

## Abstract

**Introduction:** Assessment of diaphragm function should ideally be assessed using magnetic twitch pressure or esophageal and gastric balloons.

Conventional sonographic techniques as thickness and fractional thickening (FT), only provide limited insight in diaphragm function. Speckle tracking echocardiography allows reliable quantification of muscle function by tracking of grey patterns and their motion; strain as parameter of muscle deformation and strain rate as deformation velocity.

**Aim:** To investigate whether speckle tracking can quantify loading of the diaphragm, superior to FT.

**Methods:** 13 healthy volunteers underwent an inspiratory loading protocol with recording of transdiaphragmatic pressure (Pdi) and diaphragm electromyography (EMGdi). Inspiratory loading of 0 to 30% of maximal inspiratory pressure was applied in random order for 5 minutes per applied load. Diaphragmatic sonography was performed using a 2-4 MHz linear phased array transducer positioned at the right-lateral thoracic wall in the anterior axillary line longitudinal to the body axis. Ultrasound recordings of the diaphragm were made at the marked location during 10 seconds.

**Results:** Increased inspiratory loading increased Pdi and EMGdi. Sonographic markers of contractility increased with incremental loading. Pdi correlated with strain ( $r=0.75$ ;  $p=0.000$ ) and strain rate ( $r=0.77$ ;  $p=0.000$ ). Contrarily, FT was not correlated with Pdi.

**Conclusion:** Speckle tracking of the diaphragm can detect changes in diaphragmatic loading up to 30% of maximal inspiratory pressure. It might be a valuable tool to detect changes in loading in specific patient categories, including patients with acute respiratory failure and ventilated ICU patients.