Planigraphy (Body Section Radiography) in Detecting Tuberculous Pulmonary Cavitation

EDWARD A. FAVIS, M.D., F.C.C.P.*
White Haven, Pennsylvania

For this study all planigrams taken at the White Haven Division of the Jefferson Medical College Hospital in White Haven, Pennsylvania, from July 1948 to May 1953 were reviewed. The White Haven Division is a division of the Department for Diseases of the Chest of the Jefferson Medical College Hospital and has an average monthly census of 147 patients.

Body section radiography or planigraphy is not a new technique. It was done originally in France by Bocage in 1921 and by Portes and Chause in 1922. Prior to 1934 an American technician, Jean Kieffer, had perfected and patented an apparatus which he called “The Laminagraph.” Dr. Sherwood Moore collaborated with Kieffer in this pioneer work. In 1937 the Siemens planigraph was placed on the market and has had extensive use, although it was designed for upright planigraphy and vertical motion. Since then planigraphy is being used in more and more hospitals and sanatoria throughout the country.

During the period under study 320 planigrams were taken on 204 patients (bilateral planigrams were counted as two). Forty-nine taken on 32 patients were not available for review. Therefore, this report will be based on planigrams taken on 172 patients or 85 per cent of the total number of patients that were planigraphed during this period under study. Since 271 planigrams were taken on this group (172) it represents 85 per cent of the total number of planigrams (320) taken. Each planigram was reviewed and interpreted with special emphasis on identifying cavitation.

Planigraphy is now universally used by most chest specialists. The indications for it as followed in this Hospital will be briefly enumerated. The 320 planigrams were taken because one or more of the following conditions were present:

1) Suspicious area or areas for cavitation had been seen in the conventional posterior-anterior, Bucky, or apical lordotic films.

2) “Clear-cut” cavitation had been noted in the conventional films, but further confirmation was desired as to the location and depth of the cavity.

3) Chest surgery was being contemplated on one side and since there was a history of disease in the contralateral lung this side was planigraphed, regardless of the absence of cavitation on this side on the conventional films.

4) Persistent positive sputa in patients who had undergone chest surgery, especially thoracoplasties, in spite of no roentgen evidence of cavitation on the conventional posterior-anterior films.

*Physician-in-Charge of the White Haven Division of the Jefferson Medical College Hospital, White Haven, Pennsylvania.

668
5) Patients who were definitely known to have had pulmonary cavitation at one time, and regardless of the fact that no cavitation was noted on the conventional views that were taken routinely before a patient was discharged. In these cases planigrams were taken prior to discharge as an added precaution to minimize the possibility of discharging a patient with an undiagnosed cavity.

6) In uncollapsed lungs when persistent positive sputa were present or in patients having hemoptysis and no significant infiltrative disease could be detected in the conventional films.

7) Re-expansion of the lung or lungs collapsed by pneumothorax and/or pneumoperitoneum was being considered. Before the collapse was abandoned planigrams were taken to be further assured that cavitation was no longer present.

8) Decision had to be made whether a patient should undergo pneumothorax, pneumoperitoneum, resection, or thoracoplasty for known tuberculous cavitation. Planigraphy was an aid in gaining some insight as to the thickness of the cavitary wall. (Whenever the cavity was seen as having a thick wall, resection was the treatment of choice provided all other conditions were suitable.)

9) Conventional films revealed suspected honeycombing or bronchiectatic cavitation. (Planigraphy is most helpful in distinguishing between areas of honey-combing and frank cavitation.) This study revealed that by planigrams it is easier to decide whether bronchograms are required to aid in the diagnosis of bronchiectasis.

It is obvious that after careful consideration of all of the above-mentioned indications for planigraphy and after a thorough study of all of the planigrams taken that one would expect to have arrived at a large number of conclusions. However, this discussion is being limited to the role these planigrams played in detecting tuberculous cavitation. Any other knowledge that may have been acquired in reviewing these films will not be included.

All patients in this study have pulmonary tuberculosis and cavities found were considered tuberculous. Planigrams were taken in the recumbent position, and in most instances 4 centimeter to 12 centimeter cuts inclusive were the routine. In certain special cases where cavitation was believed to be present more posteriorly, a 3 centimeter cut was also taken; and when cavitation was believed to be present more anteriorly, 13 and 14 centimeter cuts were included. The group includes 96 planigrams taken of the left lung and 103 of the right lung with 36 taken of both lung fields.

