Identification Of Probable Lung Zones Prone For Infection
B Manoj

Citation

Abstract
This study is about correlating chest X-ray findings in normal persons (pulmonary lung vasculature) and in patients (pulmonary lung vasculature & pulmonary lesions) with the nasal cavity constrictions. This relationship can be used for identifying probable lung zones prone for infection.

In this study, 22 Patients were screened in the chest OPD of Sikkim Manipal Institute of Medical Sciences, Gangtok, Sikkim, India as per the protocol for this study. Of them, 7 persons, who were found to be normal, had prominent lung lobar vessels in different zones, which in turn were found to be related to nasal cavity constrictions at different places. It shows that a relationship exists between nasal cavity constriction & appearance of pulmonary opacity(ies) in normal individuals too.

In case of 15 patients, there were pulmonary opacity(ies) in the area(s) of prominent lung vasculature which in turn was found to be related to relatively increased nasal cavity narrowing at different places. These pulmonary opacity(ies) were of tubercular origin and these patients were put on treatment under REVISED NATIONAL TUBERCULOSIS CONTROL PROGRAMME (R.N.T.C.P) and are improving.

Therefore, the correlation between nasal cavity constrictions and prominence of lung vasculature can be used in identifying the probable zones of pulmonary infections and thereby diagnosing pulmonary opacity(ies) in ambiguous situations in a cost-effective manner.

AIM
1. Study the existence of a correlation between nasal cavity constriction, lung vasculature and pulmonary opacity.
2. Identify the probable lung zones prone for infections by correlating nasal cavity constriction and lung vasculature.

MATERIALS AND METHODS
This study was conducted at the Department of T.B & Respiratory Diseases in Sikkim Manipal Institute of Medical Sciences, 5th Mile Tadong, Gangtok, Sikkim(State), India, Pin :737101.

For this study, 22 patients were examined as per the protocol (discussed below) from September to October 2004.

EXCLUSION CRITERIA
While selecting the patients for the study, the following criteria were used to exclude patients to remove any possibility of bias, as this is a pilot study.
1. Previously treated cases of pulmonary tuberculosis.
2. Extra pulmonary manifestations of pulmonary tuberculosis.
3. Extra pulmonary T.B & non-T.B diseases affecting nasal cavities other than allergic manifestation(s)
4. Opacity (ies) of pulmonary lesion(s) completely overshadowing the pulmonary lobar vessels.

CODING SYSTEM
For conducting the study, a coding system was developed and used. The coding system is based on three factors of investigation - nasal cavity constriction, lung vasculature and pulmonary opacity. This coding system has been discussed in the section “Triple Coding System”.

CHEST ROENTGENOLOGY
The normal pulmonary vasculature is particularly well seen
in the medial portion of the base of the lung. In outer third of the lungs, the vessels become rapidly attenuated and seldom measure more than a millimeter. The wide difference in the appearance of pulmonary vasculature depends not only on individual variation but also on film quality, body habits and age. Lower lobe vessels appear larger than upper lobe vessels in a majority of patients. This is reversed in congestive cardiac failure. The normal veins are slightly larger and less well defined than the arteries and in the upper lobes it usually lies lateral to them.

They take a wider arc to the hilum and are straighter and have fewer branches than the arteries. The bilateral course of the upper pulmonary veins has been likened to the moustache of a British Sergeant Major, and the lower lobe arteries to that of a Chinese Mandarin. Attempts to differentiate upper lobe arteries from veins proved futile. This study involves observing not only lower lobe and middle lobe vessels, but also upper lobe vessels. So to bring about uniformity in our approach, the term vasculature has been used throughout the text representing arteries and veins together or separately.

The pulmonary vasculatures observed in this study are:

1. Upper lobar vessels
2. Middle lobar vessels
3. Lower lobar vessels

TRIPLE CODING SYSTEM
To identify the relationship between lung vasculature, nasal cavity constriction & appearance of pulmonary opacity (ies), a coding system consisting of above mentioned variables had to be put in place to ease data collection & analysis. This coding system has been referred to as Triple Coding System in this study.

