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Lung sonography is an useful guide to lung decongestion in hemodialysis patients at high cardiovascular risk

Dangerous lung congestion or overhydration can be detected relatively easily in dialysis patients by means of ultrasound examinations and the application of this technique is useful to safely guide lung decongestion.

ABSTRACT: In hemodialysis patients at high cardiovascular risk, including patients with coronary artery disease and heart failure, lung congestion, a condition predisposing to decompensated heart failure and pulmonary edema, is much common. By means of ultrasound examination of the lungs, the degree of lung congestion can be estimated relatively easily, and the therapy aimed at lung decongestion can be adapted individually. In one study, the systematic application of lung ultrasound safely resolved lung congestion in most cases. However, this study missed the primary endpoint (including mortality) and only in a post hoc analysis the therapeutic intervention guided by lung ultrasound reduced the risk for repeated episodes of decompensated heart failure [1].

Accumulation of water in the lungs (lungcongestion) is a common condition in hemodialysis patients, particularly in those at high cardiovascular risk, like those presenting coronary artery disease and/or heart failure. This alteration can be detected in an X-ray image, but cannot be heard easily with a stethoscope. When the congestion becomes so severe that fluid floods the alveoli ('alveolar pulmonary edema'), the sound of rattling breathing can be heard (and without a stethoscope at a later stage). Then, at the latest, pulmonary gas exchange is severely impaired, and the patients experience shortness of breath or even fear of death.

For hemodialysis patients, especially, lung congestion is a strong risk factor for mortality. Between dialysis sessions, all fluid which patients introduce is retained. Severe overhydration may ensue and this can then lead to heart decompensation. The degree of lung congestion can be assessed by ultrasound examination (sonography), and this may be used to adjust fluid removal during hemodialysis and drug therapies.

An international, multicenter study in 363 patients investigated whether such an ultrasound-based approach improves patient outcomes [1]. The primary endpoints were mortality, heart attack and decompensated heart failure. This strategy was compared with standard care in hemodialysis patients with a high cardiovascular risk.

The ultrasound examinations were carried out by the nephrologists themselves after brief instruction via a web platform. Sonographic control examinations were also performed periodically by cardiologists (blinded, i.e. without prior knowledge of the treatment that patients were receiving). The measurement parameters were B-lines in the ultrasound image, indicating fluid accumulation in lung tissue. The target for hemodialysis management was less than 15 sonographic B-lines.

In the sonography group (n=183), the number of B-lines decreased from 15 to nine from the beginning to the end of the study; in the control group (n=180), however, the number increased from 16 to 30 (p=0.002). In the sonography group, 117 patients (78%) reached the target value (<15 B-lines), compared to 85 patients (56%) in the control group (p<0.001). In the follow-up period lasting an average of 1.49±0.72 years, the primary endpoint was reached by 62 patients (34%) from the sonography group and by 71 (39%) from the control group (HR 0.88, p=0.47). However, secondary, post-hoc analyses showed significantly less frequent episodes of decompensated heart failure (HR=0.37; p=0.04) and cardiovascular events (HR=0.63; p=0.04) for the sonography group.

'The lung ultrasound-guided treatment strategy significantly reduced individual secondary, post hoc endpoints: decompensations of heart failure occurred 63% less frequently – and severe cardiovascular events 37% less frequently,' summarizes Dr Torino. Yet, because decompensated heart failure was not the primary end point of the study, new trials are still needed to confirm this finding. 'The fact that this did not significantly affect the composite end point could be due to the fact that decongestion improved gradually during the trial reaching the maximum at the end of the trial. Therefore, there could haven't been sufficient time for the beneficial effect of the lung ultrasound guided treatment to materialize.'

'Ultrasound examinations are available virtually everywhere in the hospital environment and do not take long to perform, so they can be deployed to diagnose and treat an ominous complication like lung congestion in hemodialysis patients.'

[1] 2453 Claudia Torino, Reggio Calabria, Italy. A lung ultrasound guided treatment strategy (LUST) in endstage kidney disease patients at high cardiovascular risk: a randomized multicenter trial.

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