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Value of Computed Tomography in T-Stage Assessment and Therapy of Nasopharyngeal Carcinoma

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Abstract : The accurate evaluation of tumor size, localization and spread of nasopharyngeal carcinoma help optimal treatment planning. The purpose of our retrospective study is to compare the T-stage of nasopharyngeal carcinoma between evaluated by physical examination and CT scan and to compare the response to treatment in the group also underwent CT (147 patients) and the group without CT staging (40 patients). The sex ratio, and the mean age of the patients in both groups was not significantly different. Radiological study showed Stage 1 the tumor confined in nasopharyngeal region. Stage II showed tumor spreading with lateral extension to the parapharyngeal region. Stage III and stage IV, the tumor spread in a superior direction to the paranasal sinus and the base of the skull. CT staging resulted in upgrading the T-stage in 88/147 cases (59.9%). A complete response was higher in the CT than the non CT group at the T2 and T4 stage. CT imaging is better than clinical examination and conventional imaging in detecting the involvement of more than one wall, base of skull involvement, differentiating tumor from sinusitis, detecting intracranial invasion and neck node involvement. In conclusion, a CT scan is require in nasopharyngeal carcinoma patients for accurate staging, modified radiation treatment and improved treatment results.

เรื่องย่อ : คุณค่าของการตรวจซีทีในการเปลี่ยนแปลง T stage และผลการรักษาผู้ป่วยมะเร็งโพรงจมูก
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การประเมินขนาดของเนื้องอก ตำแหน่งการกระจายของมะเร็งโพรงจมูกอย่างถูกต้องช่วยในการวางแผนการรักษาอย่างถูกต้อง เพื่อประเมินว่าการตรวจซีทีที่มีผลต่อการเปลี่ยนแปลง T-stage ผลการรักษาโดยได้ศึกษาย้อนหลังผู้ป่วยสองกลุ่ม คือกลุ่มที่ตรวจ CT จำนวน 147 รายและกลุ่มที่ไม่ได้ตรวจ CT จำนวน 40 ราย ผลการศึกษพบว่า เพศ อายุ ของกลุ่มผู้ป่วยที่ตรวจ CT และกลุ่มผู้ป่วยที่ไม่ได้ตรวจ CT ไม่มีความแตกต่างกัน ลักษณะภาพ CT ผู้ป่วยมะเร็งโพรงจมูกระยะที่หนึ่งพบว่าเนื้องอกจะอยู่ในบริเวณ Nasopharynx, ผู้ป่วยระยะที่สองมักมีการแพร่กระจายของเนื้องอกไปด้านข้างบริเวณ parapharynx และผู้ป่วยระยะที่สาม และสี่ มักมีการแพร่กระจายของเนื้องอกไปด้านบนเข้าสู่ paranasal sinus และ base of skull การตรวจซีทีที่มีผลต่อการเพิ่ม stage ของผู้ป่วยมะเร็งโพรงจมูก 88 ราย จากผู้ป่วย 147 ราย คิดเป็น 59.9% พบว่าการตอบสนองต่อการรักษาแบบสมบูรณ์สูงในกลุ่มผู้ป่วย ที่ได้รับการตรวจ CT เมื่อเปรียบเทียบกับผู้ป่วยที่ไม่ได้รับการตรวจ CT ในผู้ป่วย stage T2 และ T4 นอกจากนี้การตรวจ CT มีข้อได้เปรียบมากกว่าการตรวจร่างกายปกติ หรือการตรวจเอกซเรย์ปกติในผู้ป่วยที่มีรอยโรคมากกว่าหนึ่งด้าน หรือมีการแพร่ของโรคเข้าไปบริเวณฐานของกะโหลกศีรษะ และการตรวจ CT สามารถแยกเนื้องอกออกจากการติดเชื้อใน sinus สามารถวินิจฉัยรอยโรคในสมองและการแพร่กระจายมาที่ต่อมน้ำเหลืองได้ดีกว่า

