

Therapeutic Management of Massive Subcutaneous Emphysema, Bilateral Pneumothorax and Pneumomediastinum after Anterior Cordectomy for in situ Vocal Cord Carcinoma - Case Report

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Rezumat

Conduita terapeutică a emfizemului subcutanat masiv, pneumotoraxului bilateral și pneumomediastinului după cordectomie anterioară pentru carcinomul in situ al corzii vocale – prezentare de caz

Prezentăm cazul unui pacient fumător de 70 ani, internat pentru extirparea unei formațiuni tumorale localizate la nivelul corzii vocale stângi. În urma laringoscopiei directe suspendate (cu prelevarea unui fragment tumoral), examenul histopatologic preliminar a evidențiat un carcinom in situ. La 2 săptămâni după confirmarea histopatologică, s-a practicat sub anestezie generală o intervenție chirurgicală care a vizat îndepărtarea corzii vocale stângi prin abord anterior. În primele 24 de ore după intervenția chirurgicală, pacientul a prezentat un accident vascular cerebral, cu instalarea unei stări de comă profundă și a hemiplegiei stângi, care a necesitat susținerea mecanică a ventilației și tratament neurologic specific. Sub ventilație mecanică, pacientul a dezvoltat emfizem subcutanat masiv, pneumotorax bilateral și pneumomediastin, care au impus efectuarea unei traheostomii și a drenajului pleural bilateral, în vederea limitării gradului de insuficiență respiratorie

care se instalase brutal. După un interval de 18 zile de la practicarea cordectomiei stângi, pacientul a fost externat vindecat chirurgical, rămânând cu un deficit brahial stâng, care s-a remis aproape în totalitate după 6 luni.

Cuvinte cheie: cordectomie anterioară, emfizem subcutanat, pneumotorax, pneumomediastin

Abstract

We present the case of a 70 year-old smoker patient, who was admitted in hospital for removal of a tumour located on the left vocal cord. After direct suspension laryngoscopy (with tumor biopsy sampling), preliminary histopathological exam revealed an in situ carcinoma. At 2 weeks after histopathological confirmation, the left vocal cord was removed by anterior approach, under general anesthesia. In the first 24 hours after surgery, the patient presented an ischaemic stroke, with a deep coma and left hemiplegia, which necessitated mechanical ventilation and specific neurological treatment. Under mechanical ventilation, the patient developed massive subcutaneous emphysema, bilateral pneumothorax and pneumomediastinum, which required tracheostomy and bilateral pleural drainage, in order to limit suddenly installed respiratory insufficiency. After an 18-day interval of intensive care therapy, the patient was released at home, considered to be surgically cured and had a moderate remaining left brachial monoplegia, which was almost totally cured in the next six months.

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Key words: anterior cordectomy, subcutaneous emphysema, pneumothorax, pneumomediastinum

Introduction

Cordectomy is generally a minor surgical intervention that is performed for vocal cord dysplastic or incipient malignant (T₀, T₁ stage) lesions, with unaffected mobility of vocal cords on laryngoscopy exam. (1) T₀ lesions are usually treated by conservative surgery which consists in mucosal stripping or superficial layer excision, associated or not with radiation therapy. (2) In the majority of T₁ cases, cordectomy involves the ablation of the membranous vocal cord and the vocalis muscle, with or without partial or total removal of the subjacent layer of thyroid cartilage and, also, of the arytenoid cartilage. (3) There are two major methods in performing cordectomy, through laryngofissure or by laser endoscopy. (3)

Complications of vocal cord surgery are rare and relatively less severe. There are general complications (respiratory or circulatory disturbances, as a consequence of general anesthesia technique) and local complications (injury of lips, teeth or tongue during laryngoscopy, larynx bleeding during or after intervention, postoperative edema, postoperative neck emphysema, infection, granuloma scars and adhesions, phonatory impairment). (3) In very rare cases, subcutaneous emphysema could extend to the head, thorax and upper limbs, and could impair ventilation.

Case report

We present the case of a 70 year-old male patient who addressed the ENT Surgery Clinic for unproductive coughing, dysphonia and mild dyspnoea.

On the same day of hospital admission, the patient was explored by direct suspended laryngoscopy, under general anesthesia and a fragment of the left vocal cord was biopsied.

Histopathological exam of the biopsy fragment revealed squamous epithelium with acanthosis, papillomatosis, parakeratosis and several areas with low- and high-degree of dysplasia and *in situ* carcinoma, without possibility to establish the degree of regional invasion.

