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Complications of mediastinoscopy

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Abstract
From 1968 to 1987, mediastinoscopy was performed on 2021 consecutive patients. The procedure was carried out in 35.7 per cent on patients with a pulmonary infiltrate and in 28.8 per cent with bronchogenic carcinoma. Mediastinoscopy was positive in 54 per cent of the cases. The total number of complications was 2.3 per cent (47/2021). There were four cases with major haemorrhage, three tracheal ruptures and three wound infections. Recurrent nerve paralysis was verified in three patients and pericardial rupture in two patients. The total of major complications was 0.5 per cent (10/2021). There was no deaths in this series. In the authors' opinion, mediastinoscopy can be regarded as an effective and safe procedure in the hands of an experienced surgeon.

Introduction

Mediastinoscopy has been widely employed during the last 25 years as a diagnostic method for investigating the superior mediastinum. The attitude to mediastinoscopy varies a great deal in different countries and even in different hospitals (Carlens, 1959; Carlens and Hambraueus, 1967; Lincoln and Provan, 1970; Inberg *et al.*, 1972; Otto *et al.*, 1972; Preciado *et al.*, 1973; Ashraf *et al.*, 1980; Jolly *et al.*, 1980; Pearson *et al.*, 1982; Coughlin *et al.*, 1985; Rubinstein and Baum, 1986). Many clinicians consider mediastinoscopy a dangerous procedure.

Mediastinoscopy is an invasive surgical method. Therefore, less invasive techniques such as computed tomographic scanning have been proposed instead (Liippo *et al.*, 1980; Therman *et al.*, 1984; Brion *et al.*, 1985; Khan *et al.*, 1985, Rhoads *et al.*, 1986). However, mediastinoscopy is an effective method for investigating the superior mediastinum and it gives a precise definition of the histology, site, extent of the tumour and the degree of invasion (Jepsen, 1966, 1967; Trinkle *et al.*, 1969).

The aim of this study was to investigate, the complications of mediastinoscopy in a large series of patients.

Material and methods

From 1968 to 1987, mediastinoscopy was carried out on a total of 2021 consecutive patients. General anaesthesia and investigative methods presented by Palva (Palva, 1964) were employed in this series. All the mediastinoscopies in this material were performed by one surgeon (H.P.). Lymph nodes in the superior mediastinum were collected from three different levels. In patients with bronchogenic carcinoma, only N2 nodes were biopsied. In patients with an undiagnosed mediastinal shadow, an attempt was made to get biopsy specimens even outside the routine mediastinoscopy area. All the complications were classified and attempts were made to analyze the possible aetiology.

Of the patients, 72.3 per cent were men and 27.7 per cent women, the mean age being 56 years (57 years for men and 52 for women). The oldest patient was 83 years and the youngest 12 years (Table I). In four patients, mediastinoscopy could not be performed because of anatomical relationships in the superior mediastinum and these patients were excluded.

Results

Mediastinoscopy was carried out in 35.7 per cent on patients with a pulmonary infiltrate and in 28.8 per cent on patients with a verified bronchogenic carcinoma (Table II). There were 18 cases of repeat mediastinoscopies in this material. Age groups and sex distribution of the patients with complications secondary to the procedure are listed in Table III. Of the patients, 68 per cent were men and 32 per cent women. Only 9 per cent of the patients were under 40 years of age.

The indications for mediastinoscopy in patients with complications are listed in Table IV. A pulmonary infiltrate was the indication in 24 patients (51 per cent) and verified bronchogenic carcinoma in nine patients (19 per cent).

A pulmonary infiltrate or bronchogenic carcinoma was situated in the upper lobe in nine patients, in the lower lobe in seven patients and in the hilar area in 17 patients. In 12 patients with complications, the macroscopic feature of the mediastinum was regarded as malignant, and in 23 patients pathological. The surgeon recorded the procedure as difficult in 29 of those with complications. The mediastinum was slightly fibrous in 18 patients and abnormally fibrous in 21 patients with complications.

The complications secondary to mediastinoscopy are

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TABLE I
AGE GROUPS AND SEX DISTRIBUTION OF PATIENTS

Age (years)	Men (No)		Women (No)		Total (No)	%
–20	9		4		13	0.6
21–50	319		220		539	26.7
51–60	469		123		592	29.3
61–70	512		163		675	33.4
71–	161		41		202	10.0
Total	1470	72.7%	551	27.3%	2021	100.0

TABLE II
INDICATIONS FOR MEDIASTINOSCOPY (N=2021)

