



Sonographic evaluation of diaphragmatic dysfunction in predicting pulmonary complications in upper abdominal surgery

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Background and aim:

Postoperative pulmonary complications (PPCs) in upper abdominal surgery are associated with increased morbidity and mortality. Diaphragmatic dysfunction (DD) is common following this type of surgery and seems to be a risk factor in the occurrence of PPCs. We used sonography to evaluate diaphragmatic excursion and thickness. The aim of our investigation was to evaluate the association between the presence of postoperative DD and the occurrence of PPCs.

Material and methods :

After approval of the local ethics committee, we conducted a prospective, observational study in patients aged 18-75 years undergoing elective upper abdominal surgeries. These surgeries were performed under combined general and epidural anesthesia. Ultrasound evaluation of the diaphragm was done by measuring the diaphragmatic excursion (DE) and thickening fraction (TF) during quiet and deep breathing before surgery and postoperative days (PODs) 1 and 3. DD is defined as DE during quiet breathing ≤ 1 cm and/or TF $\leq 20\%$. PPCs are defined as conditions affecting the respiratory tract that can adversely influence the clinical course of a patient after surgery. Their occurrence was assessed up to 7 days after surgery using clinical, laboratory, and radiology data. We performed univariate and then multivariate analysis.

Results :

Among 76 patients, the incidence of DD on POD1 was 41%. Main risk factors of DD were the ASA score ($p=0.011$), less advanced age ($p=0.009$), type of surgery ($p=0.046$), intraoperative plateau pressure ($p=0.01$) and VAS at rest and during movement ($p=0.04$ and $p=0.003$, respectively). Forty four percent of patients with DD on POD1 developed PPCs. Univariate analysis showed that DD on POD1 was not a risk factor for PPCs ($p=0.369$). Using logistic regression analysis, we identified a DE of the right hemidiaphragm on POD3 less than 2.47 cm in deep breathing, a decrease in TF of the right hemidiaphragm on POD3 from pre-operative value more than 14.5%, and a dose of neuromuscular blocker administrated more than 19 mg as independent risk factors of PPCs.

Conclusions :

Following upper abdominal surgery, DD on POD1 is not associated with the occurrence of PPCs.

We conclude that the evaluation of diaphragmatic function using sonography in post operative contexts seems interesting and further multicentric studies are needed to confirm the results.

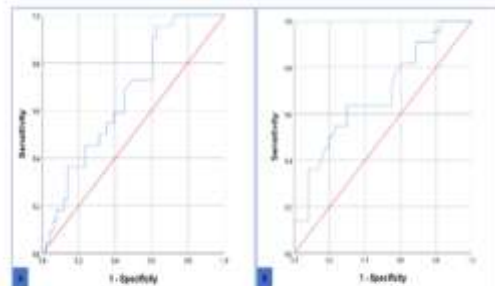


Fig 3A and B : Receiver operating characteristics of (A) right hemidiaphragm DE in deep breathing on POD3 (AUC of 0.666, 95% CI 0.536-0.776) and a value 0.52) and (B) variation in right hemidiaphragm TF on POD3 (AUC of 0.684, 95% CI 0.503-0.819) and a value 0.035).