Mini-mediastinotomy under local anesthesia for biopsy of anterior mediastinal masses with airway compression

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REZUMAT

Mini-mediastinotomie sub anestezie locală pentru mase mediastinale anterioare cu compresia căilor aeriene

Introducere. *Strategiile de abord a maselor mediastinale anterioare (MMA) depind foarte mult de diagnosticul histopatologic. Manifestările clinice ale acestor mase reprezintă uneori o urgență datorită compresiei pe căile aeriene mari și vasele mari, situații în care anestezia generală este dificilă și riscantă; mulți autori au subliniat pericolele anesteziei generale la astfel de pacienți.* ***Metode.*** *Acest studiu prospectiv a inclus 23 de pacienți cu MMA și compresie de căi aeriene mari sau vase mari, la care s-a făcut prelevare bioptică prin mini-mediastinotomie sub anestezie locală.* ***Rezultate.*** *La toate cazurile s-a precizat un diagnostic histopatologic. Morbiditatea s-a înregistrat la un pacient, cu efracție a spațiului pleural, fără mortalitate. Din cei 23 de pacienți, 9 deja fuseseră supuși unor manevre diagnostice mai puțin invazive fără a se preciza diagnosticul.* ***Concluzii.*** *Mini-mediastinotomia, sub anestezie locală pentru biopsie diagnostică la MMA cu compresie pe căile aeriene, este sigură, minim invazivă, eficientă și utilă în decizia terapeutică a MMA.*

Cuvinte-cheie: *mini-mediastinotomie, mase mediastinale anterioare, compresie de căi aeriene, compresie de vase mari, anestezie locală*

ABSTRACT

Introduction. *Management strategies for anterior mediastinal masses (AMMs) depend strongly on the histopathological diagnosis. The manifestations of these masses sometimes are an emergency because of large airway or great vessel compression which make general anesthesia challenging and hazardous and many authors have emphasized the dangers of general anesthesia in such patients.* ***Methods.*** *This prospective study carried on 23 patients with AMMs and large airway or vessel compression via mini-mediastinotomy under local anesthesia for taking histological biopsy.* ***Results.*** *A definite histolopathological diagnosis was made in all cases. Morbidity was seen in one patient with entering the pleural cavity, there was no mortality. Out of 23 patients, 9 patients had already undergone less invasive procedures without definite diagnosis.* ***Conclusions.*** *Mini-mediastinotomy under local anesthesia for diagnostic biopsy in AMMs with airway compression is safe, minimally invasive, effective, and is useful in therapeutic decision making for AMMs.*

Keywords: *mini-mediastinotomy, anterior mediastinal masses, airways compression, great vessel compression, local anesthesia*

Introduction

Anterior mediastinal masses (AMMs) sometimes present with severe and often life-threatening complications mostly related to compression of airway or great vessels [1-3]. Definite histopathologic diagnosis is necessary because the management strategies are different in various types of masses [4]. Empiric chemo-radiotherapy is not acceptable any more [5-7].

Noninvasive procedures for biopsy of AMMs have low diagnostic yield. Open surgical biopsy under general anesthesia might be required, which is sometimes life threatening [8]. There are many reports of patients with AMMs with undiagnosed or underestimated airway obstruction in whom ventilation became impossible and ultimately died during induction of anesthesia and muscle relaxation [5,7,9]. We had such bad experiences in our hospital, also.

The main goal of this study is to evaluate the safety and feasibility of biopsy of AMMs under local anesthesia.

Material and methods

Twenty-three patients with AMMs associated with compression of main airways or great mediastinal vessels were enrolled in the study. Nine of them had already undergone computed tomography guided biopsy or fiberoptic bronchoscopy without a definite diagnosis.

We first explained the nature of problem to the patients and all patients gave informed written consent. Only one thoracic surgeon operated on all patients.

The operation was performed under local anesthesia; however an anesthesiologist was on patient's bedside during surgery for any possible requirement for general anesthesia and emergency extensive thoracotomy. Patients were placed on supine position with about 30 degree elevation of the head. The patients were monitored with pulse oximetry, electrocardiogram and controlling vital signs.

