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Contents

Socioeconomic disparities in hypertension medication adherence in Quezon City: A cross-sectional study

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Abstract

Introduction Hypertension is a major risk factor for cardiovascular diseases, with adherence to treatment often influenced by socioeconomic status. This study assessed adherence to hypertension medication among patients in Quezon City across economic classes from August to October 2023.

Methods An analytical cross-sectional design was employed, surveying 116 hypertensive Filipinos aged 18-64 years using the Brief Medication Questionnaire-1 (BMQ-1) and socioeconomic classifications based on multiples of the poverty line.

Results Findings revealed that 50.9% of respondents were adherent or probably adherent to treatment, while 49.1% exhibited low or probable low adherence. Those who are low adherent and probable low adherent are 1.399 times more likely to belong to the "Low Income and Below.", though this association was not statistically significant.

Conclusion Adherence to hypertension treatment among the respondents was suboptimal, particularly among the lower-income groups. While the association between socioeconomic status and adherence was not statistically significant, the findings underscore the need for interventions targeting financial barriers and improving healthcare accessibility. Addressing these challenges can enhance adherence levels and reduce the burden of hypertension and cardiovascular risks across socioeconomic strata.

Key words: Cardiovascular diseases, hypertension, prescription drugs, medication adherence, developing countries

Hypertension is one of the leading risk factors for cardiovascular diseases (CVDs) which have been rapidly rising in low-middle-income countries due to lack of awareness of the disease and limited access to healthcare services.[1,2] In Asia, hypertension presents a major burden, characterized by high prevalence rates coupled with low levels of awareness, treatment and effective control measures.[3] Effective management of hypertension typically involves a multifaceted approach that includes pharmacological treatment, lifestyle modifications, and continuous monitoring. Central to the successful control of hypertension is strict adherence to prescribed treatment regimens; however, this adherence is often compromised by various factors such as treatment-related adverse effects, polypharmacy,

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forgetfulness, comorbidities including depression, and sociodemographic influences.[4] Among these factors, socioeconomic status significantly impacts patients' ability to seek medical assistance and adhere to prescribed treatments.

The COVID-19 pandemic has further complicated these dynamics, affecting not only national economies but also individual financial situations. Reports indicate that approximately 7.3 million Filipinos lost their jobs during the pandemic, leading to an unprecedented unemployment rate of 18%.[5,6] This economic upheaval may have altered patients' attitudes toward their treatment regimens and their capacity to adhere to prescribed hypertension management strategies. Given these circumstances, recent studies examining patient adherence to hypertension medications are crucial.

While existing literature highlights the prevalence of nonadherence among low-income patients, the specific influence of economic class on treatment adherence remains unclear. Therefore, this study aimed to investigate adherence to prescribed treatment guidelines among hypertensive patients in Quezon City across different economic strata from August to October 2023.

Methods

The research proposal was approved by the Ethics Review Committee of UERMMMCI Research Institute for Health Sciences (RIHS) under ERC Code: 1464/C/2023/036. Using an analytical cross-sectional research design, a total of 116 hypertensive Filipinos aged 18-64 years old residing in Quezon City were surveyed from August 2023 to October 2023 to assess adherence to treatment of hypertensive patients. The study's inclusion criteria were as follows: participants had to be Filipino aged 18 to 64 years old, residing in Quezon City, diagnosed with Hypertension, and currently taking hypertensive medications. Individuals on hypertensive medications but were not prescribed by physicians were excluded in the study.

The minimum sample size was determined to be 94 participants using the OpenEpi tool, which utilized data from a previous study.[7] Data collection involved both online and in-person surveys, utilizing questionnaires available in Filipino. The online survey was disseminated through various social media platforms including Facebook and Instagram.