INTRODUCTION

The incidence of nasopharyngeal carcinoma is 2.35% of all tumors at Siriraj Hospital¹. It is 9th most common malignancy in male¹. Genetic, environmental and viral factor all seem to have a part in the genesis of this cancer. Nasopharyngeal carcinoma most often arises in the Rosenmueller and the most common presenting signs are a lump in the neck and serous otitis media². External beam supervoltage irradiation is the standard therapy. Imaging plays an important role in the staging of carcinoma of the nasopharynx. Accurate staging is necessary as the treatment given is directly dependent on the stage. Clinical examination provides information on mucosal involvement but is unable to determine deep extension or presence of skull base invasion or intracranial spread³. The influence of CT on tumor staging and treatment decision is high. CT helps also at radiotherapy planning and control of tumor response after therapy. CT is of great value in detecting recurrence. MRI might offer more diagnostic detail than CT. However, at present choice of therapy is not influenced much by this. Since CT is cheaper and faster, MRI could be used as an additional procedure when CT produces equivocal findings⁴. The purpose of our study was to compare the T- stage of CA nasopharynx as evaluated by physical examination or CT scan and to compare the

treatment response in the group with CT staging and the group without CT staging.

MATERIALS AND METHODS

Between January 1996 - December 1999, There were 439 cases documented with nasopharyngeal carcinoma and treated with radiation therapy. One hundred and eighty seven patients with proven nasopharyngeal carcinoma who underwent radiotherapy treatment had clinical information available. All patients underwent clinical staging with complete history, physical examination, and direct or indirect inspection of the nasopharynx. A confirmatory biopsy was obtained. The essential clinical data were reviewed by radiotherapists and age, sex, histological section, clinical TNM staging, radiation therapeutic technique and result of treatment were recorded. Results of treatment were evaluated at least 3 months after treatment as either complete response, partial response (response more than 50%), stable disease (response less than 50%) and progressive disease. One hundred and fifty four patients were studied with CT. Retrospective review of the CT scans of nasopharynx in both axial and coronal plans was performed in 102 patients (film available in 102/159). Additional bony window images were also reviewed retrospectively for bony

destruction. The CT images were reviewed by a radiologist who did not know the clinical stage of the patient. The essential data were recorded for tumor extension in all directions and for, nodal and hematogeneous metastasis. The clinical and CT staging was based on The American Joint Committee on Cancer (AJCC) 1997. The reported results of 102 patients reviewed by the radiologist was not

significantly different from the previous radiological report. Forty patients were studied without CT.

RESULTS

Demographic and radiological data were analyzed separately and are shown in the following tables.

Table 1. Demographic data both the CT-stage and the non CT-stage groups.

Demographic data		CT	Non - CT
Sex	Male (%)	102 (66.2%)	27 (67.5%)
	Female (%)	52 (33.8%)	13 (32.5%)
Age (year)	Range	6-81	16-74
	Mean \pm SD	46.8 \pm 13.3	47.4 \pm 13.6

The sex ratio and mean age of the patients in both groups were not significantly different.

Table 2. T-stage of the CT-staged compared with the non CT-staged group.

T- stage	CT	Non - CT
T0	1 (0.7%)	-
T1	70 (47.6%)	27 (67.5%)
T2	41 (27.9%)	7 (17.5%)
T3	1 (0.7%)	1 (2.5%)
T4	34 (23.1%)	5 (12.5%)
Total	147 (100%)	40 (100%)

Table 3. Restage of the CT staged group compared with the non CT-staged group.

N- stage	CT	Non - CT
N0	45 (31.5%)	6 (15.0%)
N1	30 (21%)	8 (20.0%)
N2	35 (24.5%)	15 (37.5%)
N3	33 (23.1%)	11 (27.5%)
Total	143 (100%)	40 (100%)

The number of patients in T1 stage in the CT group was lower than non CT group (47.6% vs 67.5%) but the number with T4 stage in the CT group was higher than the non CT group (23.1% vs 12.5%). There was no difference in the number with T0, T2, T3 between the CT and non CT group. The number

of patient at N0 stage was higher in the CT group than the non CT group (31.5% vs 15%). N2 stage was lower in the CT group than the non CT group (24.5% vs 37.5%). There was no difference in N1 and N3 between the CT and the non CT group.