In all instances data were collected on the X-ray findings on the conventional films (posterior-anterior, Bucky, or apical lordotic views) before the planigrams were taken. By this means it was possible to draw conclusions as to the value of planigrams in the light of the findings beforehand on the conventional films. These conventional films were usually taken on the same day as the planigrams, or else earlier, but never earlier than three months.
Of the 271 planigrams included in this study (Table I) in 29 or 10.7 per cent although cavitation was conclusively shown no cavitation was apparent on the conventional films. In 24 or 8.8 per cent the planigrams conclusively showed cavitation, while on the conventional films only suspicious areas were seen. This whole group totals 53 or 19.5 per cent. It is believed that this figure of 19.5 per cent is quite high and certainly justifies the use of planigraphy in discovering tuberculous cavitation. When one considers that planigraphy is not only used to detect cavitation but that other information, can also be acquired, it is felt that its more extensive use should be encouraged.

This study also revealed that in 37 planigrams where cavitation was found it had also been seen on conventional views. In nine planigrams no cavitation could be found, although it was reported as being present in conventional films. In 51 no cavitation was noted, while the posterior-anterior film showed suspicious areas. The planigrams were of no help in 20 cases where the areas in question were suspicious before planigraphy and were still reported as suspicious on the planigrams. In 82 no cavities were seen, by either technique. Eleven planigrams showed suspicious areas for cavitation, while the conventional films showed no cavitation. In one case a cavity was seen on the conventional film and planigrams only revealed a suspicious area. One group of seven planigrams were not included in any of the above groups because no conventional films were available for comparison.

Planigrams should by no means be considered the "last word" in the detection of cavities, so much so that if one received a negative report that it is not to be interpreted as absolute proof that a cavity is not present. This would be most unfortunate because patients might then be treated as if the disease were completely arrested, when in reality a cavity was
present, denoting active disease. In fact, one needs only to review the results cited in the paragraph above to see that conflicting findings were present between conventional posterior-anterior views and planigrams. The detection of pulmonary cavitation in tuberculosis is most important as in one way or another the treatment of this disease is centered on this finding. The present belief held by most specialists is that a cavity denotes the presence of active disease. This is especially true since chemotherapy has rendered the sputa of so many patients negative for tubercle bacilli, while X-ray films still demonstrate disease, particularly pulmonary cavitation. It is felt that the presence of a cavity, is the surest sign of failure of or inadequate treatment of this disease.

Planigraphy should be considered one of those procedures to help in detecting cavitation, without which the examination is incomplete. It is further felt that knowledge gained from planigrams should be used with any other findings that may be present, but hardly ever as the sole means of disposing of a case.

When planigrams show "clear-cut" cavitation the interpretation is relatively simple. Unfortunately most planigrams do not reveal cavities so clearly.

It has been found that films most difficult to interpret are planigrams taken of portions of lungs collapsed by thoracoplasty, since not all radiolucencies seen are cavities. The following rule has been most helpful: "Before any radiolucency can be called a cavity its walls can be made up of no such structures or part of structures as blood vessels, ribs, transverse processes, or bodies of vertebrae, fibrotic strands, or thickened pleura, walls of a bronchus, or any of the spicules of regenerated rib so often seen in patients who have had thoracoplasties."

At times even when this rule is followed, it has been impossible to definitely confirm or deny the presence of a tuberculous cavity. Cases such as these require repeat planigrams. It is often easier to over-read than under-read planigrams. For example, one set may be interpreted as showing presence of cavity, while subsequent ones may reveal that the pre-

<table>
<thead>
<tr>
<th>TABLE II</th>
<th>Per Cent of Planigrams Taken</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Total</td>
</tr>
<tr>
<td>Planigrams taken from July 1948 to May 1953</td>
<td>320</td>
</tr>
<tr>
<td>Planigrams in study</td>
<td>271</td>
</tr>
<tr>
<td>Planigrams unavailable (omitted from study)</td>
<td>49</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>TABLE III</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of Planigrams</td>
<td>Per Cent</td>
</tr>
<tr>
<td>Right Planigrams</td>
<td>103</td>
</tr>
<tr>
<td>Left Planigrams</td>
<td>96</td>
</tr>
<tr>
<td>Bilateral Planigrams</td>
<td>36</td>
</tr>
</tbody>
</table>
viously reported radiolucency was made up only of fibrotic strands or other structures and not a cavity.

