Scalene Node Biopsy:  
Its Value as a Diagnostic Aid in Chest Diseases*, **

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Introduction

The difficulty of absolute diagnosis in a significant proportion of intra-thoracic disease has long been recognised by clinicians. A large number of cases are still seen in which the diagnosis is uncertain, despite refinements during the past decade of such procedures as roentgenology, cytological study of the sputum, bronchoscopy, bronchoscopic biopsy, thoracoscopy and exploratory thoracotomy.

Daniela in 1949 suggested a new diagnostic method: biopsy of the scalene lymph nodes. These easily accessible nodes lie in unique anatomical relationship to the thoracic lymph nodes.

Although many series of scalene node biopsies have been recorded in the literature since then, this is the first series based on the examination of the glands obtained from a series of almost consecutive routine autopsies. Our aim has been to show how often pathological changes in these nodes may be correlated with changes elsewhere in the body, particularly with those of intra-thoracic origin.

Review of the Literature

Since Daniel's paper in 1949 many others have been published on the subject. Bosman, Orje and Hadders (1951) performed the operation on 100 patients, 70 for diagnostic purposes (32 of which were positive) and on 30 cases of proved bronchogenic carcinoma to determine the operability, prognosis etc., (four positives). Löfgren and Lundbäck (1952) studied 212 patients presenting with what they termed "the bilateral lymphoma syndrome." Among other procedures carried out, scalene node biopsy was done on 55. Of these, 43 showed sarcoid changes while in one tuberculosis was demonstrated. Shefts, Terrill, and Swindell (1953) found among 187 patients (205 biopsies), a total of 67 abnormal nodes, i.e., an incidence of positive findings of 35.8 per cent. Seghers, Orje, Hadders and Minderhout (1954) removed the nodes in 330 patients—197 for diagnostic purposes (95 positives) and the remainder to indicate prognosis in proved cases of bronchogenic carcinoma (14 positives).

Piper (1954) carried out scalene lymph node biopsy in 185 patients establishing positive diagnosis in 52 instances. Odelberg (1954) performed the biopsy on 211 patients and found that the method helped positively to establish the diagnosis in 58 per cent of the cases. Harken, Clauss, Black and Farrand (1954) as well as removing the scalene nodes

*Awarded Second Prize, 1956 Essay Contest, American College of Chest Physicians.  
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also dissected the superior mediastinum for lymph nodes in 142 patients. They claimed that this increased the percentage of positive diagnoses. In 45 cases the nodes provided a diagnostic answer.

The most recent review of the technique is by Conneal\(^9\) (1955). He cites his experience of "prescalene and deep cervical lymph node biopsy" in 50 consecutive cases with previously undiagnosed intrathoracic lesions. He deals in particular with bronchial carcinoma, and mentions the fact that the incidence of positive tissue diagnosis in the nodes, 31 per cent, is the same as that obtained by bronchoscopic biopsy.

**Lymphatic Connections of the Scalen e Lymph Nodes:** with special reference to the lung lymphatic system.

In scalene node biopsy used as a diagnostic procedure to clarify unknown lung conditions, regard must be given to the area of lymph drainage of the region containing the lesion.

The question of which nodes to take in the individual case must be answered in terms of two factors: where the lesion is suspected to be, and which node is the more likely to show pathological changes from anatomical considerations of the drainage path from the area of the lesion.

The following facts are from Drinker\(^10\) (1942). As shown in Diagram 1 the lungs are divided into six areas of lymphatic drainage approximately corresponding to the six functional lobes. The right scalene node has lymphatic connections with the whole right lung, the left lower lobe and portion of the left "middle lobe" (lingula), and, therefore, in all lesions of the lungs except those of the left upper lobe the right scalene nodes should be taken when scalene node biopsy is performed. In lesions of the lingula when the right node returns a negative finding and if the diagnosis is still in doubt, the left should be biopsied.

In the vast majority of nodes examined by us it was found that macrophages with black pigment were present. This demonstrates the movement of cells from the lung lymphatic system to the scalene nodes.

The right scalene node being in close proximity to the great lymph trunks of the right side of the body receives collaterals from them and sends tributaries to them. Tumour emboli from the areas of drainage of these great trunks lodge in these nodes; and metastases may therefore occur in the right scalene node when derived from tumours on the right side of the head and neck; right upper limb, thoracic wall on the right, right side of the heart, and part of the convex surface of the liver.

