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Pump operations in locally advanced thoracic malignancies

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Background. The study objective is to evaluate the efficacy of pump operations in locally advanced IIIB (T4N0-1M0) lung cancer and other thoracic malignancies and the results of treatment.

Materials and methods. In the period 2003–2011, 6 patients (pts) with locally advanced thoracic malignancies underwent surgery in the Center of Cardiac Surgery of Vilnius University Hospital Santariskiu Clinics (VUH SC). Patients' characteristics and stage: lung cancer – 3 pts (50.0%), stage IIIB (T4N0-1M0), sarcoma of mediastinum – 2 pts (33.3%), fibrous tumour of mediastinum – 1 pt (16.7%). Patients according to morphology: squamous cell carcinoma – 3 pts (50.0%), neuroangiosarcoma – 1 pt (16.7%), neurosarcoma – 1 pt (16.7%), solitary fibrous tumour – 1 pt (16.7%). After surgery patients received adjuvant treatment: 3 pts with lung cancer received 4 cycles of chemotherapy Gemcitabine with cisplatinum, 2 pts with angiosarcoma received radiation therapy 66 Gy and 6 cycles of chemotherapy Ifosfamide.

Results. We performed pneumonectomy with left atrium resection – 2 pts (33.3%), left pneumonectomy with aorta resection – 1 pt (16.7%), left atrium resection with left upper lobectomy – 1 pt (16.7%), mediastinum resection with chest wall reconstruction – 1 pt (16.7%), left pneumonectomy – 1 pt (16.7%). We had no complications after pump operations. Median survival of patients with lung cancer was 2.5 ± 0.5 years, with angiosarcoma 3.5 ± 1.0 years. Five-year survival was 25%.

Conclusions. 1. Pump operations are safe and possible in locally advanced thoracic malignancies. 2. Pump operations and adjuvant treatment may prolong median survival in IIIB (T4N0-1M0) lung cancer patients by 2.5 ± 0.5 years and in angiosarcoma patients by 3.5 ± 1.0 years.

Key words: pump operations, surgical treatment, thoracic malignancies

INTRODUCTION

Treatment of thoracic malignancies is a rather difficult field of surgery. Earlier, some locally advanced diseases, for example, with invasion to the heart or great vessels, seemed to be inoperable. But when cooperating with cardiac surgeons and using cardiopulmonary bypass, it became possible to help these patients. These operations are not of usual practice. For example: Lang G. (2011) (1) – 9 patients, Gomez-Caro A. (2008) (2) – 10 patients, Wiebe K. (2006) (3) – 13 patients, Park B. J. (2004)

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(4) – 10 patients, Byrne J. G. (2004) (5) – 14 patients, Vaporciyan A. A. (2002) (6) – 19 patients, Kodama K. (2000) (7) – 6 patients. So we decided to share our experience in the surgical management of thoracic malignancies, using pump operations.

The study objective was to evaluate the efficacy of pump operations in locally advanced IIIB (T4N0-1M0) lung cancer and other thoracic malignancies and the results of treatment.

MATERIALS AND METHODS

In the period 2003–2011, 6 patients (pts) with locally advanced thoracic malignancies underwent surgery in the Center of Cardiac Surgery of Vilnius University Hospital Santariskiu Clinics (VUH SC). Patients' characteristics and stage: lung cancer – 3 pts (50.0%), stage IIIB (T4N0-1M0), sarcoma of mediastinum – 2 pts (33.3%), fibrous tumour of mediastinum – 1 pt (16.7%). Patients according to morphology: squamous cell carcinoma – 3 pts (50.0%), neuroangiosarcoma – 1 pt (16.7%), neurosarcoma – 1 pt (16.7%), solitary fibrous tumour – 1 pt (16.7%). After surgery patients received adjuvant treatment: 3 pts with lung cancer received 4 cycles of chemotherapy Gemcitabine with cisplatinum, 2 pts with angiosarcoma received radiation therapy 66 Gy and 6 cycles of chemotherapy Ifosfamide.

RESULTS

We performed pneumonectomy with left atrium resection – 2 pts (33.3%), left pneumonectomy with aorta resection – 1 pt (16.7%), left atrium resection with left upper lobectomy – 1 pt (16.7%), mediastinum resection with chest wall reconstruction – 1 pt (16.7%), left pneumonectomy – 1 pt (16.7%) (Table). We had no complications after pump operations. Median survival of patients with lung cancer was 2.5 ± 0.5 years, in patients with angiosarcoma it was 3.5 ± 1.0 years. Five-year survival was 25%.

