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Computed tomographic findings in lymphomas of the head and neck at King Chulalongkorn Memorial Hospital

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Background : *Lymphoma is the second most common neoplasm in the head and neck. According to the recent study in Thailand, the incidence of malignant lymphoma was increasing. The roles of CT were assessment of known tumor, identification of occult tumor sites, assessment of treatment response, and recurrent tumor diagnosis.*

Objective : *To describe and characterize CT findings of lymphoma of head and neck of Patients at King Chulalongkorn Memorial Hospital (KCMH).*

Design : *Retrospective descriptive study*

Setting : *Department of Radiology, King Chulalongkorn Memorial Hospital (KCMH)*

Materials and Methods : *We retrospectively reviewed nodal and extranodal findings on baseline CT scan of 62 patients, who were newly diagnosed with lymphoma of the head and neck by tissue pathology and underwent pretreatment CT scan of the neck, orbit or paranasal sinuses in KCMH from January 1, 2006 to October 31, 2011.*

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Results : *Three patients had Hodgkin lymphoma (HL) and 59 Non-Hodgkin lymphomas (NHL). Forty six patients (74%) had primary lymphoma of the head and neck. The other 16 patients (26%) had systemic lymphoma that partly involved the head and neck. CT manifestations in lymphoma of the head and neck varied; 24% were isolated nodal disease (type I CT pattern); 15% were isolated extranodal lymphatic/extralymphatic disease (type II CT pattern); 56% were combined nodal and extranodal lymphatic/ extralymphatic diseases (type III CT pattern); and, 5% were multifocal extranodal lymphatic/extralymphatic diseases (type IV CT pattern). Sites of extranodal involvement found in this study were at Waldeyer's ring (39%), orbital (32%), nasal cavities (13%), mandible (2%) and thyroid gland (2%). About 16% of the patients had bone destruction.*

Conclusions : *There were variable CT manifestations of lymphoma, from nodal to extranodal lymphatic to extranodal extra-lymphatic disease. NHL is much more common than HL and frequently presents with combined nodal and extranodal diseases (either lymphatic or extralymphatic diseases). Frequently extranodal sites in this study are Waldeyer's ring, orbital and sinonasal cavities in descending order of frequency. There is HIV-associated lymphoma, such as plasmablastic lymphoma of the mandible, that has unusual presence in patients with normal immune status.*

Keywords : *Lymphoma, head and neck, CT.*

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นวพร กฤตยล, สุกัลยา เลิศล้ำ. ลักษณะทางเอกซเรย์คอมพิวเตอร์ของผู้ป่วยโรคมะเร็งต่อมน้ำเหลืองบริเวณศีรษะและคอที่พบในโรงพยาบาลจุฬาลงกรณ์. จุฬาลงกรณ์เวชสาร 2556 ก.ย.-ต.ค.;57(5): 555 – 71

เหตุผลของการทำวิจัย : *โรคมะเร็งต่อมน้ำเหลืองเป็นโรคมะเร็งที่พบบ่อยเป็นอันดับที่ 2 ของมะเร็งบริเวณศีรษะและคอ เอกซเรย์คอมพิวเตอร์มีบทบาทสำคัญในการประเมินก้อน, บ่งชี้บริเวณที่มีโรคซ่อนอยู่, ประเมินการตอบสนองของโรคต่อการรักษา และการวินิจฉัยการกลับเป็นซ้ำของโรค*

วัตถุประสงค์ : *เพื่อบรรยายและอธิบายลักษณะทางเอกซเรย์คอมพิวเตอร์ที่พบในผู้ป่วยโรคมะเร็งต่อมน้ำเหลืองบริเวณศีรษะและคอที่พบในโรงพยาบาลจุฬาลงกรณ์*

รูปแบบการวิจัย : *การศึกษาย้อนหลังเชิงพรรณนา*

สถานที่ทำการศึกษา : *ภาควิชารังสีวิทยา โรงพยาบาลจุฬาลงกรณ์*

ตัวอย่างและวิธีการศึกษา : *ผู้ป่วยจำนวน 62 คน ซึ่งได้รับการวินิจฉัยว่าเป็นโรคมะเร็งต่อมน้ำเหลืองบริเวณ ศีรษะและคอรายใหม่ที่ได้รับการยืนยันจากผลพยาธิวิทยา และได้ทำการตรวจเอกซเรย์คอมพิวเตอร์บริเวณคอ หรือกระบอกตา หรือโพรงจมูกและไซนัสก่อนการรักษาตั้งแต่ 1 มกราคม 2549 ถึง 31 ตุลาคม 2555 โดยการทบทวนเอกซเรย์คอมพิวเตอร์ของผู้ป่วย รวบรวมและบรรยายลักษณะต่าง ๆ ที่พบในเอกซเรย์คอมพิวเตอร์ก่อนการรักษา และแสดงข้อมูลในรูปของตารางและเปอร์เซนต์*

