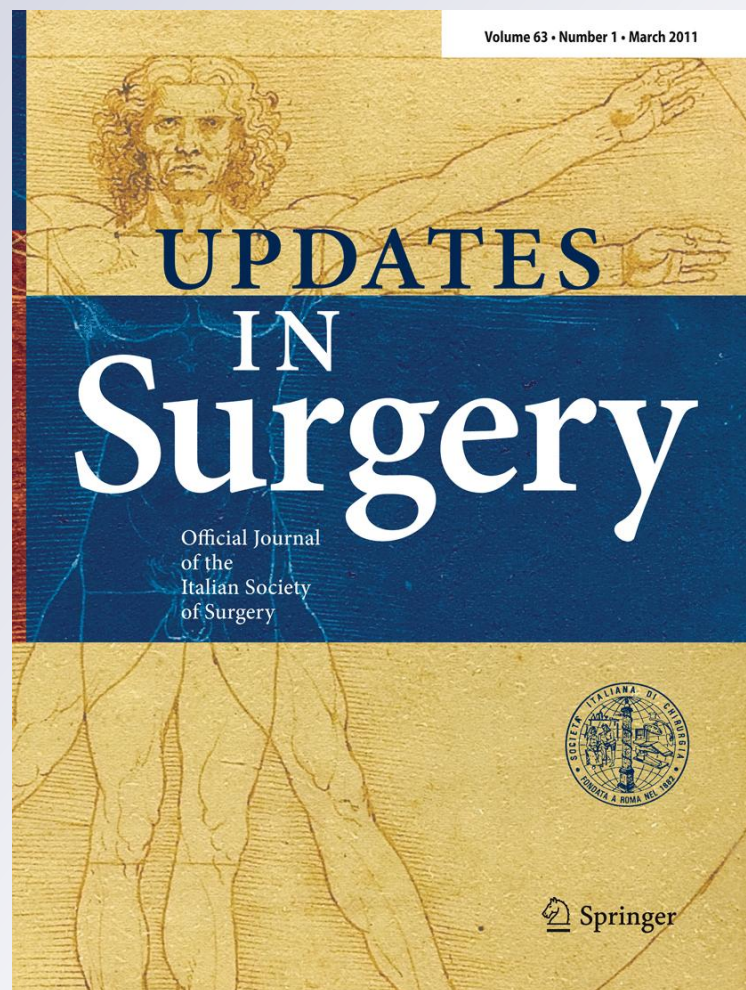


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## Cervico-mediastinal schwannoma of the vagus nerve: resection with intraoperative nerve monitoring

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**Abstract** Schwannomas are usually benign, single, encapsulated, slow-growing tumours originating from cranial or spinal nerve sheaths. The vagus nerve involvement at the mediastinal inlet is very uncommon. For anatomical reasons, the resection of cervical and mediastinal schwannoma of the vagus nerve has a high risk of vocal fold paralysis. We describe the case of a 67-year-old female with a cervico-mediastinal schwannoma of the vagus nerve that we removed using the intraoperative neuromonitoring technique. The patient presented with mild hoarseness and complained of discomfort behind the jugular notch. Neck and chest computerized tomography described a 35 × 30 mm solid lesion behind the left clavi-sternal junction; preoperative fine needle aspiration cytology revealed schwannoma. Resection of the mass was performed with a cervical approach and the vagus nerve tumour was completely removed under continuous neuromonitoring (NIM-3<sup>®</sup> System), preserving the vagus and the recurrent laryngeal nerve function. Pathology on the resected mass documented A-type schwannoma with “ancient schwannoma” areas. The intraoperative neurostimulation and neuromonitoring approach for the resection of vagus schwannoma are recommended because it may reduce the risk of injury to the vagus and to the recurrent laryngeal nerve.

**Keywords** Schwannoma · Cervical–mediastinal · Vagus nerve · Intraoperative nerve monitoring · Recurrent laryngeal nerve

### Introduction

Schwannomas (neurinomas, neurilemmomas) are usually benign, single, encapsulated, slow-growing tumours that in about 25% of cases occur in the head and neck. The vagus nerve involvement is uncommon, less than 100 cases having been described in the literature [1, 2]. Cervical schwannomas are typically diagnosed in the 3rd–5th decade of life, without sex predominance [3]. They usually present as a palpable bulge in the neck, slow-growing and painless. Large schwannomas may cause dysphagia, hoarseness or dyspnoea by the compression of adjacent structures in the neck [4]. The chest computed tomography (CT) findings are those of a parapharyngeal or paratracheal mass with smooth border and relatively homogeneous structure. Because clinical and CT findings are non-specific, differential diagnosis with other cervical masses is necessary [2]. Definitive diagnosis is best achieved by needle biopsy; surgery is the treatment of choice for these tumours. Resection of schwannomas localized at the cervico-mediastinal junction may be technically challenging, in order to avoid injury to the vagus and to the recurrent laryngeal nerve [5].

