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Background. Huge mediastinal teratomas (MT) occupying more than two compartments of the mediastinum and encroaching in the pleural spaces often pose a significant challenge in the surgical treatment. Initially asymptomatic benign teratomas grow slowly and can reach huge size. Despite real invasion of MT to the neighboring anatomic structures is rare, this tumor because of its location in the anterior mediastinum close to the heart, great blood vessels and lungs in the process of its growth causes severe clinical symptoms.

The aims of this study is to present our experience and to draw attention to the main problems in this field.

Methods. A review was performed of 17 patients operated on the cases of huge MT. The age was 15 to 57 years. Male/female ratio 11/6. In 5 cases exploratory thoracotomies were earlier undertaken in other hospitals. The main reason for inability to perform the removal were firm adhesions to the chest wall simulated tumor invasion and severe bleeding during the tumor dissection. Previous biopsies showed mature MT in all cases.

We performed median sternotomy in all patients. In 1 patient in whom tumor was recurrent after incomplete resection we had to perform repeated sternotomy. All patients were followed from 2 to 7 years after the operation.

Results. In 15 patients the tumor was removed completely. Resection of the pericardium was necessary in 9 cases. Lobectomy or wedge lung resections were performed in 7 cases. In 1 patient the operation was palliative because of vena cava and atrium invasion, and in 1 patient was exploration only. Pathologic examination revealed malignant transformation in these 2 patients. The blood loss was from 425 to 2530 ml (average = 690 ml) mainly from enormously vascularised adhesions between the tumor and the chest wall. One postoperative complication - bleeding occurred in the patient after exploration with lethal outcome. Twelve patients are free of disease. Two patients where malignancy was found in removed tumor died from tumor progression despite irradiation (RT) and chemotherapy (CT). Brief data about patients operated upon are presented in the table.

Table. Short history of patients included in the study.

No	Sex	Age	Previous surgery	Our intervention	Pathology	Outcome
1.	F	17	Partial sternotomy, incomplete resection	Full median sternotomy (FMS), removal	Matured	Good
2.	M	34	No	FMS, removal	Matured	Good
3.	F	16	No	Partial sternotomy	Matured	Good
4.	F	29	No	FMS, removal	Matured	Good
5.	M	53	No	FMS, removal	Matured	Good
6.	F	25	No	FMS, removal	Matured	Good
7.	M	19	No	FMS, removal	Matured	Good
8.	M	53	No	FMS, removal	Matured	Good
9.	M	35	Thoracotomy expl.	FMS, removal	Malignant	Died in 3 y.
10.	F	57	No	FMS, removal	Matured	Good
11.	M	20	Thoracotomy expl.	FMS, removal	Matured	Good
12.	M	17	No	FMS, incomplete res. + CT+RT	Malignant	Died
13.	F	51	Thoracotomy expl.	FMS, removal	Matured	Good
14.	M	17	No	FMS, exploration	Malignant	Died
15.	M	24	No	FMS, removal+ CT+RT	Malignant	Died in 2 y.
16.	M	39	Thoracotomy expl.	FMS, removal	Matured	Good
17.	F	16	No	FMS, removal	Matured	Good

Case report I. A male person 20 years old (No 11 in the table). The disease was disclosed in 2003 because of blunt thoracic trauma. Large opacity was found in the chest radiograph and pleural drainage revealed hemorrhage (about 500 ml). Left thoracotomy was performed for suspected clotted hemothorax. A huge tumor occupying left hemithorax was found, and considered inoperable. Biopsy showed matured teratoma. CT scan at admission to our clinic showed in fig.1.

