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Original Article

Sociodemographic and Immunohistochemical Expression of P53 in Nasopharyngeal Carcinoma

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A R T I C L E I N F O

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A B S T R A C T

Nasopharyngeal carcinoma (NPC) is an aggressive malignant tumour of the head and neck region with a distinct geographic and ethnic distribution. Its development is often associated with genetic alterations, viral infections such as Epstein-Barr virus (EBV), and environmental factors. Among the molecular markers implicated in its pathogenesis, the tumour suppressor protein p53 plays a critical role in regulating cell cycle, DNA repair, and apoptosis. Aberrant expression of p53 has been reported in various malignancies, including NPC, and may provide important diagnostic, prognostic, and therapeutic implications. This study investigates the immunohistochemical expression of p53 in nasopharyngeal carcinoma cases diagnosed at the National Hospital, Abuja. Formalin-fixed, paraffin-embedded tissue samples of confirmed NPC were retrieved and subjected to immunohistochemical staining using monoclonal antibodies specific for p53. The expression pattern was evaluated based on nuclear staining intensity and percentage of positive tumour cells, and results were correlated with clinicopathological parameters such as age, sex, and histological subtype. Findings from this study revealed that a significant proportion of NPC cases showed overexpression of p53 protein, suggesting possible involvement of p53 pathway alterations in the tumorigenesis of NPC among Nigerian patients. The expression was more pronounced in undifferentiated carcinoma compared to differentiated subtypes, with no significant gender variation. The study concludes that p53 overexpression is common in NPC in Abuja and may serve as a useful biomarker in understanding tumour biology, prognosis, and in guiding therapeutic strategies. It further recommends larger multicenter studies incorporating molecular assays to validate the prognostic significance of p53 in NPC within the Nigerian population.

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INTRODUCTION

Nasopharyngeal carcinoma (NPC), known as the lymphoepithelioma, is a cancer that occurs at the back of the throat, at the upper part of the nose, and above the rear of the mouth. It is an undifferentiated form of squamous cell cancer that is derived from the epithelial lines of this area [1]. The pathophysiology of the disease is both environmental in nature and genetic. Risk factors that have been implicated include smoking, excessive alcohol consumption, and eating foods that contain nitrosamines. Genetic susceptibility is also present as part of the predisposition to developing the disease [2,3].

Nodal involvement and enlarged cervical lymph nodes are commonly the initial indication. The most commonly involved nodes include retropharyngeal, posterior triangle apex, and upper jugular nodes and supraclavicular nodes are most likely signs of advanced disease [4]. NPC is known to be linked with distant metastasis and paraneoplastic syndromes, which also make its management difficult [5]. This results in a large number of patients being diagnosed late in the stage, hence poor prognoses. These cancers are typically treated with radiotherapy, usually with chemotherapy as well, though chances of survival vary vastly on the stage at which they are diagnosed, and access to healthcare [6,7].

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The pathogenesis and evolution of NPC can be linked to the mechanism of tumour suppressor genes, which are able to preserve genomic stability by controlling cell processes, including cell cycle and apoptosis. Mutation or loss of the functions of these genes may also cause unregulated cell growth and cancer. TP53, which encodes p53, is the most commonly mutated gene of human cancer; it is one of the key molecular actors in carcinogenesis, and as such has been termed the guardian of the genome [8,9]. Despite the well-established role of p53 as a tumour suppressor, its functional status in nasopharyngeal carcinoma (NPC) remains ambiguous. Recent studies have highlighted that overexpression of p53 in NPC is not necessarily indicative of its tumour-suppressive activity. These findings underscore the complexity of p53's role in NPC and the need for further investigation into the mechanisms underlying its dysregulation.

MATERIALS AND METHODOLOGY

Research Design

This was a retrospective cross-sectional study to investigate the presence of p53 protein expression in diagnosed NPC cases using archived formalin-fixed paraffin-embedded (FFPE) tissue samples. This enables the assessment of p53 without the need for prospective patient recruitment. The method used is a cost-effective, ethically non-invasive and efficient method for evaluating historical medical and pathological data.

Study Area

The study was conducted at the National Hospital, Abuja, in a functional histopathology laboratory. The population included patients previously diagnosed with NPC, whose tissue blocks were archived and well-preserved for retrospective immunohistochemistry analysis.

