Intraoperative neurophysiological monitoring of the phrenic nerve in videothoracoscopic surgeries.

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INTRODUCTION

There are few publications dealing with the intraoperative stimulation of the phrenic nerve to assess their functionality, which is important since their intraoperative assessment could significantly reduce the rate of injuries and complications related to their manipulation (Until 25%). In Video assisted thoracic surgery (VATS), this is of vital importance, since the right VATS approach allows direct visualization of n. right phrenic, but limits left vision, which can be compromised without absolute certainty until complications are observed. This fact is enhanced when the objective of surgery is oncological, as in the case of thymic lesions, where complete excision of the mediastinal gland and fat is key to controlling the disease. In this present study, our working group wants to validate the feability and reliability of these previously described techniques for monitoring and mapping the phrenic nerve during videothoracoscopic surgeries.

METHODS

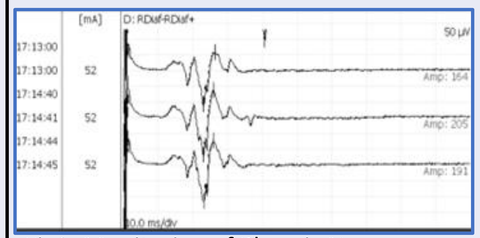
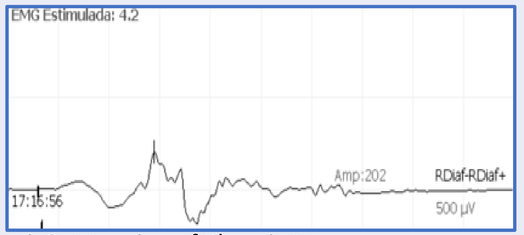
We report a cohort of 6 patients who underwent VATS for excision of mediastinal tumors performing intraoperative neurophysiological monitoring of the phrenic nerve between the years 2022 and 2023.

MONITORING	MAPPING
STIMULATION: 12mm, 23G bipolar subcutaneous needle electrodes. Placed on the posterior edge of the Sternocleidomastoid ***Parameters***: duration of 0.2ms – negative polarity Intensity between 30 and 100mA Frequency: Manual, 0.5 and 1Hz. 	**STIMULATION:** Specially designed monopolar surgical steel probe 50cm long and 2mm in diameter referenced to a needle electrode placed in the thorax. Placed through trocar designated only for this. ***Parameters***: duration of 0.2ms, Negative polarity, Intensity between 2 and 6 mA. Frequency: 1Hz. 
RECORDS: Two 15 cm long, 27G monopolar needles with anchoring system designed by a biomedical engineering team. Placed by 18 G catheter guide through internal control by mediastinoscopy. Parameters: Low Filters: 30 Hz, High Filters: 1500 – 2000 Hz, Sweep: 50 ms, Gain: 50 uv/div. 	**RECORDS:** Two 15 cm long, 27G monopolar needles with anchoring system designed by a biomedical engineering team. Placed by 18 G catheter guide through internal control by mediastinoscopy. Parameters: Low Filters: 30 Hz, High Filters: 1500 – 2000 Hz, Sweep: 50 ms, Gain: 50 uv/div 

ACTION PROTOCOL

- Stimulation electrodes for monitoring will be placed at the neck level prior to creating the surgical field.
- The intrathoracic recording electrodes will be placed once the surgical field is created using a designated trocar.
- A reference electrode will be placed on the skin at the level of the xiphoid process once the surgical field is created.
- During de approach continuous control of the phrenic nerve (monitoring) with stimulation at neck level will be perform.
- Once the phrenic nerve has been visualized, it will be stimulated (mapping).
- Changes in pulmonary pressures measured by the automatic respirator will also be evaluated as another indicator of diaphragm contraction.
- Alarm criteria will be defined as a 50% decrement of amplitudes and 10% prolongation of latencies.

RESULTS

	MONITORING	MAPPING
Latency	14+/-5 ms	8,5 +/- 5ms
Intensity	52+/- 20 mA	4,2 +/- 2mA
Amplitude	176+/-70 mA	758 +/- 500mA
Records	 Fig1: Monitoring of Phrenic Nerve.	 Fig2: Mapping of Phrenic Nerve

CONCLUSIONS

- **The described methodology for mapping and monitoring the phrenic nerve during laparoscopic thoracic surgeries is safe, feasible and reliable.**
- **Real time monitoring of phrenic nerve encourages the surgeon to optimize the tumor resection, stopping in time if eventual lesion is detected or completing the resection if functional integrity is preserved.**
- **Despite the promising results, larger series must be studied in order to establish standard protocols for laparoscopic thoracic surgery.**