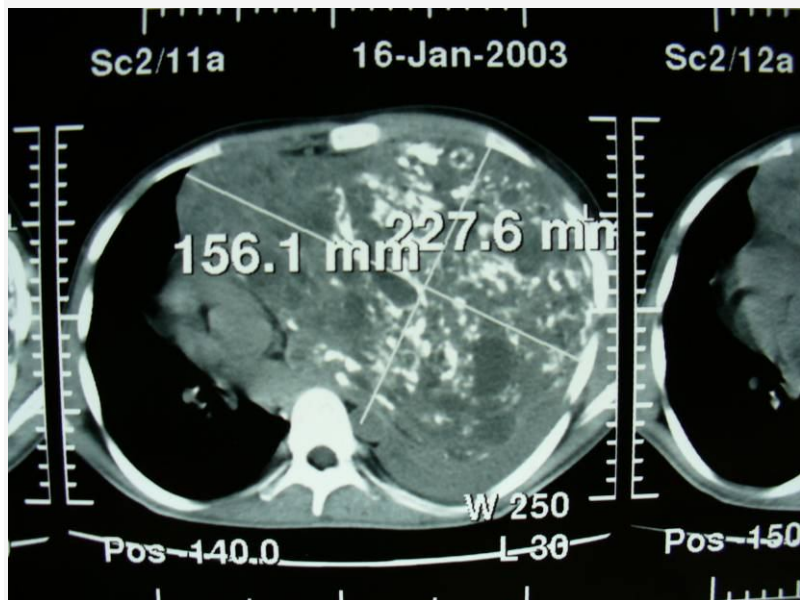


Fig. 1. CT scan showed giant mediastinal tumor deviated the heart, right lung and fully compressed the left lung. Bones, calcified foci and cysts were visible in the tumor.

Total median sternotomy was performed (Fig. 2), and tumor was completely removed. Left wall of pericardium was excised and upper lobectomy had to be performed because of dense and firm adhesions with the tumor. Compression atelectasis of the lower lobe took place. Lower lobe was divided from adhesions. New pericardiac wall was done with parietal pleural flap. The weight of the removed tumor was 3,5 kg (Fig. 3). Blood loss was 783 ml. Postoperative course was uneventful.

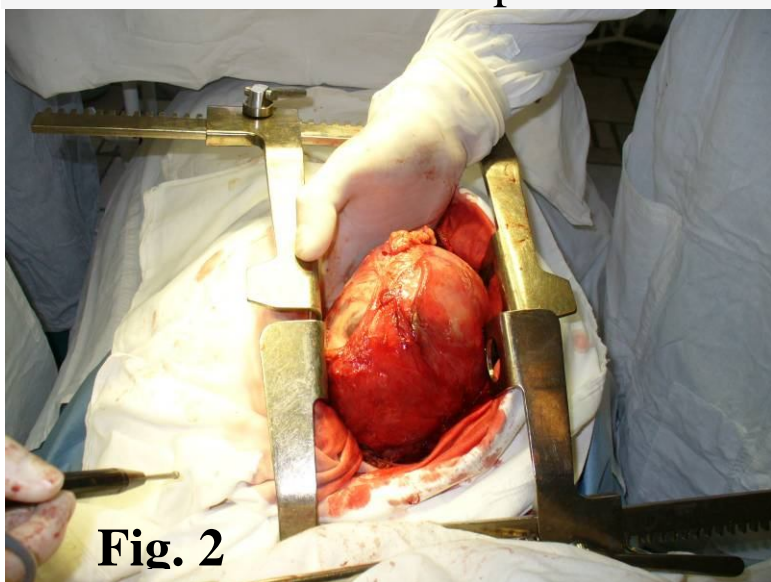


Fig. 2

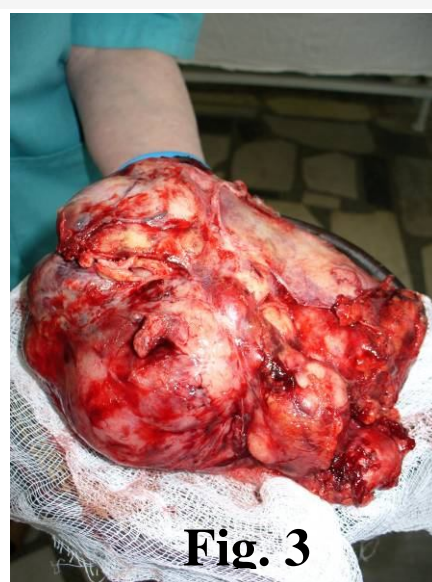


Fig. 3

Fig. 2. Median sternotomy. The tumor was mobilized and partially elevated in the operative wound.

Fig. 3. The removed tumor.

