EMBOLISATION OF BRONCHIAL ARTERIES ASSOCIATED WITH THORACOPLEUROPLASTY FOR A PLEURALISED GIANT CAVERN WITH MULTIDRUG-RESISTANT MYCOBACTERIA AND MASSIVE RECURRENT HEMOPTYSIS

**SUMMARY:** We report a case of a 48 years old male patient presenting bilateral pulmonary TB with multi-drug resistant (MDR) atypical mycobacteria. The patient presented a completey pleuralised giant left upper lobe cavern, with recurrent massive hemoptysis (including an episode requiring admission to the intensive care unit). The biological status, poor respiratory tests (VC 34%, FEVI 26%) and the presence of pulmonary hypertension (51 mmHg) have contraindicated pulmonary resection. We practiced selective bronchial artery embolisation with Tachocomb for the control of hemoptysis (the first procedure of this kind performed in Romania) followed by obliteration of the cavity through a thoracopleuroplasty (Boțianu personal procedure) associated with muscle plombage (pectoralis, latissimus dorsi and intercostals). Closure-reinforcement of the bronchial fistulae was performed using a parietal pleura and intercostal flap and inclavation of the scapula. Postoperative course was excellent, with disappearance of the hemoptysis, obliteration of the cavity, improvement of the biological status and of the functional respiratory tests (VC 39,5%, FEVI 28,0%) despite performing a collapse procedure. Combination of endovascular techniques with less risky collapse procedures offers these patients who cannot tolerate a major lung resection a supplementary chance for healing.

**Key words:** MDR atypical TB, hemoptysis, bronchial artery embolisation, thoracopleuroplasty

**EMBOLIZARE DE ARTERE BRONŞICE ASOCIATĂ CU TORACOPLEUROPLASTIE PENTRU O CAVERNĂ GIANTĂ COMPLET PLEURALIZată CU MYCOBACTERII ATIPICE POLICHIIMOIREZISTENTE CU HEMOPTIZII MASIVE RECIDIVANTE**

**Rezumat:** Prezentăm un bolnav de 48 de ani cu tuberculoză pulmonară bilaterală cu bacili atipici polichimiorizistenți, cu o cavernă giantă de lob superior stâng pleuralizată, cu hemoptizi masive recidivante (inclusiv un episod necesitând internare la terapie intensivă). Statusul biologic, probele respiratorii slabe (CV 34%, VEMS 26%) și prezența hipertensiunii pulmonare (51 mmHg) au contraindicații resecții pulmonare. S-a practicat embolizare selectivă de artere bronșice cu Tachocomb pentru controlul hemoptizi (prima procedură de acest gen din România) urmată de desființarea cavitatei prin-o toracopleuroplastie procedeu Boțianu asociată cu plombaj muscular (pectoral, mare dorsal și intercostal), sutură-asigurare a fistulelor cu lambou de pahpleure parietală și mușchi intercostali și inclavare de omoplăt. Evoluția postoperatorie a fost excelentă, cu dispariția hemoptiziilor, desființarea cavitatei, ameliorarea stării generale și mai ales a probelor respiratorii (CV 39,5%, VEMS 29,0%) în ciuda efectuirii unei operații de colaps. Combinarea unor tehnici endovascularce cu intervenții mai puțin riscante de colaps oferă o șansă suplimentară de vindecare la bolnavii tuberculoși ce nu suportă o resecție pulmonară majoră.

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INTRODUCTION

Despite some remarkable progresses during the lost years massive hemoptysis remains one of the most dramatic thoracic emergencies, with a mortality which is still high (1, 2). In patients with tuberculosis, most of them have a poor respiratory and biological status which makes them to be less than ideal candidates for major lung resections (3, 4, 5). The progresses from the last years are related to the improvement and higher access to endobronchial and interventional radiology (hemostasis procedures) (6, 7).