Medication adherence was evaluated using the Brief Medication Questionnaire-1 (BMQ-1), which is a self-report tool designed to screen for adherence and barriers to medication compliance. The socio-demographic data collected included age, annual family income, financial assistance received (if any), and household size. The BMQ-1 comprises a 5-item Regimen Screen assessing medication intake over the past week, a 2-item Belief Screen evaluating perceptions about drug effects, and a 2-item Recall Screen addressing difficulties in remembering medication schedules. The sensitivity of the Regimen and Belief Screens ranges from 80-100% for "repeat" non-adherence, while the Recall Screen demonstrates 90% sensitivity for "sporadic" non-adherence. This tool has shown greater sensitivity compared to existing measures for identifying issues related to medication adherence, with its original English version validated for hypertensive patients.[8]

Socio-demographic data were utilized to classify participants into appropriate income strata based on multiples of the poverty line as defined by the Philippine Statistics Authority (PSA). Participants were categorized into low-income groups and below or lower-middle-income groups and above. This dichotomization is critical as low-income individuals often face significant barriers to accessing proper healthcare.[9]

Responses from the BMQ-1 were categorized into four levels of adherence: adherence (no positive responses in any screening), probable adherence (positive response in one domain), probable low adherence (positive responses in two domains), and low adherence (positive responses across all domains). Similar studies have further grouped these into two categories: non-adherent (including probable non-adherent and non-adherent) and adherent (including adherence and probable adherence).[10]

Data analysis was performed using IBM® SPSS® version 29.0. Summary statistics for socio-demographic data were presented as frequencies and percentages. The odds ratio was calculated to assess the association between hypertension medication adherence (dependent variable) and economic strata (independent variable). Statistical significance was determined using the chi-square test, with a significance threshold set at a p-value of less than 0.05 and a confidence interval of 95%.

Results

A total of 116 survey responses were received (Table 1). The majority of the respondents' ages were between 42-64 years old (81%). The income class distribution showed that most belonged to the poor income class (44.8%). Yearly income mean of the population is Php 832,283. With regards to the number of medications that the respondents took, the majority took only 1 kind of medication (56.0%) (Table 1).

In Table 2, the respondents were classified by income class by grouping "Lower Middle Class & Above" and "Low Income & Below", making up 33.6% and 66.4% of the respondent population (n = 116) respectively. Adherence based on the BMQ was categorized into "Adherent & Probable Adherent" (50.9%) and "Low Adherent & Probable Low Adherent" (49.1%). Majority of those who had low adherence and probable low adherence to their hypertension medication, belonged to those of the "low-income and below" income class. Based on the computed odds ratio, those who are low adherent and probable low adherent are 1.399 times more likely to belong to the "Low Income and Below."

Table 1. Socio-demographic characteristics of the participants

		Frequency	Percentage
Age	18-41 years old	22	19.0
	42-64 years old	94	81.0
Income Class	Poor *(Php <10,481)*	52	44.8
	Low Income *(Php 10,481 - 20,962)*	25	21.6
	Lower Middle Income *(Php 20,962 - 41,924)*	11	9.5
	Middle Income *(Php 41,924 - 73,367)*	7	6.0
	Upper Middle Income *(Php 73,367 - 125,772)*	9	7.8
	Upper Income *(Php 125,772 - 209,620)*	3	2.6
	Rich Income *(Php >209,620)*	9	7.8
Number of Medication	3	10	8.6
	2	41	35.3
	1	65	56.0

Table 2. Odds ratio of income class to hypertension medication adherence based on BMQ

		Adherence Based on BMQ		Odds Ratio	95% CI		P-value
		Low Adherence & Probable Low Adherence	Adherent & Possibly Adherent				
Income Class	**Low Income & Below**	40	37	1.399	0.645	3.036	0.396
	Lower Middle Income & Above	17	22				
Total	*Count*	57	59				

Discussion

Adherence to antihypertensive medications is a key component to control blood pressure levels.[10] Despite the availability of hypertensive treatment, suboptimal adherence is a well-recognized factor contributing to the poor control of blood pressure.[11] In 2021, the Philippines reportedly had a control rate of 20% with a reported medication adherence of 66%.[12] Findings of this study revealed a lower medication adherence at 50%. Determinants of medication adherence are multifactorial, including demographics and socioeconomic status.[12] A systematic review done on the effect of COVID-19 revealed that barriers to medication adherence during the pandemic stem from fear of infection, medication shortage, and financial restriction.[13] Notably, one study reported that 57% of its respondents identified that the COVID-19 pandemic posed negative impacts on their affordability of medication prices.[14] Understanding the level of adherence in different economic classes will help provide insights into tailoring multifaceted interventions to improve adherence in a specific population.