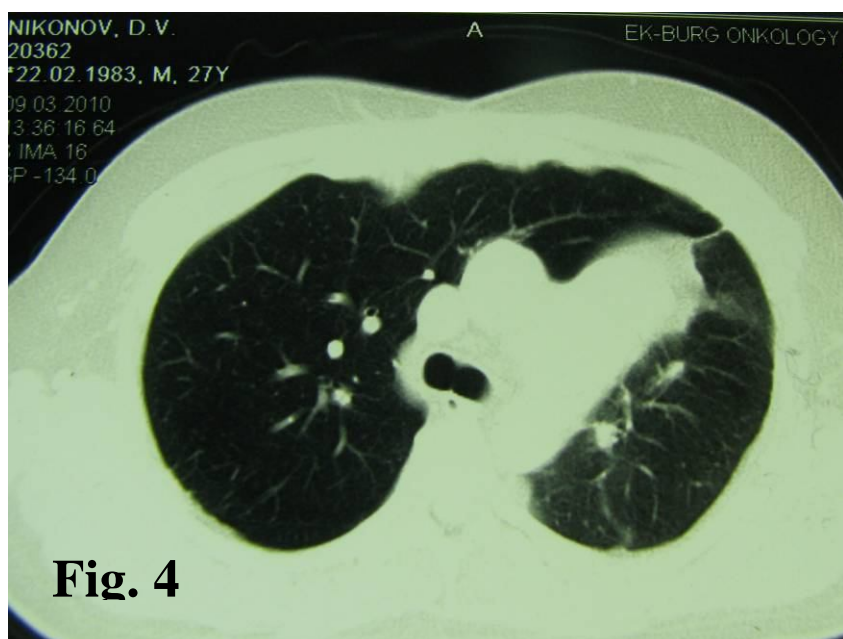


Fig. 4

The patient was examined 7 years after the operation. He was healthy without any complaints. General appearance and physical activity were good. He worked full day, got married. CT-scan (Fig. 4) showed hyperexpanded right lung, and left lower lobe was also expanded satisfactory. Cardiac shadow remained deviated to the left side.

Case report II. A male person 24 years old (No 15 in the table). Initial symptoms of the disease developed during 2 weeks and were dispnea, pain in the left side of the chest wall and fever up to 38. Total darkness in the left hemithorax was seen at chest radiograph, and 2,0 l serous liquid were evacuated from the left pleural cavity. No tumor cells were found in this liquid. CT-scans performed after evacuation of the fluid revealed giant tumor originating from the mediastinum and occupying left hemithorax (Fig. 5).