N.C.C.C (NASAL CAVITY CONSTRUCTION CODE)
For this study, narrowing of nasal cavity is to be noted at roughly three places i.e. Outer (O), Middle (M) and Posterior (P) on left and right nostrils. In the process, we have six points in total to be noted. Constrictions at these points have been allotted numbers ranging from one to six starting from outer part to posterior part of nostrils. These codes are referred to as N.C.C.C (NASAL CAVITY CONSTRUCTION CODE) in rest of the discussion.

N.C.C Codes values range from 1 to 6 corresponding to decrease in severity of the nasal cavity constrictions. Code values are allotted restrictively to three places, where nasal cavity constrictions are noted on both sides for better quantitative & comparative analysis.

The coding scheme is shown below:

Figure 1

<table>
<thead>
<tr>
<th>Right Nostril</th>
<th>Left Nostril</th>
<th>Possible Codes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Outer</td>
<td>Outer</td>
<td>1, 2 (Code '1' indicates relatively increased nasal cavity narrowing)</td>
</tr>
<tr>
<td>Middle</td>
<td>Middle</td>
<td>3, 4 (Code '3' indicates relatively increased nasal cavity narrowing)</td>
</tr>
<tr>
<td>Posterior</td>
<td>Posterior</td>
<td>5, 6 (Code '5' indicates relatively increased nasal cavity narrowing)</td>
</tr>
</tbody>
</table>

Illustration:
In case there is a relatively increased nasal cavity constriction in right outer, left middle and left posterior parts of nasal cavities, the codes will be allotted as shown below:

Figure 2

L.V.C (LUNG VASCULATURE CODE)
The lung vasculature prominence is to be noted in upper, mid and lower zones in both right and left lungs. At the level of each zone only one set of loblar vessels may turnout to be more prominent than the other. There can be a maximum of three such prominent loblar vessels. In this study, codes allotted to each zone range from 1 to 6. This code is referred to as L.V.C (LUNG VASCULATURE CODE) in rest of the discussion.

L.V Code values range from 1 to 6 corresponding to the decrease in the prominence of the pulmonary lobar vessels. Code values are allotted restrictively to three zones on both sides, where prominences of the pulmonary lobar vessels are noted on both sides for better quantitative & comparative analysis.

The coding scheme is shown below:
**Identification Of Probable Lung Zones Prone For Infection**

**Figure 3**

<table>
<thead>
<tr>
<th>Right Side Lung Zone</th>
<th>Left Side Lung Zone</th>
<th>Possible Codes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Right Upper Zone (R.U.Z)</td>
<td>Left Upper Zone (L.U.Z)</td>
<td>1.2 (Code 1 indicates relative prominence of pulmonary vasculature)</td>
</tr>
<tr>
<td>Right Middle Zone (R.M.Z)</td>
<td>Left Middle Zone (L.M.Z)</td>
<td>3.4 (Code 3 indicates relative prominence of pulmonary vasculature)</td>
</tr>
<tr>
<td>Right Lower Zone (R.L.Z)</td>
<td>Left Lower Zone (L.L.Z)</td>
<td>5.6 (Code 5 indicates relative prominence of pulmonary vasculature)</td>
</tr>
</tbody>
</table>

Illustration:

In case there is relatively increased prominence of pulmonary vasculature in right upper zone, left middle & left lower zones, the codes will be allotted as shown below:

**Figure 4**

<table>
<thead>
<tr>
<th>L.V.C (LUNG VASCULATURE CODE)</th>
<th>P.O.C (PULMONARY OPACITY CODE)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Right Side Lung Zone</td>
<td>Left Side Lung Zone</td>
</tr>
<tr>
<td>1</td>
<td>4</td>
</tr>
</tbody>
</table>

**P.O.C (PULMONARY OPACITY CODE)**

In this study, the pulmonary opacity is to be noted in upper, mid and lower zones in both right and left lungs. The codes are allotted to each zone ranging from 1 to 6. This code is referred to as P.O.C (PULMONARY OPACITY CODE) in rest of the discussion.

P.O Codes values range from 1 to 6 corresponding to the increase in the volume of the pulmonary opacity (ies). Codes are not restrictively allotted to any zone(s), as increased volume of pulmonary opacity(ies) noted in upper, middle & lower zone(s) are present on the side of posterior part nasal cavity constriction.

Unlike L.V.C, P.O.C is not used for direct analysis of pulmonary opacity(ies) appearing in different zone(s), but it is used with other corroborative factors, namely L.V.C and N.C.C.C.

