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access of anterior mediastinotomy can be reached if proper instruments for fine needle aspiration biopsy and an efficient cytological service are available [7]. However, because of the low yield and more tissue requirement for certain diagnosis [4,8,9], we have occasionally used tru-cut needle biopsy, others [9] use punch biopsy technique with ASAP 18 (Boston Scientific, Watertown, MA 02172) core biopsy system routinely. Lesions that are adherent to fragile vessels and are risky to biopsy by standard technique have been biopsied inevitably by multiple visualised fine needle aspirations. While the controversy over the diagnostic yield from fine needle aspiration biopsy rages [10], AM provides access for most minimally invasive biopsy techniques of the contiguous lung, and mediastinum. AM is preferred in patients with superior vena cava syndrome, prior mediastinal radiation therapy, mediastinal inflammatory disease or prior mediastinoscopy, [3].

Until recently, exploratory thoracotomy or sternotomy was advocated for most patients seen with an undiagnosed mediastinal mass [5,6,8]. In a review of anterior mediastinal masses, 61% of these masses were preferably treated non-operatively [6]. More than 95% of lung cancer is diagnosed with one of the many less invasive procedures, AM inclusive [11,12]. When compared with thoracotomy or sternotomy, AM is more appropriate and selective for obtaining tissue diagnosis.

The diagnostic yield in our series both for mediastinal masses and carcinoma is high because all the patients studied had advanced disease and no form of therapy preceded the procedure. In other studies [7], the yield was as high as 84.5% for mediastinal mass and lower when performed for the staging of upper lobe tumours that showed radiological evidence of continuity with the mediastinum. The yield in early lung cancer for hilar lesions in the same study was 50%. This makes it an invaluable procedure even in early disease.

AM has a longer operating time and causes greater postoperative pain and debilitation than does cervical mediastinoscopy [7]. We also agree with the fact that there is also an associated delayed wound healing with AM when used in patients with superior vena cava obstruction [5]. Although AM has been described as a relatively safe procedure [3,4,5], we found that in certain patients with superior vena cava obstruction, care with conventional biopsy technique is mandatory to avert life-threatening haemorrhage.

Two patients in the present study needed subsequent sternotomy, previous AM did not interfere with this procedure. Although no patient in the present series needed thoracotomy but after AM it is the experience of others (5,7,9), that AM does not interfere with subsequent thoracotomy. The only major set back for patients who had AM is that chemotherapy or radiation may need to be delayed for 2 or 3 weeks postoperation to allow adequate wound healing.

We conclude that in diseases of the mediastinum and lungs evaluation is not complete without tissue diagnosis. Various minimally invasive tissue diagnostic options are available and the diagnostic criteria are standardized, there are instances when bigger specimens for conclusive tissue diagnosis are indicated. AM is the procedure we have used to achieve this end. It

is relatively simple, with virtually no mortality and attended by relatively easily managed complications. Within the scope of these advantages it is cost effective.

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Anterior mediastinotomy - a diagnostic tool

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Summary
This is a review of our experience with anterior mediastinotomy (AM) in the diagnosis and evaluation of diseases of the mediastinum and lung. Thirty consecutive patients who had AM between 1984 and 1999 were retrospectively studied. The mean age of patients was 28 ± 6.5 years. There were 22 males to 8 females. Sixteen patients had superior vena cava (SVC) obstruction (12 patients with lung cancer, 4 with primary mediastinal tumours), 4 patients had radiological evidence of mediastinal contiguity of upper lobe tumours and 10 patients had primary mediastinal tumours. AM was 1st procedure in 10 patients and 2nd procedure in 20 patients after failed or inconclusive result from FNAB, scalene node/cervical lymph node biopsy or bronchoscopy. Eighteen right-sided and 12 left-sided AMs were performed. Satisfactory histological diagnoses were achieved in all patients. Complications were easily controlled bleeding (4 patients) and life-threatening haemorrhage in 2 patients. Three patients had delayed wound healing and 4 had inadvertent pleural entries. There was no mortality temporarily related to the procedure. We conclude that AM is valuable as a surgical technique for obtaining tissue for histological purposes in diseases of the mediastinum and the lung when tissue specimens from less invasive procedures are unsatisfactory.