Indication	Number	(%)	Mean age (yrs)
Pulmonary infiltrate of unknown aetiology	722	(35.7)	60
Bronchogenic carcinoma	583	(28.8)	61
Suspicion of sarcoidosis	390	(19.3)	45
Mediastinal shadow of unknown aetiology	170	(8.4)	54
Suspicion of metastatic extrathoracic malignancy	60	(3.0)	57
Suspicion of malignant lymphoma	26	(1.3)	36
Systemic diseases	20	(1.0)	44
Suspicion of tuberculosis	18	(0.9)	44
Pleuritis	1	(0.1)	72
Miscellaneous	31	(1.5)	52
Total	2021	(100.0)	56

listed in Table V. Moderate or major bleeding occurred in 34 cases (72 per cent). All cases in which visibility to the exploration area in the mediastinum was lost because of haemorrhage were considered. All these cases could be treated with tamponade. In cases with major bleeding (over 500ml.), blood transfusion was needed. Even these four cases could be treated with tamponade and without thoracotomy. Minor bleedings from bronchial arteries in the tracheobronchial area could be treated with placement of clips and tamponade and these cases are not included in this series. The total number of complications was 47/2021 (2.33 per cent), but only 10/2021 (0.5 per cent) severe complications occurred. There were no complications when doing repeat mediastinoscopy. There were no deaths and no complications requiring thoracotomy.

Of the four major bleedings, two occurred in the right tracheobronchial angle because of rupture of the vena azygos. In both these cases, the mediastinum was abnormally fibrous and no malignant tissue could be found on histological investigation. In the third case, major bleeding occurred in exploration of the anterior mediastinum of a patient with a malignant lymphoma. In the fourth case, haemorrhage was produced when biopsy was taken from a large metastatic lymph node in the right paratracheal region. Moderate bleedings were produced from different regions of the mediastinum, both in taking a biopsy from lymph nodes and in exploration of the fibrous mediastinum. All moderate bleedings could be treated with tamponade only.

In this series, there were three cases of tracheal rupture. All the ruptures were located in the anterior trachea and were produced in exploration of fibrous peritracheal tissue. In two patients the space between the tracheal wall and the cervical spine was abnormally narrow and the endoscope had to be introduced laterally. In both cases, the tracheal rupture was produced when the endoscope was moved contralaterally. Both these ruptures were diagnosed immediately and were treated by Surgicel® tamponade without thoracotomy. In the third case, the tracheal rupture was produced in exploration of the anterior tracheal wall in a patient with an abnormally fibrous mediastinum. Two hours after mediastinoscopy, subcutaneous emphysema was observed and fibreoptic bronchoscopy performed. At bronchoscopy, a small rupture in the anterodistal tracheal wall was observed and repeat mediastinoscopy performed. The rupture could be treated by Surgicel tamponade only. In the tissue specimens mediastinal amyloidosis was diagnosed.

There were only three wound infections in this series. These patients were treated by opening the wound clips and by antibiotics. Operative procedures were not needed.

Recurrent nerve paralysis was produced in three patients, all on the left side, and were diagnosed on the first post-operative day. One case occurred in a patient with sarcoidosis and two others in exploration of a metastatic lesion in the left tracheobronchial angle. The first case was controlled after three months and she still had paralysis on the left side. Two patients with metastatic carcinoma in the mediastinum died of the disease.

In two patients, a small pericardial rupture developed in exploration of the subcarinal region. In both cases there was abnormal fingerlike extension of the pericardium and pericardial fluid ran out after rupturing. Mediastinoscopy was continued normally without any accessory treatments.

In one patient, tension pneumothorax occurred during mediastinoscopy when a biopsy was taken from a large metastatic lesion in the right paratracheal region. Pneumothorax had to be treated by drainage.

TABLE III
AGE GROUPS AND SEX DISTRIBUTION OF PATIENTS WITH COMPLICATIONS SECONDARY TO MEDIASTINOSCOPY

Age (years)	Men	Women	Total
under 40	3	1	4
40–60	12	7	19
over 60	17	7	24
Total	32	15	47

mean age 57 years (the youngest 36 years, the oldest 71 years).

TABLE IV
INDICATIONS FOR MEDIASTINOSCOPY IN PATIENTS WITH COMPLICATIONS SECONDARY TO MEDIASTINOSCOPY (N=47)

Indication	Number
Pulmonary infiltrate of unknown aetiology	24
Bronchogenic carcinoma	9
Mediastinal shadow of unknown aetiology	8
Suspicion of sarcoidosis	3
Suspicion of metastatic extrathoracic carcinoma	1
Suspicion of malignant lymphoma	1
Suspicion of tuberculosis	1

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TABLE V
COMPLICATIONS SECONDARY TO MEDIASTINOSCOPY (PERCENTAGES OF 2021 PROCEDURES)

Complication	Number	(%)
Minor complications		
Moderate bleeding	30	(1.5)
Infection	3	(0.1)
Recurrent nerve paralysis	3	(0.1)
Haemoptysis	1	(0.05)
Severe complications		
Major bleeding	4	(0.2)
Tracheal rupture	3	(0.1)
Pericardial rupture	2	(0.1)
Pneumothorax	1	(0.05)
Death	0	(0.0)
Total of complications	47	(2.33)
Severe complications	10	(0.5%)

TABLE VI
HISTOLOGICAL CLASSIFICATION OF THE LYMPH NODE SPECIMENS OBTAINED BY MEDIASTINOSCOPY IN PATIENTS WITH COMPLICATIONS (N=47)

