A Critique of the International Association for the Study of Lung Cancer Lymph Node Map

A Radiation Oncology Perspective

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Accurate assessment of nodal involvement is essential in the management of lung cancer. Recently, the International Association for the Study of Lung Cancer (IASLC) Lung Cancer Staging Project published a new lymph node map with the aim of creating an internationally agreed framework that would allow precise and uniform determination of lymph node status by centers around the globe.[1] This new map contains important changes to the previously used Mountain-Dresler[2] and Naruke[3] maps.

Conformal radiotherapy planning requires accurate delineation of target volumes. Although there is debate regarding the merits of elective versus involved mediastinal nodal irradiation,[4–6] accurate outlining of nodal groups is essential regardless for both prognostication and treatment delivery. Nodal stations are usually outlined as contiguous volumes on computed tomography (CT) scans of the chest, and this generally requires complete and precise descriptions of the anatomical limits to be outlined. Atlases have been created to assist with this task and aim to provide comprehensive guides regarding station boundaries (e.g., Chapet[7]). We feel that the new IASLC map contains some ambiguities from the viewpoint of radiotherapy planning and outline these here in the hope of promoting discussion that clarifies how radiation oncologists should implement the IASLC map.

Station 1

The upper limit of station 1 has now been defined as the lower limit of the cricoid cartilage. The lower border is the clavicles bilaterally (the definition does not specify superior or inferior clavicle) and the upper border is the manubrium centrally. While the upper border of station 2 in midline is also the upper border of the manubrium, the lateral borders of stations 2 and 3 are the apex of lung and pleural space. The location of the clavicle laterally varies depending on shoulder position and creates variability in outlines based on this border. In addition, the relative location of clavicle and lung apex are also variable leading to potential uncertainty as to the relative borders between stations 1, 2, and 3 (Figure 1). As this is a distinction between N2 and N3 disease, clarity in this definition is important.

Station 2

The inferior border of 2R is now the intersection of the caudal margin of the innominate vein with the trachea. As has been pointed out by Ichimura et al.,[8] this is usually an oblique intersection and raised questions as how best to represent this on CT. For the purposes of completeness, we note the clarification by Rusch in reply[8] that CT-based outlines should follow the caudal margin precisely (and therefore obliquely when required).

Station 3

Like the problem of the junction of station 1 and 2, the inferior and superior lateral limits of stations 1 and 3 are the clavicles and apex of chest, respectively. There is no specific definition of the upper limit of level 3 in the midline, although for 3a it would presumably be intended to match the lower midline limit of station 1 at the upper manubrium.

Station 4

Previously, the lower border of 4R was defined as a horizontal line extending across the right main bronchus at the upper margin of the origin of the upper lobe bronchus. It is now at the lower border of the azygos vein where it meets the superior vena cava. In theory, this now joins below with station 10 laterally (which ends superiorly at the same point). However, as station 10 is restricted to nodes immediately adjacent to proximal portions of mainstem bronchi and hilar vessels, there may be potential for confusion for nodes located below 4R but not clearly fitting the definition of station 10, especially the region immediately in front of the tracheal bifurcation. Is it the intent to classify such centrally located nodes as N1? (Figure 2).

Previously, the lower border of 4L was defined as a horizontal line extending across the left main bronchus at the upper margin of the origin of the upper lobe bronchus. It is now the upper rim of the left main pulmonary artery. Like the

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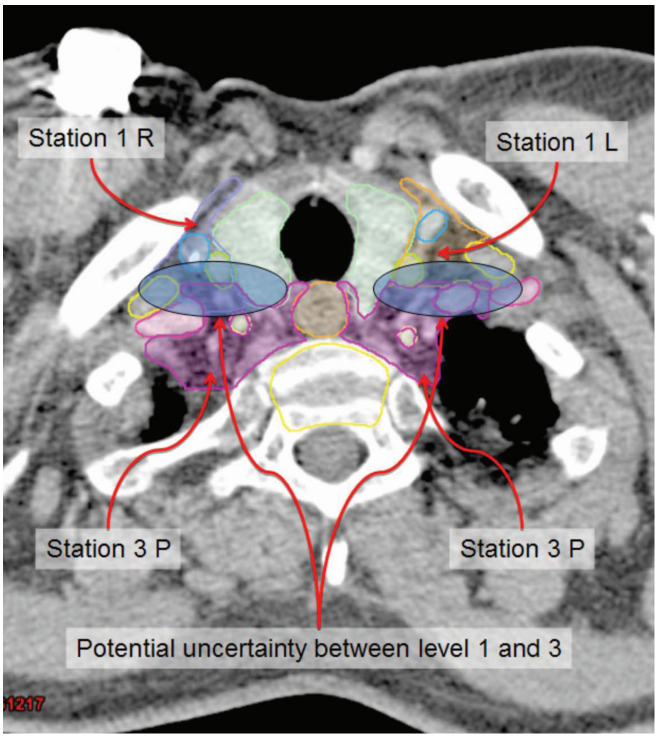

FIGURE 1. Axial computed tomography section through root of neck/upper chest. Vessels and organs are outlined. Stations 1 and 3 are shown with potential for overlap highlighted.