ผลการศึกษา : *ผู้ป่วย 3 คนเป็นโรคมะเร็งต่อมน้ำเหลืองชนิดฮอดจ์กิน (Hodgkin lymphoma) และผู้ป่วยอีก 59 คนเป็นโรคมะเร็งต่อมน้ำเหลืองชนิดนอนฮอดจ์กิน (Non-Hodgkin lymphoma) ผู้ป่วย 46 คนเป็นมะเร็งต่อมน้ำเหลืองที่มีรอยโรคเริ่มแรกที่ศีรษะและคอ ที่เหลืออีก 16 คนเป็นผู้ป่วยที่มีโรคแพร่กระจายร่วมกับมีรอยโรคที่ศีรษะและคอ ลักษณะทางเอกซเรย์คอมพิวเตอร์ที่พบในผู้ป่วยโรคนี้มีหลากหลายแบบ โดย 24% ของผู้ป่วยมีลักษณะของต่อมน้ำเหลืองที่คอโตเพียงอย่างเดียว (ลักษณะทางเอกซเรย์คอมพิวเตอร์แบบที่ 1) 15% มีลักษณะของรอยโรคนอกต่อมน้ำเหลืองทั้งบริเวณเนื้อเยื่อน้ำเหลือง*

และนอกเนื้อเยื่อน้ำเหลือง non-nodal lymphatic and extralymphatic tissue) (ลักษณะทางเอกซเรย์คอมพิวเตอร์แบบที่ 2) 56% มีต่อมน้ำเหลืองโตร่วมกับกับรอยโรคนอกต่อมน้ำเหลืองทั้งในเนื้อเยื่อน้ำเหลืองและนอกเนื้อเยื่อน้ำเหลือง (ลักษณะทางเอกซเรย์คอมพิวเตอร์แบบที่ 3) และ 5% มีรอยโรคมากกว่า 1 แห่งนอกต่อมน้ำเหลือง (multifocal extranodal disease) (ลักษณะทางเอกซเรย์คอมพิวเตอร์แบบที่ 4) บริเวณที่พบรอยโรคนอกต่อมน้ำเหลืองเรียงตามลำดับที่พบบ่อย ได้แก่ เนื้อเยื่อต่อมน้ำเหลืองบริเวณคอหอย (Waldeyer's ring) (37%) ตา (32%) โพรงจมูก (13%) กราม (2%) และต่อมธัยรอยด์ (2%) ประมาณ 16% ของผู้ป่วยมีการทำลายของการดูก

สรุป : *ลักษณะที่พบของเอกซเรย์คอมพิวเตอร์ในโรคมะเร็งต่อมน้ำเหลืองบริเวณศีรษะและคอพบได้หลากหลาย ตั้งแต่ต่อมน้ำเหลืองที่คอโตรอยโรคที่เนื้อเยื่อน้ำเหลืองนอกต่อมน้ำเหลือง (extranodal lymphatic disease) และรอยโรคที่เนื้อเยื่ออื่นนอกต่อมน้ำเหลือง (extranodal extralymphatic disease) ผู้ป่วยโรคมะเร็งต่อมน้ำเหลืองชนิดนอนฮอดจ์กินพบได้บ่อยกว่าผู้ป่วยโรคมะเร็งต่อมน้ำเหลืองชนิดฮอดจ์กินมาก บริเวณที่พบรอยโรคนอกต่อมน้ำเหลืองได้บ่อย คือ เนื้อเยื่อน้ำเหลืองบริเวณคอหอย (Waldeyer's ring) ตา และโพรงจมูกตามลำดับ พบว่ามีโรคมะเร็งต่อมน้ำเหลืองบางชนิดที่มีความเกี่ยวข้องกับการติดเชื้อเอชไอวี ยกตัวอย่างเช่นโรคมะเร็งต่อมน้ำเหลืองชนิด plasmablastic ที่พบบริเวณกรามซึ่งไม่ค่อยพบในผู้ป่วยที่มีภูมิคุ้มกันปกติ*

คำสำคัญ : *โรคมะเร็งต่อมน้ำเหลือง, ศีรษะและคอ, เอกซเรย์คอมพิวเตอร์.*

Lymphoma is the second most common neoplasm of the head and neck. According to a recent study in Thailand, the incidence of malignant lymphoma has been increasing especially the incidence of non-Hodgkin lymphoma (NHL). [1]

When suspicion of lymphoma arises during investigation of a focal mass lesion, the diagnosis still relies on tissue pathology. CT of the neck, chest, abdomen and pelvis with intravenous contrast material are the first investigations of choice for assessment, not only the extent and distribution of lymphadenopathy but also evidence of extranodal spreading. [2] The roles of CT in patients with lymphoma of head and neck are assessment of known tumors, identification of occult tumor sites, assessment of treatment response, and recurrent tumor diagnosis and giving information for radiotherapy planning.[3] The imaging manifestations of the lymphoma of head and neck vary from cervical lymphadenopathy to masses at the affected areas and overlap with many other pathologic entities. The imaging patterns of lymphoma of the head and neck have been previously described in 4 patterns[4] :

- Type I: Nodal lymphoma (Purely nodal disease)
- Type II: Extranodal lymphoma (Purely extranodal disease)
- Type III: Combined nodal and extranodal lymphoma
- Type IV: Multifocal extranodal lymphoma

Hodgkin lymphoma (HL) most commonly presents as cervical lymphadenopathy alone (type I pattern), whereas NHL usually presents as cervical lymphadenopathy and/or extranodal diseases that have a wide spectrum of presentations from patterns 1 to 4. [5]

Material and Methods

We retrospectively reviewed the medical records and findings on CT examinations of 62 patients, who were newly diagnosed head and neck lymphoma from January 1, 2006 to October 31, 2011. The patients who had proven pathology and underwent baseline CT scan before receiving any treatment, were included in the study. The patients who did not had performed pre-treatment CT examination or who did not have pathologically confirmed diagnosis or who had any other pathologies of the head and neck were excluded.