The left scalene node is closely connected with the jugular chain, the mediastinal group and the thoracic duct, and receives afferents from the surrounding organs, the paratracheal and other local nodes. As it is at the hub of the lymphatic system it closely reflects the state of the lymphatic system as a whole, and if there has been carcinomatous invasion of the lymphatic system in the area of drainage of the above lymph ducts, then if given sufficient time, this node will be affected by the tumour. The left node is therefore involved first, and the right one is affected secondarily, in the spread of secondary carcinoma from a tumour in the
abdomen. In several cases of abdominal carcinoma in our series the left side only was involved, while in others, a stage later in the disease process, both nodes were affected; but in these cases the involvement was more extensive in the left node.

Materials and Methods

During the months September 1955 to February 1956 inclusive, scalene lymph nodes were routinely removed by us at autopsies performed on an unselected series of 123 adults, at the Royal Prince Alfred Hospital, Sydney. Nodes were taken from both sides. A limited amount of similar material was received from Royal North Shore Hospital and Sydney Hospital. The following method was employed in the removal of the nodes.

The skin and platysma muscles are reflected from both sides of the neck (Diagram 2). The sterno-cleido-mastoid muscle is then completely removed from its insertion into the sternum and clavicle, and reflected. This exposes an area bounded medially by the internal jugular vein, supero-laterally by the inferior belly of the omo-hyoid, and inferiorly by the subclavian vein and upper border of the clavicle. The floor of this triangle is formed in its medial two-thirds by the scalenus anterior and laterally by the scalenus medius muscles, with their covering fascia.

Diagram 1: The lymphatic drainage of the human lungs (after Drinker).
Coursing across this area are the transverse cervical and inferior thyroid veins, and phrenic nerve, the thoracic duct on the left and the lymphatic duct on the right side. On incision of the deep cervical fascia overlying the scalenus anterior muscle, a pad of fat is revealed, which extends down behind the clavicle into the superior mediastinum. This, together with its retroclavian extension is removed, and is practically always found to contain lymphoid tissue. Paraffin sections then are made, stained with haematoxylin and eosin, and examined.

Results:

The "scalene lymph nodes" show a remarkable diversity in both forms of organisation and in content. In some cases relatively large lymph nodes may be present, while in others lymphoid tissue may be scanty or
even absent. As well as variation in the amount and pattern of the lymphoid tissue present, there is also variation in the contents of the sinuses. While in the true lymph node these contain only lymph, in many of the scalene nodes they are found to contain varying numbers of red blood cells and polymorphs. When the sinuses contain an excessive number of red cells the node is known as a haemolymph node. The cervical region is recognised as being one of the most frequent sites of occurrence in man. It is not surprising, therefore, that in many cases of our series haemolymph nodes were found in the scalene node group. Although when first discovered, these nodes were thought to be pathological, they are now believed to be structures sui generis.

The following table sets out the diagnostic value of the scalene nodes removed by us.

<table>
<thead>
<tr>
<th>Carcinoma of:</th>
<th>From Royal Prince</th>
<th>Alfred Hospital</th>
<th>Positives From Other Hospitals</th>
</tr>
</thead>
<tbody>
<tr>
<td>N. nasopharynx</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Thyroid</td>
<td>1</td>
<td></td>
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</tr>
<tr>
<td>Lung</td>
<td>4</td>
<td>4</td>
<td>1</td>
</tr>
<tr>
<td>Breast</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Oesophagus</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Stomach</td>
<td>2</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>Liver &amp; gallbladder</td>
<td>2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pancreas</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Colon &amp; rectum</td>
<td>6</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Kidney</td>
<td>1</td>
<td></td>
<td></td>
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<tr>
<td>Bladder</td>
<td>1</td>
<td></td>
<td></td>
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<tr>
<td>Prostate &amp; uterus</td>
<td>2</td>
<td></td>
<td></td>
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<tr>
<td>Gonads</td>
<td>2</td>
<td></td>
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<td><strong>Leukaemias:</strong></td>
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<td></td>
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</tr>
<tr>
<td>Acute</td>
<td>1</td>
<td></td>
<td></td>
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<tr>
<td>Chronic myeloid</td>
<td>1</td>
<td></td>
<td></td>
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<tr>
<td>Chronic lymphatic</td>
<td>1</td>
<td></td>
<td></td>
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<tr>
<td>Hodgkin's disease</td>
<td>2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lymphosarcoma</td>
<td>1</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Reticulosarcoma</td>
<td>1</td>
<td></td>
<td></td>
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<tr>
<td>Mixed mesodermal tumour of uterus</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Multiple myeloma</td>
<td>1</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Osteogenic sarcoma</td>
<td>1</td>
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<td></td>
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<tr>
<td>Tuberculosis</td>
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<td></td>
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<tr>
<td>(pulmonary)</td>
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<td></td>
</tr>
<tr>
<td>(disseminated)</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>TOTALS</strong></td>
<td>20</td>
<td>26</td>
<td>4</td>
</tr>
</tbody>
</table>
As can be seen from this table in 26 cases no diagnostic pathological features were found in cases which might have shown them.