Sample Size

A total of 40 formalin-fixed, paraffin-embedded (FFPE) nasopharyngeal carcinoma (NPC) tissue samples were selected for this study. The sample size was determined based on availability within the pathology archives from the National Hospital, Abuja, while also considering statistical justification for the prevalence of P53 in NPC cases. To determine the adequacy of the sample size, the formula for estimating a single proportion was applied:

n = (Z^2 × p × (1 - p)) / d^2
Where:
- n = required sample size
- Z = Z-score corresponding to the desired confidence level (1.96 for 95%)
- p = estimated prevalence of p53 in NPC (assumed to be 0.5 for maximum variability)
- d = margin of error (0.14 or 14%)

Substituting the values:

n = (1.96) ^2 × 0.5 × (1 - 0.5) / (0.14) ^2
= 3.8416 × 0.25 / 0.0196
= 0.9604 / 0.02401
= 40

Thus, a sample size of 40 is considered sufficient to estimate the prevalence of p53 among NPC cases with 95% confidence and a margin of error of approximately ±15.5%. This level of precision is deemed acceptable for an exploratory, retrospective study and is consistent with sample sizes used in similar research within the field of oncologic virology and histopathology.

Data Analysis

Data analysis included descriptive statistics, summarising demographic and clinical features of the study population. Chi-square test or Fisher's exact test was used to examine associations between p53 expression and variables like tumour grade or age group. A p-value of <0.05 was considered statistically significant.

Ethical Considerations

Approval was obtained from the Institutional Ethics Review Committee. The study used de-identified archived materials, ensuring confidentiality and eliminating the need for individual informed consent.

Data Collection Procedure

Histopathological Confirmation

Hematoxylin and Eosin (H\&E) staining was used to reconfirm the diagnosis and classify the NPC subtypes. A certified pathologist reviewed all histological slides independently.

Immunohistochemistry for p53 Expression

The Avidin-Biotin Complex (ABC) technique, also known as the Avidin-Biotin Immunoperoxidase method, was used to detect p53 protein expression. All antibodies used were Novocastra™ products, now manufactured by LEICA Biosystems, with a dilution factor of 1:100 for all markers.

The Immunohistochemistry Method

1. FFPE tissue blocks were sectioned at 3 microns using a rotary microtome and dried on a hot plate at 70°C for at least 1 hour.

2. Sections were deparaffinized in two changes of xylene, followed by three changes of descending grades of alcohol (100%, 95%, 70%), then rinsed in water.

3. Antigen retrieval was performed by heating the sections in citrate buffer (pH 6.0) using a pressure cooker for 25 minutes.

4. Slides were cooled in running water for 5 minutes to displace the acid (hot citrate buffer).

5. Endogenous peroxidase blocking was done using 3% hydrogen peroxide (H_2O_2) for 15 minutes.

6. Sections were washed in PBS, and nonspecific protein blocking was performed using avidin for 15 minutes.

7. After that section were washed again in PBS, biotin was used to block endogenous biotin in the tissues for 15 minutes.

8. Slides were then incubated with the primary antibody (anti-p53, diluted 1:100) for 60 minutes at room temperature.

9. Excess primary antibody was removed with PBS, and a new secondary antibody (LINK) was applied for 15 minutes.

10. After washing, Horseradish Peroxidase (HRP)–conjugated label (LABEL) was applied for 15 minutes.

11. A working DAB solution is made by using DAB chromogen mixed freshly by combining 1 drop (20 µL) of DAB chromogen with 1 mL of DAB substrate. This solution was applied for about 5 minutes after washing HRP with PBS to visualise the antibody-antigen reaction.

12. Excess DAB is then washed off with water.

13. The stained sections were counterstained with hematoxylin for 2 minutes.

14. Then dehydrated in alcohol, cleared in xylene and mounted in DPX as described with little modification by Gamde et al. [10].