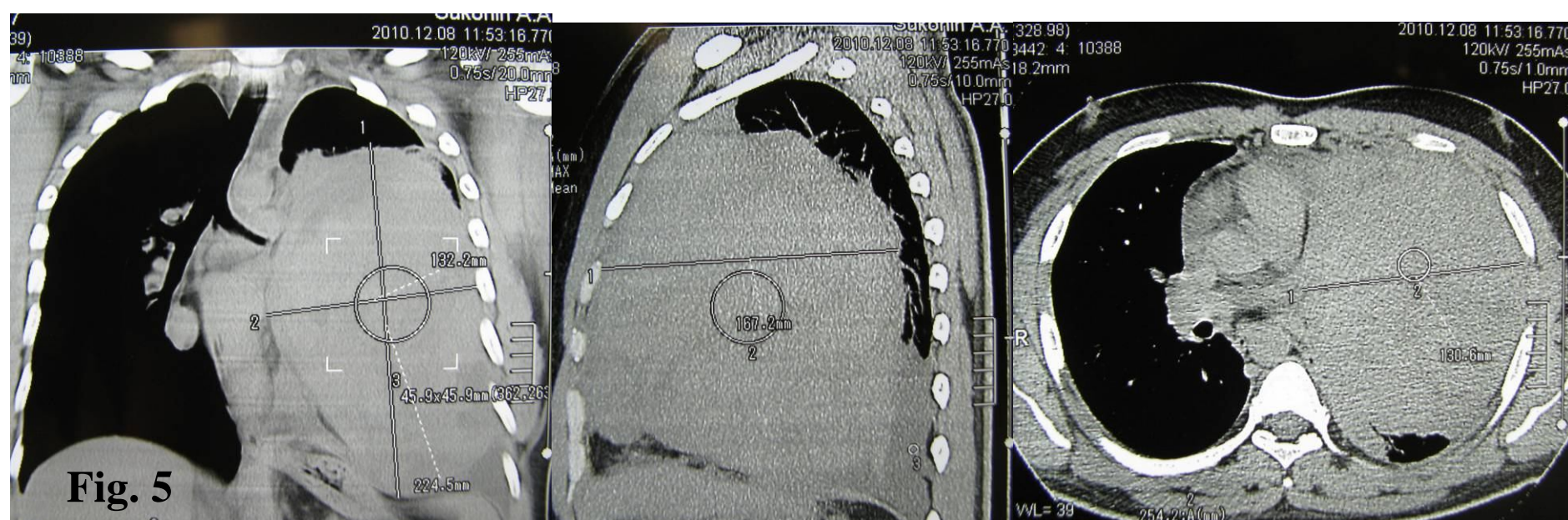


Fig. 5

Total median sternotomy was performed. The blood vessel originated from the mediastinum were ligated but severe bleeding occurred from enormously vascularised adhesions between the tumor and the chest wall. The main blood loss was at the stage of tumor dividing from the chest wall. The tumor was completely removed (Fig. 6). Left upper lobe was removed “en block” because of firm adhesions to the tumor. Overall blood loss was 2530 ml. Fibrinolytic hemorrhage continued after the operation but nevertheless was controlled. Pathologic examination showed teratoma with areas of malignant transformation. Further postoperative course was uneventful. Chest radiograph 3 months after the operation is presented in the fig. 7.