Keywords: Anterior mediastinotomy, tissue diagnosis, mediastinum and lung diseases

Résumé

Voici un bilan de notre expérience avec la médiastinotomie antérieure (MA) dans le diagnostique et l'évaluation des maladies du médiastinum et du poumon. On a étudié en retrospectif trente malades consécutif qui avaient le MA entre 1984 et 1999. L'âge moyenne des malades était $28 \pm 6,5$ ans. La proportion des hommes aux femmes était 22:8. Sixteen malades avaient l'obstruction cava vena supérieur (CVS) (12 malades avec un cancer du poumon, 4 avec une tumeur médiastinale primodiale), 4 malades avaient montré l'évidence radiologique de la contiguïté médiastinale des tumeurs du lobe supérieur et 10 malades avaient des tumeurs médiastinales primodiales. Le MA était le 1^{er} et 2^{ème} procédures dans 10 et 20 malades respectivement après un résultat raté ou peu probant de "FNAB", la lympho scalene/ganglion lymphatique cervical de biopsie ou de bronchoscopie. Dix-huit MA à coté droit et douze MA à coté gauche ont été faits. Les diagnostiques histologiques satisfaisants étaient réalisés dans les malades. Les complications étaient le saignement contrôlé à l'aise (4 malades) et l'hémorragie grave en 2 malades. Trois malades avaient une guérison relantie de blessure, et 4 avaient des entrées inadvertance de plèvre. Il n'y avait pas la mortalité temporairement relatif au procédure. Nous concluons en disant que le MA est une technique chirurgique très utile pour l'obtention de tissu en raison histologique au cadre des maladies

du médiastinum et de poumons lorsque les specimens des procédures moins invasives sont peu satisfaisant.

Introduction

Anterior mediastinotomy (AM) was developed by McNeil and Chamberlain in 1996 to sample lymph nodes in the subaortic and periaortic regions that are not accessible through cervical mediastinoscopy [1]. Apart from its role in the staging of lung cancer, it is of value in biopsying mediastinal masses and lymph nodes to establish the diagnosis in diseases such as sarcoidosis, lymphoma and mediastinal tumours [2]. We hereby review our experience with this procedure.

Materials and methods

This report is based on experience with patients referred from other medical departments of the University College Hospital, Ibadan, between 1984 and 1999. The patients were all examined. Routine chest-x-rays, barium swallows and skeletal radiological surveys have been done in most cases before referral. Computed tomography (CT) were done in some patients. Where necessary sputum was examined both for malignant cells and for the presence of acid-fast bacilli.

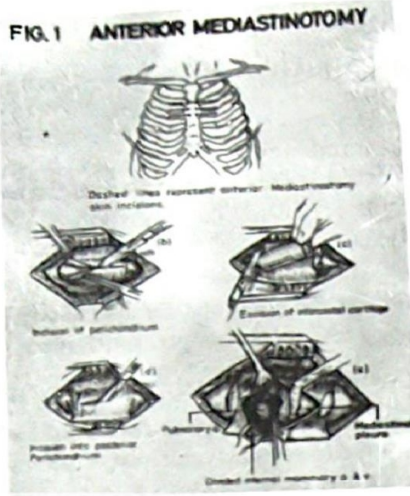
Some of the patients had fine needle aspiration biopsies (FNAB) or scalene node, cervical lymph node biopsy before mediastinotomy. Patients with respiratory symptoms had bronchoscopy.

All patients case notes were reviewed some retrospectively and some who were on follow-up at the time of this report were interviewed at the surgical outpatient department.

Technique

Anterior Mediastinotomy was performed under general anaesthesia with endotracheal intubation. Each patient was placed in a supine position and routine aseptic skin preparation and drapping was done to expose the operation site. A transverse skin incision about 4 – 6cm long was made over the second or third costal cartilage depending on the location of the lesion. The costal cartilage was excised subperichondrially and the posterior perichondrium was incised. Alternatively an incision was made through the second intercostals space without removing the costal cartilage (figure 1) after the intervening pectoralis major muscle was separated along its fibres. The internal mammary artery and vein are ligated individually after the intercostal vascular bundle in the field has been divided between ligatures. A search for mediastinal disease was made. When there was inadequate exposure or extensive matting, the pleura was opened to enhance the search and biopsy of the lesion. Hemostasis was meticulously maintained. Any tissue ambiguous or with bluish discoloration was punctured with 23G needle before a biopsy was done. Fine needle aspiration biopsy or tru-cut needle was used for biopsies in certain situations where standard biopsy was considered dangerous.