CASE REPORT

We report a 48 years old male, diagnosed with bilateral TB 1.5 years ago, with multiple admissions to pneumology units. The patient developed a giant cavity which destroyed the entire left upper lobe, being repeatedly referred for surgery (lobectomy) which he refused. During the last months the patient presented a progressive alteration of the general state, important weight loss (9 kg in 6 months) and daily episodes of medium hemoptysis without improvement after a new tuberculostatic cure. Sputum cultures showed an infection with a multidrug-resistant atypical mycobacteria (resistant to isoniaid, rifampycin, streptomycin, ethambutol, ciprofloxacin, PAS and ethionamide, sensible only to kanamycin and cycloserine).

During the last admission the patient presented an episode of massive hemoptysis with asphyxia requiring transfusion and admission to the intensive care unit. After stabilization, the patient agreed with surgery.

Chest radiography showed a giant cavity in the upper half of the left hemithorax, with bilateral nodular TB lesions. Thoracic CT scan showed a giant cavity (maximum diameters of 113/62/120 mm) which destroyed the entire left upper lobe and communicated with the pleural space, with no demarcation; the walls of the cavity were irregular with a width up to 25 mm. Multiple bilateral nodules were disseminated in the pulmonary parenchyma, mainly in the inferior 2/3. The right lung presented 2 scars in the upper lobe and blebs with a

Fig. 1 and 2. Preoperative chest radiographs.

Fig. 3 and 4. Preoperative thoracic CT scan.
diameter up to 40 mm with apical and parahilar location. The left basal pleura appeared thickened.

**Functional respiratory tests** showed a severe mixed dysfunction: VC of 1570 ml - 34% and FEV1 of 930 ml/sec - 26%.

After broad-spectrum antibiotics, individualised tuberculostatic treatment, reequilibration, bronchodilators, cardiotonics, hemostatics and blood transfusion, there was a mild clinical improvement but with persistence of medium daily hemoptysis.

In order to control the hemoptysis we performed (25.07.2006) an **embolisation of the left bronchial arteries** (Clinic of Radiology and Medical Imagistics Târgu-Mureș, Romania). The arteriography showed a common trunk with a diameter of 2 mm emerging from the thoracic aorta, with 3 relatively large size branches travelling towards the upper lobe. The common trunk of these 3 branches was embolised using fragments of Tachocomb (® Nycomed, Austria). Immediate course was favourable, without complications and further hemoptysis.

After 10 days a **left pulmonary angiography** showed a normal aspect with a pressure in the left pulmonary artery of 51 mmHg - medium/severe pulmonary hypertension, which contraindicated a possible embolisation of the branches for the left upper lobe.

For obliteration of the pleuro-pulmonary TB cavity surgery was performed (14.08.2006) using general anesthesia with one-lung ventilation and a postero-lateral thoracotomy incision prolonged towards the inter-scapulo-vertebral space. After resection of a 10 cm length from the 6th rib we entered a cavity which extended up to the apex (pleural dome); the underlying lung parenchyma presented almost no reexpansion despite hyperinflation. After topographic subperiostal resection of 5th rib the cavity was widely opened and we found a 6 cm² surface on which 5 bronchial openings were dispersed: 2 of them larger (4-5 mm diameter) and 3 smaller (less than 1 mm diameter). The parietal pleura appeared very thick – up to 1,5-2 cm, presenting in some places a thin layer (less than 1 mm) of tissue resembling with the lung parenchyma; this aspect suggested a LUL cavern with complete pleuralisation in evolution. After topographic subperiostal resection of ribs 4, 3 and 2 the pachypleura + periost + intercostal layer was sectioned anterior with the electrocautery resulting a single flap with posterior irrigation. Both visceral and parietal pleural surfaces were debrided with important diffuse bleeding. The surface with bronchial fistulae was covered (suture-reinforcement) with the pachypleura + intercostal muscles flap using 2 stitches of 2/0 polyglycolic acid (®Dexon, USDG Sutures) with immediate stop of the air leaks. The pleural surfaces were

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**Fig. 5.** Selective angiography before and after embolisation of the left bronchial arteries.
Fig. 6 and 7. Intraoperative images showing the subperiostal resection of ribs 5 and 2.

