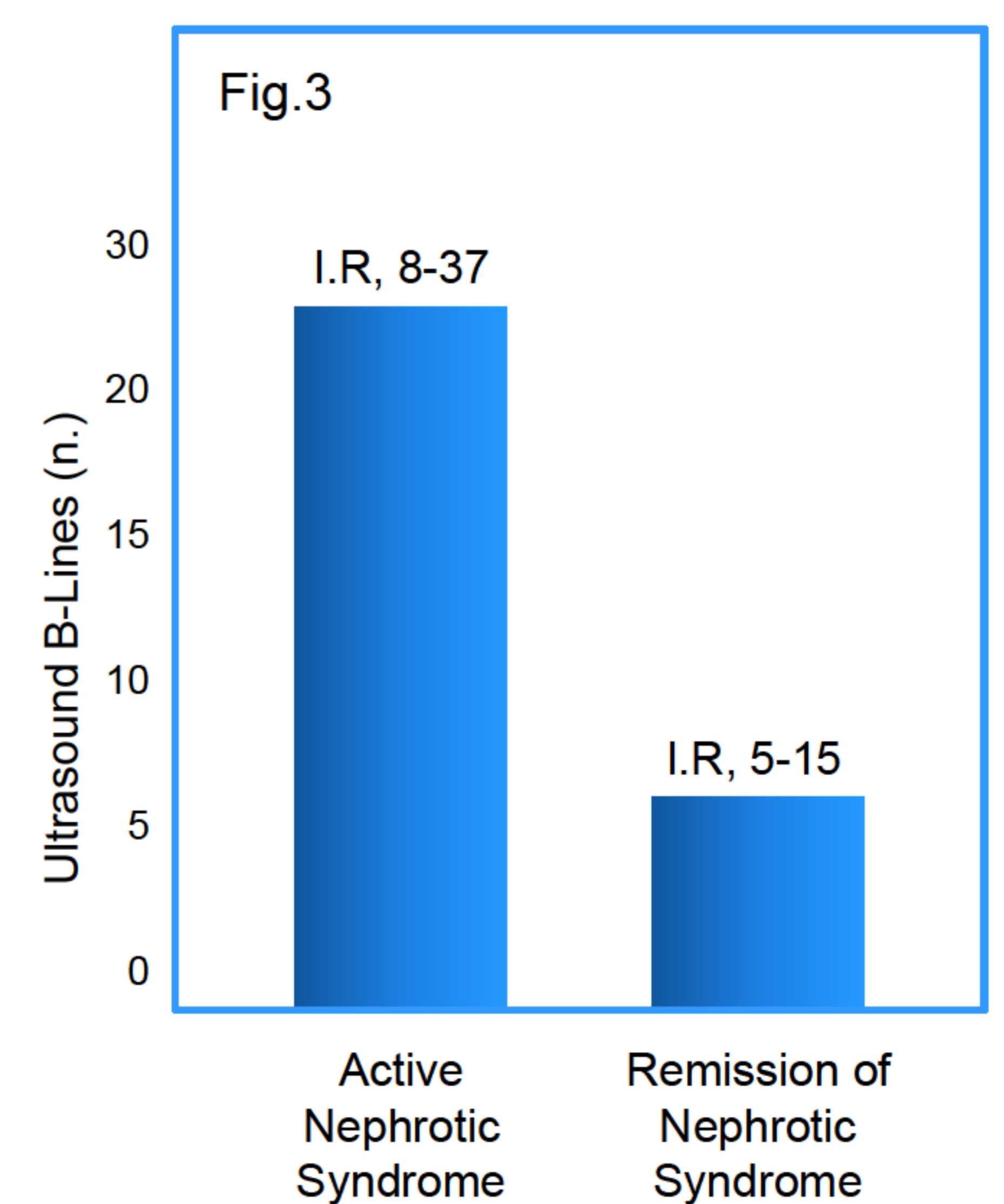
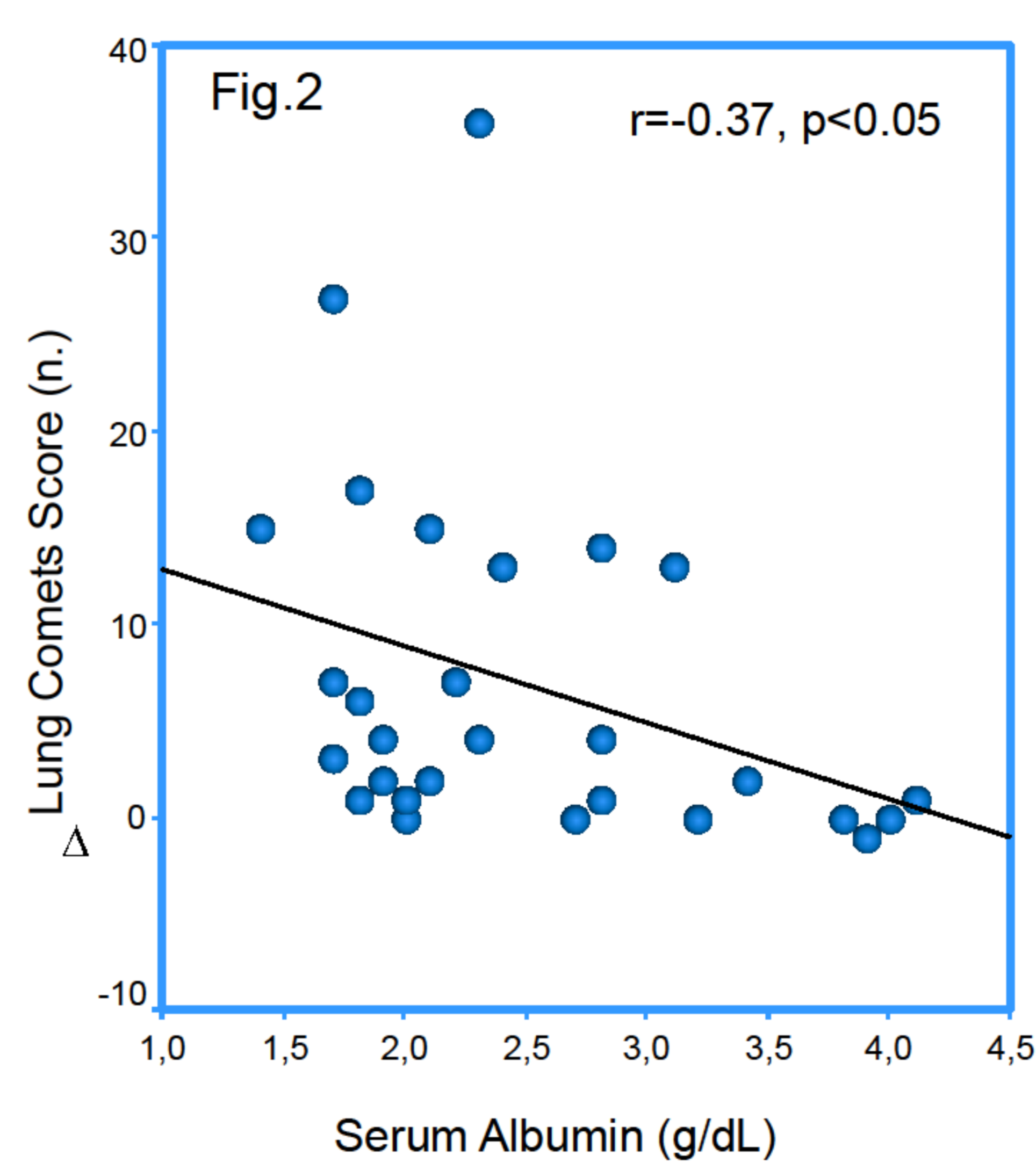
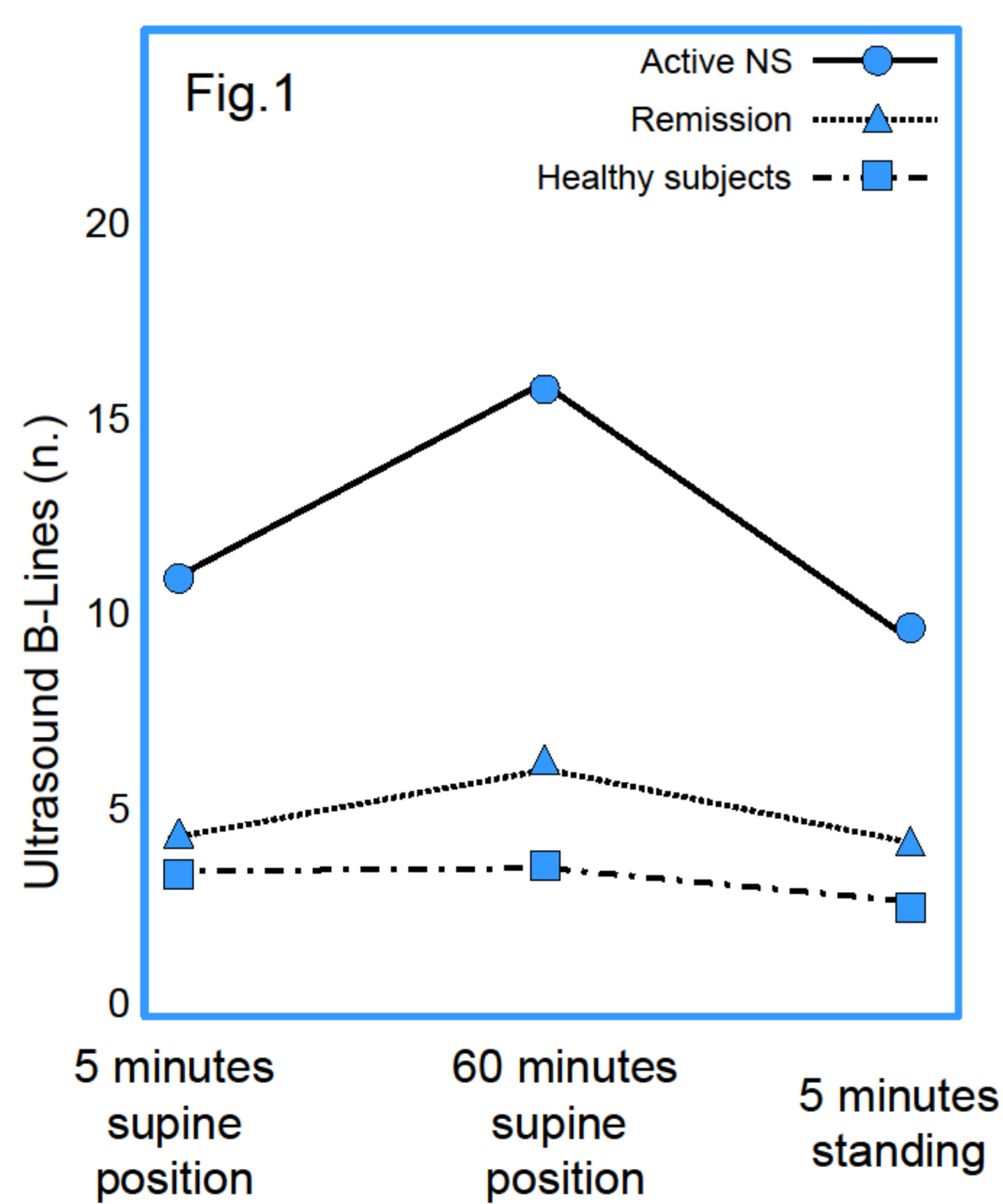
In patients with Nephrotic Syndrome (NS) the lung is considered as an organ protected from the risk of edema because of the “lung safety factor”, i.e. the very low net filtration pressure at alveolar level (just 1 mmHg), the increased lymphatic flow and the high interstitial compliance. Symptomatic pulmonary edema is rare in NS but no study based on systematic lung water measurements in NS patients has been performed until now.

