Introduction:
Diaphragmatic dysfunction may occur following open-heart surgery. Diaphragm Ultrasound (US) provides a reliable evaluation of diaphragmatic motion. Surface Electromyography (sEMG) is a novel non-invasive technique to assess its electrical activity. [1] Aim of this study is to evaluate, through both sEMG and US, postoperative changes of diaphragm function in patients undergoing cardiac surgery.

Methods:
US measurements of right and left hemidiaphragm excursion during Quiet Breathing (QB) and Deep Breathing (DB) were obtained before surgery, and postoperatively, at the first spontaneous breathing trial. We simultaneously recorded bilateral sEMG traces. Values of Diaphragmatic Excursion (DE) and sEMG amplitude were analyzed and compared. Unilateral DD was defined as an asymmetry index (right/left excursion at DB) of >1.5 (left DD) or < 0.5 (right DD), as previously reported [2]. DP was defined as an excursion lower than 0.1 cm at DB, or evidence of paradoxical inspiratory motion.

Results:
18 adult patients undergoing elective open-heart surgery were enrolled. A significant overall reduction of DE could be identified postoperatively, particularly at DB (5.4 [4.5-6.3] cm vs. 3.2 [2.8-3.6] cm, before vs. after surgery, p< 0.0001). As well, a significant reduction of sEMG amplitude could be measured during DB (18.1 [11.7-27.3] vs. 5.1 [3.2-7.4] μV, p< 0.0001). DD with evidence of asymmetry was detected through US in 4/18 patients (22%) postoperatively (Fig. 1). Patients with DD showed a higher reintubation rate (2/4 vs. 0/14, DD vs. no DD), leading to a longer time of mechanical ventilation, ICU and hospital length of stay.

Conclusion:
Compared to baseline, postoperative diaphragmatic function was globally reduced in our patients, as shown by both US and sEMG data. A subgroup of subjects showed a monolateral DD, with an apparent impact on clinical outcome, despite the small sampled population.

References:
Fig. 1 - Diaphragmatic excursion at deep breathing