Fig. 8 and 9. Intraoperative images showing the pleuro-periosteum-intercostal flap sectioned anteriorly and the cavity widely opened (left); the arrow indicates the area with bronchial fistulae (right).

Fig. 10 and 11. Intraoperative images showing the suture and reinforcement of the bronchial fistulae using a parietal pachipleura and intercostal flap. On the left image appears the closed-circuit irrigation-aspiration system (background).

Fig. 12 and 13. Final aspect showing the inclavation of the scapula and the muscular plombage (left). Immediate postoperative aspect showing the external contention (right).
badijonated with iodinated sulphamide and then covered with kanamicine powder (considering the results of the antibiogramme). Underwater drainage + irrigation system using a polithen thin drain was placed antero-superior. The stumps of the resected ribs were covered with oxidised cellulose (®Traumastem, Bioster). Considering the persistence of an important diffuse bleeding, with no tendency to stop after using plasma and usual hemostatic drugs we administered 120kUI of recombinant factor VII activated (®Novoseven, NovoNordisk). The pectorals, the upper half of the latissimus dorsi and the subscapular muscle were mobilised and used to obliterate the cavity. The tip of the scapula was fixed under the 7th rib using a no. 2 polyglycolic acid (®Dexon, USSDG Sutures). The skin and subcutaneous fat were sutured in a single layer; compressive bandage with external contention was placed. The duration of the procedure was 3.5 hours; we used only intraoperative transfusion of 400 ml of blood.

Bacteriologic examinations of the pus from the cavity showed the presence of pseudomonas aeruginosa and enterobacter spp. Specific cultures from the wall of the cavity showed the same multidrug-resistant mycobacteria.

The immediate postoperative course was unexpectedly favourable, with a stable hemodynamic and respiratory status. At one hour postoperative the patient presented efficient spontaneous breathing with SpO$_2$ of 96-97%, being extubated after 6 hours. The patient presented minimal sero-sanguinolent secretions on the drain from the cavity and minimal hemoptoic sputums which completely dissappeared after 3 days. The individualised tuberculostatic treatment was continued postoperatively, being associated with reequilibration, bronchodilatatory and cardiotonic treatment. Local care consisted on lavages using the irrigation-aspiration system, which was removed on the 15th postoperative day.

Postoperative course was favourable – disapearence of hemoptyis, primary wound healing, progressive improvement of the general state. Postoperative CT scans showed an obliterated cavity with viable muscle flaps. Respiratory tests showed a mild improvement – VC 1800 ml – 39,5%, FEV1 1030 ml – 29,0%, the patient

![Fig. 14 and 15. Chest radiographs at 3 months postoperative.](image1)

![Fig. 16 and 17. CT scan at 3 months postoperative](image2)
being able to perform medium physical efforts. The patient was discharged after 8 weeks, being admitted to the Pneumology Clinic from Târgu-Mureș to continue the individualised tuberculostatic treatment.

**DISCUSSIONS**

Embolisation of the bronchial arteries has gained an important place in the treatment of massive hemoptysis during the last 20 years (8). The first larger series was published by Remy (9, 10). Studies from recent years present impressive success rates with minimal complications (11, 12, 13, 14).

The main problems are related to the availability of this procedure and the technical difficulties due to the small caliber and the variable anatomy of these arteries: besides the 4 classical variants (15) a lot of origin and trajec anomalies were described (16, 17); the quite frequent existence of non-bronchial systemic collaterals as source of hemoptysis should also be noted (18). Because massive hemoptysis is not very often encountered, gaining of an important personal experience is most often impossible – very few centers perform more than 10 procedures/year (19).