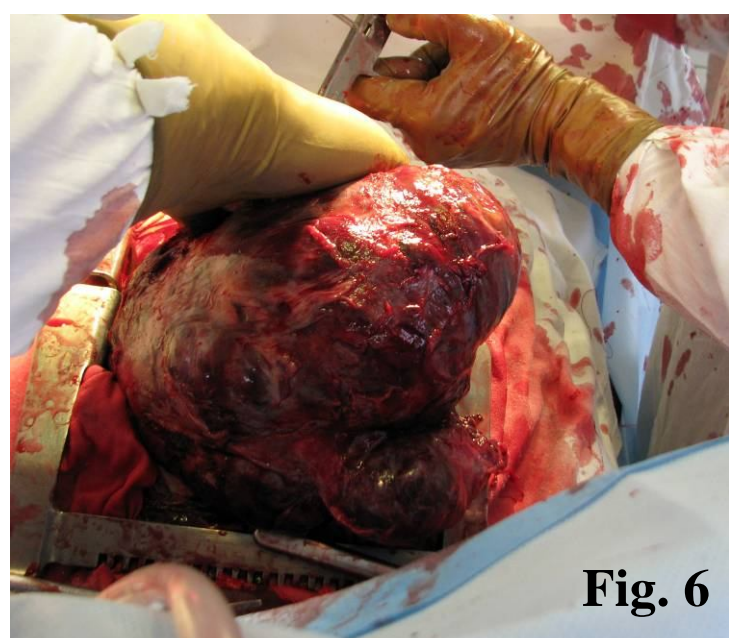


Fig. 6

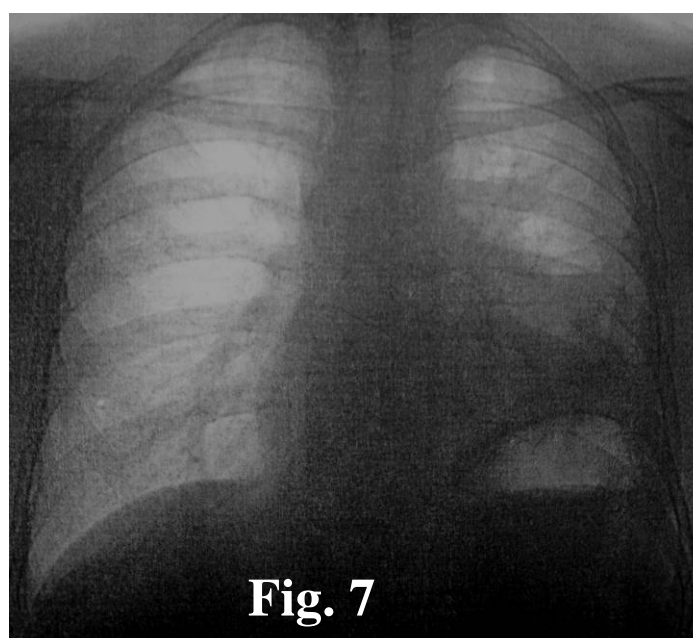
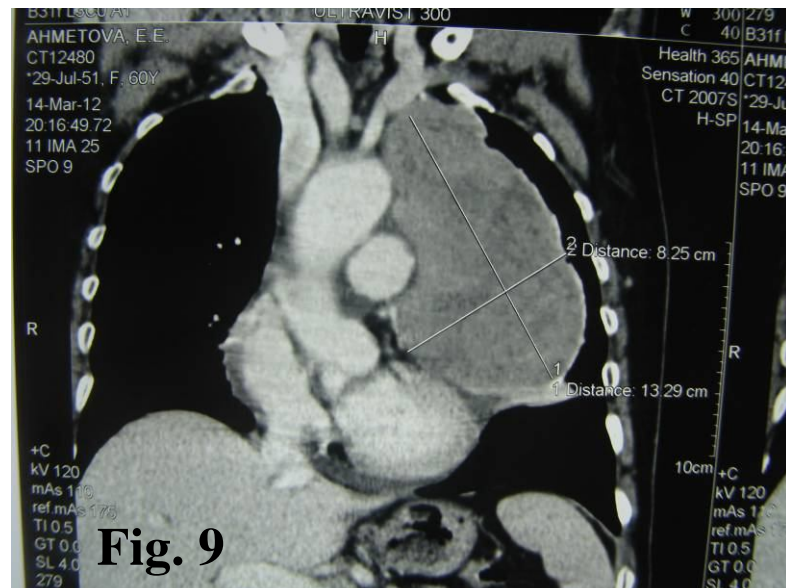
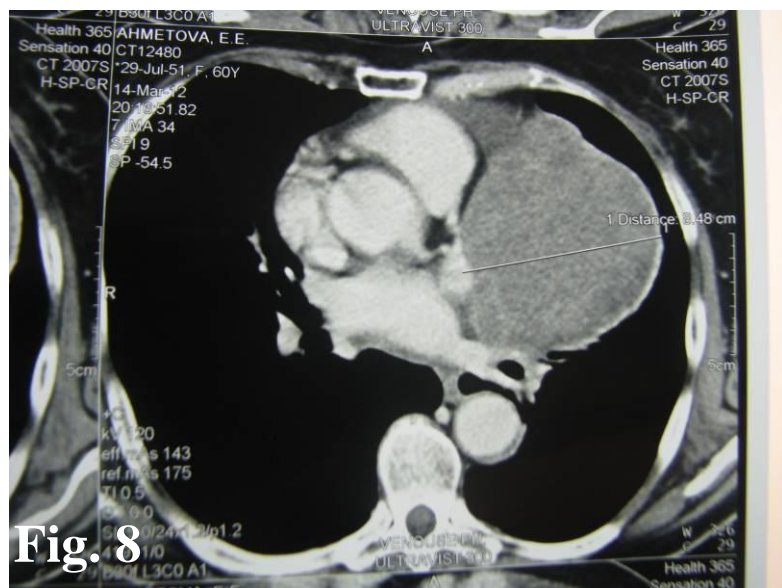


Fig. 7

Postoperative radiotherapy and three courses of chemotherapy were performed. The patient died from the disease progression 2 years after the operation.

Case report III. Women 57 years old (No 10 in the table). She felt pain in the left chest and had 8 kg weight loss during 3 months. Chest radiograph and CN-scan revealed bulky tumor originating from the mediastinum and compressed heart, great vessels and left lung (Fig. 8-9). Tachycardia up to 90 took place during this period. Biopsy under CT guidance showed mature teratoma.



Median sternotomy was performed. Wide invasion of the pericardium and left upper lobe was found at the operation (Fig. 10). Firm adhesion of the tumor and the chest wall at the cupola of left pleural cavity were divided with marked blood loss. The tumor was removed together with the portion of pericardium and left upper lobe. Parietal pleural flap was used to cover the defect of pericardium. Vascular collapse with a decrease in blood pressure and hemodynamic instability developed in the immediate postoperative period. Overall blood loss was 810 ml. Vasopressor support was necessary during 3 days, and after that hemodynamic became stable. Further course was uneventful. Microscopic examination of the tumor confirmed mature teratoma. Removed specimen see in fig. 11.

