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FIRST EXPERIENCE OF SIMULTANEOUS EXTRAPLEURAL LUNG RESECTION WITH SILICONE PLOMBAGE FOR WIDESPREAD DRUG-RESISTANT DESTRUCTIVE PULMONARY TUBERCULOSIS: A CASE REPORT

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Background. *The increase of the number of patients with drug-resistant forms of disseminated destructive lung tuberculosis dictates not only expansion of indications for a surgical treatment but development of new intraoperative techniques, which may reduce the risks of postsurgical complications and further progressing of tuberculosis. For a long-lasting chronic course of destructive drug-resistant tuberculosis, it is often impossible to reach the process stabilization necessary for a successful lung resection. Toracoplasty usually performed when the resection intervention is contraindicated is not only traumatic for a patient but also does not provide the proper lung compression.* ***Clinical case description.*** *The clinical case is presented by disseminated fibrous-cavernous tuberculosis with a wide drug resistance of the pathogen, with the cavernous changes observed against the background of the pronounced lung tissue cirrhosis. To achieve the effect, we performed extrapleural lung resection followed by the immediate extrapleural silicone plombage in order to prevent overextension of the remaining part of the lung. The histological study data confirm the significant degree of the tuberculosis inflammation activity, in spite of the preceding long-term antituberculosis therapy.* ***Conclusion.*** *Due to the low trauma and high efficiency, the operation of simultaneous extrapleural pneumolysis with silicone implant plombage may be used in the complex treatment of disseminated destructive pulmonary MDR/XDR TB with a chronic relapsing course of the disease.*

Keywords: *widespread destructive tuberculosis, case report, surgical treatment, simultaneously extrapleural pneumolysis with silicone plombage and lung resecton.*

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BACKGROUND

The use of surgical methods increases the effectiveness of fibrous-cavernous tuberculosis treatment to up to 75% [1, 2]. In case of low effectiveness of antituberculosis chemotherapy due to the multidrug-resistant or extensively drug-resistant mycobacterium tuberculosis, the widespread nature of the destructive process often prevents performing a resection surgery [3]. Therefore, it is often necessary to perform a collapse surgery, which has an effectiveness of 53%–70% [4].

Extrapleural thoracoplasty with resection of five to eight ribs is extremely traumatic, since it deforms and changes the excursion of the chest, which leads to dysfunction of

the shoulder girdle [5]. For this reason, many patients with fibrous-cavernous tuberculosis with multidrug-resistant or extensively drug-resistant mycobacterium often refuse thoracoplasty, which reduces the efficiency of their treatment. So, far, research has been made on an effective collapse surgical method, which is an alternative to the traditional thoracoplasty [5, 6]. The extrapleural pneumolysis with silicone implants developed at the Central Research Institute of Tuberculosis (CRIT), Moscow, showed good results, as it provides persistent collapse of cavity formations in a lung altered by tuberculosis and does not modify the configuration of the chest. The method is patented [7]. A silicone breast implant is used as a seal, designed to be permanently placed in the human body and not cause a rejection reaction. Sometimes, due to the cirrhotic deformity of the lung tissue, the density of the implant is not enough to provide the necessary collapsing effect. Therefore, under these conditions, extrapleural pneumolysis and extrapleural lung resection should be performed simultaneously. We provide a clinical case of the first experience of such a successful surgery in a patient with destructive pulmonary tuberculosis with an extensively drug-resistant mycobacterium pathogen and the presence of a cirrhotic component.

CLINICAL CASE

Patient Information

Patient A, 48 years old, a resident of the Republic of Dagestan, was admitted for treatment to the surgical department of CRIT on 03.23.2016. The patient's past medical history was studied. Since 2013, the patient started having cough with sputum of a mucopurulent nature, along with a rise in temperature to subfebrile values and hemoptysis. He went to the phthisiotherapist at the primary healthcare facility, and a diagnosis of infiltrative pulmonary tuberculosis in the destruction phase was established. Antituberculous chemotherapy was prescribed as follows: isoniazid 0.6 g/day, ethambutol 1.8 g/day, protionamide 5.0 mg/day, pyrazinamide 1.5 g/day, and levofloxacin 1.5 g/day. Negative changes were noted. The process was transformed into fibrous-cavernous tuberculosis, due to which the patient was referred to the CRIT, and due to episodes of hemoptysis reported in the anamnesis, he was hospitalized in the surgical department on 10.31.2015.

At admission, the patient's condition was satisfactory. He had complaints of cough with mucopurulent sputum and shortness of breath with strong physical exertion. During auscultation, breath sounds were reduced in the upper parts on the right, where moist rales of various sizes were heard. The respiratory rate was 16 breaths/min, pulse was 76 beats/min, blood pressure was 120/80 mmHg, and heart tones were clear and regular. The abdomen was soft and nontender. Bowel and bladder functions were normal.