RESULT: POSITIVE staining was indicated by brown colour of cytoplasm, cell membrane or nucleus, depending on the antigenic site in tumour cells. The hematoxylin-stained cells without any form of brown colour are scored NEGATIVE. Non-specific brown artefacts on cells and connective tissues are disregarded.
3.9Scoring of p53 Expression

The Quick-score method was used to evaluate p53 immunoexpression in tumour cell nuclei. This approach is semi-quantitative, combining two parameters:

1.Percentage of positively stained tumour cells – scored from 1 to 5:

Score-1 = < 25% of tumour cells stained
Score-2 = 26–49% of tumour cells stained
Score-3 = 50% of tumour cells stained
Score-4 = 51–75% of tumour cells stained
Score-5 = > 75–100% of tumour cells stained

2. Staining intensity – scored from 1 to 3:

1 = weak intensity
2 = moderate intensity
3 = strong intensity

Interpretation:

The final score was obtained by adding the intensity score to the percentage score, giving a total range from 0 to 8.
0 = Negative (no staining observed)
2–4 = Low expression
5–8 = High expression
For example, a tumour showing strong intensity (3) in >75% of cells (5) yields a score of 8, interpreted as high p53 expression.

Image Analysis

The evaluation of p53 protein expression in nasopharyngeal carcinoma tissues was performed using digital image analysis. Stained sections were observed under an Olympus light microscope equipped with a Spot digital camera. Images were captured using a 40× objective lens (scale bar = 50 μm) with a 16-bit digital resolution (1280 × 1024 pixels). The captured images were processed and analysed using Image software (NIH, USA) integrated with MATLAB routines. For each case, ten representative microscopic fields were randomly selected. The number of p53-positive nuclei (brown-stained) was counted in these fields. To quantify staining intensity, the Image Optical Density (IOD) was measured. Grey-level pixel values ranged from 0 (dark) to 250 (light). For accuracy, IOD measurements were taken from 10 fixed areas in one image, across five images per case, and the mean IOD value was used for statistical analysis. This approach provided both qualitative assessment (presence or absence of brown nuclear staining) and quantitative assessment (intensity of immunoreactivity) of p53 expression in nasopharyngeal carcinoma samples.

RESULTS

Socio-Demographic Characteristics of the Study Population
This section presents the distribution of the study participants by age and sex based on the 40 nasopharyngeal carcinoma cases analysed.

Age Distribution

The age of the patients ranged from 7 years to 86 years, and the 40 samples were categorised into four age groups. The distribution is presented below: (Table 1)

Table 1. Age Frequency

Age Group(year)	Frequency(n)	Percentage (%)
≤20	11	27.5
21-40	8	20.0
41-60	15	37.5
>60	6	15.0
Total	40	100

Description:

i.The highest number of participants (37.5%) fell within the 41–60 years age group.

ii.The ≤20 years group followed with 27.5%, indicating a significant representation among younger individuals.

iii.The 21–40 years group made up 20% of the cases.

iv.The smallest group was those aged over 60 years, comprising 15% of the study population.

.2.2 Sex Distribution

Out of the 40 patients studied, the distribution by sex is shown below: (Table 2)

Table 2. Sex Frequency

Sex	Frequency (n)	Percentage (%)
Female	22	55.00
Male	18	45.00
Total	40	100

Description:
i.There were more female patients (55.0%) compared to males (45.0%).
ii.This indicates a slight female predominance in the study population.

P53 Expression Analysis

The expression of the p53 protein was assessed across all 40 confirmed nasopharyngeal carcinoma (NPC) cases using immunohistochemistry. The expression levels were categorised as high, low, or negative based on the cumulative immunostaining scores provided in the dataset.

Out of the 40 patients:

i. 21 (52.5%) exhibited high p53 expression
ii. 17 (42.5%) had low p53 expression
iii. 2 (5.0%) showed no detectable (negative) p53 expression

These findings suggest a predominance of p53 overexpression in the study population, which may be indicative of p53 gene mutation, accumulation of dysfunctional protein, or its role in NPC tumour progression. (Table 3)

Table 3. Distribution of p53 Expression Levels among NPC Patients

Expression Level	Frequency (n)	Percentage (%)
High	21	52.5
Low	17	42.5
Negative	2	5.0
Total	40	100

Relationship Between Age and p53 Expression

This section presents the distribution of p53 expression levels among patients in different age groups. Each group's p53 status is classified as High (HPE), Low (LPE), or Negative (NPE) expression, and the results are presented as both absolute frequency and percentages relative to each group's size. (Table 4)