Histological diagnosis		Number
Metastasis of bronchogenic carcinoma		
Non small cell carcinoma	5	10
Small cell carcinoma	5	
Metastasis of extrathoracic malignancy		1
Malignant lymphoma		1
Sarcoidosis		4
Tuberculosis		2
Silicotic lymph nodes		2
Retrosternal struma		1
Miscellaneous		3
Anthracotic or silicotic lymph nodes		23

Histological classification of lymph node specimens in these patients is presented in Table VI. In 23 patients (49 per cent), anthracotic lymph nodes only and in 12 patients (26 per cent), a malignant process of the mediastinum was verified. In 24 patients (51 per cent), mediastinoscopy was considered positive in spite of complications.

Discussion

The reported incidences of mortality and morbidity with mediastinoscopy have been low, despite the fact that the procedure is performed in a region of the body with a high concentration of vital structures (Palva, 1964; Jepsen, 1966; Foster *et al.*, 1972). In the earlier literature, a complication rate of between 1–3 per cent has been reported (Carlens and Hambraeus, 1967; Ross *et al.*, 1970; Kliems and Savic, 1979). It is generally accepted that a patient must not be relegated to a lone, inexperienced operator for mediastinoscopy. A thorough knowledge of the mediastinal anatomy and respectful handling of mediastinal structures are necessary if the surgeon is to avoid disaster. Lymph nodes can only be biopsied or removed after having been enucleated and isolated. Reported complications have included fatal biopsies of pulmonary and innominate arteries as well as of the aortic arch, the superior vena cava and the azygos vein. Repeated mediastinoscopy has generally been considered a dangerous procedure (Palva *et al.*, 1975; Lewis *et al.*, 1984; Balle and Bretlau, 1985).

The most serious complication is haemorrhage from one of the large vessels in the mediastinum (Foster, 1972; Nohl-Oser, 1979, 1980; Farrow, 1985; Luke *et al.*, 1986). For an inexperienced surgeon it may be difficult to decide whether a mediastinal mass is a true tumour or contains some vascular structures in an abnormal position in the mediastinum. Therefore, one should prefer to make a puncture before biopsy. Especially tumours located in the anterior mediastinum may be problematic in this respect. Generally, in the normal mediastinum, it is quite easy to identify the left recurrent nerve, the vagus nerve as well as the azygos vein and avoid complications. In the abnormal mediastinum, on the contrary, it may be impossible to find these structures and the possibility of complications is real. Much depends on the indications for mediastinoscopy. In patients with mediastinal masses, mediastinoscopy may be a difficult and dangerous procedure to perform especially when the tumour is located under the aortic arch or in the anterior mediastinum. In the present series, mediastinoscopy was performed on 170 patients with a mediastinal shadow and only on four patients (0.2 per cent) could the procedure not be performed because of anatomical relationships in the upper mediastinum. In seven patients only (7/2021 = 0.3 per cent), no lymph node tissue in the mediastinum could be discovered.

Patients undergoing mediastinoscopy often develop temperature elevation the following day. This is true especially in patients with sarcoidosis. In the present series no antibiotic treatment was used routinely and only three cases of wound infection occurred. When proper sterile conditions are employed, wound infections are quite rare and acute mediastinitis can be avoided.

Superior vena cava obstruction is often cited as a contra-indication for mediastinoscopy. In these cases, the entrance to the mediastinum may be difficult because of large subcutaneous veins. In the mediastinum, there are only a few large vessels and it is generally quite safe to take biopsies. Abnormal inferior thyroid veins may cause problems and produce problematic haemorrhage but this is usually avoided by careful retraction of these veins. The thyroid isthmus, when situated retrosternally, can even prevent entrance to the mediastinum but it should always be passed anteriorly.

In the tracheobronchial angles, especially in the subcarinal region, the arches of the bronchial arteries cross the exploration area. These arteries originate from the aortic arch and when damaged can cause moderate bleeding. Generally, these vessels can easily be verified and haemorrhage prevented. If a moderate haemorrhage occurs, one should keep the mediastinoscope in the proper position without losing visual contact with the bleeding area. It is quite easy to place a metal clip on the proximal end of the damaged artery and stop the bleeding immediately. If haemorrhage originates from a large vein or artery, the only solution is to make tamponade for 10-20 minutes, and, if necessary, to perform thoracotomy.

Histological examination of mediastinal biopsy specimens revealed anthracotic nodes only, which were

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regarded as a normal finding in about 50 per cent of the cases with complications. However, in most of these cases only minor complications occurred. The most serious complications e.g. major haemorrhages, usually occur in patients with a malignant process of the mediastinum when anatomical relationships in the mediastium are confused. In patients with benign mediastinal disease such as sarcoidosis, one should avoid exploration of the dangerous regions in the subaortic or right tracheobronchial angles and only take biopsies from enucleated and isolated lymph nodes. Especially in a mediastinum with strong peritracheal fibrosis the possibility of complications is increased.

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