The coding scheme is shown below:

**Figure 5**

Secondly it differs from other codes by the fact that the codes are allotted as per increase in the volume of pulmonary shadows. That is, code 3 indicates relatively lesser volume of lung shadow compared to code 4 or 5 or 6.

In the Data chart (Appendix – A), pulmonary opacities codes have been shown superscripted on L.V code. Below example, shows increased volume of pulmonary opacities in right upper zone compared to left upper zone, followed by left mid zone and then left lower zones.

**Figure 6**

**PROTOCOL**

**Figure 7**

Illustration:

There is appearance of pulmonary opacities in the areas of prominent pulmonary vasculature. But the unlike L.V.C & N.C.C.C, the allotted codes are not restricted to any zone.

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OBSERVATIONS
The data captured during the study has been presented in the Appendix – A.

GENDER AND TUBERCULAR CASE DISTRIBUTION

CORRELATION BETWEEN N.C.C.C AND L.V.C

<table>
<thead>
<tr>
<th>Number of cases in whom N.C.C.C and L.V.C has matched</th>
<th>Number of cases in whom N.C.C.C and L.V.C has not matched</th>
</tr>
</thead>
<tbody>
<tr>
<td>22</td>
<td>0</td>
</tr>
</tbody>
</table>

Number of cases in whom N.C.C.C and L.V.C has matched=22. These cases have increased nasal cavity constriction in outer, middle & posterior parts showing prominent pulmonary vasculature in upper, mid & lower zones respectively.

Number of cases in whom N.C.C.C and L.V.C has not matched=0

CORRELATION BETWEEN L.V.C & P.O.C

Table 4: Showing Correlation Between L.V.C & P.O.C In Cases Of Unilateral Pulmonary Opacity

<table>
<thead>
<tr>
<th>No. of cases with pulmonary opacity in any one side of a zone</th>
<th>No. of cases with prominent pulmonary vasculature in following zones</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cases of unilateral pulmonary lesions in following zones</td>
<td>Right Lung Zones</td>
</tr>
<tr>
<td>R.U.Z (Right Upper)</td>
<td>2</td>
</tr>
<tr>
<td>R.M.Z (Right Middle)</td>
<td>2</td>
</tr>
<tr>
<td>R.L.Z (Right Lower)</td>
<td>3</td>
</tr>
<tr>
<td>L.U.Z (Left Upper)</td>
<td>3</td>
</tr>
<tr>
<td>L.M.Z (Left Middle)</td>
<td>3</td>
</tr>
<tr>
<td>L.L.Z (Left Lower)</td>
<td>3</td>
</tr>
</tbody>
</table>

If data in Tables 4 & 5 are taken together, the number of
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cases appears to have exceeded the total number of cases with pulmonary opacity, because each individual case was analyzed in such a manner that even if there was case of bilateral lung lesion, it was analyzed on the basis of individual zone involvement.

Number of cases in which the side, zone & volume of pulmonary opacity(ies) (P.O.C) appeared didn't match with side & zone of prominent lung vasculature (L.V.C) = 0

Therefore number of cases in whom N.C.C.C has not matched with P.O.C = 0

DISCUSSION

CORRELATION BETWEEN N.C.C.C AND L.V.C

The relationship between N.C.C code and L.V code in all 22 patients indicate that the nasal cavity constrictions are responsible for reciprocal pulmonary lobar vessel prominence.

The side and site of increased Nasal Cavity Constriction is found to be related to the side and site of pulmonary lobar vessels prominence.

It has been observed that on the side of increased constrictions in the outer, middle & posterior parts of nasal cavity there is increased prominence of upper, middle & lower lobar vessels in the lungs respectively.

CORRELATION BETWEEN N.C.C.C AND P.O.C

Side and site of increased nasal cavity constriction is found to be related to the side and site of pulmonary opacity.

It has been observed that, with the increased nasal cavity narrowing in the posterior part, the pulmonary opacity of infective origin appears in the lower zone (if pulmonary lesion is unilateral). If pulmonary opacities are present on both sides of any given zone, the quantum of shadows was found to be more on the side of increased nasal cavity narrowing in the lower zone.

The increased nasal cavity constrictions in middle and outer parts on a particular side are found to be related to the appearance of pulmonary opacities of infectious origin in mid zones and upper zones respectively on the same side in the event of unilateral pulmonary lesions.

