



Sinonasal or nasopharyngeal undifferentiated Carcinoma?: diagnostic pitfall and the role of Epstein-Barrvirus (EBV) and human papillomavirus (HPV) examination

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ABSTRACT

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Undifferentiated carcinoma of the head and neck is frequently observed in nasopharynx, however it may also occur in oropharynx, salivary gland and sinonasal. Overlapping lesions in those regions create difficulty in determining the origin of the tumor. Thus, it causes diagnostic pitfall not only for pathologists, but also for clinicians. A 40 yearold man, presented with nasal obstruction, epistaxis, diplopia, and headache for a year and showed nasal cavity sinistra and nasopharynx masses on CT-scan. Lymph node enlargement was not detected. First biopsy was performed and histopathologically diagnosed as nasopharyngeal undifferentiated carcinoma (NPC), extended into nasal cavity. Chemo-radiation protocol for NPC was conducted, and showing uncomplete response. Second biopsy was done, and reviewed with the first biopsy result. The tumour was arranged in solid, syncytial and trabecular pattern, with vesicular nuclei, prominent nucleoli, and lack of lymphoplasmacytic infiltrate. Immunohistochemistry (IHC) analysis of p16, EBNA1 and LMP1 were negative. PCR analysis of HPV-18 was positive, while EBV detection showed negative result. General association of EBV with NPC suggests that the presence of latent EBV infection can serve as a positive marker for NPC. Therefore, in this case, the EBV negativity and strong HPV association led to diagnosis of SNUC. The distinction of sinonasal undifferentiated carcinoma (SNUC) or from NPC was important for appropriate management and therapy.

ABSTRAK

Undifferentiated carcinoma pada regio kepala dan leher biasanya terjadi pada daerah nasofaring, tetapi juga bisa terjadi pada daerah orofaring, kelenjar liur dan sinonasal. Lesi-lesi yang muncul pada daerah ini sering tumpang tindih dan menyebabkan kesulitan penetapan asal tumor, serta menimbulkan kesalahan diagnosis tidak saja bagi ahli patologi, tetapi juga bagi ahli bedah. Seorang laki-laki berusia 40 tahun dengan keluhan hidung tersumbat, epistaksis, diplopia, dan nyeri kepala selama 1 tahun. CT-Scan menunjukkan massa pada kavum nasi kiri dan massa pada nasofaring. Tidak didapatkan pembesaran limfonodi. Dilakukan biopsi pada massa kavum nasi kiri, dan didiagnosis secara histopatologi sebagai *nasopharyngeal undifferentiated carcinoma* (NPC) yang meluas ke kavum nasi. Dilakukan radiasi dan kemoterapi untuk NPC, dan menunjukkan respon yang kurang sempurna. Kemudian dilakukan biopsi yang kedua, dan direview dengan biopsi yang pertama. Gambaran histopatologi menunjukkan tumor epitelial yang tersusun solid, insisial, dan trabekuler, dengan inti vesikuler, dan anak inti prominent, dengan sebaran sedikit limfosit. Pengecatan imunohistokimia dengan p16, EBNA1 dan LMP1 menunjukkan hasil negatif. Analisa PCR mendeteksi adanya HPV tipe 18, sedangkan PCR untuk EBV menunjukkan hasil negatif. Dapat disimpulkan, hubungan yang erat antara EBV dengan NPC dapat digunakan sebagai penanda bahwa infeksi latent EBV menunjukkan keberadaan karsinoma nasofaring. Sehingga tidak adanya hubungan dengan EBV dan adanya hubungan dengan HPV pada kasus ini mengarahkan diagnosis pada *sinonasal undifferentiated carcinoma* (SNUC). Membedakan NPC dan SNUC sangat penting untuk manajemen dan terapi yang optimal.