The entire anterior chest was prepared and draped. The patients were sedated with midazolam and fentanyl. After infiltration of operation area with lidocaine 1%, a 6 centimeter incision was made over the second or third rib on left or right depending on the location of the mass. Incision was deepened through skin and subcutaneous tissue, the muscles were splited. After lidocaine infiltration to perichondrum, the cartilaginous part and sometimes a few centimeter of osseous

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part of rib were removed subperichondraly and subperiosteally. Posterior perichondrum was incised sharply. Internal mammary artery and vein were identified under perichondrum and ligated with 00 silk. We were able to ligate these vessels in all 23 patients but sometimes we had to ligate also vessels in the mass. Using a scalpel number 11 enough tissue samples were taken for biopsy. Blood loss from the biopsy site was controlled with monopolar electrocautery but in some cases we were compelled to use surgi-cell. After homeostasis the muscles and subcutaneous tissues were approximated with vicryl 1 and 00 respectively, and skin was sutured with 3/0 nylon simple separately. We didn't use any drain. Four hour after operation diet was started.

Results

Twenty-three consecutive patients were enrolled in the study (see Table I). The mean age was 39.36 (range 15-80 years), 16 were male and seven female. The main symptoms were dyspnea, chest pain, cough, facial and upper extremity edema (superior vena cava syndrome). All patients had plain chest X-ray and intravenous contrast enhanced chest CT-scan which showed airway compression (Figure 1). Nine of the patients had already undergone fiberoptic bronchoscopy, or CT guided fine needle biopsy without obtaining a definite diagnosis. In 14 patients left hemithorax was opened and right hemithorax in 8 patients.

There was no complication during the operations, except for a 40 years old male, in which the left pleural cavity was opened inadvertently and the patient experienced severe pain. We needed to insert a chest tube in this patient.

A 7 years old boy with large AMMs and presumptive diagnosis of lymphoma was excluded from this study because of poor cooperation. A biopsy was taken under general anesthesia. As soon as induction of anesthesia, the airway pressure raised, he became cyanotic and arterial oxygen saturation fell below 80%. He died two days later due to respiratory failure. The pathology was reported high grade non-Hodgkin's lymphoma.

Discussion

In the 23 patients clinically presenting as having large AMMs with airway or great vessel compression, we success-

Table I. Charateristics of the patients and the results of anterior mediastinal masses biopsy under local anesthesia

Result of mini-mediastinotomy biopsy	Main symptom	Age years	Sex	No
Malignant germ cell tumor	Dyspnea-chest pain	27	male	1
Malignant non-Hodgkin's high grade lymphoma	Respiratory distress	19	female	2
Lymphoblastic lymphoma	Dyspnea, facial edema	16	male	3
High grade lymphoma	Chest pain-cough	40	male	4*§
non-Hodgkin's lymphoma	Facial and upper extremity edema	23	female	5*
Malignant germ cell tumor	Chest pain	28	male	6*
Hodgkin's lymphoma nodular sclerosing	Dyspnea	25	male	7*
Poorly differentiated squamous cell carcinoma	Dyspnea-cough	80	female	8
Metastatic neuroblastoma	Dyspnea in exertion-tightness of chest	17	male	9*
Diffuse lymphoma(small cleaved)	Head and neck edema	46	male	10
Poorly differentiated carcinoma	Chest pain-dyspnea	63	male	11*
Malignant lymphoma	Dry cough	59	male	12
Lymphoblastic lymphoma	Chest pain-dyspnea	17	female	13
High grade diffuse large cell lymphoma	Dyspnea-tightness of chest	55	male	14
Carcinoma thymus origine	Incapacitating cough with dyspnea	67	male	15*
High grade lymphoma	Severe dyspnea	24	female	16*
Malignant germ cell tumor	Progressive facial edema	30	male	17
Lymphoma	Dyspnea	25	female	18
Carcinoma metastatic	Dyspnea-facial flushing	70	male	19*
Malignant lymphoma	Dyspnea	19	male	20*
Diffuse large cell lymphoma	Chest pain-blood tinged sputum	43	male	21*
Malignant non-hodgkin (lymphoblastic lymphoma)	Cough & dyspnea	16	male	22
Lymphoblastic lymphoma	Dyspnea and respiratory distress	15	female	23

** patients who had already nondiagnosic transthoracic needle biopsy or bronchoscopy, §A patient with pleural perforation*

Figure 1. CT scan image of a patient with anterior mediastinal mass compressing the trachea

fully reached to definite diagnosis with mini-mediastinotomy under local anesthesia without mortality and only one case with morbidity.

