

## Case report - Thoracic oncologic

# The role of video-assisted thoracic surgery in the surgical treatment of superior sulcus tumors

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### Abstract

The surgical resection of sulcus superior tumors, also referred to as Pancoast tumors, remains a challenging surgical procedure. A patient presented with a superior sulcus tumor situated anterior in the thoracic inlet. The tumor was resected through a transmanubrial approach of Grunenwald combined with a video-assisted thoracic surgery (VATS) lobectomy. VATS can be very helpful in determining the exact location of the resection and at the same time performing a lobectomy avoiding extra morbidity due to a classical thoracotomy.

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### 1. Introduction

Non-small cell lung carcinomas (NSCLC) of the superior sulcus are called Pancoast tumors. During recent years the combined treatment of superior sulcus tumors with induction chemotherapy with local radiation followed by surgical resection became an effective treatment strategy resulting in high rates of complete resection and complete pathological response. Therefore, local control and overall survival improved [1]. Surgical treatment can be difficult due to the invasion of adjacent structures, such as the brachial plexus, subclavian vessels and spine [2]. The surgical standard for superior sulcus tumors is a radical en-bloc resection through an extended posterolateral thoracotomy as described by Shaw et al. [3]. A new anterior approach was defined by Darteville and colleagues, using a transclavicular approach to the thoracic inlet thereby creating a new access point to this complex anatomical region [4]. Modifications to this technique were made by Grunenwald who described a transmanubrial osteomuscular sparing approach. In this technique, in contrast to the transclavicular approach, the sternoclavicular articulation stays intact due to an L-shaped incision in the manubrium [5]. A disadvantage of Grunenwald's technique is the associated morbidity since the operation must be completed by a posterolateral thoracotomy to perform the upper lobe lobectomy. We report on a patient with a superior sulcus tumor who underwent a resection following Grunenwald's approach, combined with a video-assisted thoracic surgery (VATS) lobectomy.

### 2. Case report

A 60-year-old woman was referred to the Atrium Medical Center Parkstad with the diagnosis of a superior sulcus tumor in the right upper lobe. The patient presented with complaints of progressive cough and intermittent pain to her right shoulder. A chest radiograph revealed a mass in the upper lobe of the right lung. MRI showed a superior sulcus tumor invading the thoracic inlet at the anterior site with invasion of the brachial plexus and encircling of the subclavian vein (Fig. 1). Whole-body fluorodeoxyglucose – positron emission tomography (FDG-PET) showed no extra-thoracic disease. A mediastinoscopy was performed and showed no mediastinal nodal metastases. The patient was treated with three cycles of cisplatin and etoposide concurrently with 45 Gy radiation. Staging with MR-imaging after inducing chemoradiation revealed a partial regression of the tumor. The patient was scheduled for surgical resection six weeks after ending of the chemoradiation.

First, surgical resection started with a thoracoscopy to determine the resection margins. Second, an L-shaped incision was made along the anterior border of the right sternocleidomastoid muscle which was horizontally extended parallel to the right clavicle. An L-shaped transmanubrial incision according to Grunenwald was performed with preserving the sternoclavicular joint. This allowed mobilization of an osteomuscular flap to the lateral border. Inlet dissection and resection was undertaken with a neurosurgeon. Resection of the T1 nerve roots of the brachial plexus, the first rib and the subclavian vein was necessary to obtain a radical resection. After finishing the anterior dissection the patient was positioned in the lateral decu-

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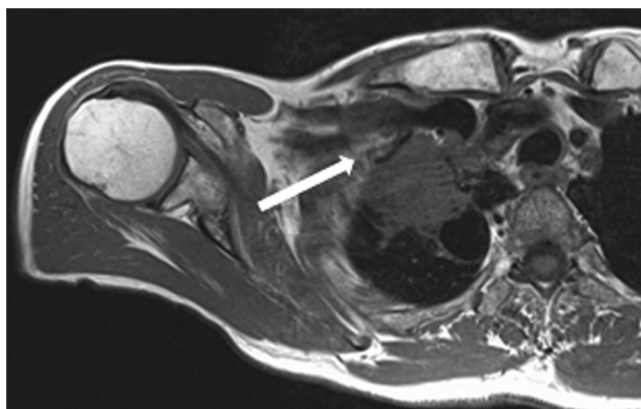


Fig. 1. MR-image showing superior sulcus tumor in the right lung, situated in the anterior site of thoracic inlet invading brachial plexus and subclavian vein (arrow).

bitus position to perform the lobectomy of the upper right lobe. This was performed through a complete video-assisted thoracic surgery (c-VATS) procedure. Three trocars were inserted to perform the VATS lobectomy. The anterior L-shaped Grunenwald incision served as a fourth entrance (the utility incision). The lobe was taken out through this incision.