Keywords:

undifferentiated carcinoma;
sinonasal carcinoma;
nasopharyngeal carcinoma;
Epstein-Barr virus;
human papilloma virus;

INTRODUCTION

Undifferentiated carcinoma of the head and neck mostly occurred in the nasopharynx.¹ However, tumors with identical morphological features can also occur in oropharynx, salivary gland and sinonasal.²⁻⁴ Undifferentiated carcinoma in the sinonasal tract may occur as primary lesion (sinonasal undifferentiated carcinoma / SNUC) or extension from a destructive undifferentiated nasopharyngeal carcinoma (NPC).^{5,6} Palomba A & Cardesa A (2011) Overlapping lesions in these region and similarity in morphology produced difficulty in determining definitive diagnosis of the tumor, and often bring diagnostic pitfall not only for pathologists, but also for clinicians. The difference of SNUC and NPC has traditionally rested on histopathology finding, however the association of EBV with NPC suggests that the presence of latent EBV infection serve as a marker to discern those tumors.^{5,6}

SNUC usually presents as large necrotic exophytic masses involving multiple sites in sinonasal tract and may extend into the nasopharynx. The tumor is invasive, with common orbital and cranial infiltration.⁷ This complex anatomic region may represent the site of aggressive, non-squamous cell epithelial and non-epithelial malignant neoplasms of varying histogenesis, which are grouped under the term undifferentiated malignant neoplasms. Frequently, these undifferentiated malignancies share clinical and light microscopic features, which makes differentiation of one from the other virtually impossible without the use of adjunct analyses (eg, immunohistochemistry, electron microscopy, or molecular biologic studies). SNUC harbors high-risk association with HPV DNA (types 16 and 18) virus infection.⁸ Its immunohistochemical staining profile has been incompletely characterized, and little work has been

done on its expression of the markers for human papillomavirus (HPV). In contrast to NPC, an association with Epstein-Barr virus infection has not been clearly demonstrated.^{6,9} SNUC have been incompletely characterized immunohistochemically, and their undifferentiated appearance often requires such ancillary studies to aid in their distinction from other high-grade neoplasms. To address these two issues, 25 cases of SNUC diagnosed between the years 1983 and 1999 were selected from our files. EBER in situ hybridization (ISH) Morphologically, SNUC are composed of nests of cells with a delicate fibrous background, distinct cellular borders, coarse chromatin, prominent nucleoli, brisk mitotic, extensive necrosis, and scant lymphoplasmacytic infiltrate.^{5,6,10} SNUC have been incompletely characterized immunohistochemically, and their undifferentiated appearance often requires such ancillary studies to aid in their distinction from other high-grade neoplasms. To address these two issues, 25 cases of SNUC diagnosed between the years 1983 and 1999 were selected from our files. EBER in situ hybridization (ISH) There is no optimal management guidelines proved to be successful in treating this tumor.¹¹ Combined radical resection, radiotherapy and chemotherapy have evolved to the current recommendation treatment regimens.¹²

NPC presents with one or more of 4 groups of symptoms; including nasal symptoms (epistaxis), nasal obstruction and discharge; otologic symptoms (deafness and tinnitus); cranial nerve palsies (commonly 5th and 6th cranial nerves); and neck masses (usually appear in the upper neck).¹³ EBV plays a role in the development of NPC.^{6,14,15} Histopathologically, NPC are composed of syncytial cells aggregates with indistinct cellular borders, vesicular chromatin, inconspicuous nucleoli, variable mitotic, infrequent necrosis, and

usually with a lot of lymphoplasmacytic infiltrat.^{5,6,10} NPC has a better prognosis and more responsive to radiation therapy than SNUC.⁵ The distinction of undifferentiated carcinoma from the nasal cavity (SNUC) or the nasopharynx (NPC) is important for appropriate management and therapy.⁵

CASE

A 40 year old man, present with nasal obstruction, epistaxis, diplopia, and headache for a year before admitted to Dr.Sardjito General Hospital, Yogyakarta, Indonesia. CT Scan showed right nasopharynx mass, with infiltration to surrounding tissue and

infiltrated to intracranial. Biopsy from ear and nasal cavity was performed in other hospital, and histopathologically diagnosed as undifferentiated carcinoma, with possible extention from nasopharynx. Chemo-radiation protocol for NPC was conducted. The patient recieved cysplatin 100 mg/m² for the first day, and 5-fluorouracil 1000 mg/m² for the first until the fourth day, in 28 day cycle, for 4 cycle, continued with secondline chemotherapy regimen for 4 cycle. The patient also received 31 cycle radiotherapy. Six months following completion of treatment, the tumor showed uncomplete response, and repeat imaging wasperformed as shown in FIGURE 1.