Table 4. Differences histological diagnosis between the CT staged group and the non CT staged group.

Pathology	CT	Non - CT
Undifferentiated carcinoma	60 (40.8 %)	15 (37.5%)
Squamous cell carcinoma		
- poorly differentiated carcinoma	75 (51.0%)	18 (45%)
- moderate differentiated carcinoma	5 (3.4%)	2 (5%)
- nonspecific	5 (3.4%)	4 (10%)
Other	2 (1.4%)	1 (2.5%)
Total	147 (100%)	40 (100%)

Table 5. Present CT finding distributed by T stage and finding.

Nasopharyngeal carcinoma lesion	CT stage			
	T1	T2	T3	T4
Nasopharynx				
- Upper/Posterior wall	5 (100%)	39 (100%)	13 (100%)	45 (100%)
- Right lateral wall	4 (80%)	26 (66.7%)	7 (53.8%)	37 (82.2%)
- Left lateral wall	2 (40%)	24 (61.5%)	9 (69.2%)	32 (71.1%)
Anterior spread				
- Choanae	1 (20%)	13 (33.3%)	6 (46.2%)	36 (80%)
- Nasal fossa	-	1 (2.6%)	5 (38.5%)	23 (51.1%)
- Maxillary sinus	-	-	-	12 (26.7%)
- Ethmoid	-	-	3 (23.1%)	22 (48.9%)
- Orbit	-	-	1 (7.7%)	6 (13.3%)
Lateral spread				
- Parapharyngeal space	-	30 (76.9%)	9 (69.2%)	36 (80%)
- Pterygoid plates	-	11 (28.2%)	2 (15.4%)	26 (57.8%)
Superior spread				
- Sphenoid	-	-	6 (46.2%)	34 (75.6%)
- Petrous apex	-	-	1 (7.7%)	21 (46.7%)
- Base of skull	-	-	9 (69.2%)	44 (97.8%)
- Cavernous sinus	-	-	-	45 (97.8%)
- Intracranial	-	-	-	43 (95.6%)
Inferior spread				
- Oropharynx	-	27 (69.2%)	8 (51.5%)	28 (62.2%)
No of patients	5	39	13	45

The radiological study showed that patients at stage 1 had tumor confined to the nasopharyngeal region (Figure 1) and at stage 2 our patients had tumor spreading laterally to the parapharyngeal region (76.9%) (Figure 2A) more often than anterior extension to the nasal cavity (35.9%) (Figure 2B). AT

a more advanced stage (stage 3 and stage 4), tumor spreads superiorly to the paranasal sinuses (Figure 3) and the base of the skull (69.2%) (stage 3) and intracranial extension which usually occupies the cavernous sinuses (97.8%) at stage 4 (Figure 4A, 4B).

Table 6. T-stage conversion by CT scan.

T-stage	Clinical stage	CT stage conversion			
		T1	T2	T3	T4
T0	1	1 (100%)	-	-	-
T1	70	11 (15.7%)	28 (40.0%)	14 (20.0%)	17 (24.3%)
T2	41	-	14 (34.1%)	10 (24.4%)	17 (41.5%)
T3	1	-	-	-	1 (100%)
T4	34	-	-	-	34 (100%)
Total	147	12	42	24	69

Comparing clinical staging and CT staging revealed that CT exasuration increased the T-stage conversion in 88/ 147 cases (59.9%). At a clinical stage T1, of those who had a CT scan 84.3% were beyond this stage (T2,3,4) (Figure 5) and at a clinical

stage T2, CT scan 65.9% were beyond this stage (T3, T4) (Figure 6). We had only one case that was clinically stage T3, but with CT staging, it turned out to be T4 (Figure 7,8).

Table 7. Comparative study of T-stage conversion after CT between our study and previous study.

Study	CT produce a T- stage change	
	Up stage	Down stage
Our study	88/147 (59.9%)	-
Yu ZH ⁵	10/22 (45.4%)	1/18(6%)
P. Olmi ⁶	23/97 (23.7%)	-

Our study corresponded with previous studies by Yu ZH and P. Olmi.