Prediction of one's health outcome is multifactorial and can be attributed to both medical and nonmedical elements. Social determinants of health are nonmedical factors that influence health outcomes.[15] Health may be influenced by the social and economic environment, the physical environment, and the person's individual characteristics and behaviors.[16] High income and social status are both associated with better health outcomes; hence, the larger the gap in wealth, the greater the health disparity.[16] In the Philippines, the poverty line is calculated using food poverty metrics based on fixed welfare standards that are adjusted for price variations.[17] Variations across regions reflect differences in living costs. The Family Income and Expenditure Survey (FIES) published by the PSA in 2021 showed that 18.1% of Filipinos had incomes that were not sufficient to afford minimum basic necessities such as food and non-food items which is a significant increase against the 16.7% pre-pandemic period (2018).[18] This inflation affects both food and non-food items, including medications, thereby reducing accessibility and contributing to higher rates of non-adherence.

The majority of participants in this study represented the low-income hypertensive population. This aligns with findings from other studies indicating that individuals with low socioeconomic status have a higher prevalence of hypertension.[19] Their increased risk for low adherence may stem from limited access to healthcare despite numerous government programs aimed at reducing health inequalities and inequities.[20] Additionally, local government initiatives in Quezon City provide free access to monthly hypertension maintenance medications while requiring quarterly follow-ups for patients.[21] Research on a population from Indonesia revealed that having a higher economic status was associated with better living standards, healthcare education access, and medication access.[22] Utilizing the multiples of poverty line and BMQ-1, findings yielded a positive association between income and adherence to hypertensive medications. Respondents who are low adherent and probable low adherent are 1.399 times more likely to belong to the "Low Income and Below". Other studies conducted in Korea and Indonesia consistently demonstrated similar associations that were statistically significant.[7,22] The Philippine government through the Department of Health provides free medications for hypertension and this might have affected the results.

It is also important to note that many cited studies were conducted pre-pandemic or during the pandemic; these temporal factors may contribute to findings due to shifts in individual income, disruptions in global supply chains, and resource depletion affecting routine healthcare access.[5] Current findings mirror these amplifications of healthcare burden.

This study sheds light on the critical issue of hypertension medication adherence within varying socioeconomic contexts in Quezon City. Hypertension is a significant risk factor for cardiovascular diseases, and its effective management relies heavily on strict adherence to prescribed treatments. The COVID-19 pandemic has profoundly impacted individual finances and may have further complicated medication adherence issues as financial constraints and economic disparities have grown. The economic burden resulting from job losses and rising prices has likely affected individuals' abilities to afford medications and maintain treatment regimens.

Conclusion

The research found that adherence to hypertension medication in Quezon City was suboptimal, with only 50.9% of respondents categorized as adherent or probably adherent. The majority of those categorized

as having low adherence or probable low adherence belonged to the low-income group, suggesting that socioeconomic factors may play a role in adherence levels. However, this association was not statistically significant.

Recommendation

Understanding the complex interplay between socioeconomic status and medication adherence is essential for tailoring interventions to improve adherence among hypertensive patients. While the study did not find a statistically significant association, it highlights the need for targeted efforts to support those in lower income groups, ensuring that they can access necessary healthcare resources and maintain their medication regimens.

Efforts to improve medication adherence in this population should include interventions aimed at alleviating the economic burden, increasing healthcare accessibility, and promoting awareness of the importance of adhering to prescribed treatments. Addressing these issues can contribute to better hypertension control and, subsequently, reduced cardiovascular disease risk among individuals across all socioeconomic strata in Quezon City.