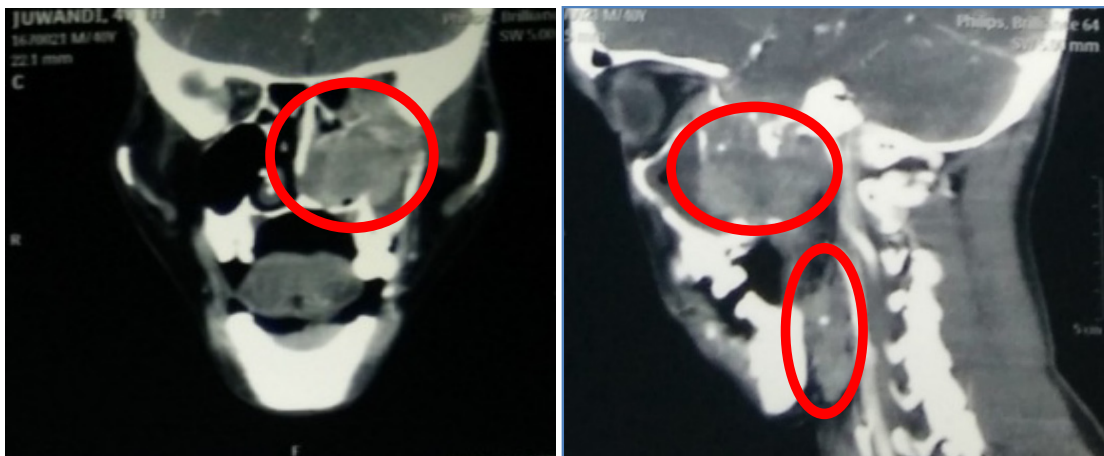


FIGURE 1. Head and neck MSCT scan after complete chemo-radiotherapy. The analysis result showed inhomogen mass in the left nasal cavity, left nasopharynx, left maxillary sinus and infiltrated into left fossa temporalis.

The second biopsy was performed in Dr.Sardjito General Hospital, Yogyakarta, Indonesia, and reviewed with the first biopsy result. Macroscopic features showed fragmented tissue from nasal cavity sinistra, 0.8 cc, tan to white and rubbery in consistency, mean while sample from the nasopharynx was 0.5 cc, tan to white in colour and also rubbery. Microscopically, nasal cavity specimens showed tumour nests arranged in solid,

and trabecular pattern, with vesicular nuclei and prominent nucleoli. The background showed desmoplastic stroma with scant lymphoplasmacytic infiltrat, without prominent necrosis (FIGURE 2). There was no tumor in the nasopharynx specimen. IHC analysis was performed, using p16, EBNA1 and LMP1 (Abcam and Novocastra) antibodies. The staining revealed negative result as shown in FIGURE 3.