The procedures for biopsy of AMMs include transthoracic fine needle aspiration (FNA), transthoracic core needle biopsy, mediastinoscopy, video-assisted thoracoscopy, and open lung biopsy [8,10]. An ideal diagnostic procedure should have a high diagnostic yield and be as minimally invasive as possible. The development of the minimally invasive technique of percutaneous needle biopsy is valuable in obtaining diagnostic tissue from most body compartments. The most recent anatomical area to be targeted for needle biopsy is the mediastinum. The least invasive method is FNA. With it, carcinomatous pathologies are more easily diagnosed than non-carcinomatous lesions [11]. It is valuable in lung cancer, but has limited value in diagnosis of AMMs, because only a minimal amount of tissue is harvested with FNA, making the procedure basically a cytological examination instead of a histological one.

There are reports of misdiagnosis of malignant melanoma as spindle cell thymoma [12]. Normal thymus was reported as thymoma with FNA [13]. In germ cell tumors, the diagnostic yield of FNA is as low as 16.7% (one in six patients) [14].

The amount of tissue harvested via core needle biopsy is larger than that from FNA. However, its use in the diagnosis of AMMs has usually been associated with unsatisfactory results, or the tumor may be adjacent to vascular structure such as the aorta, making this approach inadvisable. Robinson et al. [15] reported misdiagnosis of B cell lymphoma located in anterior mediastinum, as a carcinoid tumor with percutaneous transthoracic core needle biopsy.

In series reported by Fang [8], the diagnostic yield of core needle biopsy for mediastinal lesions was significantly lower, being only 41.7%, but for pulmonary and pleural diseases was as high as 81.3%.

Reasons stated for failing to achieve a definite diagnosis via core needle biopsy are: 1. small amount of tissue harvested 2. the 'crushing effect' on the tissue harvested during the cutting process of biopsy needle may cause morphological changes 3. the tissue at the center of the tumor tended to be necrotic due to rapid tumor growth as suggested by Fang et al [8].

Generally, core needle biopsy has a high diagnostic yield in pulmonary and pleural disease, yet in AMMs its diagnostic yield is relatively low [8].

Mediastinoscopy has higher diagnostic yield and is less traumatic than open surgical biopsy. It is suitable mainly for middle mediastinal tumors rather than for AMMs. In addition, it still requires general anesthesia, and has significant morbidities such as hemorrhage or airway obstruction.

In open surgical biopsy with large mediastinotomy, the diagnostic yield may be as high as 100%, however significant morbidity, poor long term results and increased chance of pleural dissemination is reported [8].

On the other hand, the life threatening hazards in mediastinoscopy and large incisional surgical biopsy require general anesthesia.

Neuman and coworkers [5,9] stated three reasons for the exacerbation of airway obstruction with general anaesthesia: 1. under general anaesthesia, lung volume is reduced to as little as 500-1,500 ml; 2. bronchial smooth muscle relaxation leads to greater compressibility of the airway from the overlying mass; 3. loss of chest wall tone and diaphragmatic paralysis induced by myorelaxants reduces the normal transpleural pressure gradient which dilates the airway. This decreases the calibre of the airways and enhances the effect of extrinsic compression. Even asymptomatic patients have developed life-threatening complications at induction of general anesthesia [5]. In this condition, tracheostomy may be futile because the obstruction is usually intrathoracic.

Fang and coworkers demonstrated that mini invasive approaches under local anesthesia may be successful [8].

Our results are in concordance with Fang [8] study, in which the diagnostic yield of biopsy through mini-mediastinotomy was similar to mediastinoscopy or open surgery. It is also safer than open surgery, or mediastinoscopy. No patient in the current series and in Fang study showed any mortality with minor morbidity.

As stated by Fang, mini-mediastinotomy advantages are that when a large tumor is pushing the pleura aside, it is not necessary to enter the pleural cavity [8]. In Fang patients, the pleural cavity was entered in only one case where the mass was located in the right hilum. In our series in a patient left pleural cavity was entered, the mass being located in the left side of the mediastinum, and the biopsy revealed a high grade malignant lymphoma.

Almost all common pathologies were encountered, including lymphoma, germ cell tumor, metastasis from extrathoracic sites, teratoma, sarcoma, and malignant thymoma. Definite diagnosis were required in all of them because treatment strategy was different according to the etiology: for example, lymphomas are mainly treated with chemotherapy with or without radiation; seminoma is quite sensitive to radiation, and in malignant teratoma the cornerstone of treatment is surgery.

Conclusion

Mini-mediastinotomy under local anesthesia for diagnostic biopsy in AMMs with airway compression is safe, minimally invasive and is effective in therapeutic decision making.

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Conflict of Interest

There is no conflict of interest.

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