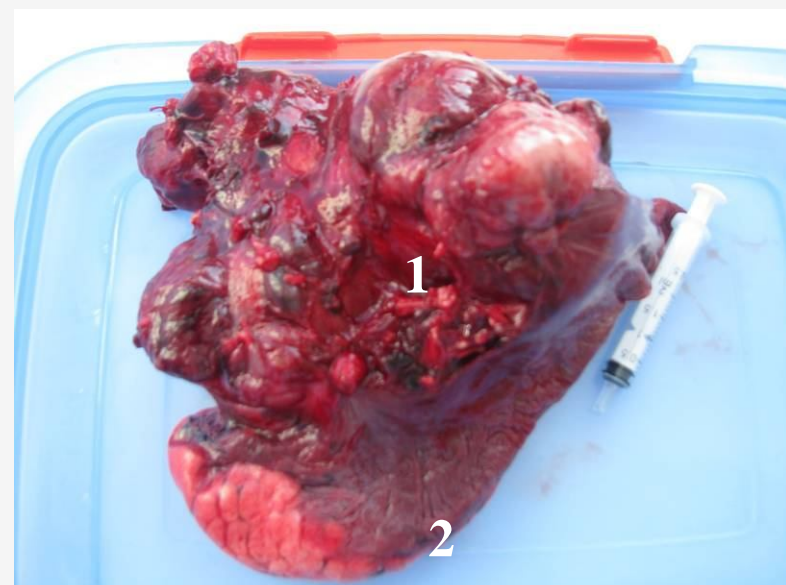
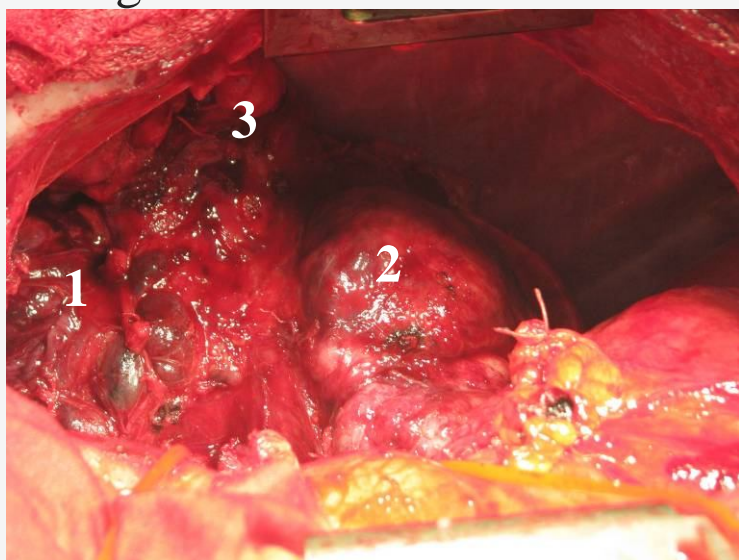


Fig.10. Median sternotomy. 1 – tumor, 2 – upper lobe, 3 – chest wall covered by hemostatic sponge.

Fig. 11. Removed specimen. 1 – tumor, 2 – upper lobe.

The patient was followed 1,5 years after the operation, had no complaints and any symptoms of recurrence of the disease. CT-scan did not reveal any abnormality either.

Conclusion. Benign mediastinal teratomas are initially asymptomatic so that are usually revealed upon having grown to bulky size. Slow and long growth also promotes forming wide and firm adhesions which simulate tumor invasion, forcing the surgeon to resect neighboring anatomic structures, and are a source of massive blood loss during dissection of the tumor.

In 5 patients previous exploratory thoracotomy was performed but the attempts to remove the tumor failed. Since we had performed repeated operation via median sternotomy we found this approach optimal for removal of giant mediastinal tumors. Further experience confirmed that median sternotomy provided a proper access to the great blood vessels, pericardium, lungs, and the chest wall. It is to be stressed the most blood loss volume occurs during the dissection of the tumor from the chest wall but control bleeding remains difficult unless the tumor has been removed. After its removal all facilities for hemostasis can be easily applied: argon-plasma, hemostatic sponge, etc.

In 4 patients circulatory disorders with marked hypotension occurred after removal of bulky mass from the mediastinum. These patients were older than 50 years. Medical support by vasopressive drugs was necessary during 1-3 days after the operation.

Surgical treatment of mature mediastinal teratomas results in good outcome. Areas of malignant transformation found at the microscopic examination of tumor force us to treat these tumors as malignant and resort to radiation and/or chemotherapy after the operation. Late results however appeared to be unsatisfactory despite these measures.



Fig. 12. Polar Urals

***Thank you
for your
attention!***