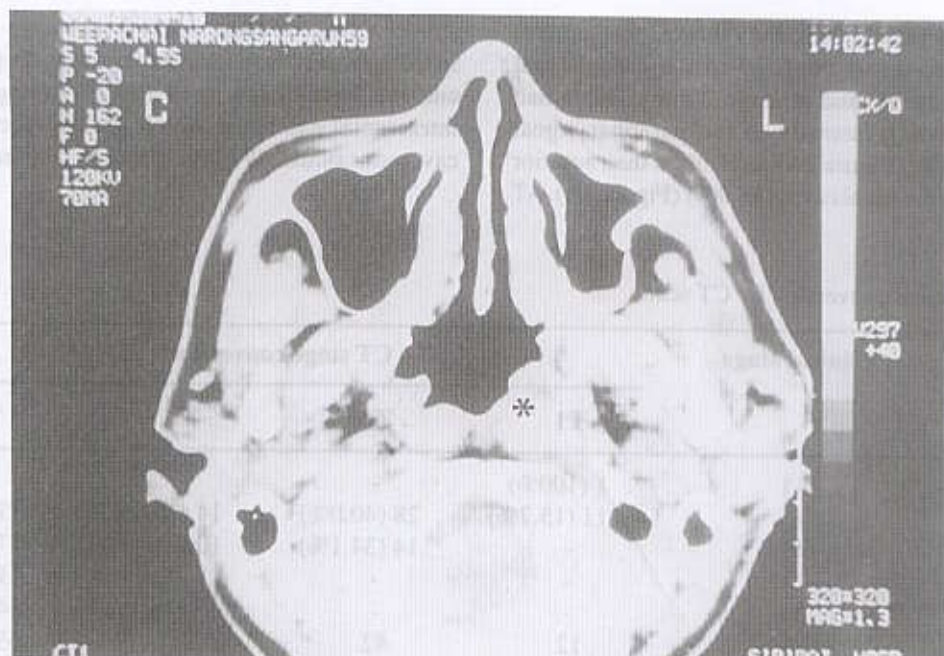


Figure 1. Axial CT scan of CA nasopharynx showing asymmetrical blunting of the left Rosenmuller fossa (stage T1).

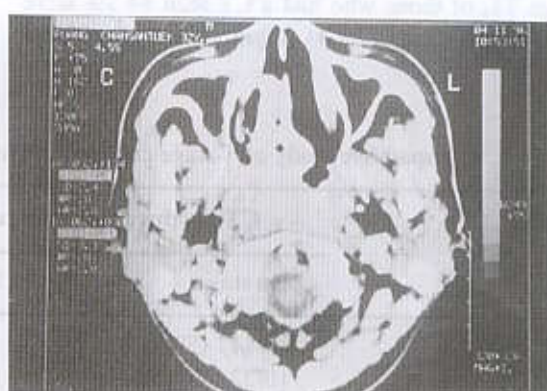


Figure 2A,B. Stage T2 of CA nasopharynx. The tumor extended into the parapharyngeal space of the oropharynx (figure 2a) or into the nasal cavity (Figure 2b).

