

Diaphragm Ultrasound in Lung Transplant Patients: a prospective observational study of early diaphragmatic dysfunction

by Elise Crothers

Thesis submitted in fulfilment of the requirements for the degree of
Master of Physiotherapy Thesis

Under the supervision of Dr. David Kennedy and Dr. George Ntoumenopoulos

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CERTIFICATE OF ORIGINAL AUTHORSHIP

I, Elise Jane Crothers declare that this thesis, is submitted in fulfilment of the requirements for the award of Master of Physiotherapy Thesis, in the Graduate School of Health at the University of Technology Sydney.

This is a conventional thesis which is wholly my own work unless otherwise referenced or acknowledged. In addition, I certify that all information sources and literature used are indicated in the thesis.

This document has not been submitted for qualifications at any other academic institution.

This research is supported by the Australian Government Research Training Program.

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At the time of submitting this thesis, the following oral presentations have been given by Elise Crothers:

St Vincent's Campus Research Week, September 2020 – Research Poster and Presentation “Diaphragmatic dysfunction after lung transplantation: a prospective observational study”

Nursing and Allied Health Research Symposium, St Vincent's Hospital, September 2020 – Presentation. “Diaphragmatic dysfunction after lung transplantation: a prospective observational study”.

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Abstract

Diaphragmatic dysfunction is a well-known complication after cardiothoracic surgery, but few studies have documented its incidence and consequences after lung transplantation. Previous research has demonstrated that patients with postoperative diaphragmatic dysfunction frequently require increased duration of mechanical ventilation, longer length of stay in Intensive Care Units, and longer length of stay in hospital due to compromised pulmonary function. Point-of-care ultrasound is emerging as a convenient, accurate, and non-invasive tool for assessing diaphragmatic function at the bedside. The aim of this thesis was to use of point-of-care ultrasound to prospectively report the incidence of diaphragmatic dysfunction after lung transplantation up to three months postoperatively, and evaluate its impact on clinical outcomes.

In our prospective observational study we documented the prevalence and natural history of diaphragmatic dysfunction in 27 lung transplant recipients using ultrasound preoperatively; then at one day, one week, one month, and three months postoperatively. The ultrasound methods used were diaphragmatic excursion during quiet breathing, deep breathing, voluntary sniff, and thickening fraction. Patients with and without diaphragmatic dysfunction according to each of these methods were compared for differences in clinical outcomes: duration of mechanical ventilation, length of stay (LOS) in Intensive Care (ICU), hospital LOS and discharge destination.

The prevalence of diaphragmatic dysfunction on all four outcome measures was highest at one day after transplant and then reduced over time. Diaphragmatic dysfunction, at three months after transplant was similar to preoperative measures, suggesting good recovery of diaphragmatic function within three months. No statistically significant differences in clinical

outcomes were found between those with diaphragmatic dysfunction compared to those without. However, the increase in hospital length of stay is likely clinically significant.

In conclusion, this thesis has demonstrated that early diaphragmatic dysfunction is common, but mostly recovers within three months after surgery. Ultrasound examination of diaphragmatic excursion during quiet breathing is the most useful method for clinical practice because it is valid, reliable, independent of patient effort, and can discriminate between those with and without dysfunction. Although our study did not find a negative impact on clinical outcomes of statistical significance, patients with diaphragmatic dysfunction had an increased hospital length of stay which is of clinical importance to investigate further. To fully understand whether diaphragmatic dysfunction is important in this cohort, future research will need to consider patient-centred outcomes and be across multiple sites to examine more of the lung transplant population.