References

1. World Health Organization (WHO) [Internet]. Non communicable diseases; 2022 Sep 16 [cited 2022 Oct 21]. Available from: https://www.who.int/news-room/fact-sheets/detail/noncommunicable-diseases#:~:text=Cardiovascular%20diseases%20account%20for%20most,disease%20deaths%20caused%20by%20diabetes)
2. World Health Organization (WHO) [Internet]. Cardiovascular diseases; 2019 Jun 11 [cited 2022 Oct 21]. Available from: https://www.who.int/health-topics/cardiovascular-diseases#tab=tab_1
3. Menyanu E, Russell J, Charlton K. Dietary sources of salt in low- and middle-income countries: A systematic literature review. Int J Envir Res Public Health [Internet] 2019 Jun 12 [cited 2022 Nov 11];16(12):2082. Available from: https://doi.org/10.3390/ijerph16122082
4. Poulter NR, Borghi C, Parati G, Pathak A, Toli D, Williams B, Schmieder RE. Medication adherence in hypertension. J Hypertens 2020 Apr;38(4):579-87. doi: 10.1097/HJH.0000000000002294.
5. Shang Y, Li H, Zhang R. Effects of pandemic outbreak on economies: evidence from business history context. Frontiers in Public Health [Internet] 2021 Mar 12 [cited 2022 Nov 25];9. Available from: https://doi.org/10.3389/fpubh.2021.632043
6. Kong YC, Sakti VV, Sullivan R, Bhoo-Pathy N. Cancer and COVID-19: economic impact on households in Southeast Asia. Ecancermedicalscience 2020 Nov 3;14:1134. doi: 10.3332/ecancer.2020.1134.
7. Setiadi AP, Widiyastuti S, Mariati ID, Sunderland B, Wibowo YI. Socioeconomic impacts on medication adherence among patients with hypertension: A multicentre cross-sectional study in Lombok, Indonesia. Pharmacia [Internet] 2021 Nov 25 [cited 2023 Oct 3]:327-38. Available from: https://doi.org/10.3897/pharmacia.69.e78441
8. Svarstad BL, Chewning BA, Sleath BL, Claesson C. The brief medication questionnaire: A tool for screening patient adherence and barriers to adherence. Patient Educ Couns [Internet] 1999 Jun [cited 2023 Oct 3];37(2):113-24. Available from: https://doi.org/10.1016/s0738-3991(98)00107-4
9. Lazar M, Davenport L. Barriers to health care access for low income families: A review of literature. J Comm Health Nurs 2018 Jan-Mar;35(1):28-37. doi: 10.1080/07370016.2018.1404832.
10. Tania Tania & Yunivita Vycke & Afiatin Afiatin. Adherence to Antihypertensive medication in patients with hypertension in Indonesia. Int J Integr Health Sci 7 2019; 74-80. 10.15850/ijihs.v7n2.1588.
11. Burnier M, Egan BM. Adherence in Hypertension. Circ Res [Internet] 2019 Mar 29 [cited 2023 Oct 3];124(7):1124-40. Available from: https://doi.org/10.1161/circresaha.118.313220
12. Gutierrez MM, Sakulbumrungsil R. Factors associated with medication adherence of hypertensive patients in the Philippines: a systematic review. Clin Hypertens 2021 Oct 1;27(1):19. doi: 10.1186/s40885-021-00176-0.
13. Ruksakulpiwat S, Zhou W, Niyomyart A, Wang T, Kudlowitz A. How does the COVID-19 pandemic impact medication adherence of patients with chronic disease?: A systematic review. Chronic Illn 2023 Sep;19(3):495-513. doi: 10.1177/17423953221110151. Epub 2022 Aug 16.
14. Shimels T, Asrat Kassu R, Bogale G, et al. Magnitude and associated factors of poor medication adherence among diabetic and hypertensive patients visiting public health facilities in Ethiopia during the COVID-19 pandemic. PLoS One 2021; 16: e0249222. [PMC free article] [PubMed] [Google Scholar]
15. World Health Organization (WHO) [Internet]. Social determinants of health; [cited 2023 Nov 1]. Available from: https://www.who.int/health-topics/social-determinants-of-health#tab=tab_1
16. World Health Organization (WHO) [Internet]. Determinants of health; 2017 Feb 3 [cited 2023 Nov 1]. Available from: https://www.who.int/news-room/questions-and-answers/item/determinants-of-health
17. Albert JR, Molano W. PIDS - Philippine Institute for Development Studies [Internet]. Estimation of the Food Poverty Line; 2009 Jun 1 [cited 2023 Nov 1]. Available from: https://www.pids.gov.ph/publication/discussion-papers/estimation-of-the-food-poverty-line

