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Long-term survival after bronchial sleeve resections

Anatomical resection of lung tissue reminds the only radical treatment of non-small cell lung cancer (NSCLC) and some other pulmonary pathologies (3, 5).

In 1947 Price Thomas introduced bronchial sleeve resection (BSR), including lung tissue removal with partial bronchial resection and re-anastomosis (9). The edges of the cut off bronchies were stitched to restore the continuity of bronchial tree. At the beginning sleeve resections have been used in benign lesions such as carcinoids or adenomas only (12, 13). This technique was soon accepted as a method of treatment in lung cancer. Indications were initially respiratory restrictions precluding pneumonectomy. Jensik et al. introduced sleeve pneumonectomy in cases of cancer located close to a tracheal carina (4). During the last two decades chest surgeons have been also performing sleeve resections because of anatomical localisation of NSCLC. Many of them reported promising long term results (30–50% of 5 years' survival) of such treatment (1, 2, 10, 11, 14). Nowadays the opinion that anatomical localisation of the cancer itself is the indication for sleeve resection is widely accepted particularly that a wide lymphadenectomy can be performed as during standard pneumonectomy (7, 10, 12, 13, 14).

The aim of our study was the evaluation of long-term results, of sleeve resection of the carina and main bronchies in patients with neoplasmatic or benign lesions.

MATERIAL

Between February 1990 and February 2000 53 BSR procedures have been performed in the Department of Thoracic Surgery of the Medical University of Lublin. Demographic and clinical characteristics are presented in Table 1.

Table 1. Demographic and clinical characteristics of patients

Parameter	Value	Number of patients
Sex	Male.	48
	Female	5
Age [years]	37-74 (mean 57)	
WHO performance status	0	30
	1	21
	2	2
Diagnosis	NSCLC	46
	Bronchial carcinoid	4
	Other*	3
Pathological NSCLC staging	IB	12
	IIB	18
	IIIA	11
	IIIB	5
Radicality of resection in NSCLC	R0	39
	R1-2	7

*Ovarian cancer metastasis, hamartoma and myxofibroma.

METHODS

All patients were scheduled for operation after standard diagnostic procedures. In 8 cases of NSCLC in preoperative stage cIIIA neoadjuvant therapy has been administered (VP-16 + Cisplatin; 2 courses in 1 patient and 3 courses in 7 cases).

Sleeve pneumonectomies have been performed in 14 (26.4%) cases and sleeve lobectomies – in 39 (73.6%). All pneumonectomies and 32 lobectomies have been performed in NSCLC patients. In 2 cases of pneumonectomy and 2 cases of lobectomy angioplastic procedures have been performed because of pulmonary artery branches infiltration.

Bronchial anastomosies have been performed with mattress PDS 3/0 or interrupted continuous Vicryl 3/0 suture and angioplasties with Prolene 4/0.

Data have been recorded in all patients and the period of observation has been closed on 13th February 2001. The relations between the survival rate and indications for surgery, stage of NSCLC, preoperative WHO performance status, extension and radicality of the resection and functional tests (spirographic – FVC, FEV1, FEV1%, blood gases – pO_2, pCO_2, pH) have been analysed. For statistical analysis the post hoc Scheffe test, Kaplan–Meier test and Cox test have been used.

RESULTS

No death or complication related to bronchoplasty was noted during procedures. Causes of in-hospital deaths and postoperative complications are listed in Table 2.

Bronchopleural fistula occurred in 1 patient after pneumonectomy (7.1%) and in 1 after lobectomy (2.6%). Two perioperative deaths occurred after lobectomy (5.2%) and 1 after pneumonectomy (7.1%). 26 patients have died during the period of observation (Fig. 1). All deaths, early and late, occurred in NSCLC patients. The causes of late deaths were: local recurrence in 2 patients (7.7%), distant metastases in 14 patients (53.9%), both local and distant recurrence in 8 patients (30.8%), lymphoma in 1 case (3.8) and other in 1 case (3.8%). The mean time of survival for all patients was 45.6 months and for NSCLC patients – 41.2 months. The survival after 1 year in NSCLC patients was 78.2%, after 3 years – 56.6, after 5 years – 38.6 and after 7 years – 28.1 (Figure 1). The difference in survival between NSCLC and non-NSCLC patients was significant (β=31.7; $p<0.01$).