Percentage positive = 16.3 of the total number of autopsies
= 43.5 of those with possible diagnostic lymph node involvement.

“Positive” in this table means that if these scalene nodes had been biopsied during life an unequivocal diagnosis could have been made upon the histological examination of such nodes.

It may be noticed that the positive:negative ratio decreases as the distance of the primary carcinoma from the scalene node increases e.g.

in the neck positive:negative ratio = 2:0
in the thorax = 6:5
in the abdomen = 6:13

In the six cases of abdominal carcinoma met with in this series which metastasized to the scalene lymph nodes four did not affect the right side at all and in the other two the carcinomatous deposit was more extensive in the left set of nodes than in the right.

Discussion

No diagnostic procedure should be performed or recommended without some appraisal of the risks involved. Scalene node biopsy is performed under local anaesthesia and is a simple operation. However, such complications as lymph fistula, air embolism, injury to the phrenic nerve and haemorrhage may occur, but no death due to such procedure has been recorded in the literature.

While, by virtue of their position these nodes are easily accessible, their connections ensure that they reflect the state of the lymphatic system in the thorax and abdomen. In well selected cases much valuable information may be obtained from scalene node biopsy.

Indications for scalene node biopsy:

In generalised disease processes with secondary involvement of the lung, scalene node biopsy may elucidate the disease in general and thereby clarify the situation with regard to the lung in particular. We may cite as an example a case of chorionic carcinoma which presented with epigastric pain and blood stained sputum. At autopsy the lungs were found to be grossly involved with large cannon-ball metastases. The scalene nodes showed clear evidence of metastatic deposits of chorionic carcinoma with large areas of haemorrhage, Langhans cells and the syncytial cells so characteristic of this tumour.

One of the most important applications of this diagnostic procedure is in the evaluation of operability of patients with bronchial carcinoma. In cases of known bronchial carcinoma, in whom thoracotomy with a view to resection is contemplated, scalene node biopsy should be performed. The easily accessible scalene nodes can provide the surgeon with definite information regarding prognosis, in the form of secondary involvement of the nodes. Secondary deposits in the scalene nodes do
not necessarily indicate absolute inoperability in all cases. We consider
that the decision, as to whether a radical operation would benefit
the patient, even if only temporarily, must be left to the surgeon.

In cases where lymphadenopathy is suspected, scalene node biopsy
may provide the final diagnosis, e.g. in cases of leukaemia, Hodgkin's
disease, lymphosarcoma, etc.

Anaplastic bronchogenic carcinoma may spread predominantly by the
blood stream. In our series four cases of patients who died from wide-
spread blood-borne secondary deposits of bronchogenic carcinoma had no
metastases in the scalene nodes. In these cases the lymphatic involve-
ment was slow in onset and was outstripped by the blood spread.

Involvement of these nodes by carcinoma was commoner in our series
in cases in which there was a small primary tumour, which sometimes
was not suspected clinically but had formed widespread lymphatic metas-
tases, rather than in cases with a fulminating fast growing primary
which killed the patient by local invasion into vital structures.

It is interesting to note that in our series no case of sarcoidosis was
found. This contrasts with other scalene node biopsy series which were
done for prognostic and diagnostic reasons and in which many cases of
sarcoïd were diagnosed. A school of thought links the incidence of
sarcoidosis with that of tuberculosis and this may explain the low figures
in this country, where the incidence of tuberculosis is low, although, out
of a series of 68 scalene node biopsies performed at Royal North Shore
and Royal Prince Alfred Hospitals eight cases of sarcoidosis were
diagnosed.

However, as ours is the first series of scalene node examinations from
routine autopsy material, the difference may also be explained by the
fact that patients suffering from this disease are more likely to die at
home than in hospital.

It is well to know that the presence of sarcoïd-like lesions in the lymph
nodes may mask underlying malignancy. Ten Seldam11 has recently
presented his own observations and reviewed the literature on this subject.
It will be realised that in such cases the findings might be misleading
and Bosman, Orie and Hadders,2 in fact, discuss such a case.