Definitive pathological examination of the specimen revealed a complete response with no vital tumor cells left. Postoperative the patient had a short recovery time and the length of hospital stay was seven days. Besides mild edema of the right arm due to the resection of the subclavian vein there were no complications.

### 3. Discussion

Lobectomy still remains the surgical standard in the treatment of NSCLC with lower rates of local recurrences and higher overall survival as compared to limited resection [6]. Consequently, resection of superior sulcus tumors must be accompanied with a lobectomy to be oncologically justified. Also, one must not be seduced into performing a smaller resection after a positive effect of chemoradiation on tumor size (see Fig. 2). Especially in superior sulcus tumors this should not be followed by smaller resection because of the risk of positive tumor margins.

In the surgical treatment of superior sulcus tumors different surgical approaches exist. In this case the anterior approach of Grunenwald was chosen. If the tumor is situated in the anterior inlet this approach offers a good overview during local tumor dissection. Main disadvantage of this technique is that complementing the lobectomy can only be completed via the same incision in specific cases and therefore mostly requires an additional thoracotomy to perform the lobectomy [4]. Therefore, in this case the anterior transmanubrial approach was combined with a VATS lobectomy to complete the operation. VATS lobectomy is well-known because of the low morbidity and quick postoperative recovery time [7, 8].

The opening created by the anterior approach can be used as the utility incision of the VATS lobectomy. This incision can be used for the dissection with standard non-

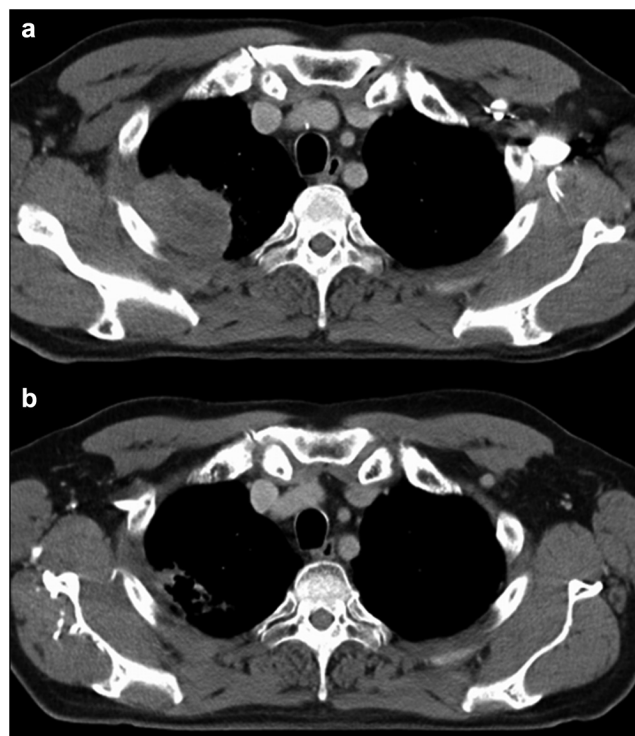


Fig. 2. Computed tomography scan of another patient showing a sulcus superior tumor in the right upper lobe of the lung before (a) and after (b) chemoradiation.

endoscopic instruments and to remove the specimen. Only two or three additional small incisions are required to perform the VATS lobectomy.

VATS lobectomy is especially useful in surgery for sulcus superior tumors because hilar dissection is often not impaired due to chemoradiation. Therefore, the lobectomy can be performed in a normal hilar anatomy. However, one can expect more problems in bronchial healing.

If the thoracoscope is introduced at the beginning of the operation it is beneficial during the dissection of the tumor. The thoracoscope will help to determine the intercostal space through which the incision has to be made for the lobectomy.

The Atrium Medical Center Parkstad has experience in c-VATS lobectomies with patients in the lateral decubitus position. Therefore, the position of the patient had to be changed for the lobectomy. It is likely, if experience progresses, that VATS lobectomy can also be safely performed in the supine position. An alternative is to place the patient in a position with the hips in lateral position and the shoulders in the supine position.

If the tumor is situated in the posterior position, a high posterolateral thoracotomy is the classical approach. In this situation a new entrance through an intercostal space must be made in order to perform the lobectomy. Also in these cases a VATS lobectomy could be of help to avoid an extra intercostal incision leading to increased morbidity.

In conclusion VATS lobectomy has an additional value in the surgical treatment of superior sulcus tumors: mainly by avoiding extra morbidity caused by a thoracotomy and offering a good overview on the superior sulcus which is also helpful in determining the level of thoracic wall

resection. Also, the Grunenwald incision used for the local dissection can be used as a utility incision in VATS lobectomy which, as a final advantage, can be performed in a non-disturbed hilar anatomy.

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