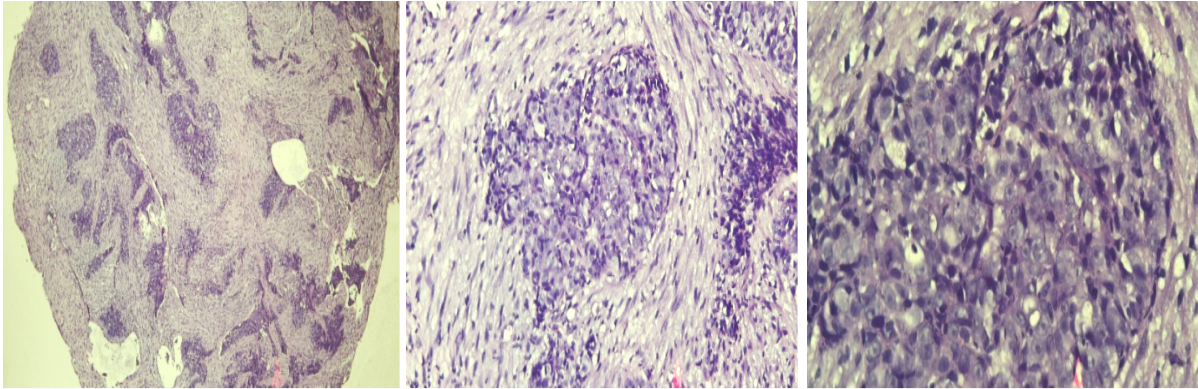


FIGURE 2. Microscopic features of sinonasal specimen. Tumor composed of solid, syncytial and tubercular nests. The cells were pleomorphic, with indistinct borders, vesicular nuclei, and prominent nuclei. The background was desmoplastic stroma with scanty lymphoplasmatic infiltrate (HE, 40, 200x, 400x).

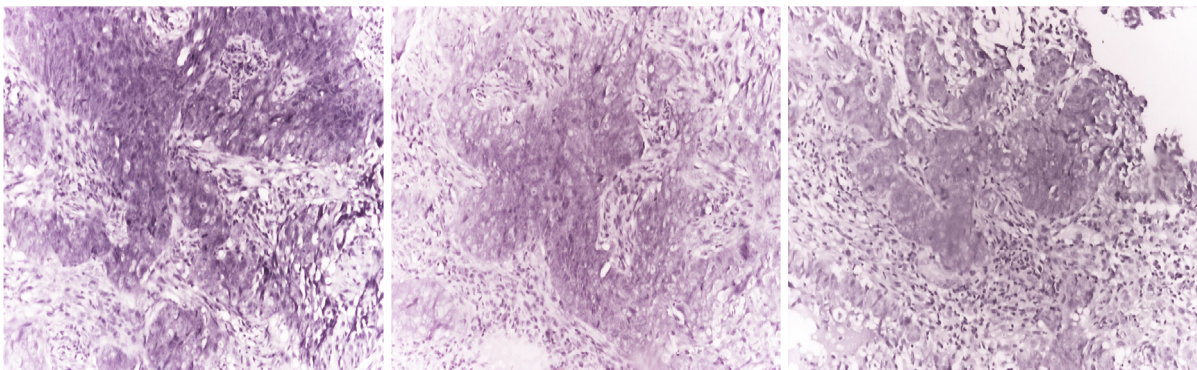


FIGURE 3. Immunohistochemistry result. Staining for p16, EBNA1, LMP1 showed neative result (100x)

PCR analysis of HPV and EBV were then performed. DNA was extracted from formaline-fixed paraffin-embedded (FFPE) tissue specimens. DNA amplification for HPV was performed

with AB Analitica Ampliquality HPV-TYPE Express v3.0, and continued with genotyping with reverse line blot. The test revealed HPV-18 positive as shown in FIGURE4.

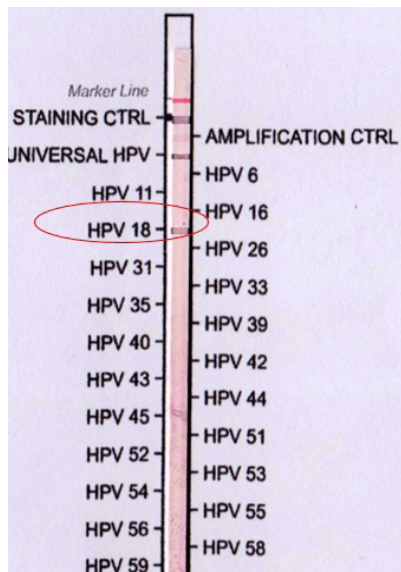


FIGURE 4. DNA amplification of HPV. The genotyping used reverse line blot, showed positive result for HPV-18.

DNA amplification for EBV was using two primers that target EBV1_F: 5' – AAGGAGGGTGGTTTGAAAG – 3', and EBV1_R: 5' – AGACAATGGACTCCCTTAGC – 3'. Gel electrophoresis showed negative result for EBV (FIGURE5).