Table 4. Age Group vs. p53 Expression Levels

Age Group(year)	HPE (n, %)	LPE (n, %)	NPE (n, %)	Total (n)
≤20	6 (54.5)	4 (36.4)	1 (9.1)	11
21-40	6 (75.0)	2 (25.0)	0 (0.0)	8
41-60	7 (46.7)	8 (53.3)	0 (0.0)	15
>60	2 (33.3)	3 (50.0)	1 (16.7)	6
Total	**21 (52.5)**	**17 (42.5)**	**2 (5.0)**	**40**

Interpretation of Findings:

i. In the ≤20 group, high expression dominated (54.5%), but a notable portion (36.4%) had low expression, and 9.1% had negative p53 expression.

ii. The 21–40 group showed a strong predominance of high expression (75%), with no negative cases.

iii. The 41–60 group had a nearly even split, with 53.3% low and 46.7% high expression.

iv. In the >60 age group, low expression (50%) was most frequent, and 16.7% had negative p53 — the highest negative rate among all groups. These findings suggest a potential age-related pattern in p53 expression, where younger patients more frequently exhibit high p53 expression, while older patients are more likely to have low or absent expression, possibly indicating age-associated loss of p53 tumour suppressor function or mutational events.

Relationship Between Sex and p53 Expression

This section explores the variation in p53 expression levels between male and female patients with nasopharyngeal carcinoma. Expression patterns are categorised into High (HPE), Low (LPE), and Negative (NPE). (Table 5)

Table 5. Sex vs. p53 Expression Levels

Sex	**HPE (n, %)**	**LPE (n, %)**	**NPE (n, %)**	**Total (n)**
Male	9 (50.0)	9 (50.0)	0 (0.0)	18
Female	12 (54.5)	8 (36.4)	2 (9.1)	22
Total	21 (52.5)	17 (42.5)	2 (5.0)	40

Interpretation of Findings:

i.Among male patients, p53 expression was evenly distributed between high (50%) and low (50%) expression. No male showed a negative expression.

ii.Among female patients, 54.5% exhibited high p53 expression, 36.4% showed low expression, and 9.1% (2 out of 22) had negative expression.

iiiHigh p53 expression was slightly more common among females (54.5%) than males (50.0%), though the difference was marginal.

iv.Negative expression was observed only in females, accounting for all NPE cases in this study.

These findings suggest that while the general distribution of high and low p53 expression is comparable between sexes, negative expression may be slightly sex-biased, occurring only in female patients in this sample.

Summary of P53 Expression Across Age and Sex

This section presents a comprehensive view of how p53 expression levels are distributed across both age groups and sex in patients with nasopharyngeal carcinoma. The aim is to identify patterns that may reflect demographic influences on p53 activity. (Table 6)

Table 6. Combined Distribution of p53 Expression by Age and Sex

Age Group (years)	**Sex**	**HPE (n)**	**LPE (n)**	**NPE (n)**	**Total (n)**
≤20	Male	2	2	0	4
	Female	4	2	1	7
21-40	Male	3	1	0	4
	Female	3	1	0	4
41-60	Male	3	4	0	7
	Female	4	4	0	8
>60	Male	1	2	0	3
	Female	1	1	1	3
Total	Male	9	9	0	18
	Female	12	8	2	22
	Grand Total	21	17	2	40

Key Observations:

i.In the ≤20 age group, females showed higher frequency of HPE and the only NPE case in this group.

ii.For 21–40 and 41–60, both males and females had comparable patterns, though females slightly dominated in HPE.

iii.The >60 age group had more low and negative expression cases, especially among female patients.

iv.All NPE cases (n=2) were observed in female patients, both under 20 and over 60.

Summary:

This combined table highlights a subtle but noteworthy age- and sex-related variation in p53 expression:

i.High expression is fairly evenly distributed but slightly more common among females across age groups.

ii.Low expression increases with age, particularly noticeable in the 41–60 and >60 groups.

iii.Negative expression appears exclusively in females, possibly indicating a demographic subset with more profound p53 pathway disruption.