Many embolisation materials were described, the most used being the resorbable gelatin sponges and the polyvynil alcohol particles (20). In our case, we used fragments of TachoComb (®Nycomed, Austria) since this was the only available embolisation material.

The most frequent complications are transitory chest pain and dysphagia, explained by the ischemia induced by the embolisation (20). The most feared complication is spinal ischemia which may lead to definitive paraplegia, explained by accidental embolisation of some spinal branches originating at this level. Use of microcatheters which can be introduced and secured in distal branches of the bronchial arteries (“superselective” embolisation) has raised the success rate and decreased the incidence of complications (21). Our patient has tolerated the procedure very well, presenting only a sensation of heat at the level of the left hemithorax during the first minutes after the procedure.

Embolisation of the bronchial arteries remains a palliative procedure which solves only the symptom and not the basic disease. For this reason, it is mandatory to associate another kind of etiologic – medical and/or surgical treatment (1).

Our patient is an example of the difficulties encountered in modern surgery for thoracic tuberculosis. A growing number of patients present extended lesions, infection with multidrug-resistant mycobacteria and a poor respiratory and biological status (22, 23, 24). In such situations, both the decision to perform surgery and choice of the procedure are extremely difficult (25, 26).

Our patient had an absolute indication for surgery based on:

- failure of medical treatment;
- irreversible lesion (giant cavity destroying the entire left upper lobe);
- presence of recurrent hemoptysis, with life-threatening episodes.

On the other hand, the patient presented functional contraindications for a major lung resection (left upper lobectomy):

- severe ventilatory disfunction;
- presence of mild/severe pulmonary hypertension with cor pulmonale;
- altered general state;
- last but not least, presence of bilateral nodular TB lesions. Overdistension of the lower lobe parenchyma after left upper lobectomy presented a high risk for development of new cavitary lesions in the circumstances of infection with multidrug-resistant mycobacteria.

In this situation we decided to combine an endovascular treatment – for the control of hemoptysis with a space-filling procedure to obliterate the cavity the left upper lobe cavity.

The surgical procedure consisted on a 5-ribs one-stage thoracopleuroplasty (Boțianu (27, 28) personal procedure) combined with muscle transposition and inclavation of the scapula; the indication for thoracopleuroplasty was a mixed one (pleural and parenchymatous) – in evolution the obliteration of a pulmonary cavity led to complete pleuralisation. Bronchial fistulae were sutured and reinforced using a flap of parietal pachypleura and intercostal muscles. We tried to reduce to maximum the extent of the thoracopleuroplasty by a limited topographic resection of ribs. Use of muscle flaps allowed not only filling of the cavity with well-vascularised tissues, but also a reduction of the extent of the thoracopleuroplasty with preservation of the first rib. Inclavation of the scapula under the 7th rib allowed a better collapse and secured the muscle flaps into the cavity.

**CONCLUSIONS**

Considering the raised number of TB patients associated with a grown proportion of the patients with multidrug-resistant mycobacteria (28, 29, 30), the number of patients resembling with the presented one
will grow. The thoracic surgeon faces very often patients techniques with less risky collapse procedures offers with absolute indication for surgery who cannot tolerate these patients a supplementary chance for healing.

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REFERENCES

5. Ayed A - Pulmonary resection for massive hemoptysis of benign etiology, Eur J Cardiothorac Surg 2003;24:689-93
REFERENCES (continued)


28. Boțianu AM - Personal procedure of thoracoplasty as ultimate therapeutical solution for healing and social reinsertion after failure of prolonged medical treatment in thoracic tuberculosis, CHEST 2002; 122:4:218S

29. Boţianu PVH - Spontaneous pneumothorax in tuberculosis, CHEST 2004; 126:4:894S

30. Corbett EL et al - The growing burden of tuberculosis: global trends and interactions with the HIV epidemic, Arch Intern Med 2003;163:1009