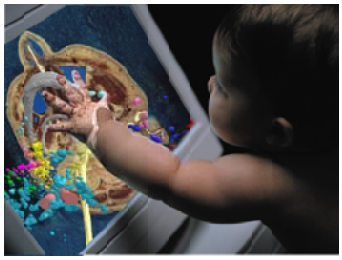
3D Lymph Node Topography Atlas Based on the Visible Human Dataset



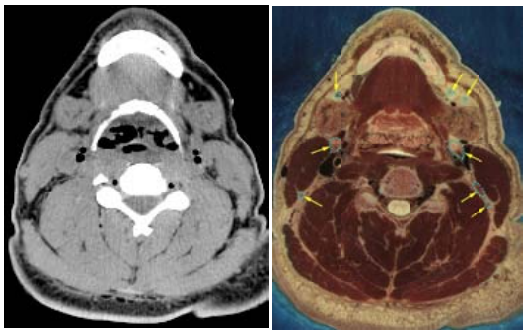
Sharif M. Qatarneh[1], Ion-Christian Kiricuta[2], Anders Brahme[1], Bengt K. Lind[1]

(1) Department of Medical Radiation Physics, Karolinska Institutet & Stockholm University, Stockholm, Sweden.
(2) Institute of Radiation Oncology, St. Vincenz Hospital, Limburg, Germany.

Purpose

This work describes a procedure to build up a three dimensional (3D) atlas on lymph node topography based on the anatomical microtome images of the Visible Human Male Optical (VHMO) dataset.

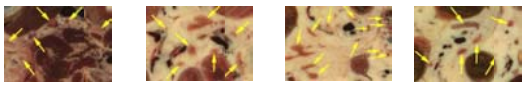
• The Visible Human Dataset: Advantages



(a) **(b)**

Figure.1 The high resolution and color advantages of the VHMO offer better identification of normal lymph nodes. It is not possible to identify 8 lymph nodes in the H&N region on (a) a CT slice that corresponds to (b) a VHMO cross section.

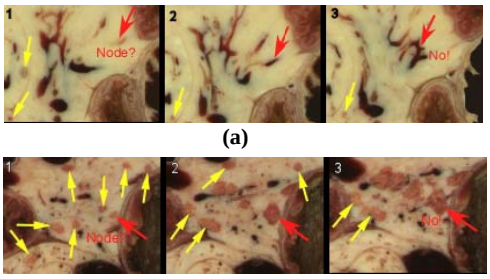
• Identification of Lymph Nodes



(a) **(b)** **(c)** **(d)**

Figure.2 Different characteristics, of size, shape and color intensity of various normal lymph nodes (a) Head and Neck (b) Presacral and (c,d) Mesenterial lymph nodes as identified on the VHMO dataset.

• Procedure to identify a Lymph Node



(a)

(b)

Figure.3 The decision making process to identify lymph nodes includes inspecting subsequent slices to distinguish (a) blood vessels and (b) cross sectional islands of pancreas that have similar cross sectional properties to lymph nodes (red arrow).

Procedure

The high resolution VHMO images were inspected thoroughly to identify lymph nodes in each cross section. The localized nodes were then delineated and the resultant contours were superimposed to develop a volumetric nodal model.

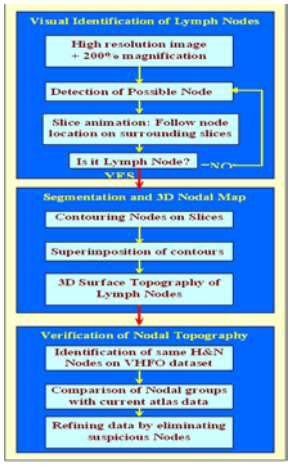
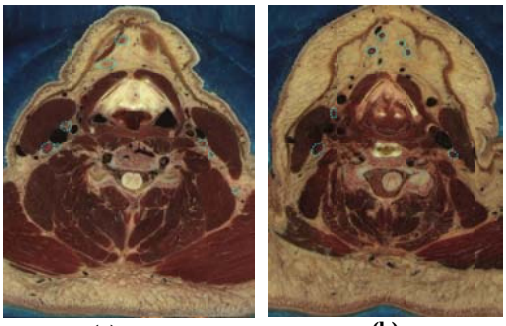


Figure.4 Steps in the Construction Procedure of the 3D Nodal Topography.

• Verification: Lymph Nodes of the Visible Human Male/ Female



(a) **(b)**

Figure.5 Optical microtome cross sections from the H&N region of the Visible Human (a) Male and (b) Female datasets showing similar distribution of submental normal lymph nodes.

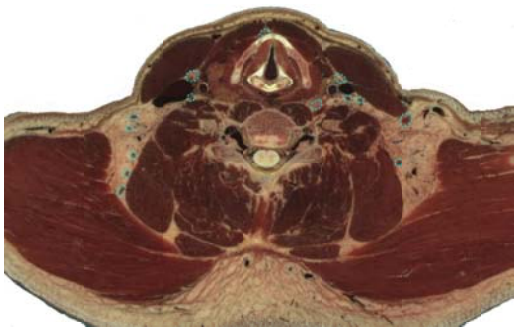


Figure.6 Localized lymph nodes on a cross section from the H&N region in the VHMO dataset.

Results

Most normal lymph nodes in the whole body have been localized in the VHMO dataset. The nodal distribution was verified by comparing the result to current anatomical and cross sectional lymph node atlases.

• The 3D Nodal Distribution Model

A polygonal surface grid of the lymph nodes was generated to create a semi realistic 3D visualization.

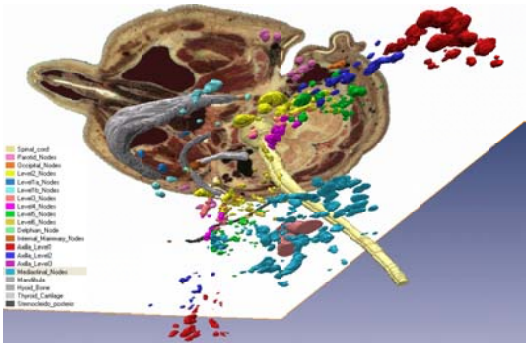


Figure.7 A volumetric model of the Head and Neck for 3D visualization of the supradiaphragmal nodal distribution. The H&N lymph nodes were labeled by different colors to demonstrate their location and level according to Robbins classification. The axillary nodes were labeled and classified according to Berg.

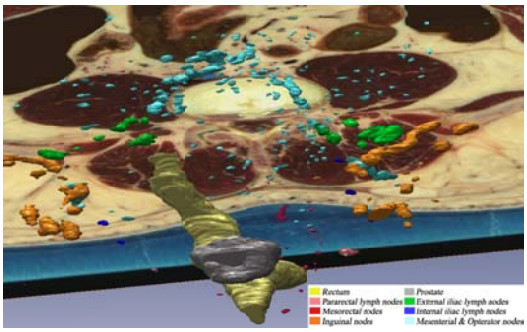


Figure.8 A volumetric model of the nodal distribution in the pelvis and the inguinal area for 3D visualization.

Conclusions

The nodal data presented in this atlas give a more accurate description of the nodal distribution, which can assist in defining the clinical target volume. The developed lymph node topography will form part of a whole body atlas database for radiation treatment planning. The atlas consists of most major lymph nodes in the body and it is useful for many clinical applications including surgery and radiation therapy.

References

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