Summary of Immunohistochemical Results of p53 Expression

Immunohistochemical staining for p53 protein was validated using both positive and negative controls to ensure accuracy of interpretation. The

positive control (cervical cancer tissue) demonstrated strong nuclear brown staining, confirming full p53 expression, while the negative control (reactive lymph node) showed only blue hematoxylin-stained nuclei with no brown colouration, confirming absence of p53 expression. In the study samples, positive p53 expression was identified by the presence of brown colouration in the nuclei, cytoplasm, or cell membrane of tumour cells, depending on antigenic localisation. In contrast, cells stained only by hematoxylin (blue-purple nuclei) without any brown colouration were considered negative. Non-specific brown deposits occasionally observed in stromal or connective tissue were disregarded. At high magnification (200×), positively stained nuclei appeared as dark brown deposits of varying intensity within the nuclear compartment. Some cells demonstrated diffuse nuclear staining, while others showed granular brown deposits concentrated in certain regions of the nucleus. This staining pattern allowed for clear differentiation between positive and negative tumour cell populations. (Figures 1-7)

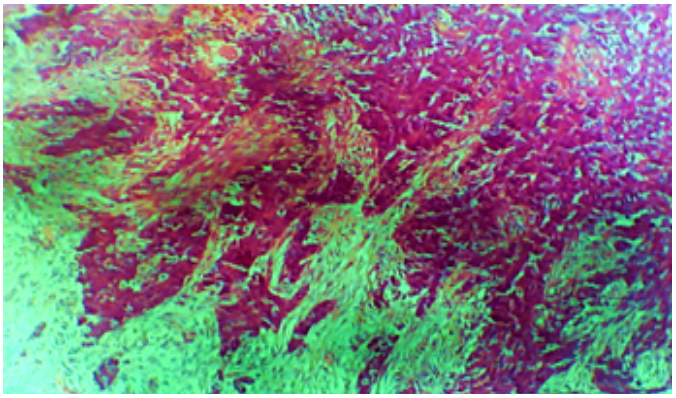


Figure 1: Illustrates hematoxylin and eosin (H&E) staining of nasopharyngeal carcinoma seen at X 200.

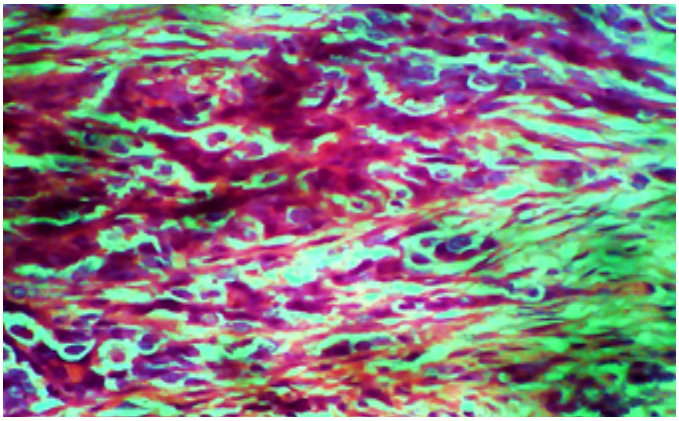


Figure 2: Illustrates hematoxylin and eosin (H&E) staining of nasopharyngeal carcinoma tissue seen at X 200.

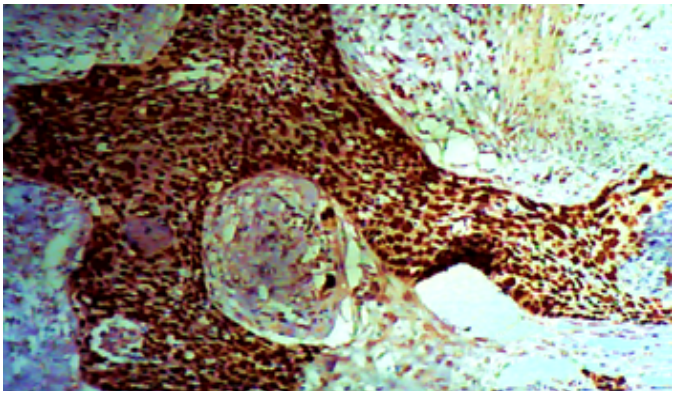


Figure 3: Illustrates high Expression of p53 protein, respectively, showing only blue-purple hematoxylin-stained nuclei with dark brown colouration, (X 200 MAG).