Therefore, a neck MRI exam was performed after one week and revealed a focal deformation of the larynx and the presence of a tumour located on left vocal cord, with 9/9 mm dimensions, with a relatively homogenous capture of contrast substance and without regional extension or pathological capture of contrast substance in the lymph nodes (Fig. 1).

The histopathological and MRI results conducted to the conclusion that the patient must suffer from vocal cord ablation. Surgery was performed two weeks after direct suspension laryngoscopy and was a classic vocal cord removal by anterior approach, under general anesthesia with thiopental, atropine, succinylcholine, atracurium, sufentanyl and with



Figure 1. Neck MRI scan showed a focal deformation of the larynx and the presence of a tumour located on the left vocal cord, with a relative homogenous capture of contrast substance and without regional extension

inhalator pivotal maintenance anesthesia with sevoflurane.

The ongoing patient arterial pressure was 171/89 mm Hg and intraoperative variations were between 78/52 mm Hg and 182/98 mm Hg. Surgery duration was 55 minutes and proceeded without incidents.

In the postoperative care unit, the patient recovered consciousness, was extubated and continued the unproductive coughing episodes, with frequent elimination of tracheal hemorrhagic secretions.

Ten hours after surgery, the patient presented a sudden severe increase of arterial pressure to 245/138 mm Hg, loss of consciousness, deep degree coma, with Glasgow Coma Scale (GCS)=4, left hemiplegia, severe haemoptysis and acute respiratory insufficiency which imposed tracheal intubation and mechanical ventilation with pressure SIMV, FiO₂=0.5, P_{insp} =12 cm H₂O, I/E=1/2, PEEP=5 cm H₂O.

On the next postoperative day, the patient developed a progressive subcutaneous emphysema, which extended from neck to head, chest, abdomen and pelvis, and was confirmed by a chest X-ray radiography, which revealed bilateral-thoracic and cervical subcutaneous emphysema, multiple round opacities within 3-4 mm in diameter on the left subclavicular zone, pronounced reticular-like interstitial lines, suggesting pulmonary fibrosis (Fig. 2).

On palpation of head, neck and thorax we observed characteristic air crepitation.

This situation determined the surgical team to practice necessity tracheostomy under general anesthesia.

Because the patient remained in deep coma, with GCS = 6, a head CT scan was performed at 48 hours after the time of vocal cord removal and revealed right parietal porencephalic sequela zone, with slight traction of the right lateral ventricle; right cortico-subcortical parietal hypodensity which suggested a recent ischemic stroke (Fig. 3). In figure no. 3 emphysema

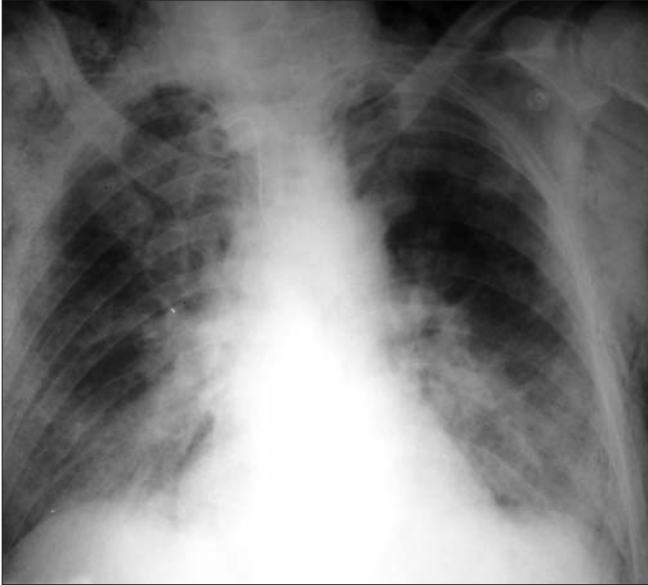


Figure 2. Chest radiography revealed bilateral thoracic pneumothorax and bilateral subcutaneous emphysema of the neck and thorax

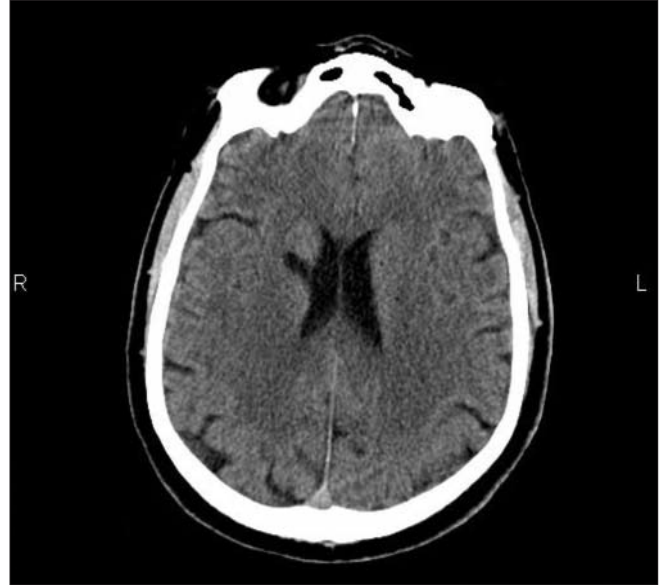


Figure 3. Head CT-scan revealed right cortico-subcortical parietal hypodensity, suggesting a recent ischemic stroke and skull emphysema