Most tissues biopsied were considered macroscopically pathological hence no frozen section was done. When the pleura was opened, a multifenestrated chest tube connected to a pleural drainage system was placed within a mid-axillary stab



incision. The mediastinotomy wound was closed in anatomic layers with 2-0 absorbable sutures and 2 - 0 silk to skin. Skin sutures were removed after one week.

Results

AM was not a diagnostic procedure we used before 1983. The scope of diagnostic or therapeutic surgical procedures used by the Cardiothoracic Surgical Unit (CTSU) in evaluation-management of primary mediastinal masses and superior vena cava obstruction are shown on Tables 1 and 2, respectively. The only indication for AM in our series was to obtain adequate tissue specimen for conclusive tissue diagnosis necessary for appropriate treatment.

Table 1: Diagnostic-therapeutic surgical procedures in 105 primary mediastinal masses

Procedure	Number performed	Number Positive n (%)	Number Negative n (%)
Fine needle aspiration	80	-	-
Biopsy (FNAB)	61	40 (65.6)	21 (34.4)
Mediastinal mass	19	15 (78.9)	4 (21.1)
Cervical lymph node	27	23 (85.2)	4 (14.8)
Cervical node biopsy (CNB)	14	14 (100)	-
Anterior mediastinotomy (AM)	31	31 (100)	-
Thoractomy	21	21 (100)	-
1st Procedure	6	6 (100)	-
2nd Procedure	4	4 (100)	-
3rd Procedure	40	40 (100)	-
Sternotomy	29	29 (100)	-
1st Procedure	11	11 (100)	-
2nd Procedure			

AM produced diagnostic specimen in 16 patients with superior vena cava (SVC) obstruction of which, 12 patients had lung cancer and 4 had primary mediastinal tumours. AM was also the source of definitive tissue diagnosis in 4 patients with radiological evidence of mediastinal contiguity of upper lobe tumours and in 10 other patients with primary mediastinal tumours. There was no negative or inconclusive diagnosis of lesions biopsied through AM.

Table 2: Diagnostic or therapeutic procedures in 88 patients with superior vena cava obstruction

Procedure	Patient	Diagnostic (n)	Therapeutic (n)	Condition diagnosed or treated		
				Lung Cancer	Lymphoma	Primary Mediastinal Tumour
Fine needle aspiration						
Biopsy (FNAB)	75	66	-	30	27	9
Bronchoscopy	62	46	-	41	5	-
Lymph node biopsy	37	37	-	13	19	5
Anterior mediastinotomy	16	16	-	12	-	4
Mediansternotomy	7	7	7	-	-	7
Right posterolateral thoractomy and cervical exploration	3	3	3	-	-	3
Right posterolateral thoractomy	6	6	6	-	-	6

NB - Combination of procedures were applied to arrive at histologic diagnosis.

Thirty patients had AM for biopsies. AM was the 1st invasive diagnostic procedure in 10 patients and the second invasive diagnostic procedure in 20 patients after failure of diagnosis from or inconclusive diagnosis from specimens obtained from either rigid bronchoscopy, scalene node, cervical lymph node or fine needle aspiration biopsy (FNAB). On the whole 18 right-sided and 12 left-sided AMs were done. The histologic diagnosis from the AM specimens are given in Table 3.

The ages of this patients ranged between 21 and 68 years (mean 28 ± 6.5 years), there were 22 males to 8 females.

The presenting features among the 30 patients who had AM are shown in Table 4. Local symptoms of invasive disease are the commonest indication and the ultimate purpose was to obtain tissue diagnosis on which precise management was to be based. Patients represented by figure 2 had symptoms of locally invasive disease, figure 3 represents a patient with huge anterosuperior mass and the patient represented by figure 4 had a right upper lobe lesion contiguous on the mediastinum.