Helical CT scans in all patients were obtained with Somatom sensation 16 (Siemens) with 3-mm slice thickness and 60-second delayed scanning after contrast material administration.

CT images were reviewed by consensus of two radiologists, who were blinded to the clinical histories, tissue pathologies and final diagnoses. CT findings were evaluated with regard to primary sites and nodal diseases. Morphologic features such as density that was compared to muscular density, patterns of enhancement (homogeneous, heterogeneous or peripheral enhancement), calcification, necrosis, adjacent structure involvement and bony destruction were reported. Lymph nodes with a minimal axial diameter of 10 mm or more were considered lymphomatous involvement. [3, 4] Levels of cervical nodes were assessed by imaging-based nodal classification to level I-VII.[6]

Pathologic results were recorded for the location of tissue and final results of tissue pathology. Patient's data, for example, age, gender, underlying disease and drugs that affect the immune status were collected from clinical data correlated with pathologic results and CT findings.

Results

Sixty-two patients who were newly diagnosed with lymphoma of head and neck at King Chulalongkorn Memorial Hospital (KCMH) were 36 men and 26 women, ranging in age from 16 - 82 years (mean 51.3 years). Ten patients (16%) had isolated nodal disease; 3 were HL and 7 NHL. Twenty-four patients (39%) were Waldeyer's ring NHL; 20 patients (32%) orbital NHL; 8 patients (13%) sinonasal NHL; 1 patient (2%) thyroid NHL, and one mandibular NHL. Multifocal extranodal diseases were found in 2 patients (orbital with sinonasal NHL and Waldeyer's ring with sinonasal NHL).

Two patients were diagnosed with HIV infection for 2 - 3 years with no treatment of antiretroviral drugs (ARV). Another patient had HIV infection on ARV for 2 years.

All patients had proven pathology by tissue biopsy. The results and locations of the tissues are demonstrated in Table 1. NHLs are much more common than HL. According to the 2008 World Health Organization (WHO) classification of lymphoma [7], pathologic results in our study are classified as followings:

Table 1. Pathologic results classified by sites of biopsy.

	Sites of biopsy (No of case)	Pathology	No of case
Pharynx and oral cavity (19)	Tonsil (12)	DLBCL	9/12 (75%)
		Mantle cell	2/12 (17%)
		Burkitt lymphoma	1/12 (8%)
	Nasopharynx (4)	DLBCL	2/4 (50%)
		NK/T, Mantle cell	1/4 (25%)
	Other site (3); oropharynx, alveolar ridge, hard palate	DLBCL, NK/T, Plasmablastic lymphoma	1/3 (33%)
Orbit (18)	Lacrimal gland (9)	MALT	8/9 (89%)
		DLBCL	1/9 (11%)
	Eye lid (4)	MALT	4/4 (100%)
	Subconjunctival mass (3)	MALT	3/3 (100%)
	Non-specified site (2)	MALT	2/2 (100%)
Nasal cavity (8)	Nasal mass	NK/T	6/8 (75%)
		DLBCL	2/8 (25%)
Cervical LN (18)		DLBCL	8/18 (40%)
		Mantle cell, HD	4/18 (24%)
		Small lymphocytic lymphoma, PTL	1/18 (6%)
Neck mass(2)		DLBCL, SPLTL	1/2 (50%)

1. Hodgkin lymphoma (3 patients): All were classical HL with 2 of nodular sclerosis and 1 lymphocytic-rich HL;

2. Non-Hodgkin lymphoma (59 patients) were divided into mature B-cell neoplasms and the mature T-cell and NK/T cell neoplasms;

- The mature B-cell neoplasms (49 patients) were 22 of diffuse large B-cell lymphoma (DLBCL), 16 of extranodal marginal zone B-cell lymphoma of mucosa-associated lymphoid tissue (MALT lymphoma), 7 of Mantle cell lymphoma and 2 of Burkitt lymphoma, 1 of each small \lymphocytic lymphoma and plasmablastic lymphoma.

- The mature T-cell and NK/T cell neoplasms (10 patients) were 8 of extranodal NK/T cell lymphoma, nasal type, 1 of each peripheral T-cell lymphoma (PTCL) and subcutaneous panniculitis-like T-cell lymphoma (SPTL).

According to patterns of CT imaging, CT findings were categorized into 4 types as demonstrated in Table 2. The rest 22 patients in this group were performed CT scan of orbits or paranasal sinuses, so nodal disease and classification of CT pattern could not be done. Forty six patients (74%) had primary head and neck lymphoma. The other 26% had systemic lymphoma that part involved the head and neck.