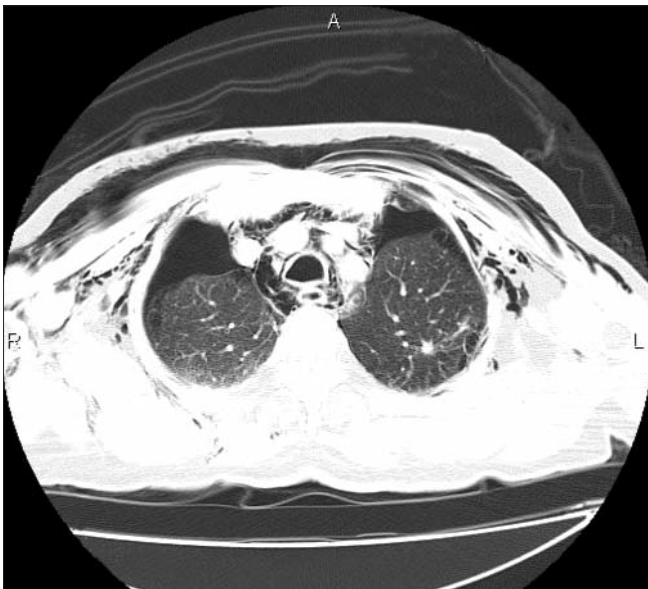


Figure 4. Thoracic CT scan revealed bilateral pneumothorax and subcutaneous emphysema of the chest wall



Figure 5. CT Scan revealed bilateral pneumothorax, pneumomediastinum and subcutaneous emphysema of the chest wall (another chest section)

extended to the skull could be seen.

The thoracic CT scan, that was performed simultaneously, revealed bilateral pneumothorax, pneumomediastinum and subcutaneous emphysema extended from the site of surgical incision to the head, upper limbs, thorax, abdomen and pelvis (Figs. 4, 5 and 6) and imposed insertion of thoracotomy tubes in both pleural cavities and active suction of air and fluid. The drainage tubes were removed after 6 days.

Several short subclavian incisions and a moderate compression of face, neck and chest were performed for

reduction of subcutaneous emphysema.

With the aim of reducing the neurological deficits caused by the ischemic stroke, patient received intravenous cerebral antiedema treatment (Mannitol 1 g/kg/day, Furosemid 40 mg/day, Dexamethasone 0.2 mg/kg/day, elevated position of head and thorax, appropriate ventilation), nootropics (Piracetam 10 g/day divided in glucose 10 % perfusions, group B vitamins and Cerebrolysin 50 ml/day, in one hour low volume intravenous perfusion) and appropriate control of highly arterial pressure (with repeated intravenous



Figure 6. CT scan revealed massive subcutaneous emphysema of the abdominal wall



Figure 7. Chest CT scan confirmed dissolution of the pneumothorax and important reduction of the subcutaneous emphysema

infusions of Enalapril 1.25 mg and even Nitroglycerine in perfusion, 50-100 mcg/min).

In order to prevent ventilator acquired pneumonia (VAP), we used an intravenous combination of Ertapenem (1 g/day), Linesolid (600 mg every 12 hours) and Moxifloxacin (400 mg/day), for twelve days.

On postoperative day 7 the patient regained consciousness and the movement of the left lower limb and had a GCS=12, was disconnected from mechanical ventilation and presented efficient respiratory parameters with spontaneous breath through the tracheostomy tube with minimal oxygen supplementation (4 L/min).

The tracheostomy tube was removed after 9 days and the patient continued to take efficient breaths. A CT scan confirmed pneumothorax resolution, the reexpansion of the lungs and the reduction of the subcutaneous emphysema (Fig. 7).

The outcome was favorable and the patient was discharged from the intensive care unit after 18 days.

The patient recovered mostly from the hemiplegic deficit and the MRI scan performed after one year revealed no recurrence of the tumour (Fig. 8).