Plain radiographs and computed tomography (CT) images of the lungs revealed fibrotic shrinkage of the superior lobe and S_6 of the right lung and $S_{1–2}$ of the left lung. Multiple different-sized thin- and thick-walled caverns, of a large size in the upper sections and small size in the lower sections of the right lung, were present (Fig. 1).

External respiration function revealed a vital capacity of the lungs of 62.9%; forced expiratory volume per 1 s was 48.1%; blood gas composition was PaO_2 of 61 mmHg, SaO_2 of 90.9%, and $PaCO_2$ of 42 mmHg. A decrease in the ventilatory lung capacity was by a mixed type, with a moderate decrease in the vital capacity of the lungs. Moderate arterial hypoxemia was present.

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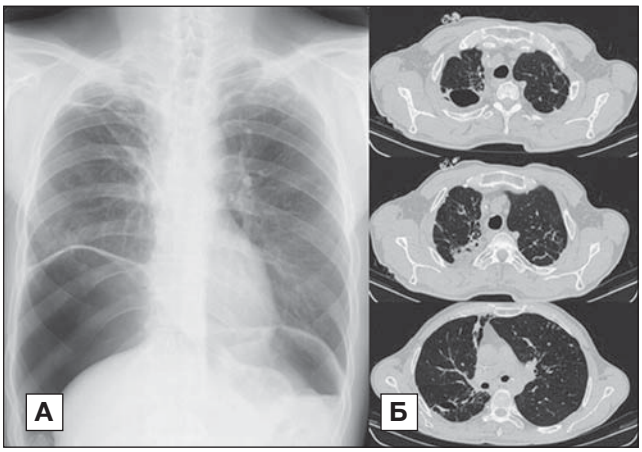
Fig. 1: Chest x-ray (A) and CT (B) scans of patient A upon admission (description is in the text).



The electrocardiogram shows a sinus rhythm and overexertion of the right atrium.

The sputum was examined using luminescence microscopy, which revealed acid-resistant mycobacterium (+++) three times. The DNA of mycobacterium was detected by polymerase chain reaction. The liquid nutrient media were inoculated (BACTEC MGIT 960), and an increase in the culture of mycobacterium with drug resistance to isoniazid, rifampicin, ethambutol, ethionamide, capreomycin, amiacin, and fluoroquinolones was detected. Sensitivity of mycobacterium to linezolid was observed.

Complete blood count showed a hemoglobin level of 142 g/l, white blood cells count of 6.4 × 10^9/L (1% stab neutrophils, 53% segmented neutrophils, 4% eosinophils, 29% lymphocytes, and 3% monocytes), and erythrocyte sedimentation rate of 20 mm/h (W).

Diagnosis and Treatment

The clinical diagnosis established was fibrous-cavernous tuberculosis of the right lung in the dissemination phase: mycobacterium (+); extensively drug-resistant mycobacterium.

Considering the data on the extensively drug-resistant mycobacterium, in the department, the patient received antituberculosis chemotherapy, which included moxifloxacin, terizidone, pyrazinamide, para-aminosalicylic acid (PASA), linezolid, and capreomycin in dosages corresponding to the patient's body weight, as well as vitamin therapy and hepatoprotective drugs. An artificial pneumoperitoneum was applied as a pathogenetic treatment. A course of intravenous laser blood irradiation was conducted, which included 15 daily procedures lasting 8 min, using a semiconductor gallium arsenide laser with a wavelength of 630 nm and a power of 25 mW at a frequency of 3000 Hz.

As a result, the patient had a positive clinical and radiological dynamics in the form of weight gain of 6 kg over 6 months, persistent abacillation, further resorption of perifocal infiltration, and compaction of dissemination sites according to control radiographs.

The patient was examined at the multidisciplinary team meeting and given the bilateral nature of the process; it was decided to perform an extrapleural pneumolysis on the right lung with the installation of a silicone seal.

On 05.18.2016, when performing the extrapleural pneumolysis, pronounced cirrhosis of the lung apex was revealed, against which a rigid fibrous cavity with abnormal pleura was determined in its projection. Extrapleural resection of the rigid site was decided. Thus, S_{1-2} of the right lung, containing the cavern, was resected by applying a SOMI-80 suturing device, after which a 275 mL silicone seal was installed. The position of the seal is presented in Fig. 2. The surgery lasted for 175 min, and blood loss was 610 mL.

A cirrhotically altered lung tissue was visible on the gross specimen (Fig. 3), against which a thick-walled cavity, containing liquid caseous masses surrounded by small foci of caseous necrosis, was determined.

Fig. 2. The position of the implant in the extrapleural space after resection of the upper lobe of the right lung.