DISCUSSION

In our series of pump operations we mean cardiopulmonary bypass (CPB) through canulating the ascending aorta and upper and lower vena cava.

Lang G. et al. (2011) (1) reviewed their experience with resection of advanced thoracic malignancies performed with extracoporeal membrane oxygenation (ECMO) support. Cannulation was central, peripheral or combined. Nine patients underwent complex tracheobronchial resections or resections of greater thoracic vessels under ECMO. A complete resection was achieved in 8 patients from nine. Lang G. et al. consider venoarterial ECMO support to be a safe alternative to cardiopulmonary bypass for advanced thoracic operations (1).

Gomez-Caro A. et al. (2008) (2) reviewed the use of cardiopulmonary bypass and evaluated long-term clinical and immunologic outcomes of cryopreserved arterial allografts (CAA), in revascularisation of intrathoracic vessels invaded by malignancies. Revascularisation was made using human lymphocyte antigen (HLA) and ABO – mismatched CAAs. They performed 10 of 26 such operations with cardiopulmonary bypass. The operation was technically feasible and results clinically attractive, because of no infection and postoperative antico-

Table. Patients histology and operations

Disease	Histology	Operation
Lung cancer	Squamous cell carcinoma	Pneumonectomy with resection of left atrium
Lung cancer	Squamous cell carcinoma	Pneumonectomy with resection of left atrium
Lung cancer	Squamous cell carcinoma	Left pneumonectomy with resection of aorta
Sarcoma of mediastinum	Neurosarcoma	Left upper lobectomy with resection of left atrium
Sarcoma of mediastinum	Neuroangiosarcoma	Resection of mediastinum with resection of thoracic wall
Huge solitary tumor of mediastinum	Solitary fibrous tumor	Left pneumonectomy

agulation, and exellent long-term survival potency, and nonimmunogeneicity (2). In our series, we performed only one vascular resection – aorta resection, and revascularisation was achieved using a synthetic prosthesis.

Wiebe K., (2006) (3), Byrne J. G. (2004) (5) reviewed their experience during approximately ten years, as in our study, and the pathology, for which they perform extendend pulmonary resections, was similar. Wiebe K. et al. showed results of sarcomas (n = 8), non small cell lung carcinomas (n = 3) and others (n = 2) (3), with 15% mortality rate, and major complications, such as acute lung injury (n = 4), right heart failure (n = 1) and multiorgan failure (n = 1). The cumulative survival at 1, 3, and 5 years in patients presenting with sarcomas was 62.5% compared to 33%, 0%, and 0%, respectively, in patients with non-small cell carcinoma (n = 3).

Park B. J. et al. (2004) conducted a review of the results in 10 patients who underwent resection of thoracic malignancies that included either great vessel or the heart (4). Histologic diagnoses included soft tissue sarcoma (n = 7), squamous cell carcinoma (n = 1), malignant thymoma (n = 1), and mediastinal teratoma (n = 1). Structures resected included superior vena cava (n = 5), left atrium (n = 4), right atrium (n = 2), descending aorta (n = 1), and main pulmonary artery (n = 1). Six patients underwent postoperative systemic therapy. The overall median survival was 21.7 months (range 3.2 to 69 months) and was 33.3 months (range 3.7 to 69 months) for patients who had R0 or R1 resection (4). These data are similar to ours, as 5 of 6 patients recieved adjuvant chemo- or radiotherapy, and median survival in our series was 2.5 years for lung cancer patiens, and 3.5 years for sarcoma. Byrne J. G. et al. (2004) (5) review fourteen consecutive patients who underwent CPB during the resection of locally advanced thoracic malignancies. It is interesting that 6 of 14 patients (43%) required emergent institution of CPB due to injury of the superior vena cava (2 patients), inferior vena cava (2 patients), or pulmonary artery (2 patients). The operative mortality rate was 1 of 14 patients (7%) due to pulmonary embolism. The overall 1-year, 3-year, and 5-year survival rates were 57%, 36%, and 21%, respectively. This article shows that the availability of CPB also provides a safety net in the event of injury to vascular structures during tumor resection (5). In our patients, all of them were operated with planned CPB, so there were no injuries of great vessels.

Vaporciyan A. A. et al. (2002) (6) reviewed the study where nineteen patients were included. Eleven patients underwent surgery with curative intent, and eight underwent surgery with palliative intent. Two patients (11%) died in the hospital after resection with palliative intent. Major complications occurred in 11 patients (58%); the most common major complications were pneumonia (n = 7 patients), mediastinal hematoma (n = 4 patients), and acute respiratory distress syndrome (n = 2 patients). The overall 1- and 2-year survival rates were 65% and 45%, respectively (6). In our series we perform operations only with curative intent, so we had no postoperative mortality, maybe due to better patients' condition.