## Methods

We measured lung water (LW) with a validated ultrasound technique (US) in 30 patients (19 with active NS, 11 with partial or total remission of NS) and in 19 healthy subjects. This technique estimates LW on the basis of the number of US-B lines (US-BL) over the whole area of the lungs. US lung studies were performed immediately after adopting the supine position (within 5 min, a post-standing-situation minimizing LW accumulation) and after 60 minutes of quiet resting in the same position (a posture maximizing LW accumulation). The test was then repeated after five minutes of standing (again, a situation minimizing LW). US lung studies were longitudinally re-evaluated after NS remission in 10 patients.

## Results

No patient manifested dyspnea during ordinary physical activity. In patients with active NS, in the first lung scan (immediately after assuming the supine position) the median number of US-BL in patients with active NS [11, Interquartile range (IR): 6-26] was much higher ( $p < 0.001$ ) than in healthy subjects (3, IR: 2-7) [Fig.1]. As much as 20 NS patients (66%) had a number of US-BL exceeding the upper limit of the normal range. In patients on partial ( $n=7$ ) or complete ( $n=4$ ) remission the number of US-BL was substantially less than in those in the active phase (4, IR: 3-7,  $p=0.01$ ) and did not differ from that in healthy subjects [Fig.1]. After 60 min of resting in supine position, the difference between patients with active NS (US-BL 16, IR: 11-36) and partial or complete NS remission (6, IR: 4-8) was amplified ( $p < 0.001$ ) and attenuated after 5 min of standing (9, IR: 7-25 vs 4, IR: 3-5,  $p=0.001$ ) [Fig.1]. Remarkably, both in the first and the second US lung scan, the number of US-BL was associated in an inverse fashion with serum albumin ( $r=-0.51$ ,  $p=0.004$  and  $r=-0.60$ ,  $p=0.001$  respectively) and the change in US-BL across the two scans was again strictly dependent on serum albumin ( $r=-0.37$ ,  $p < 0.05$ ) [Fig.2]. Similarly, the number US-BL was inversely related with hemoglobin levels both after 60 min. supine resting ( $r=-0.43$ ,  $p=0.02$ ) and after 5 min standing ( $r=-0.40$ ,  $p=0.03$ ) indicating that hemodilution secondary to volume expansion is a marker of subclinical pulmonary congestions in NS. Remarkably, longitudinal observation in 10 patients with active NS, after remission revealed a dramatic reduction in US-BL after 60 minutes of resting in supine position, (Active NS: 24, IR: 8-37; Remission: 6, IR: 5-15) [Fig.3].



## Conclusions

Asymptomatic pulmonary congestion is pervasive in patients with NS. Subclinical pulmonary congestion may explain the peculiar propensity to symptomatic pulmonary edema in patients with heart disease and proteinuria.

## References

Francesca Mallamaci, Francesco A. Benedetto, Rocco Tripepi, Stefania Rastelli, Pietro Castellino, Giovanni Tripepi, Eugenio Picano, Carmine Zoccali, Detection of Pulmonary Congestion by Chest Ultrasound in Dialysis Patients. JACC Cardiovascular Imaging 2010;3:586-94