Thirty patients had been classified in WHO performance status 0.21 in WHO 1 and 2 in WHO 2 before operation. Table 3 presents survival rates related to WHO status for all patients and stage, pN and radicality of resection in NSCLC patients. No significant differences between groups were found in correlation with histology of NSCLC,

Table 2. Postoperative mortality and morbidity

Mortality	N	%
Stroke	1	1.9
Pulmonary embolism	2	3.6
T otal	*3*	*5.7*
Morbidity	N	%
Bronchopleural fistula	3	5.7
Empyema without bronchial fistula	1	1.9
Sepsis	1	1.9
Heart herniation after pneumonectomy	1	1.9
Prolonged air leak	2	3.8
Prolonged mechanical ventilation	2	3.8
Deep venous thrombosis	1	1.9
Wound dehiscence	4	7.5
Secretion retention	9	17

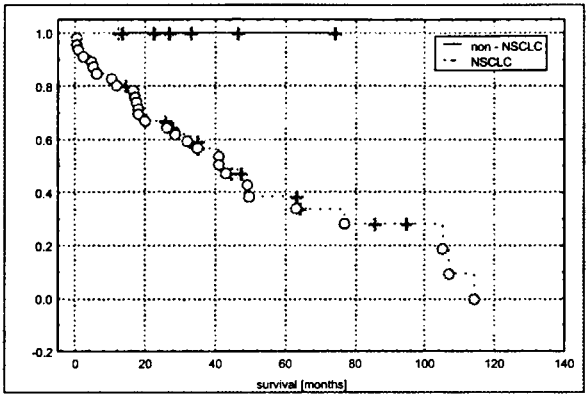

Fig. 1. Cumulated survival rates after sleeve resections for NSCLC and other indications

Table 3. Five years' survival rates in patients

Parameter		5 years survival rate (%)	p
WHO	0	63.3	
performance status	1	19	0.01
	2	0	
pTNM stage	I	42.3	
in NSCLC	II	32.6	NS
	III	35	
pN	N0	38.2	
in NSCLC	N1	45.9	N0-1 vs. N2
	N2	12.5	p=0.02
Radicality	R0	46	<0.01
of resection	R1-2	0	

bronchoscopical localisation of the tumour, pT stage or preoperative functional limitations.

Adjuvant radiotherapy has been applied in 4 patients with pN2 and 4 patients with thoracic wall or mediastinal infiltration observed during operation. Neither neoadjuvant nor adjuvant therapy influenced long time survival rate in NSCLC patients.

It has been found with Cox test that WHO performance status (b=2.4, p=0.018) with incomplete resection (b=2, p=0.046) and higher pN staging (b=1.7, p=0.046) gave the combination of negative significantly prognostic factors (b=3.4, p<0.001).

DISCUSSION

Present epidemiological data show that only about 15% of new recognised lung cancer cases are surgically treated in Poland. The others have respiratory or oncological contraindications to surgery and can obtain only palliative therapy (12-15).

Bronchial sleeve resections are helpful in radical surgical treatment of such cases. Recent publications and our own experience show that mortality, morbidity and long term survival after BSR are similar with doubtless functional benefits to those achieved after classical resections with comparable bronchial removal range. In cases of carinal infiltration sleeve pulmonectomy is the only chance of radical NSCLC treatment (1, 2, 10, 11, 14).

Ageing of population and better chronic illnesses treatment increases the number of potential patients with functional limitations. Progress in lung cancer therapy also increases the number of patients who can develop a second primary non-small cell lung cancer. Such patients can also be potential beneficiaries of lung tissue sparing procedures (1, 12, 13).

Survival rates, morbidity and in-hospital mortality in the analysed group are comparable to those presented by others surgeons. They are also comparable to those obtained in patients after classical resections with the same bronchial resection margins (in sleeve lobectomy morbidity and early mortality are lower than after classical pulmonectomy) (8, 12, 14).

In our series N2, higher WHO performance status score and non-radical resection were negative prognostic factors influencing long-term survival.