Discussions

Vocal cord surgery for early stage of squamous carcinoma is usually a minor surgical intervention, with less severe complications. In laryngofissure vocal cord removal technique, minimal subcutaneous emphysema of the neck is usually present. Extended subcutaneous emphysema is a consequence of the posterior tracheal membranous wall lesion, during tracheal intubation. (4) Tracheobronchial lacerations are life-threatening complications, causing respiratory distress, with important desaturation and need for ventilation support. (4)

Tracheobronchial lesions produce subcutaneous emphysema and pneumomediastinum, because air penetrates through the cervicofacial planes and accumulates under the skin of the neck, face and chest, and in the posterior mediastinum. (5) Air

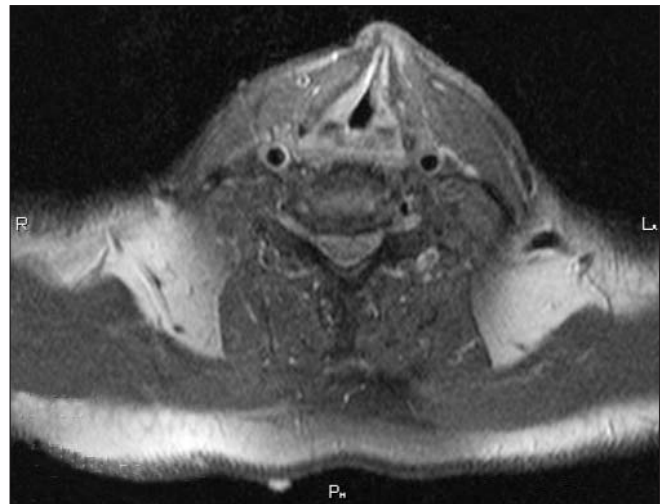


Figure 8. Neck MRI scan, at one year after vocal cord resection, confirmed the absence of cancer recurrence

penetration is favored by an increase of intrapharyngeal pressure caused by coughing, vomiting or manual mask ventilation for acute respiratory failure after surgery and air passes through the superior pharyngeal muscle and buccopharyngeal fascia and gets into the retropharyngeal space and then into the mediastinum. (5)

Commonly, subcutaneous emphysema, associated or not with pneumomediastinum, is a complication in laryngeal surgery performed with Venturi jet ventilation. (6)

Pneumothorax could be a likely complication of tracheal lesion and the mechanism is represented by air passing from the mediastinum into the pleura, most frequently on the right side. (7)

The treatment of tracheobronchial lesions presents two major options, conservative and surgical. Conservative treatment consists in passing a cuffed endotracheal tube or a tracheotomy tube under the place of the larynx wall lesion and

maintaining it for 8 to 10 days, in order to permit healing of the affected mucosa. (8,9) In a retrospective study on 14 patients, published in 2000, the conservative management of subcutaneous emphysema and pneumomediastinum secondary to tracheal lesions was superior to surgical repair and the later treatment option should be reserved to tracheobronchial ruptures that occur in lung resection interventions. (4)

Temporary tracheostomy or tracheal reintubation of such patients is recommended for preventing intrabronchial overpressures leading to coughing, which may increase subcutaneous emphysema and pneumomediastinum. (10,11)

Subclavian skin incisions and cutaneous massages for reduction of the emphysema volume can replace the necessity for tracheostomy. (4)

In our case, we adopted conservative management of the tracheal lesion. We performed cuffed tube tracheostomy, pleural cavity active aspiration and skin subclavicular incisions.

The particularity of our case was the presence of concomitant ischemic stroke, with deep coma, which necessitated 7-day ventilation.

Conclusions

1. Even though anterior removal of vocal cord by anterior incision of the larynx is considered a minor surgical intervention, multiple complications could appear, due to the associated diseases of patients (pulmonary senile emphysema, chronic coughing, arterial hypertension, stroke).
2. Normally, anterior surgery of vocal cord carcinoma conducted to a minimal neck subcutaneous emphysema, but a slight deficit of haemostasis, due to intraoperative hypotension, can irritate the upper respiratory segment and produces multiple episodes of coughing, Cough could be the cause of a tracheal effraction, which permits air penetration into the mediastinum and pleural cavities, generating massive bilateral pneumothorax and extended subcutaneous emphysema.
3. Multidisciplinary (ENT, thoracic surgery, intensive care, neurology, cardiology) approach of the described severe complications after vocal cord surgical removal led to a successful outcome.

Competing interests

The authors declare they have no competing interests.

Authors contribution

All authors of this article were actively involved in writing this paper and have equal contribution. C.C. Georgescu conducted the intensive care therapy, I. Osman, M. Mitroi, M. Stoica and V. Surlin were members of the surgery team and C. Mărgărețescu performed histological exams of biopsy fragments.

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