Nodal disease:

CT scans presented with cervical lymph node involvement in 33 patients (80%); 10 as an isolated finding, 23 in association with extranodal lymphatic or extralymphatic tumor (Fig.1). All three HL patients had pure nodal disease. Other seven NHL patients presented as pure nodal disease; 2 were DLBCL, 2 were Mantle cell lymphoma, each 1 was Burkitt lymphoma, small lymphocytic lymphoma and peripheral T-cell lymphoma.

Table 2. CT patterns in patients of head and neck lymphoma.

CT Pattern	No. (%)
Patient with no CT neck = 21: n = 41	
1. Nodal disease	10/41 (24%)
- HL	3
- NHL	7
2. Extranodal disease	6/41 (15%)
- Extranodal lymphatic	2
- Extranodal extralymphatic	4
3. Combined nodal and extranodal disease	23/41 (56%)
- Extranodal lymphatic	21
- Extranodal extralymphatic	2
4. Multifocal extranodal disease	2/41 (5%)

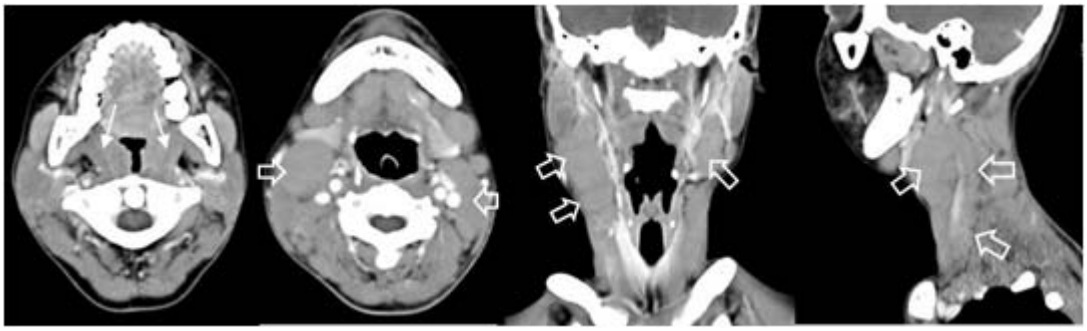

Figure 1. Combined nodal and extranodal lymphatic disease. Enhanced axial, coronal and sagittal CT scan showed bilateral tonsillar masses (arrow) and bilateral cervical lymphadenopathy at level IB, II, III, IV and V (open arrow).

Cervical lymph nodes on CT scan were range from 1.0 to 2.9 cm in short axis diameter, excluding sizes of matted lymph nodes. CT appearances of lymphadenopathy are demonstrated in table 3. Most frequently level of lymph node involvement was level II (88%) followed by level III (44%), level IV (44%) and level I (38%). Most cervical lymph nodes were isoattenuation as compared to muscular density and

Table 3. CT findings of nodal disease.

CT findings	No. (%)
Cervical lymph node level	
- Level I	29%
- Level II	97%
- Level III	48%
- Level IV	35%
- Level V	35%
Supraclavicular node	23%
Retropharyngeal node	23%
Intraparotid node	29%
Attenuation	
- Isodensity	78%
- Hypodensity	22%
Enhancement	
- Homogeneous	75%
- Heterogeneous	25%
Matted node	22%
Necrosis	16%
Calcification	0

homogeneous enhancement after contrast medium administration. Fourteen patients (45%) had bilateral cervical lymphadenopathy. Necrotic lymph nodes were found in 6 patients (4 DLBCLs, 1 plasmablastic lymphoma and 1 HL) and 2 from these 6 patients had matted nodes along level II - IV. Sizes of necrotic nodes were about 0.6 - 2.8 cm in short axis diameter. Some patients had retropharyngeal nodes and/or intraparotid nodes (Fig. 2), ranges of short axis diameter were 0.7 - 2.5 cm and 0.7 - 1.7 cm, respectively.

Extranodal lymphatic disease: Waldeyer's ring.

CT findings of NHL Waldeyer's ring are summarized in Table 4. Twenty four patients with Waldeyer's ring NHL were identified; 21 patients had combined with nodal disease; 2 had isolated extranodal lymphatic disease; and, 1 with concurrent extranodal extralymphatic disease. About 54% of these patients had unilateral involvement. The most frequently involved site was palatine tonsil and 38% bilaterally were involved. Most patients (63%) with primary lesion were bilaterally involved and had bilateral cervical lymphadenopathy. Almost all lesions showed isodensity to muscle and homogeneous enhancement (Fig.3). There was no calcification of extranodal lesion or skull base erosion.

Extranodal extralymphatic disease:

There were 29 cases of extranodal extralymphatic NHL; 4 isolated extranodal extralymphatic disease; 2 had concurrent nodal diseases; 1 with multifocal extranodal extralymphatic diseases and 1 with both extranodal lymphatic and extranodal extralymphatic disease. As mentioned earlier, the rest 21 patients who did not received CT of the neck, their imaging patterns could not be classified. Twenty patients had orbital, eight had sinonasal, and in each category was mandible and thyroid gland lymphomas. Involvement of more than one sites of extralymphatic tissues was demonstrated in 1 patients.