Honey-combed areas seen in such a large number (37 or 13.6 per cent) of the total planigrams reviewed, were not labelled cavities and thus were not included in the group demonstrating definite cavitation on planigraphy. Honey-combed areas were practically all noted in the upper lobes with single or multiple small radiolucencies usually one-half centimeter or less in diameter. These “punched-out” or “moth eaten” areas are referred to by others as “bronchiectatic cavities.” Suffice it to say that many patients with planigrams of this type had bronchograms performed and bronchiectasis was found. From the knowledge that was acquired from these planigrams, it is felt that they are not only important in detecting pulmonary tuberculous cavities but are also useful in suspecting or even diagnosing bronchiectasis. Therefore, from the observations noted on these planigrams one is justified in requesting bronchograms for a definite diagnosis.

SUMMARY

A review of 271 planigrams taken over a period of four years and 11 months at the White Haven Division of the Jefferson Medical College Hospital revealed that 19.5 per cent conclusively demonstrated cavitation, while on the conventional films either no cavity or only a suspicious area was noted. This figure is considered significantly high to justify the more liberal use of planigraphy in the detection of tuberculous pulmonary cavitation.

The indications for planigraphy were briefly enumerated. However, the discussion was limited to the role of planigraphy in detecting tuberculous cavitation.

One should not rely entirely and completely on planigrams in detecting cavitation, because there will be cases in which cavitation is missed. In cases of doubt frequent check-ups, including repeat planigraphy, are indicated.

How one would be able to minimize the possibility of calling all radiolucencies seen on planigrams cavities was discussed.

This study demonstrated the value of planigraphy as an aid in the differentiation between small tuberculous cavitation and “bronchiectatic cavitation” and further helped in deciding which patients required bronchograms to diagnose bronchiectasis.

RESUMEN

La revisión de 271 planigráfias tomadas en cuatro años y 11 meses en la Sección White Haven del Hospital de la Escuela de Medicina Jefferson, reveló que 19.5 por ciento demostraron concluyentemente la existencia de cavernas en tanto que en la película corriente no había cavidades o sólo se sospechaban. Esta cifra se considera significativamente elevada para justificar el uso más liberal de la planografía en el descubrimiento de las cavernas tuberculosas.

Se indicaron brevemente nuestras indicaciones para la planigráfia. Sin
embargo, la discusión se ha limitado al papel de la planigrafía para descubrir las excavaciones tuberculosas.

No debe uno confiar completamente en los planigramas para descubrir las cavidades porque hay casos en que las excavaciones se escapan. En caso de duda, están indicadas las frecuentes revisiones incluyendo repetidas planigrafías.

Se discute como podría uno disminuir las posibilidades de creer que todas las áreas claras vistas en las planigrafías sean cavidades.

Este estudio demostró el valor de la planigrafía como auxiliar en el diferenciación entre pequeña cavera tuberculosa y “cavidad bronquiectásica” y más aún, para decidir qué enfermos necesitan broncogramas para diagnosticar la bronquiectasia.

RESUME

L'auteur fait l'étude de 271 tomographies faites pendant une période de quatre ans et onze mois à la Division de Port-Blanc de l'Hôpital Universitaire Jefferson. Il a constaté que dans 19,5% des cas, on avait pu mettre en évidence d'une façon certaine une cavité alors que sur les films standard, on ne constatait pas de caverne ou on constatait simplement une zone suspecte. Ce pourcentage peut être tenu comme suffisamment élevé pour justifier une utilisation plus large de la tomographies pour la recherche des cavernes tuberculeuses du poumon.

L'auteur énumère rapidement ses indications de tomographies. Toutefois, il limite le problème dans ce cas au rôle de la tomographie dans la découverte des cavernes tuberculeuses.

Il ne faut pas se fier entièrement et intégralement sur les tomographies pour découvrir les cavernes, car dans certains cas, elles peuvent ne pas être mises en évidence. Il faut faire de fréquents examens complets en répétant la prise de tomographies.

Cette étude a démontré la valeur de la tomographie dans le diagnostic différentiel entre les petites cavernes tuberculeuses et les bronchiectasies kystiques. Elle a permis de décider des cas pour lesquels il fallait compléter les investigations par la bronchographie pour permettre le diagnostic de dilatation bronchique.

REFERENCE