The problem of preoperative nodal staging is one of the most difficult in lung cancer treatment. There are no available unquestionable methods of mediastinal lymph node involvement confirmation. Even CT-guided extended mediastinoscopy can be confirmed in post-resectional pathological staging in only about 30% of cases (3, 5, 12, 13). Wide introduction of new techniques such as PET may improve this situation. Difference between the number of clinical and pathological stage III groups in our material also illustrates this difficult problem.

Stage N2 influence on survival in our patients is comparable to that presented by other surgeons (6, 7, 10-13). Differences between stage groups of NSCLC patients have not reached statistical significance. In our opinion small counts of subsets of patients in different stages may have reduced statistical tests sensitivity.

In 8 cases resection was not microscopically or macroscopically radical because of surgical limitations or mediastinal involvement. None of these patients survived 3 years after operation. Local control of resection margins during operation can be improved by introduction of photodynamic imaging for cancer limits establishment.

Other factors, such as pT stage, histology of NSCLC, extension of resection, combined therapy or preoperative functional limitations were not significant prognostic fac-

tors. All patients after sleeve resection performed for other than NSCLC reasons are alive without recurrence of their diseases. All deaths occurred in NSCLC patients.

In our opinion pulmonary sleeve resections are valuable operations and can be undertaken for both anatomical and functional indications in every feasible case of pulmonary resection.

CONCLUSIONS

1. Pulmonary sleeve resections performed for anatomical and functional reasons cured nearly half of all patients (43%) and more than 1/3 of NSCLC patients (38.6%).
2. All our patients operated on for non-NSCLC indications have been cured.
3. Five years' survival rate in NSCLC patients is similar to that presented by other authors using this method of resection and similar to the one presented after classical anatomical pulmonary resections.
4. Morbidity and mortality after sleeve resections is similar to widely accepted ones after classical resections. In sleeve lobectomy they are lower than those presented after classical pulmonectomy.
5. In our opinion, in view of functional benefits, low morbidity, mortality and comparable survival, pulmonary sleeve resections should be considered instead of classical wide resections in every patient with favourable anatomical conditions.

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SUMMARY

Between February 1990 and February 2000, 53 anatomical pulmonary tissue resections with sleeve bronchial resections have been performed in the Department of Thoracic Surgery of Medical University of Lublin. The aim of the present study was the evaluation of long-term results of operative treatment. Most of the cases (86.8%) were patients with non-small cell lung cancer. Three perioperative deaths (5.7%) were recorded. The mean time of survival for all patients was 45.6 months and for NSCLC patients was 41.2 months. The cumulative 5 years' survival rate in cancer patients was 38.6%. Preoperative performance status, presence of N2 and non-radical resection have been recognised as significant prognostic factors in cancer patients. In our opinion, in view of comparable efficacy, low morbidity, mortality and functional benefits pulmonary sleeve resections should be considered in every patient with favourable anatomical and functional conditions.

Odległe wyniki resekcji mankietowych drzewa oskrzelowego

W okresie od lutego 1990 r. do lutego 2000 r. wykonano w Klinice Chirurgii Klatki Piersiowej AM w Lublinie 53 resekcje anatomiczne tkanki płuca, połączone z resekcją mankietową drzewa oskrzelowego. Celem prezentowanego badania była analiza odległych wyników leczenia operacyjnego. Większość chorych (86,8%) operowano z powodu niedrobnokomórkowego raka płuca (NDRP). Zanotowano 3 zgony okołooperacyjne (5,7%). Mediana przeżycia dla wszystkich operowanych chorych wynosi 45,6 miesiąca, a dla 45 chorych operowanych z powodu NDRP 41,2 miesiąca. Skumulowany odsetek przeżyć 5-letnich w grupie chorych operowanych z powodu NDRP wyniósł 38,6%. Znamienny wpływ na czas ich przeżycia miały: przedoperacyjny stan sprawności wg WHO oraz wystąpienie cechy N2 i nieradykalność resekcji. Wydaje się, że wobec zbliżonej skuteczności, ograniczonej liczby powikłań i zgonów okołooperacyjnych, a także korzyści czynnościowych resekcje mankietowe mogą być wykonywane zarówno ze wskazań czynnościowych, jak i anatomicznych w każdym kwalifikującym się do tego przypadku.