18. Philippine Statistics Authority [Internet]. Highlights - 2021 Full Year Official Poverty Statistics among the Basic Sectors in the Philippines 2023 Mar 24 [cited 2023 Nov 1]. Available from: https://psa.gov.ph/system/files/phdsd/Highlights.pdf
19. Fateh, Mansooreha; Emamian, Mohammad Hassanb; Asgari, Fereshtehc; Alami, Alid; Fotouhi, Akbare. Socioeconomic inequality in hypertension in Iran. J Hypert 2014; 32(9): 1782-8. DOI: 10.1097/HJH.0000000000000260
20. Flores LJY, Tonato RR, dela Paz GA, Ulep VG. Optimizing health facility location for universal health care: A case study from the Philippines. PLOS One 2021; 16(9): e0256821. https://doi.org/10.1371/journal.pone.0256821
21. How to avail of Free Medicines [Internet]. 2023 [cited 2023 Nov 4]. Available from: https://quezoncity.gov.ph/qcitizen-guides/how-to-avail-of-free-medicines/
22. Akita T, Pirmansah A. Urban Inequality in Indonesia. [Internet]. Research Institute, International University of Japan; 2011. Available from: https://ideas.repec.org/p/iuj/wpaper/ems_2011_04.html.

Prevalence of diffuse parenchymal lung disease patterns on chest x-ray and reported respiratory symptoms among salon hairdressers in the National Capital Region: an analytical cross-sectional study

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Abstract

Introduction Exposure to chemical agents in salon products, such as ammonia and formaldehyde, poses significant respiratory health risks for hairdressers. This study aimed to assess the prevalence of Diffuse Parenchymal Lung Disease Patterns (DPLD) observed in chest X-rays of hairdressers in the National Capital Region and to document their reported respiratory symptoms.

Methods An analytical, cross-sectional study was conducted involving 100 hairdressers who underwent plain chest X-ray examinations to identify any of the 12 recognized DPLD patterns. Participants also accomplished a self-administered questionnaire detailing their demographic information, working conditions, health histories and current respiratory symptoms.

Results Thirty nine percent of participants showed DPLD patterns on chest X-rays, primarily fine reticular opacities (69.23%) and coarse reticular opacities (25.64%). Positive associations (RR>1) were linked to over five years of work, lack of PPE, daily exposure to hair iron steam, respiratory symptoms, and salon vapor exposure of exceeding five hours daily. Symptoms reported included shortness of breath (27%) and throat irritation (15%). Logistic regression confirmed a significant link between DPLD and positive respiratory symptoms.

Conclusion This study highlights the risk of structural lung abnormalities and respiratory symptoms among hairdressers, emphasizing the need for improved workplace safety, consistent PPE use and routine medical screenings to reduce occupational health risks.

Key words: Diffuse parenchymal lung disease, interstitial, chest X-rays

Diffuse Parenchymal Lung Disease (DPLD) "previously called Interstitial Lung Disease, includes a heterogeneous group of diseases of the lung parenchyma, the alveolar spaces, the vessels, and the airways."[1] One of the known causes of diffuse parenchymal lung disease is environmental and occupational exposure to mineral dust, organic dust and toxic gasses.[2] Radiologically, DPLD has 12 distinct patterns. Nine covers atelectasis, segmental and lobar opacities, multiple ill-defined opacities, diffuse airspace opacities, fine reticular opacities,