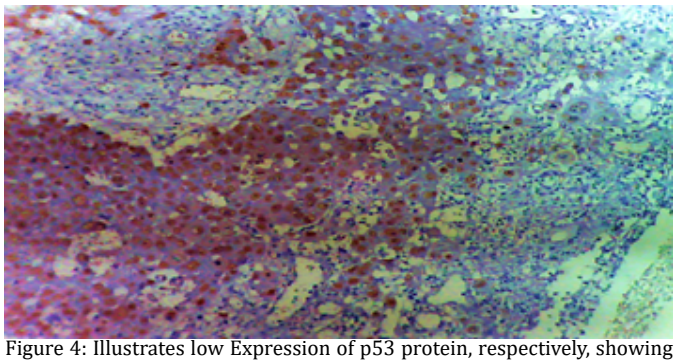


Figure 4: Illustrates low Expression of p53 protein, respectively, showing only blue-purple hematoxylin-stained nuclei with dark brown colouration, (X 200 MAG).

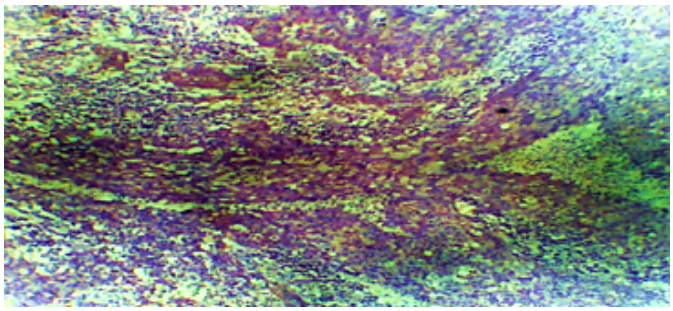


Figure 5: Illustrates a negative expression of p53, showing only blue-purple hematoxylin-stained nuclei without any detectable brown colouration, confirming absence of p53 protein expression (X 200 MAG).

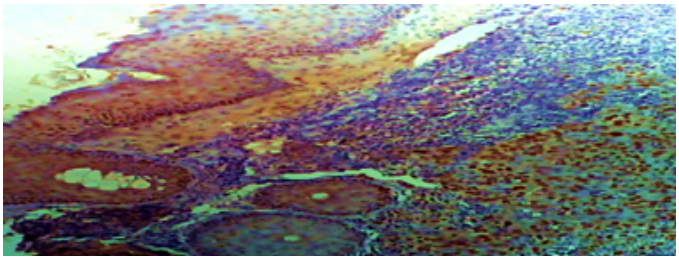


Figure 6: Positive control showing strong p53 nuclear staining in cervical cancer tissue (× 200 MAG).

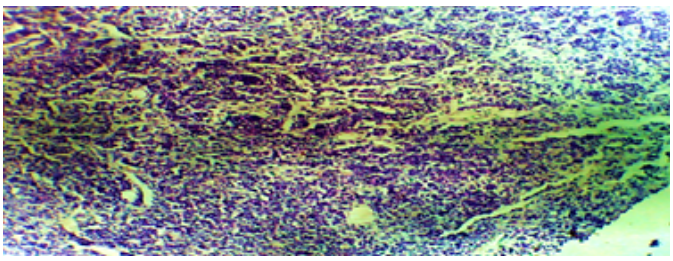


Figure 7: negative control showing absence of p53 expression in reactive lymph node tissue (× 200 MAG).

DISCUSSION

This study investigated the expression of p53 protein in nasopharyngeal carcinoma (NPC) tissues and explored its relationship with patients' age and sex. Among the 40 cases examined, high p53 expression (HPE) was the most prevalent, seen in 52.5% of the patients, followed by low p53 expression (LPE) in 42.5% and negative p53 expression (NPE) in 5.0%.