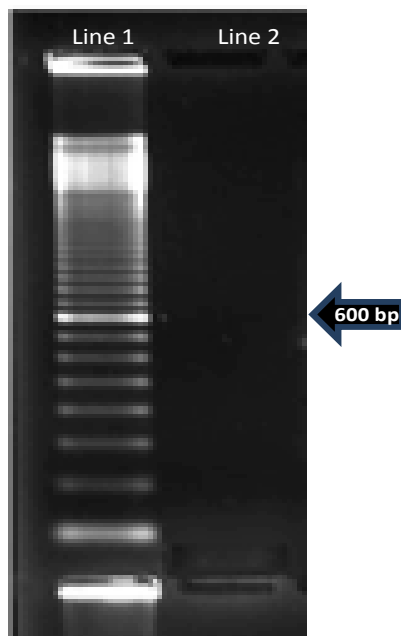


FIGURE 5. DNA amplification of EBV. Line 2 : DNA amplification for EBV and gel electrophoresis showed negative result. Line 1: Positive control

DISCUSSION

SNUC isa rare malignancy and firstly described by Frierson *et al.*¹⁶ It wasoriginally defined as a high-grade malignant epithelial neoplasm of the nasal cavity and paranasal sinuses of uncertain histogenesis with or without neuroendocrine differentiation, but without evidence of squamous or glandular differentiation. Furthermore, World Health Organization classification redefined SNUC as a highly aggressive and clinicopathologically distinctive carcinoma of uncertain histogenesis that typically presents with locally extensive disease. Although the exact histogenesis are unknown, it has been believed that SNUC was originate from schneiderian epithelium or from the nasal ectoderm of the paranasal sinuses.^{7,16}

The etiology of SNUC is unknown. Some cases have ocured after prior radiation therapy for nasopharyngeal carcinoma.¹⁷ Association of EBV with SNUC have shown controversial result.⁶ SNUC have been incompletely characterized immunohistochemically, and their undifferentiated appearance often requires such ancillary studies to aid in their distinction from other high-grade neoplasms. To address these two issues, 25 cases of SNUC diagnosed between the years 1983 and 1999 were selected from our files. EBER in situ hybridization (ISH) However, a significant subset of SNUC (7 of 11) was associated with EBV, where as all Western cases were negative for EBV. The Asian SNUC that showed EBV positivity were limited to those showing similar features to anaplastic large cell lymphoma, or mimicking undifferentiated nasopharyngeal carcinoma.^{6,18} The latter were then referredto primary sinonasal nasopharyngeal-type undifferentiated carcinoma

(lymphoepithelioma).^{6,19}

Sinonasalcarcinoma, including SNUC, harbor high-risk HPV DNA (types 16 and 18) virus infection.²⁰ Several studies have confirmed its causal role in a subgroup of upper aerodigestive tract tumours. Of the non-genital cancers, tonsillar carcinomas (TCs) Recent study reported that HPV-positive cancers of the head and neck, including the tonsil, oropharynx, and oral cavity had a better overall survival than HPV-negative cancers.²¹ Although the exact mechanism is not fully understood, three possible explanations could be a) the genome of HPV positive cancer cells is less unstable and/or, b) HPV-positive cells suffer from hypoxia and can be more easily induced to apoptosis or, c) treatment improves the local immunity favouring the eradication of HPV (and regression of the tumour).^{21,22}

HPV status is also associated with p16 expression, and HPV-positive tumours are less likely to harbour p53 mutations.²¹⁻²⁴ Rb inactivation by the viral oncoprotein E7 induces overexpression of p16, therefore immunohistochemical detection of p16 serves as a surrogate marker for high risk HPV in oropharyngeal cancers.²⁵ The HPV viral E6 protein can cause a p53 gene mutation that inactivates p53 protein and interferes with p53 function by targeting it for ubiquitination and degradation.²⁶ However, in this case, IHC staining for p16 was failed to demonstrated the correlation of HPV with the tumor. Therefore PCR analysis was performed and proved the involvement of HPV infection.