Complications encountered were as follows: Intraoperative bleeding which was mild to moderate in 4 patients and was easily controlled by pressure and sutures; but life threatening in 2 patients. Wound infection/wound dehiscence occurred

Table 1: Histologic diagnoses in 30 patients undergoing anterior mediastinotomy (AM)

Specific diagnosis	AM as 1st Procedure	AM as 2nd Procedure
Cancer	-	14
Differential	-	-
All	-	8
Metastatic carcinoma	-	6
Lipoma	4	2
Hodgkin's Lymphoma	2	4
Fibrosclerosis	-	-
Cellularity	1	-
Hodgkin's lymphoma	-	3
Strumatic thyroid	1	-
Metastatic carcinoma	1	-
Leiomyoma	1	-
Leiomyosarcoma	-	-
Cell tumour	2	-
Thymoma	1	-
Neuroma	1	-
Chymal tumour (teratomas)	1	-

Table 2: Presenting features among 30 patients who had anterior mediastinotomy (AM)

Presenting features	No. of patients
Asymptomatic	19
Severe chest pain/voice change	16
Superior vena cava obstruction	2
Resection of bone/non respectability	6
Asymptomatic enormous anterior mediastinal compartment lesion	4
Enlarged supraclavicular nodes, suspected non-metastatic malignancy, evidence of mediastinal adenopathy	-

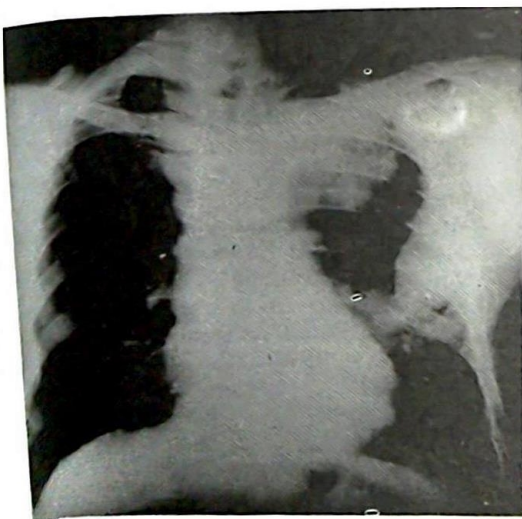


Fig. 2: Posteroanterior (PA) view showing widening of the superior mediastinum more to the left than the right. Lesion was approached via left sided AM

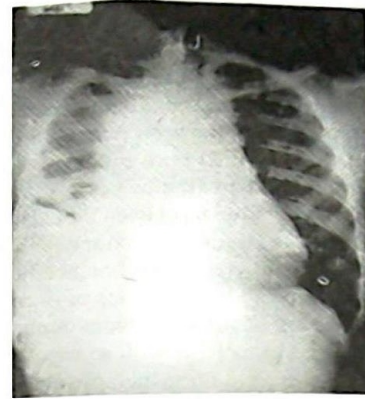


Fig. 3: PA view of a huge anterosuperior mass. Approached via a right sided AM. A left sided AM could also be used.



Fig. 4: PA view of a right upper lobe lung cancer. Contiguous to the mediastinum. Right paratracheal lymph nodes are seen and also parenchymal opacities. Approached via a right sided AM.

in 3 patients with SVC obstruction who had chest wall oedema that increased postoperatively. They healed well after the onset of treatment of the SVC obstruction and wound care. Pleural entry occurred in 4 patients and was treated with closed thoracostomy tube drainage. There was no mortality directly related to the procedure.

Discussion

We and many other authors found anterior mediastinotomy to be a valuable procedure in the diagnosis and evaluation of diseases of the mediastinum and lungs [2-6]. The specific advantages lie in the direct access it provides to a broad field of mediastinal and pulmonary lesions, and the high positive yield of biopsied specimens.

In our hands, AM serves as the proper procedure when all less invasive surgical diagnostic procedures yield inconclusive specimens when employed on some mediastinal lesions or pulmonary lesions contiguous to the mediastinum. The areas accessible to this surgical technique, though a relatively small incision are as follows: right-sided nodes and lesion in the right region of the superior vena cava and azygous vein; left hilar and sub-aortic nodes; adjacent pulmonary parenchymal tissue; and any mass occupying the anterior or superior mediastinal and retrosternal space [3,4,7]. Lesions situated beyond the usual