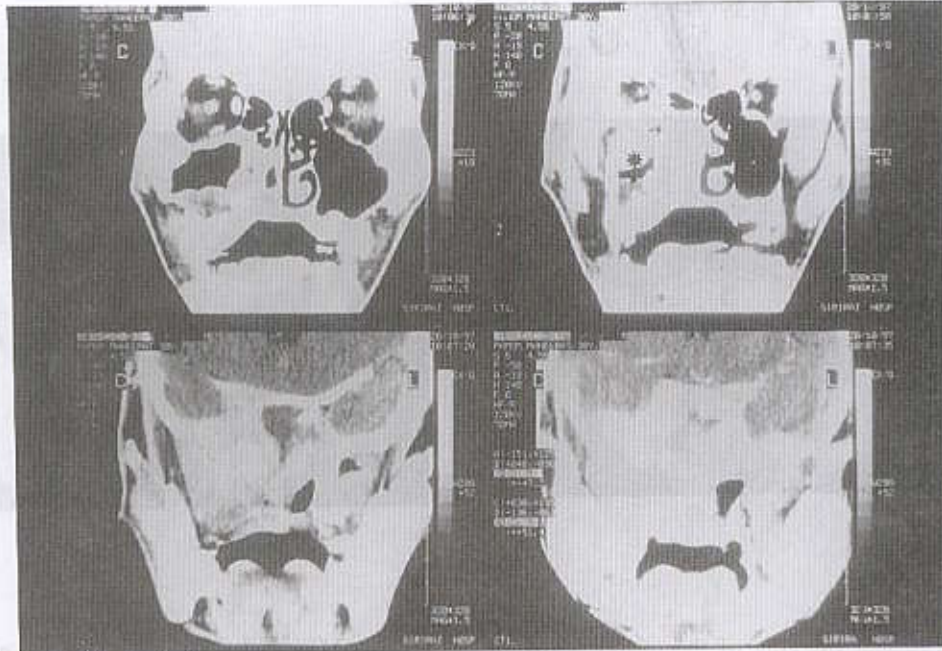


Figure 3. Coronal CT scan (stage T3) shows anterior extension of a CA nasopharynx into the right maxillary sinus.



Figure 4A,B. CT nasopharynx (stage 4) shows superior extension of a CA nasopharynx into the intracranial cavity via the foramen ovale (Figure 4A) or destruction of the base of the skull (Figure 4B).



Figure 5. Coronal imaging of the nasopharynx in Clinical stage T1 reveals a small primary tumor but with superior extension intracranially, therefore, the CT stage is stage T4.

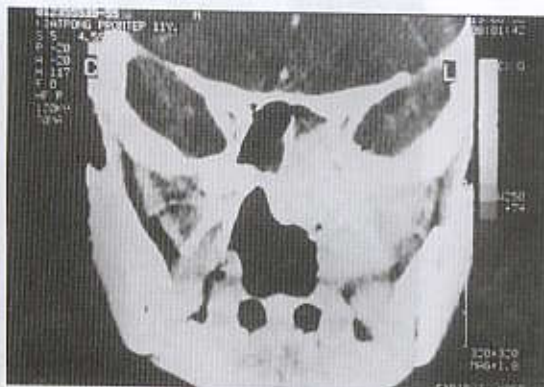


Figure 6. Coronal CT imaging of the nasopharynx at a clinical stage T2 reveals tumor extension into the cranial vault thus the CT stage is stage T4.

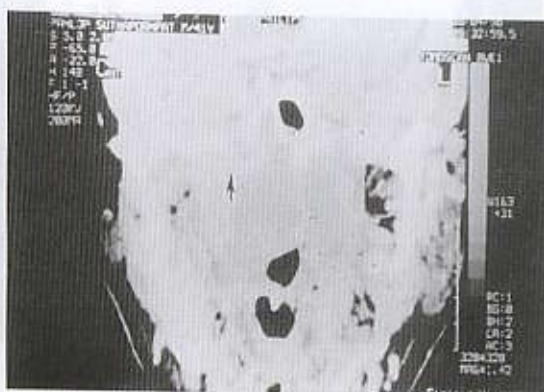
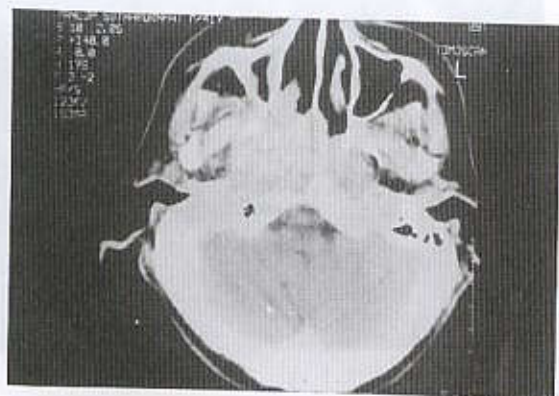


Figure 7,8. Axial/coronal CT of clinical stage T3 shows tumor extension to the cranial cavity via destruction of the base of the skull. Therefore, the CT stage is stage T4.