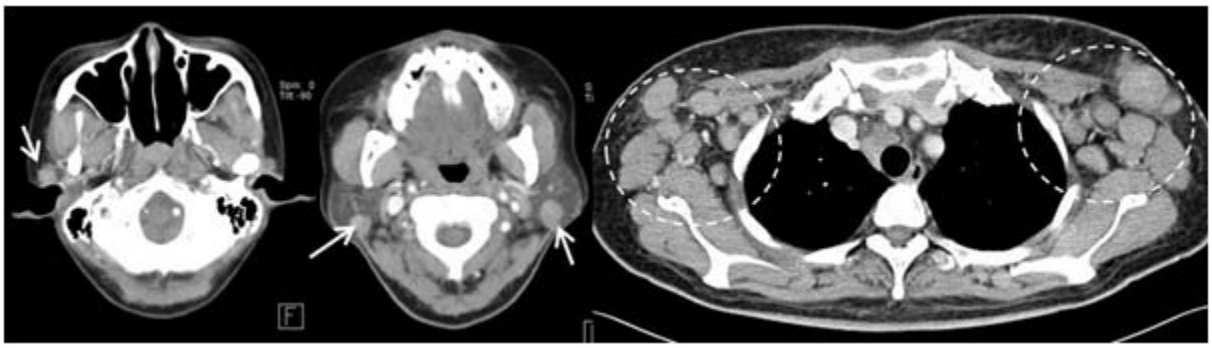

Figure 2. Intraparotid nodes. Enhanced axial CT scan revealed lymphoma at nasopharyngeal wall with intraparotid nodes (arrow) in bilateral parotid glands. There are multiple axillary (in dash circle), mediastinal and intraabdominal lymph nodes (not shown) on CT chest and abdomen. This patient had bone marrow involvement proved by biopsy.

Table 4. CT findings of Waldeyer's ring NHL.

CT finding	No. (%)
CT pattern	
- Type I	0/24
- Type II	2/24 (8%)
- Type III	21/24 (88%)
- Type IV	1/24 (4%)
Primary site	
- Nasopharynx	12/24 (50%)
- Palatine tonsil	21/24 (88%)
- Lingual tonsil	9/24 (38%)
- Oropharynx	8/24 (33%)
Density	
- Isodensity	21/24 (87.5%)
- Hypodensity	3/24 (12.5%)
Enhancement	
- Homogeneous	22/24 (92%)
- Heterogeneous	2/24 (8%)
Extension into adjacent structure	3/22 (13%)
- Nasal cavity and paranasal sinuses	1
- Soft palate	1
- Supraglottic hypopharynx	1
- Parotid glands	2
Bony destruction	4/24 (17%)
- Paranasal sinuses wall	2
- Styloid process	1
- Hard palate	1
Regional cervical lymph nodes	20/23
(1 patient had CT paranasal sinuses)	
- Unilateral	15
- Bilateral	5
Necrosis	0/24
Calcification	0/24

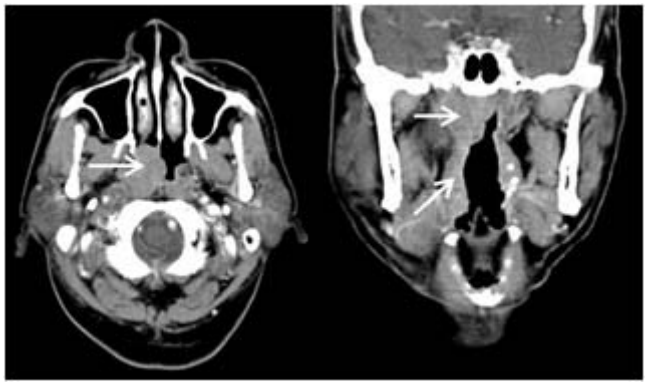

Figure 3. NHL of Waldeyer's ring. Axial enhanced CT scan showed mass at right side of nasopharyngeal wall and oropharyngeal wall (arrow), extending to posterior right nasal cavity. Pathology was diffuse large B-cell lymphoma.

CT manifestations of orbital lymphoma are summarized in Table 5. Most orbital lesions of NHL showed hyperdensity and homogeneous enhancement (Fig.4). Seventy percent of orbital cases were extraconal involvement; most frequent sites were lacrimal gland and eyelid. Bone destruction at medial orbital wall was found in 3 patients. Three patients had unilateral intraconal lymphoma with optic nerve involvement.

Table 5. CT findings of orbital NHL.