SUMMARY

1. The first series of scalene lymph node examinations from routine
autopsy material is presented. Of 123 cases, in which nodes from both
sides of the neck were examined, the overall incidence of positive findings
was 16.3 per cent; 45.5 per cent were positive in cases in which lymph
node involvement would have been possible. The incidence and distribu-
tion of scalene node changes in cases of abdominal malignancy supported
the hypothesis that the left node is involved first in such cases.

2. Indications for scalene node biopsy are: (a) In obscure
intrathoracic conditions to attempt to establish a diagnosis e.g. in carcinoma
or in sarcoidosis of the lung. (b) In cases in which the diagnosis is
certain but in which involvement of these nodes will affect the prognosis,
treatment or management of the patient, i.e. when carcinoma of the lung
has metastasized to the scalene nodes. (c) For diagnosis of disease involving lymph nodes, e.g., leukaemia, Hodgkin's disease, and lymphosarcoma.

RESUMEN

1. Se presenta la primera serie exámenes de rutina de los ganglios escalénicos hacha en material de autopsias. De 123 casos en los que se examinaron los ganglios de ambos lados, los hallazgos positivos globales fueron de 16.3 por ciento; 45.5 por ciento fueron positivos en los casos en que se consideró que sería posible el compromiso de esos ganglios.

La frecuencia y la distribución de los cambios en los ganglios escalénicos en casos de malignidad abdominal vinieron en apoyo de la hipótesis de que los ganglios izquierdos son los primarios afectados en tal grupo de casos.

2. Las indicaciones para la biopsia de los ganglios escalenos son: (a) Afeciones intratorácicas obscuras a fin de intentar comprobar el diagnóstico como en el carcinoma o en sarcoidosis pulmonar. (b) En los casos en que el diagnóstico es cierto pero en los que la invasión de esos ganglios podría comprometer el pronóstico, el tratamiento o el cuidado del enfermo, como cuando el carcinoma ha hecho metástasis a los ganglios escalenos. (c) Para el diagnóstico de las enfermedades que afectan especialmente a los ganglios: leucemia, enfermedad de Hodgkin y linfosarcoma.

RESUME

1. Les auteurs présentent la première série des examens des ganglions de la région des scalènes d'après leur prélèvement systématique au cours des autopsies. Sur 123 cas dans lesquels des ganglions des deux côtés du cou furent examinés, la fréquence moyenne des constatations positives fut de 16,3%. Il y eut un pourcentage de 45,5% de réponses positives dans les cas où l'atteinte ganglionnaire semblait probable.

La fréquence et la distribution des altérations des ganglions scaléniques dans les cas de néoplasie abdominale permettent de suggérer que le ganglion gauche est atteint le premier dans de tels cas.

2. Les auteurs posent les indications de la biopsie ganglionnaire: (a) Dans les atteintes intrathoraciques indéterminées pour essayer d'établir le diagnostic; c'est-à-dire dans les cas de cancer ou de sarcoïdose pulmonaire. (b) Dans les cas où de diagnostic est certain mais dans lequel l'atteinte de ce ganglion influencera le pronostic et le traitement du malade, c'est-à-dire quand un cancer pulmonaire a provoqué des métastases ganglionnaires. (c) Pour le diagnostic des maladies du ganglion, c'est-à-dire la leucémie, la maladie de Hodgkin et le lymphosarcome.

ZUSAMMENFASSUNG

Das Vorkommen und die Verteilung von Skalenus-Lymphknotenveränderungen in Fällen bösartiger abdomineller Erkrankungen bestätigt die Hypothese, nach der der linke Knoten in solchen Fällen als erster betroffen ist.

2. Indikationen zur Skalenus-Lymphknoten-Biopsie stellen dar: (a) Unklare intrathorakale krankhafte Veränderungen mit dem Ziel den Versuch zu machen, zu einer Diagnose zu gelangen, d.h. bei Carcinom oder Sarkoid der Lungen, (b) Fälle, deren Diagnose feststeht, aber bei denen der Befall dieser Knoten einen Einfluss auf die Prognose, Behandlung oder Führung des Patienten hat, d.h. wenn der Lungenkrebs in die Skalenusknoten metastasiert hat. (c) Zur Diagnose von die Lymphknoten befallenden Krankheiten, d.h. Leukaemie, Hodgkin'sche Krankheit und Lymphosarcom.

Acknowledgments: Our thanks are due to the Pathologists of the various hospitals from which we received material. We also wish to thank the staffs of the Department of Pathology and of Medical Artistry, University of Sydney for their co-operation and use of facilities.

REFERENCES