According to the histological conclusion no. 2475-84/16 (Fig. 4–5), foci of caseous necrosis were present in the lung tissue, most of which had signs of organization in the form of a connective tissue capsule with elements of granulation tissue. Along the periphery, a mild epithelioid-cell reaction and lymphoid accumulations, as well as single multinuclear macrophages, were observed (Fig. 4A). One of the foci of caseous necrosis had melting and leukocyte infiltration (Fig. 4B).

The morphological pattern corresponds to fibrous-cavernous tuberculosis with dissemination and pronounced activity of the process, which can be regarded as progression.

The postoperative period had no abnormalities: the drainage was removed on day 3, and

Fig. 3. The removed fragment of the lung with fibrous cavity.

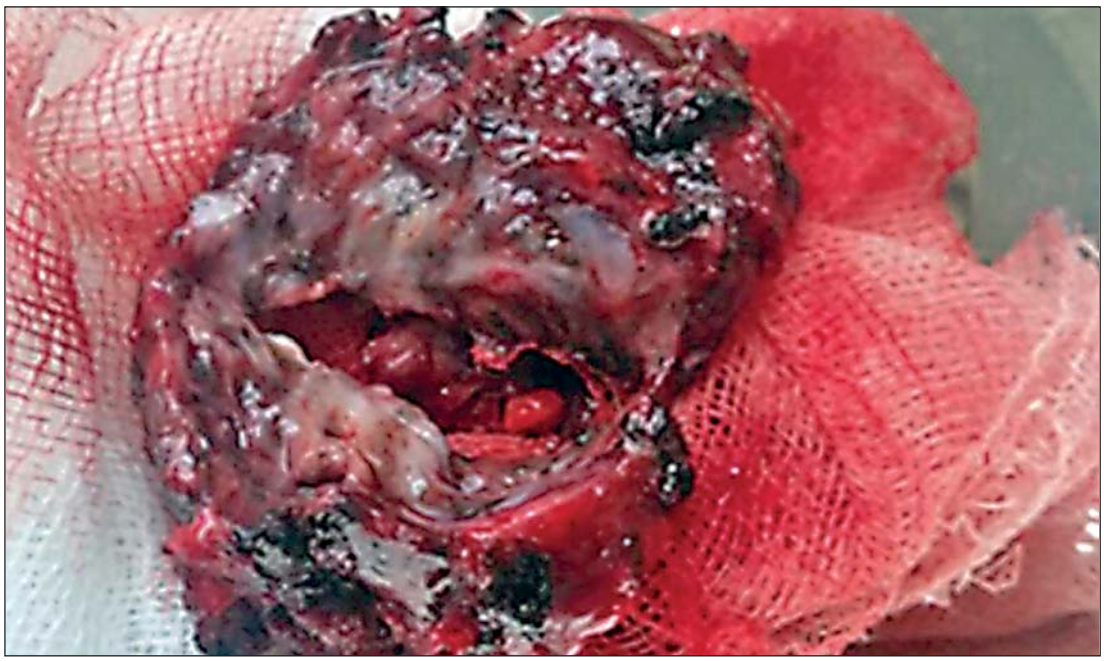


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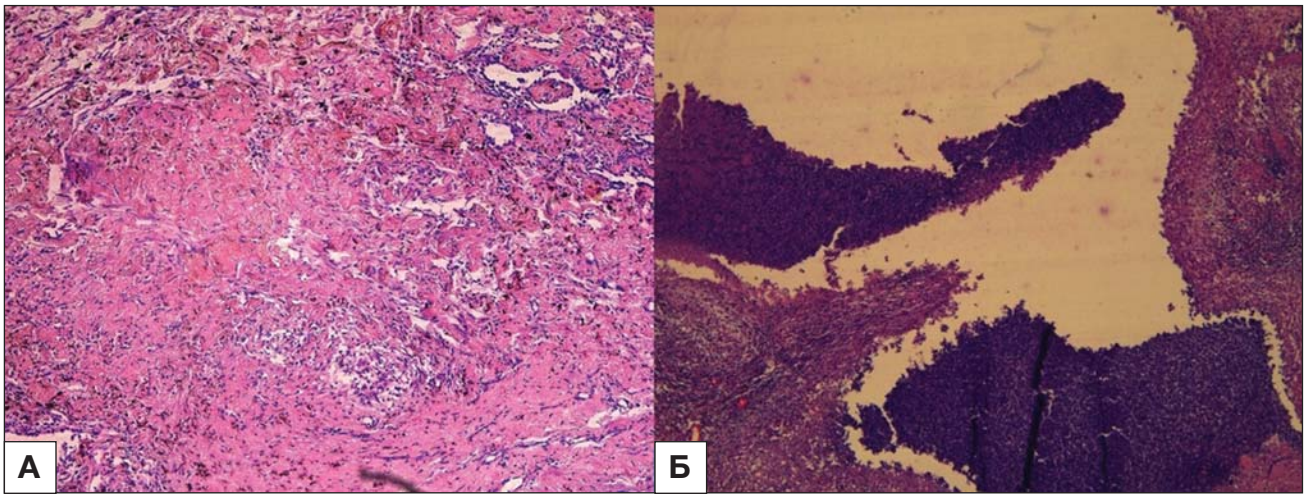
Fig. 4.: (A) Morphological signs of progression of fibrous-cavernous tuberculosis: hematogenous seeding site. (B) Melting of caseous masses with leukocyte infiltration of the tuberculous cavity walls. Hematoxylin and eosin staining (magnification: 120x).