CT findings	No. (%)
Involved site	
- Lacrimal gland	8/20 (40%) – Bilat 5
- Eyelid and conjunctiva	7/20 (35%) – Bilat 1
- Extraocular muscles	12/20 (60%) – Bilat1
- Retrobulbar region	2/20 (10%)
- Optic nerve	3/20 (15%)
Density	
- Isodensity	5/20 (25%)
- Hyperdensity	14/20 (70%)
- Hypodensity	1/20 (5%)
Enhancement	
- Homogeneous	17/20 (85%)
- Heterogeneous	3/20 (15%)
Extension to adjacent structure	1 (5%)
- Masticator space and pterygoid muscle	1
Bony destruction	3/20 (15%)
- Medial orbital wall	3/20
- Cribiform plate and paranasal sinuses	1/20
Necrosis	0/20
Calcification	0/20

Note: Bilat = Bilateral involvement

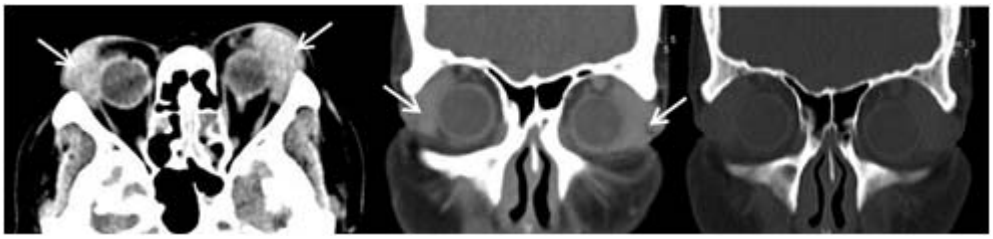

Figure 4. Lacrimal gland lymphoma. Non-enhanced axial and post contrast-enhanced coronal CT scan revealed bilateral lacrimal gland enlargement (arrow) with involvement of bilateral lateral rectus muscles. Both lacrimal glands were hyperdense to muscle. There was no bony destruction.

Eight patients had sinonasal involvement; seven unilateral involvement. Most of them had NK/T-cell lymphoma (6 from 8) and the rest DLBCL. There was destruction of the wall of paranasal sinuses in 3 patients and two had associated obstructive sinusitis.

One patient was diagnosed as NHL of the thyroid gland, proven by tissue pathology from other hospital. The CT finding showed diffuse enlargement of thyroid gland with several thyroid masses of hypodensity (Fig. 5).

There were 3 patients with HIV infection in this study. The first patient had NK/T-cell lymphoma in the nasal cavity and the second one had orbital DLBCL. The last one had plasmablastic lymphoma of the mandible that the CT scan showed enhanced mass in the mandible with mandibular destruction and enlarged cervical nodes (Fig. 6).

CT scan of one patient showed bilateral parotid enlargements without definite mass (Fig. 7), accompanied by lesions in bilateral palatine tonsils, oropharynx and lingual tonsil with matted bilateral cervical lymphadenopathy. This patient had splenomegaly and bone marrow biopsy showed lymphomatous involvement.

There were 4 cases that had non-enhancing low density in retropharyngeal space, representing to retropharyngeal edema (Fig. 8). In these patients, there was multiple cervical lymphadenopathy causing effacement or obliteration of internal jugular vein (IJV). There were two patients with IJV obstruction; one had unilateral IJV obstruction and the other bilateral IJV obstruction. The other two had effacement of unilateral IJV due to enlarged cervical lymph nodes.

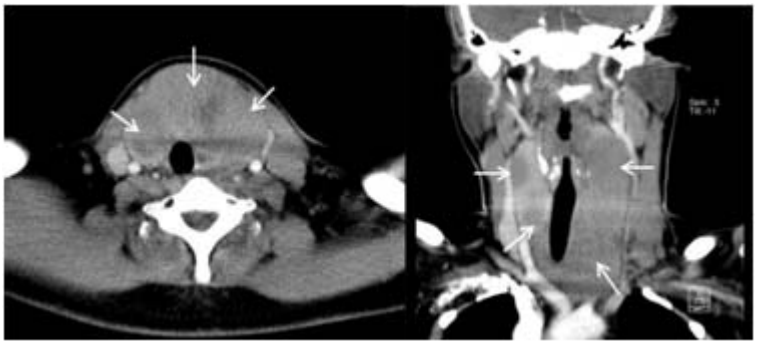

Figure 5. Lymphoma of thyroid gland. Axial and coronal enhanced CT scan showed diffuse thyroid gland enlargement with several hypodense masses (arrows). Diffuse large B-cell lymphoma of thyroid gland was proved by pathology.

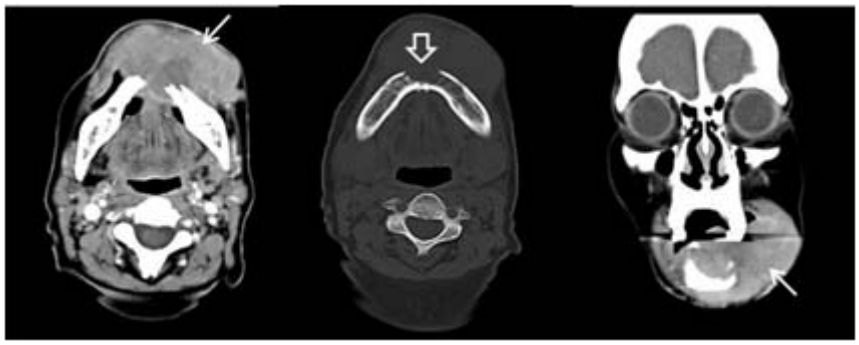

Figure 6. NHL of mandible in patient with HIV infection. Axial and coronal enhanced CT scan showed heterogeneous enhancing mass at mandible (arrow) with bony destruction (open arrow) and multiple cervical lymphadenopathy. Pathology was lymphoblastic lymphoma. CT scan of abdomen (not shown) revealed hepatosplenomegaly that classified this patient as stage IV lymphoma.