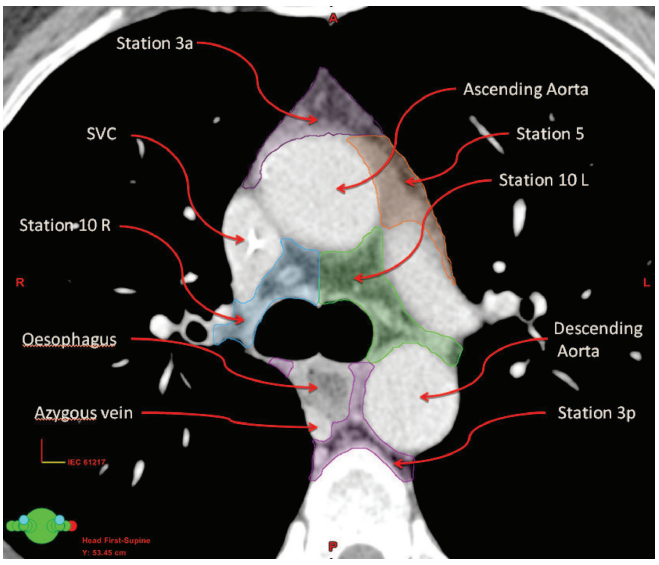

FIGURE 2. Axial computed tomography section through chest just below upper left main pulmonary artery and azygos vein. Stations 10 L and R are shown highlighting superior/anterior extension beyond close proximity to right and left main bronchi.

right side, this matches the upper border of station 10 on that side but potentially expands the reach of station 10L superiorly and anteriorly (Figure 2).

Any ambiguity between the junctions of stations 10 and 4 is particularly important given that they are N1 and N2 stations, respectively.

Station 5

Station 5 commences lower than 4L at the lower border of the aortic arch and ends inferiorly at the same level based on the upper rim of the left main pulmonary artery. Along this course, it sits lateral to 4L using the ligamentum arteriosum to separate the two stations. However, the ligamentum arteriosum is not always seen on CT scans,[9] introducing potential uncertainty in those patients whose staging is clinical rather surgical.

Station 6

Station 6 is defined as covering nodes anterior and lateral to the ascending aorta and aortic arch. However, the lower border is now defined as level with the lower border of the aortic arch, which will limit coverage of the ascending aorta. The lower border of station 6 now junctions with the upper border of station 5, so there should be no overlap between these two stations. The IASLC node map document appears ambiguous on this point as the diagrammatic representation of station 6 overlaps with station 5 by extending below the lower border of the aortic arch on the axial CT view but not the sagittal view (Figures 4*B*,*E* in the article by Rusch et al.[1]).

Station 7

One of the major changes of the IASLC node map is the enlargement of station 7. Although the lower border definitions have been altered to the upper border of the lower lobe bronchus on the left and the lower border of the bronchus intermedius on the right, the basis of the expansion is twofold. First, the inferior borders of 4R and 4L have moved superiorly. Second, the upper limit of station 8 now matches the lower limit of station 7. Thus, station 7 extends further anteriorly and posteriorly than before (Figure 3).

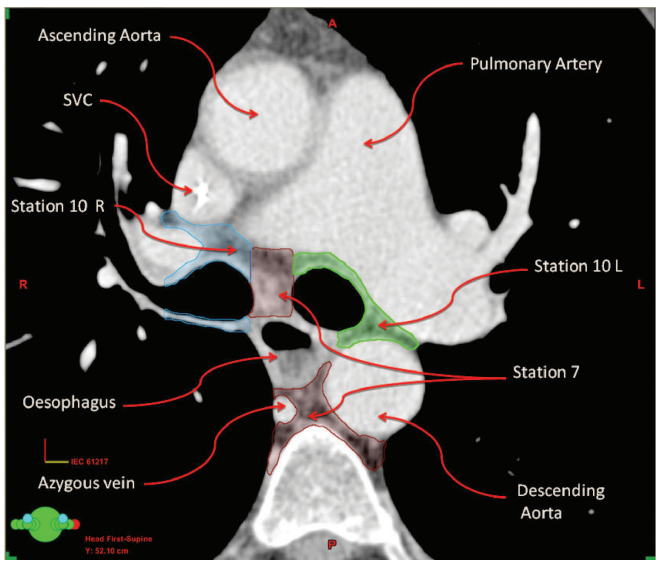

FIGURE 3. Axial computed tomography section below carina showing anterior and posterior extension of station 7.

Stations 8 and 9

The superior and inferior extent of station 8 is now clearly defined. Along the length of this station, the limit is defined as nodes adjacent to the esophagus. This could create some uncertainty when using CT-based outlining in determining a consistent border to separate station 8 with nodes of station 9 that sit more laterally within the pulmonary ligament.

Stations 10 and 11

As discussed previously, station 10 now extends further medially toward the carina. The implication of this change is that N1 regions extend further than previously. The merit of such a change had been discussed previously,[10] but certainly the change is worth highlighting.

CT-based separation of station 10 and 11 can be challenging. Given the clinical uncertainty of this separation, it is not clear whether maintaining station 11 separate from station 10 has merit and CT outlining atlases often merge these stations.[7]

CONCLUSION

The IASLC node map is a valuable addition to the staging of lung cancer and aims to create a reliable and reproducible guide. The Staging Committee is to be commended for its efforts in this endeavor. Our aim in this critique is to promote discussion that may help resolve potential ambiguities in CT-based outlining of the mediastinum based on the new IASLC map. Variation in outlining treatment target volumes is a known issue for radiation oncologists,[11–13] and we hope that clarification of the points we have raised may assist both CT-based staging and radiotherapy treatment planning.

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