It was also found that in cases mentioned above (refer 7.2.3), there was increased nasal cavity constriction in the posterior part on the side of pulmonary opacity (8 cases – refer to Appendix A).

In this study it was observed that in few cases pulmonary opacities were present on both sides of upper and or mid zones. In such cases, the volume of pulmonary opacity for any given zone was found to be more on the side of increased nasal cavity narrowing in its outer and/or middle parts. In those cases, it was also found that there was increased posterior part nasal cavity narrowing on the same side (In all the 2 cases – refer to Appendix A).

In none of the cases studied (refer to Appendix A), the trends discussed in points 7.2.4 and 7.2.5 were violated.

CORRELATION BETWEEN L.V.C & P.O.C

In 15 patients, the L.V code are found to be related to P.O code which indicate that appearance of prominent pulmonary vasculature is related to the appearance of pulmonary opacities in reciprocal area(s). These 15 patients were having pulmonary tuberculosis.

In cases of unilateral pulmonary lesions, the pulmonary lesions occurred in the areas of prominent pulmonary vasculature.

But in cases of bilateral pulmonary lesions, the volume of lung lesions occurring on both sides of a given zone was found to be more on the side & zone having prominent pulmonary vasculature.

Therefore, based on the discussion in sections 7.1 & 7.2, it can be concluded that the area (s) of prominent pulmonary lobar vasculature is related to the appearance of pulmonary opacity (ies), which in turn is related to nasal cavity constrictions at different places. Hence, all the above three factors are related to each other in all the cases of pulmonary tuberculosis studied.

By using the logic that, if there is a correlation existing between the side of increased nasal cavity narrowing, side of prominent lung vasculature and pulmonary lesion due to Pulmonary Tuberculosis, the same can be said about pulmonary opacities due to non-tubercular infective causes as well.

Given the observations of this work, more studies need to be conducted on relationships between nasal cavity narrowing, prominence of pulmonary lobar vessels and appearance of pulmonary opacity(ies).

The results of this study helps in diagnosing pulmonary opacity (ies) in ambiguous situations. By using the following factors - nasal cavity narrowing and prominent lung vasculature – as indicators, lung zone(s) prone for infections
can be identified. In cases where there are no infections, there is a possibility of non-infective diseases being present. Last but not the least, a technique of this nature will be of great help for any set-up, as it is cost-effective.

SUMMARY
In this study, 22 Patients were screened in the chest OPD of Sikkim Manipal Institute of Medical Sciences, Gangtok, Sikkim, India as per the protocol for this study. Of them, 7 persons, who were found to be normal, had prominent lung lobar vessels in different zones, which in turn were found to be related to nasal cavity constrictions at different places. It shows that a relationship exists between nasal cavity constriction & appearance of pulmonary opacity(ies) in normal individuals too.

In case of 15 patients, there were pulmonary opacity (ies) in the area(s) of prominent lung vasculature which in turn was found to be related to relatively increased nasal cavity narrowing at different places. These pulmonary opacity (ies) were of tubercular origin and these patients were put on treatment under REVISED NATIONAL TUBERCULOSIS CONTROL PROGRAMME (R.N.T.C.P) and are improving.

Therefore, the correlation between nasal cavity constrictions and prominence of lung vasculature can be used in identifying the probable zones of pulmonary infections and thereby diagnosing pulmonary opacity (ies) in ambiguous situations in a cost-effective manner.

ABBREVIATIONS
N.C.C.C=Nasal Cavity Constriction Code;
L.V.C=Lung Vasculature Code of pulmonary lobar vessel;
P.O.C=Pulmonary Opacity(ies) Code;
R.U.Z= Right Upper Zone;
L.U.Z= Left Upper Zone;
R.M.Z= Right Middle Zone;
L.M.Z=Left Middle Zone;
R.L.Z=Right Lower Zone;
L.L.Z=Left Lower Zone;
P.T.B=Pulmonary Tuberculosis;
N.T.B=Non Tubercular;
N.C.N= Nasal Cavity Narrowing

References
Author Information

Bhaskaran Sumathy Manoj
Associate Professor & Chief of T.B & Respiratory Unit, Adichunchanagiri Institute Of Medical Sciences