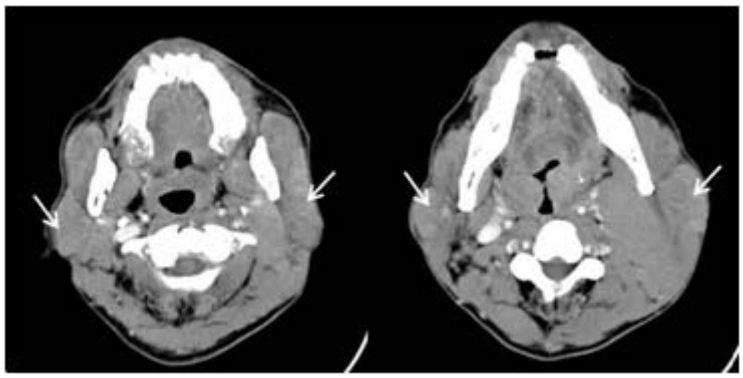

Figure 7. Parotid NHL. Enhancing axial CT scan showed bilateral parotid glands enlargement (arrow), lesions at bilateral palatine tonsils and lingual tonsil and multiple matted cervical lymphadenopathy. There was splenomegaly (not shown) on abdominal CT scan.

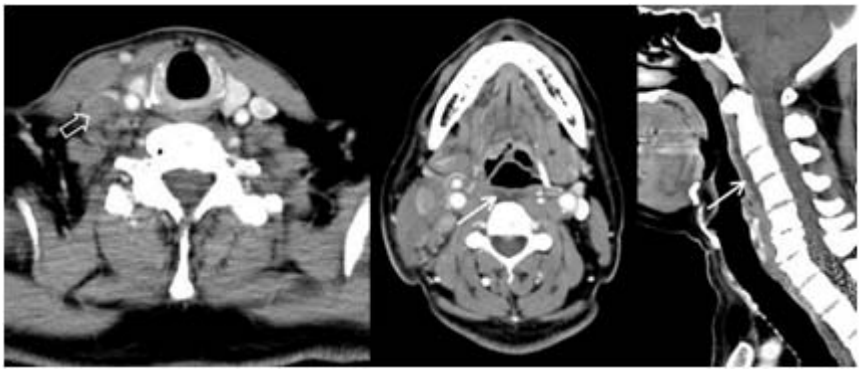

Figure 8. Retropharyngeal edema: Axial and sagittal enhanced CT scan showed low density at retropharyngeal space (arrow) with multiple cervical lymphadenopathy causing effacement of right internal jugular vein (open arrow).

Discussion

Lymphoma is a common neoplasm that frequently involves various sites of the head and neck, such as lymph nodes, lymphatic and non-lymphatic tissues. Thus, CT manifestations were frequently diverse, ranging from cervical lymphadenopathy to non-nodal lymphatic disease, involving the Waldeyer's ring, to non-nodal extralymphatic disease, for example; the orbit, nasal cavity, sinus, mandible, parotid gland and thyroid gland. [5] NHL was much more common than HL [2] with wide spectrum of CT findings that may exhibit imaging patterns 1 to 4. In distinction to HL that almost presented with pure nodal disease, extranodal diseases present more frequently in NHL and most imaging patterns are combined nodal and extranodal disease. [5]

Three cases of HL, collected in this study, were too small in number to compare for any differences to NHL. However, these cases had typical CT presentation of HL with isolated cervical lymphadenopathy and also had mediastinal lymphadenopathy. Extranodal involvement was rarely presentation of HL. [5]

Nodal disease was frequently seen in lymphoma as isolated finding or with associated extranodal manifestation. Most of cervical nodes usually appear isodensity to muscle and homogeneous enhancement. Few patients have necrotic nodes corresponding to current knowledge that nodal necrosis is an uncommon feature in lymphoma. Necrotic nodes are more frequently seen in high-grade lymphoma. [5] When this finding is detected in the cervical lymph nodes in the absence of treatment, necrosis is potentially a prognostic indicator that has more prevalence in advanced-stage lymphomas. Although squamous cell carcinoma (SCC) of head and neck is more likely to show necrotic and non-isodensity nodes than lymphoma, these findings are not pathognomonic sign to distinguish between lymphoma and SCC. [13]

The Waldeyer's ring which comprises nasopharyngeal tonsil (adenoids), palatine tonsils and lingual tonsils, is the most common extranodal sites of NHL. [5] CT manifestations of primary lesion at Waldeyer's ring were similar to the previous literature [4, 8] that nasopharyngeal lesions were exophytic fashion and skull base erosion was rare. In contrast, SCC has a propensity to invade deeply and to spread superiorly into the skull base. [9] Ten percent of primary Waldeyer's ring NHLs accompanied with lymphomatous involvement of the gastrointestinal tract [2, 10, 11] are not found in this study.