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coarse reticular opacities, diffuse fine opacities, solitary pulmonary nodule, multiple nodules, and masses. Hyperlucent thorax, solitary lucent defect and multiple lucent defects are the three other issues.[3]

Salon hairdressers have an increased exposure to hair dyes, bleaching agents and hair straighteners with strong chemical ingredients responsible for potential health risks. Ammonia, commonly found among hair dyes to raise the pH during the coloring process, can cause thermal injury and alkali burns in the airway and lung parenchyma, which then lead to structural lung damage.[4] Formaldehyde, another compound found on salon hair straightening treatments[5] can cause toxicity in the respiratory tract in the form of nasal obstruction, pulmonary edema and lung cancer.[6] Persulfates and paraphenylenediamine found in hair dyes increases risk of occupational rhinitis and asthma due to frequent exposure to these irritants and allergens during hairdressers daily work.[7] Chest radiograph findings, specifically DPLD patterns in hairdressers, are unknown, although a larger sample size would improve incidental evidence and support the idea that occupational exposure may pose lung health problems.

The general objective of this study was to determine the prevalence of DPLD patterns on chest X-ray, its reported respiratory symptoms and relationship between DPLD patterns with respect to working conditions, health history, reported respiratory symptoms and other possible risk factors present among salon hairdressers in the National Capital Region.

Methods

This analytical, cross-sectional study underwent approval by the Ethics Review Committee of the UERMMMCI Research Institute for Health Sciences with RIHS ERC Code 1778/C/2024/145. A convenience sampling method was employed for this study. The participants include 1) Filipino; 2) male or female hairdresser; 3) at least 18 years old 4) working in a salon in the National Capital Region; 5) working for at least 1 year in the same salon; 6) with at least 4 working days a week, 7 working hours per day. Those who are only offering home service and working in barber shops were excluded from the study. Pregnant and potentially pregnant individuals were excluded from undergoing the X-ray procedure, as determined through a triage questionnaire.

This study used convenience sampling. Filipino hairdressers who are at least 18 years old, have been working in the National Capital Region salon for at least one year, and working at least four days a week, seven hours a day were eligible. Exclusive home care and barbershop workers were excluded from the study. Pregnant and potentially pregnant people were excluded from the study by triage questionnaire.

One hundred participants were subjected to a plain chest X-ray procedure at posteroanterior position in a stationary X-ray bus with a safe dressing room. The radiologist who assessed the radiographs was provided with a checklist to determine whether any of the 12 main patterns of DPLD are present or absent. In addition, the participants were given a set of questionnaires composed of four (4) parts including demographic profile, working conditions, health history and current respiratory symptoms reported.

Results are summarized in tables to present the sociodemographic profile, work conditions, health history, reported respiratory symptoms and the presence or absence of DPLD patterns. Cross-tabulations between DPLD patterns and the working conditions and health histories of hairdressers were used to determine positive relationships. The statistical significance of the association between variables was determined using the chi-square test and logistic regression.

Results

Table 1 shows the demographic profile of the participants where the majority were between 25-54 age range, mostly females (57%), single (59%) and completed high school (53%).

Table 2 presents the working conditions of the study participants. A large portion of the participants work in a salon in Quezon City (42%), followed by Las Piñas (31%) and Caloocan City (24%). Regarding tenure, 40% of hairdressers have worked in a salon for 10 or more years, 35% for 5 to 9 years. Hair color application was the most commonly performed task (33%), followed by hair rebonding (27%).

Eighty nine percent of participants reported wearing a face mask while performing procedures. Daily exposure to workplace irritants was prevalent, with 83% of individuals exposed to chemical fumes, 54% to air from hair dryers, and 42% to steam from hair irons. Furthermore, 74% of participants are exposed to these irritants for five or more hours each day (Table 3)