Kodama K. et al. (2000) (7) performed operations for tumors invading the upper airway, left atrium or main pulmonary artery with percutaneous cardiopulmonary support (PCPS) stand by support available. Of 15 cases with PCPS stand by, 6 patients actually underwent operation using PCPS. There were three esophageal cancers invading the carina, two lung neoplasms with left atrial invasion and one neoplasm extending to the main pulmonary artery. One of three patients with esophageal cancer had massive bleeding in the trachea resulting in airway obstruction. PCPS should be the accepted technique for patients with advanced thoracic malignancies in whom cardiac arrest or ventilation support is thought to be necessary for the complete removal of the tumor (7). This article shows cases of esophageal cancer, managed with support or some kind of pump operation – PCPS.

All reviewed articles show more or less similar data and results, and conclude that CPB operations could be done with acceptable risk. The different thing in our material is that we had no complications. It is difficult to say why: maybe due to a low number of cases, or due to good patients selection.

We got 5-year survival 25%, patients' benefit from surgical treatment, compared to the conservative treatment – Tan W. W. et al. (2012) (8) pointed 5-year survival of lung cancer alone stage IIIA – 10%, IIIB – 3%, stage IV – 1–2%.

CONCLUSIONS

1. Pump operations are safe and possible in locally advanced thoracic malignancies.

2. Pump operations and adjuvant treatment may prolong the median survival in IIIB (T4N0-1M0) lung cancer patients by 2.5 ± 0.5 years and in angiosarcoma patients by 3.5 ± 1.0 years.

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VIETIŠKAI IŠPLITUSIŲ PLAUČIŲ PIKTYBINIŲ NAVIKŲ OPERACIJOS PANAUDOJANT DIRBTINĘ KRAUJO APYTAKĄ

Santrauka

Pagrindas. Tyrimo tikslas – įvertinti operacijų, atliekamų dėl vietiškai išplitusio IIIB stadijos (T4N0-1M0) plaučių vėžio ar kitų krūtinės chirurgijos navikų, panaudojant dirbtinę kraujo apytaką, efektyvumą ir gydymo rezultatus.

Medžiaga ir metodai. 2003–2011 m. iš Vilniaus universiteto ligoninėje „Santariškių klinikos“ operuotų 6 ligonių plaučių vėžiu (IIIB stadija, T4N0-1M0) sirgo 3 ligoniai (50,0 %), tarpuplaučio sarkoma – 2 ligoniai (33,3 %), tarpuplaučio fibroziniu tumoru – 1 ligonis (16,7 %). Pagal morfologiją plokščialąstelinė karcinoma diagnozuota 3 ligoniams (50,0 %), neuroangiosarkoma – 1 ligoniui (16,7 %), neurosarkoma – 1 ligoniui (16,7 %), solitarinis fibrozinis tumoras – 1 ligoniui (16,7 %). Po chirurginio gydymo 5 ligoniams buvo taikytas pooperacinis gydymas: 3 plaučių vėžiu sergantiems ligoniams buvo taikyti 4 chemoterapijos kursai (Gemcitabinas ir Cisplatina), 2 ligoniai su angiosarkoma buvo švitinti 66 Gy ir taikyti 6 chemoterapijos Ifosfamidu kursai.

Rezultatai. Atliktos operacijos: pulmonektomija ir kairiojo prieširdžio rezekcija – 2 ligoniams (33,3 %), kairiosios pusės pulmonektomija ir aortos rezekcija – 1 ligoniui (16,7 %), kairiojo prieširdžio rezekcija ir kairiosios pusės viršutinė lobektomija – 1 ligoniui (16,7 %), tarpuplaučio rezekcija ir krūtinės sienos rekonstrukcija – 1 ligoniui (16,7 %), kairiosios pusės pulmonektomija – 1 ligoniui (16,7 %). Dirbtinės kraujo apytakos taikymo komplikacijų nebuvo. Vidutinis išgyvenamumas sergant plaučių vėžiu – 2,5 ± 0,5 metų, angiosarkoma – 3,5 ± 1,0 metai. Penkerių metų išgyvenamumas siekė 25 %.

Išvados. 1. Operacijos su dirbtine kraujo apykaita yra saugios ir galimos gydant vietiškai išplitusius krūtinės ląstos piktybinius navikus. 2. Operacijos su dirbtine kraujo apytaka gali prailginti vidutinį išgyvenamumą.

Raktažodžiai: dirbtinė kraujo apytaka, operacijos, krūtinės ląstos piktybiniai navikai