Table 8. Results of treatment by T-stage for both CT-staged and non CT-staged patients represent as number of case and percent (%).

Result of treatment	T1		T2		T3		T4	
	CT	Non CT	CT	Non CT	CT	Non CT	CT	Non CT
Complete response	28 (66.7%)	16 (69.6%)	16 (69.6%)	3 (50%)	-	-	8 (44.4%)	1 (25%)
Partial response	5 (11.9)	3 (13)	3 (13)	-	-	-	2 (11.1)	1 (25)
Stable disease	3 (7.1%)	-	1 (4.3%)	-	-	-	1 (5.6%)	-
Progressive disease	6 (14.3%)	4 (17.4%)	3 (13%)	3 (13%)	1 (100%)	1 (100%)	7 (38.9%)	2 (50%)
Total	42 (100%)	23 (100%)	23 (100%)	6 (100%)	1 (100%)	1 (100%)	18 (100%)	4 (100%)

The total number cases that were followed up after treatment was 118.

A complete response was higher in the CT than non CT group at stages T2 and T4 (69.6% vs 50% and 44.4% vs 25%). There was no difference in the number who responded completely in stage T1 (66.7% vs 69.6%)

DISCUSSION

The accurate evaluation of tumor size, localization and spread help optimal treatment planning and enable radiation to be given to a small field. Our study, which is in agreement with Yu ZH⁵ and P. Olmi⁶ were study showed upstaging of the T stage from 23.7% to 59.9% but Yu ZH⁵ study showed a downstaging of the T stage of 6%, which was not found in our study or P. Olmi⁶ study. Yu ZH⁵ discovered involvement of two or more walls in five out of nine cases where clinical examination showed only one involved wall. CT is probably the only radiological way to show the continuous intracranial invasion^{5,7,8}, bony erosion of the base of the skull by direct invasion of the primary lesion in the nasopharynx,

The ability to CT to differentiate tumor from inflammation of the maxillary sinus was(100%), sphenoid sinus (43%) and ethmoid sinus (25%)⁹.

Histological examination of tumor involvement in the paranasal sinuses was not available. It is important to separate sinusitis from tumor infiltration as prognosis and treatment planning are different in each case. CT allowed better evaluation of the lateral wall parapharyngeal space, intracranial invasion and neck node involvement as compared with conventional radiology¹⁰. Besides the diagnostic purpose of the CT scan, our study also demonstrated that the response to treatment in the CT staged group was better than the non CT staged group because a higher complete response was obtained and less progression of the disease. An alternative method for tumor localization is magnetic resonance imaging (MRI). Several reports allow more accurate evaluation of the extent of nasopharyngeal carcinoma than CT^{11,12}. CT showed bone invasion in 12 patients vs 8 on MR¹³. MRI provides the most detailed imaging of soft tissue invasion outside the nasopharynx and of retropharyngeal node involvement¹³

CONCLUSION

CT scan is required in nasopharyngeal carcinoma patients for accurate staging, in order to modify the exact part irradiated and helps improve the result of treatment.

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DISCUSSION

The accurate evaluation of tumor stage, localization and extent help optimal treatment planning and enable radiation to be given to a wider field. Our study which is in agreement with [3, 13], and P. Olmi's study showed the staging of the T stage from T1-T4 to T4-T4b by CT, which was not a downstaging of the T stage of NPC, which was not found in our study as P. Olmi's study [3]. The CT showed involvement of two or more walls in the oral cavity which clinical examination showed only one involved wall. CT is probably the only radiological way to show the extension of the tumor, but the extent of the tumor in the skull base, direct invasion of the primary lesion in the nasopharynx.

The ability of CT in differentiating tumor from inflammation of the nasopharynx was 60.0% (95% CI 44.4-75.6) and showed more T2b/T3b

CONCLUSION

CT scan is regarded as a useful tool in the diagnosis of nasopharyngeal carcinoma because the accurate staging is useful in the treatment of the tumor. However, the results of treatment