The HPV testing methods are mostly based on detecting HPV DNA in cancer tissues either with in situ hybridization (ISH) or PCR or both. With regard to the detection method, PCR-based studies reported a higher prevalence rate than

ISH-based rates, especially in the oral cancer subgroup.²⁷

CONCLUSION

The universal association of EBV with NPC suggests that the presence of latent EBV infection serve as a marker to distinguish NPC from SNUC. SNUC are typically negative for EBV and positive for HPV. The distinction of SNUC or NPC is important for appropriate management and therapy.

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REFERENCES

1. Carpenter DH, El-Mofty SK, Lewis JS Jr. Undifferentiated carcinoma of the oropharynx: a human papillomavirus-associated tumor with a favorable prognosis. *Mod Pathol Nature* 2011; 24(10):1306–12. <https://doi.org/10.1038/modpathol.2011.87>
2. Singhi AD, Stelow EB, Mills SE, Westra WH. Lymphoepithelial-like carcinoma of the oropharynx: a morphologic variant of HPV-related head and neck carcinoma. *Am J Surg Pathol* 2010; 34(6):800–5. <https://doi.org/10.1097/PAS.0b013e3181d9ba21>
3. AK Abdulla and MY Mian. Lymphoepithelial carcinoma of salivary glands. *Head Neck*. 1996; 18(6):577–81. [https://doi.org/10.1002/\(SICI\)1097-0347\(199611/12\)18:6<577::AID-HED13>3.0.CO;2-5](https://doi.org/10.1002/(SICI)1097-0347(199611/12)18:6<577::AID-HED13>3.0.CO;2-5)
4. JK Chan, TT Yip, WY Tsang. Specific association of Epstein-Barr virus with lymphoepithelial carcinoma among tumors and tumorlike lesions of the salivary gland. *Arch Pathol Lab Med* 1994; 118:994–7.

5. Franchi A, Palomba A, Cardesa A. Current diagnostic strategies for undifferentiated tumours of the nasal cavities and paranasal sinuses. *Histopathology* 2011; 59(6):1034–45. <https://doi.org/10.1111/j.1365-2559.2011.03813.x>
6. Cerilli LA, Holst VA, Brandwein MS, Stoler MH, Mills SE. Sinonasal undifferentiated carcinoma: immunohistochemical profile and lack of EBV association. *Am J Surg Pathol* 2001; 25(2):156–63. <https://doi.org/10.1097/00000478-200102000-00003>
7. Wenig BM. Undifferentiated malignant neoplasms of the sinonasal tract. *Arch Pathol Lab Med* 2009; 133(5):699–712.
8. Wadsworth B, Bumpous JM, Martin AW, Nowacki MR, Jenson AB, Farghaly H. Expression of p16 in sinonasal undifferentiated carcinoma (SNUC) without associated human papillomavirus (HPV). *Head Neck Pathol* 2011; 5(4):349–54. <https://doi.org/10.1007/s12105-011-0285-8>
9. Hwang TZ and Tsai ST. EBER insitu hybridization differentiates carcinoma originating from the sinonasal region and the nasopharynx. *Anticancer Res* 1998; 18:4581–4.
10. Thompson LDR. Sinonasal carcinomas. *Curr Diagnostic Pathol* 2006; 12(1):40–53. <https://doi.org/10.1016/j.cdip.2005.10.009>
11. Kim B, Vongtama R, Juillard G. Sinonasal undifferentiated carcinoma: case series and literature review. *Am J Otolaryngol* 2004; 25(3):162–6. <https://doi.org/10.1016/j.amjoto.2003.12.002>
12. Goel R, Ramalingam K, Ramani P, Chandrasekar T. Sinonasal undifferentiated carcinoma: A rare entity. *J Nat Sci Biol Med* 2012; 3(1):101–4. <https://doi.org/10.4103/0976-9668.95986>
13. Wei WI and Kwong DLW. Current management strategy of nasopharyngeal carcinoma. *Clin Exp Otorhinolaryngol* 2010; 3(1):1–12. <https://doi.org/10.3342/ceo.2010.3.1.1>
14. Niedobitek G, Meru N, Delecluse H-J. Epstein-Barr virus infection and human malignancies. *Int J Exp Pathol* 2001; 82(3):149–70. <https://doi.org/10.1111/j.1365-2613.2001.iep190.x>
15. Lo KW and Huang DP. Genetic and epigenetic changes in nasopharyngeal carcinoma. *Mol Pathog Nasopharyngeal Carcinoma* 2002; 14(6):451–62. <https://doi.org/10.1016/S1044579X02000883>
16. Frierson HF Jr, Mills SE, Fechner RE, Taxy JB, Levine PA. Sinonasal undifferentiated carcinoma. An aggressive neoplasm derived from Schneiderian epithelium and distinct from olfactory neuroblastoma. *Am J Surg Pathol* 1986; 10(11):771–9. <https://doi.org/10.1097/00000478-198611000-00004>
17. Frierson HF. Sinonasal undifferentiated carcinoma. In: Barnes L, Eveson J, Reichart P, Sidransky D, eds. *World Health Organ Classification Tumours: Pathology and genetics of head and neck tumours*. Lyon: IARC Press 2005.
18. Lopategui Jr, Gaffey MJ, HF Frierson, Chan JK, Mills SE, Chang KL, et al. Detection of Epstein-Barr viral RNA in sinonasal undifferentiated carcinoma from Western and Asian patients. *Am J Surg Pathol*. 1994; 18(4):391–8. <https://doi.org/10.1097/00000478-199404000-00007>
19. YM Jeng, Sung MT, Fang CL. Sinonasal undifferentiated carcinoma and nasopharyngeal-type undifferentiated carcinoma. Two clinically, biologically, and histopathologically distinct entities. *Am J Surg Pathol* 2002; 26(3):371–6.