We describe the case of a vagus nerve schwannoma located at the cervico-mediastinal inlet, that we resected using intraoperative nerve monitoring in order to decrease the risk of recurrent laryngeal nerve paralysis.

### Case report

A 67-year-old female with a history of arterial hypertension, hiatal hernia and hypothyroidism, presented with symptoms of episodic hoarseness and mild discomfort localized under the jugular notch. Physical examination

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**Fig. 1** Computed tomography contrast enhanced scan showing a round mass with smooth margins adjacent to the left aspect of the trachea and overlying the common carotid artery

revealed a smooth-surfaced and painless soft mass under the left sterno-clavicular junction. Ultrasonography and CT-scan described a  $35 \times 30$  mm solid lesion with well-defined and vascularised margin, adjacent to the left aspect of the trachea at the cervical–thoracic transition point (Fig. 1). Ultrasonography-guided fine needle aspiration cytology (FNAC) with immuno-stain, performed in a hospital in France, revealed benign nerve cells suggestive of schwannoma. Preoperative laryngoscopy revealed normal motility of the vocal cords.

Surgical resection of the mass was performed with cervical suprasternal access. Briefly, the tumour was freed from adhesions with the internal jugular vein and the carotid sheath was dissected. The vagus nerve was identified as the structure from which the tumour originated. The mass was isolated from the vagus nerve and was dissected free from adhesions with the trachea and with the common carotid artery. Meanwhile, intraoperative recurrent laryngeal nerve monitoring was performed by stimulating the vagus nerve proximally to the lesion with the nerve integrity monitor (NIM-3<sup>®</sup> System), in order to prevent injury of vagus and recurrent laryngeal nerves [6, 7]. The neurostimulator settings were: intensity, 1 mA; pre-resection vagus nerve signal, 800  $\mu$ V. Excision of the schwannoma was completed with preservation of the vagus and of the left recurrent laryngeal nerve function, confirmed by unchanged proximal vagus nerve signal. The resected specimen consisted of an ovoid-shaped yellowish mass, partially excavated in the centre (Fig. 2). Histology documented A-type schwannoma with “ancient schwannoma” areas. The postoperative course was uneventful. Laryngoscopy revealed normally functioning vocal folds and the patient was discharged on the third postoperative day.



**Fig. 2** Cut surface of the resected schwannoma, oval shaped, measuring  $35 \times 30$  mm

## Discussion

Vagus nerve primary tumours are uncommon and their localization at the cervico-mediastinal transition point is extremely rare. Only a few cases of cervico-mediastinal and mediastinal schwannomas have been described, some of them being malignant [8–10]. Cervical schwannomas clinically present as asymptomatic slow-growing lateral neck masses palpable along the medial border of the sternocleidomastoid muscle [11]. Preoperative diagnosis is difficult because vagal schwannomas typically do not cause neurological deficits. Therefore, several differential diagnoses for tumour of the neck must be considered, including paraganglioma, branchial cleft cyst, malignant lymphoma, metastatic cervical lymphadenopathy and thyroid mass.

The usefulness of preoperative diagnosis by FNAC is controversial. If the cervical mass can be ruled out to be malignant, based on clinical and imaging findings, many authors do not recommend open or needle biopsy, because the treatment of choice of the mass is surgical anyhow. For vagus nerve tumours, there is general agreement that treatment consists of complete surgical excision. For treatment of schwannoma the primary aim should be dissection of the tumour from the vagus, with preservation of the neural pathway. For anatomical reasons, the surgical resection of vagus nerve schwannoma carries a high risk of vocal fold paralysis, particularly if the tumour is adjacent to the trachea, or is located close to the jugular foramen, or is malignant [11, 12].

The schwannoma that we are presently reporting was localized at the cervical–mediastinal inlet, close to the trachea, and its resection presented two challenges: the choice of surgical approach (cervical vs. trans-thoracic) and the

preservation of recurrent laryngeal nerve function. We chose the cervical approach because the mass was preoperatively documented benign by FNAC, therefore, it was likely to be mobilizable from the mediastinum, as it occurs with plongeant goiter. Moreover, the cervical approach allowed the successful implementation of intraoperative neuromonitoring by the NIM-3<sup>®</sup> System, a technique increasingly recommended to prevent laryngeal nerve injury [6, 7]. However, to prevent technical, anaesthesiology and anatomy pitfalls care must be taken in positioning the electrode accurately, since the adjustment of the head and neck after intubations can change the relative position of the tube and, hence, the electrode [13]. The use of a standardized approach to intraoperative neuromonitoring technology decrease the number of false and negative information and improve recurrent laryngeal nerve protection.

**Conflict of interest** The authors declare no conflicts of interest.

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