In this study, p53 overexpression was the most common finding in nasopharyngeal carcinoma (NPC), suggesting that abnormal accumulation of p53 protein is a frequent molecular event in the cancer. Such overexpression is often linked to TP53 mutations or impaired protein degradation, leading to loss of normal tumor suppressor activity, a trend also reported in other head and neck cancers. Complete loss of

p53 protein was rare, supporting the idea that NPC mutations typically result in protein build-up rather than absence. Age-related analysis showed that high p53 expression (HPE) was most frequent in younger patients (≤20 years: 54.5%; 21–40 years: 75%) but decreased with age, while low p53 expression (LPE) was more common in older groups (41–60 years: 53.3%; >60 years: 50%), suggesting that younger patients may develop more aggressive tumors. Female patients made up a slightly higher proportion (55%) and accounted for all negative p53 expression (NPE) cases, while males showed a balanced distribution between HPE and LPE, implying possible sex-related or hormonal influences. When both age and sex were considered, HPE was high in both sexes at younger ages but declined in older patients, especially females, with NPE observed only among females in the youngest and oldest groups, hinting at sex-specific molecular vulnerabilities. These results are consistent with reports from endemic NPC regions, where p53 overexpression occurs in 50–70% of cases, though the exclusive presence of NPE in females may represent a unique feature of this study. Overall, the patterns support the role of p53 dysfunction in NPC tumorigenesis, highlighting its potential impact on prognosis and the importance of considering age and sex when exploring personalised treatment strategies.

Conclusion

This study demonstrates that high p53 protein expression is a predominant molecular feature in NPC among the examined cases. Expression patterns vary with age and sex, with younger patients more likely to exhibit high expression and older patients tending toward low expression. The presence of negative p53 expression exclusively in females is noteworthy and may warrant further investigation.

REFERENCES

[1] Okekpa S I, Mydin R B S M N, Mangantig E, Azmi N S A, Zahari S N S, Kaur G, Musa Y. 2019. Nasopharyngeal carcinoma (NPC) risk factors: A systematic review and meta-analysis of the association with lifestyle, diets, socioeconomic and sociodemographic in Asian region.

[2] Adoga AA, Kokong DD, Ma'an ND, Silas OA, Dauda AM, Yaro JP, Mugu JG, Mgbachi CJ, Yabak CJ. The epidemiology, treatment, and determinants of outcome of primary head and neck cancers at the Jos University Teaching Hospital. South Asian Journal of Cancer.2018; 7(3): 183-187.

[3] Sun L, Wang Y, Shi J, Zhu W, Wang X. Association of Plasma Epstein-Barr Virus LMP1 and EBER1 with Circulating Tumor Cells and the Metastasis of Nasopharyngeal Carcinoma. Pathology & Oncology Research. 2020;26(3): 1893–1901.

[4] Batsakis J G, Solomon A R, Rice D H. The pathology of head and neck tumors: Carcinoma of the nasopharynx, Part 11. Head & Neck Surgery. 2012; 3(6): 511–524. https://doi.org/10.1002/hed.2890030610

[5] Chua M L K, Sham J S T, Wei W I. Patterns of regional lymph node metastasis of nasopharyngeal carcinoma: A meta-analysis of clinical evidence. BMC Cancer. 2013; 12: 98. https://doi.org/10.1186/1471-2407-12-98

[6] Her C. Nasopharyngeal cancer in Southeast Asian patients. American Family Physician. 2001; 63(9): 1776–1782.

[7] Dandekar V V, Thotakura N I, Alam H B. Nasopharyngeal carcinoma. StatPearls Publishing. 20241. Retrieved from https://www.ncbi.nlm.nih.gov/books/NBK558922/

[8] Levine A J. Million years of evolution and 40 years of discovery. Nature Reviews Cancer. 2020; 20(8): 471–480. https://doi.org/10.1038/s41568-020-0262-1

[9] Zhang Y, Rumgay H, Li M, Cao S, Chen W. Nasopharyngeal Cancer Incidence and Mortality in 185 Countries in 2020 and the Projected Burden in 2040: Population-Based Global Epidemiological Profiling. JMIR Public Health and Surveillance. 2023;9: e49968.

[10] Gamde SM, Francis L, Adisa JO. Immunohistochemistry in Cancer Diagnosis: A Review. Perspectives in Medical Research. 2024;12(2): 15-21.DOI: 10.47799/pimr.1202.03

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