The most common primary orbital lymphoma is MALT type [5], as shown in this study. CT findings in most cases of orbital lymphoma in our study corresponded to a previous study that typical imaging appearance was usually a homogeneous, well-circumscribed lesion of isodensity to slight hyperdensity with mild to moderate contrast enhancement. Unilateral involvement is more common than bilateral. Bony erosion is uncommon. If bony destruction is present, high-grade and aggressive clinical behavior should be considered.

The prevalence of NK/T-cell lymphoma in this study could imply agreement with previous study mentioned that NK/T cell lymphoma was more common in Asia populations and most common subtype of nasal lymphoma in Asian was NK/T-cell lymphoma. [4, 12, 13] Similar to the prior studies [12, 13],

most cases of NK/T-cell lymphoma had primary lesion in sinonasal cavity and all cases but one were unilateral involvement, presented as soft tissue infiltration along wall of sinonasal cavity with few cases of bone destruction. [12]

Primary lymphoma of the salivary gland is rare. There are 3 criteria suggested to defined salivary lymphoma as primary lesion: (1) involvement of the gland was the first disease manifestation; (2) histologically, disease involved gland parenchyma and not adjacent nodes; and, (3) lymphoid infiltrate was malignant. [5] A previous study reveals that most patients with lymphoma of parotid gland were presented as a solitary mass and unilateral involvement on CT scan. However, few patients (12%) had diffused parotid change. [10] Most patients with parotid lymphoma usually had widespread disease at other sites with extensive adenopathy [5] as the only one patient in this study that shown bilateral parotid enlargement with lymphoma at oropharynx and tonsils and bilateral cervical lymphadenopathy. Diffuse parotid enlargement in this patient could be due to lymphomatous involvement, although there was no proven tissue pathology from the parotid gland. Tissue pathology from cervical lymph node in this patient was mantle cell lymphoma.

Nearly 80% of thyroid lymphoma is associated with chronic lymphocytic thyroiditis (Hashimoto's thyroiditis). [3, 14, 15] Hyo-Cheol Kim reported that the most common CT finding of thyroid NHL in patients with Hashimoto's thyroiditis was diffuse thyroid involvement without discrete tumor [15]; while Takashima found that solitary thyroid nodule was the most common CT finding. [14] According to these two studies[14, 15], there were few cases of thyroid lymphoma that presented as multiple thyroid nodules on CT images similar to our case.

Three HIV-infected patients in our study implied agreement that HIV-associated lymphomas could be either lymphomas similar to patients without HIV infection or unusual lymphomas occurring more specifically in HIV-positive patients, plasmablastic lymphoma as the patient in our study. [1]

Bone destruction in lymphoma is rare. However, clinically aggressive lymphoma such as Burkitt lymphoma, DLBCL and NK/T-cell lymphoma could have bone destruction. There were two patients who had synchronous sites of extranodal lesions that should be suggested diagnosis of lymphoma than SCC. According to prior studies, the diagnosis of NHL could be suggested, if multiple extranodal sites are detected; if the mass appears huge without significant bone destruction or necrosis or ulceration, and/or if mass is associated with large, non-necrotic nodes. [16, 17]

Accumulation of fluid in the retropharyngeal space, retropharyngeal edema, could be due to multiple causes, such as radiotherapy, IJV thrombosis, retropharyngeal calcific tendinitis and infection in spaces surrounding the retropharyngeal space. [18] Two patients had IJV obstruction that could be cause of retropharygeal edema. However, the others had effacement of IJV and no demonstrable causes of retropharyngeal edema. There should be further studies to verify any association relevant between lymphoma and retropharyngeal edema.

Our study has some limitations. Firstly, it is a retrospective descriptive study to evaluate CT findings for documented cases of lymphoma of the head and neck. Because we did not compare the imaging

findings of lymphoma with other head and neck tumors, we are unable to comment on specificity of our findings. Thus, further investigations are needed to verify the accuracy of some findings.

Conclusion

Lymphoma is the second most common neoplasm of the head and neck region. There are variable CT manifestations of the head and neck lymphoma, from nodal to extranodal lymphatic to extranodal extralymphatic diseases. NHL was much more common than HL and frequently presented with combined nodal and extranodal diseases (either lymphatic or extralymphatic diseases). On the other hand, HL usually appears as isolated nodal disease. Enlarged cervical lymph nodes in lymphoma frequently appear isodensity to muscle with homogeneous enhancement. Necrotic nodes and bony destruction were uncommon but could present in clinically aggressive type. Calcified lymph node was not found in pre-treatment patients. Extranodal sites in this study are the Waldeyer's ring, orbit, sinonasal cavity, thyroid gland and mandible in descending order of frequency. Most primary lesion showed isodensity to muscle with homogeneous enhancement except orbital lesions that were hyperdensity with homogeneous enhancement. No calcification or necrosis of extranodal lesion is detected in this study. There was HIV-associated lymphoma such as plasmablastic lymphoma of the oral cavity, occurring more specifically in HIV-infected patients.

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