- <https://doi.org/10.1097/00000478-200203000-00012>
20. Syrjänen S. HPV infections and tonsillar carcinoma. *J Clin Pathol* 2004; 57(5):449–55.
<https://doi.org/10.1136/jcp.2003.008656>
 21. Dayyani F, Etzel CJ, Liu M, Ho C-H, Lippman SM, Tsao AS. Meta-analysis of the impact of human papillomavirus (HPV) on cancer risk and overall survival in head and neck squamous cell carcinomas (HNSCC). *Head Neck Oncol* 2010; 2:15.
<https://doi.org/10.1186/1758-3284-2-15>
 22. Ragin CCR, Taioli E, Weissfeld JL, White JS, Rossie KM, Mogduno F, *et al.* 11Q13 Amplification status and human papillomavirus in relation to p16 expression defines two distinct etiologies of head and neck tumours. *Br J Cancer* 2006; 95(10):1432–8.
<https://doi.org/10.1038/sj.bjc.6603394>
 23. Reimers N, Kasper HU, Weissenborn SJ, Stutzer H, Preuss SF, Hoffmann TK, *et al.* Combined analysis of HPV-DNA, p16 and EGFR expression to predict prognosis in oropharyngeal cancer. *Int J Cancer* 2007; 120(8):1731–8.
<https://doi.org/10.1002/ijc.22355>
 24. Wittekindt C, Gültekin E, Weissenborn SJ, Pfister HJ, Jens P. Expression of p16 protein is associated with human papillomavirus status in tonsillar carcinomas and has. *Adv Otorhinolaryngol* 2005; 62:72–80.
<https://doi.org/10.1159/000082474>
 25. El-Naggar AK and William HW. p16 expression as a surrogate marker for HPV-related oropharyngeal carcinoma: a guide for interpretative relevance and consistency. *Head Neck* 2012; 34(4):459–61.
<https://doi.org/10.1002/hed.21974>
 26. Hafkamp HC, Manni JJ, Haesevoets A., Voogd AC, Schepers M, Bot FJ, *et al.* Marked differences in survival rate between smokers and nonsmokers with HPV 16-associated tonsillar carcinomas. *Int J Cancer* 2008; 122(12):2656–64.
<https://doi.org/10.1002/ijc.23458>
 27. Termine N, Panzarella V, Falaschini S, Russo A, Matranga D, *et al.* HPV in oral squamous cell carcinoma vs head and neck squamous cell carcinoma biopsies: a meta-analysis (1988-2007). *Ann Oncol* 2008; 19(10):1681–90.
<http://doi.org/10.1093/annonc/mdn372>.