the sutures were removed on day 10 after the surgery.

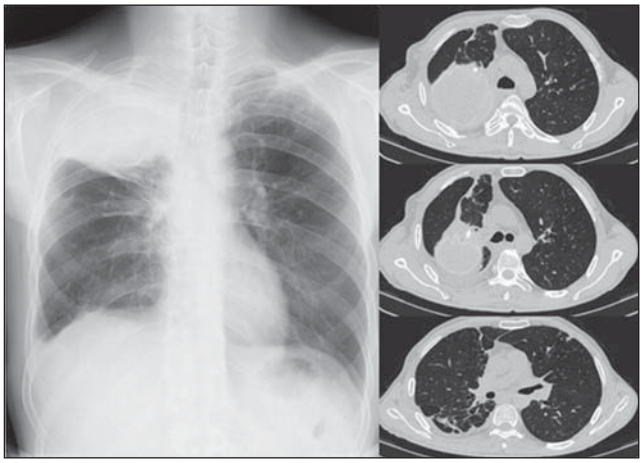
The patient completed the treatment according to the CRIT recommendations and returned to his habitual way of life. His health status was satisfactory.

One and a half months after the surgery, x-ray and CT scans revealed further expansion of the right lung under the seal in dynamics. No additional focal-infiltrative changes in the lungs were detected (Fig. 5).

DISCUSSION

Clinical and radiological aspects and data of a morphological study on the surgical material in patients with advanced destructive tuberculosis with multidrug-resistant or extensively drug-resistant mycobacterium prove the active nature of the tuberculosis process without a tendency to delimitation and healing of the inflammation foci. Therefore, collapse surgery, which, in contrast to resection surgery, provides biomechanical rest of the lung tissue and creates conditions for healing of cavities and resorption of infiltrative and focal changes in the lung, are becoming more and more in demand.

Fig. 5. Chest x-ray examination as of 07.04.2016 and chest CT as of 06.22.2016 at discharge.



Extrapleural pneumolysis with a silicone implant, which provides the maximum compression effect of cavity formations, is being increasingly introduced into clinical practice. Simultaneously, with a long course of the destructive process, fibrotic changes in the lung tissue and cavity walls develop, which usually results in an impossibility to achieve a complete collapse of the cavities using a seal. In this situation, according to our experience, it is advisable to perform an extrapleural lung resection and filling with a silicone implant simultaneously, which prevents the overstretching of the remaining lung tissue, development of emphysema, and progression of tuberculous inflammation in the remaining foci.

CONCLUSION

Resection surgeries aimed at the sanitation of the tuberculosis infection can be combined with collapse surgery that promote healing of cavities and resorption of caseous masses. The combination of these techniques may be optimal for patients with progressive widespread destructive pulmonary tuberculosis with extensively drug-resistant mycobacterium, with a predominance of the cirrhotic component. Performing extrapleural resections and sealing simultaneously, after complex preoperative preparation using pathogenetic methods such as intravenous laser blood irradiation and artificial pneumoperitoneum, proved effective in terms of achieving a stable clinical cure for patients with a chronic recurrent disease course.

Informed Consent

Informed consent was obtained from the patient to use his personal data as illustrations of professional activities, as well as in scientific work, articles, and educational materials.

FUNDING

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AUTHORS’ CONTRIBUTIONS

E.V. Krasnikova developed the concept, wrote the text, and created the research design. L.N. Lepekha was involved in the development of the concept and conducting and analyzing a histopathological study on the surgical material with the determination of the degree of activity of tuberculosis inflammation. V.K. Aliev prepared the illustrations and formatted the text. A.E. Ergeshova conducted the patient’s follow-up during the entire period of his stay in the clinic and took part in the surgery. R.V. Tarasov prepared the text, selected the illustrations, and edited the material. M.A. Bagirov was involved in the development of an organ-sparing aspect in phthisiosurgery, created the concept of this clinical case, and performed the surgery.

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