Table 1. Sociodemographic profile of the hairdressers

		No. of participants, % (N=100)
Age	18-24	7 (7)
	25-34	27 (27)
	35-44	32 (32)
	45-54	21 (21)
	55-64	12 (12)
	65 and above	1 (1)
Sex	Female	57 (57)
	Male	43 (43)
Marital Status	Single	59 (59)
	Married	38 (38)
	With Live-in Partner	2 (2)
	Separated	1 (1)
Place of Residence	Within NCR	99 (99)
	Outside NCR	1 (1)
Educational Attainment	Pre-school	0 (0)
	Elementary	19 (19)
	High School	53 (53)
	College	20 (20)
	Vocational	2 (2)
	Postgraduate	6 (6)

Table 4 presents the health history of participants, specifically evaluating the presence of risk factors related to having DPLD. Among the participants, 44% reported that they smoke cigarettes and have a history of smoking equivalent to 2.5 pack years (25%) and 5 pack years (18.2%).

A multi-response item is shown in Table 5 regarding the current respiratory symptoms among hairdressers. Twenty seven percent reported having shortness of breath at rest and while doing normal activities while 15% reported having frequent itchy throat.

Despite reported respiratory symptoms, 95% of participants indicated no noticeable changes in their lung or breathing compared to their previous state and they were not currently taking medications for respiratory conditions. Generalized symptoms reported are fatigue (22%) and headache (17%) (Table 6).

Table 7 revealed that 39% of participants have DPLD patterns on their chest X-ray with 55% opacities and 2% lucencies noted among participants.

Most common patterns identified are fine reticular opacities (69.23%) and coarse reticular opacities (25.64%) (Table 8). Most common patterns identified are fine reticular opacities (69.23%) and coarse reticular opacities (25.64%).

Table 2. Working condition - employment

		No. of participants, % (N=100)
Workplace City	Quezon City	42 (42)
	Las Pinas	31 (31)
	Caloocan City	24 (24)
	San Juan	1 (1)
	Valenzuela	1 (1)
	Taguig	1 (1)
Length of Employment	≥ 1 year	8 (8)
	≥ 2 years	17 (17)
	≥ 5 years	35 (35)
	≥ 10 years	40 (40)
Most Common Procedure	Hair color	33 (33)
Performed	Rebond	27 (27)
	Brazilian Blowout	18 (18)
	Shampoo	12 (12)
	Blow Dry	10 (10)
Source of Ventilation	Aircon and Fan	59 (59)
	Air Conditioning	41 (41)

Table 3. Working condition - gas exposure

		n (%)
*Use of Protective Equipment	Face Mask	89 (89)
	Gloves	47 (47)
	Eye Glass	6 (6)
	None	5 (5)
*Salon Vapors	Fumes from Chemicals	83 (83)
	Steam from Hair Iron	42 (42)
	Air from Blower	54 (54)
Length of Exposure to	< 1 hour	13 (13)
Salon Vapors	> 1 hour	13 (13)
	≥ 5 hours	74 (74)

**multi-response item*

Table 4. Health history

		No. of participants, % (N=100)
Cigarette Smoking	Yes	44 (44)
	No	55 (55)
	No, Vape only	1 (1)
Pack Years	≤ 1	7 (7)
	1.25 - 5	31 (31)
	≤ 10	4 (4)
	≤ 20	1 (1)
	≤ 30	1 (1)
	None	56 (56)
History of Pneumonia	Yes	1 (1)
	No	99 (99)
History of PTB	Yes	1 (1)
	No	99 (99)
History of Connective	Rheumatoid Arthritis	4 (4)
Tissue Disorders	None	96 (96)
*Medications for the	Antibiotics	6 (6)
Last 6 months	NSAIDs	10 (10)
	Paracetamol	10 (10)
	Steroids	1 (1)
	Heart Medications	4 (4)
	Chemotherapy Drugs	0 (0)

**multi-response item*

Table 5. Current respiratory symptoms

	Yes n (%)	No n (%)
Itchy throat	15 (15)	85 (85)
Runny Nose	9 (9)	91 (91)
Sneezing	9 (9)	91 (91)
Colds	8 (8)	92 (92)
Chest Tightness	5 (5)	95 (95)
Sore Throat	5 (5)	95 (95)
Dry Cough <8 weeks	5 (5)	95 (95)
Chest Pain	3 (3)	97 (97)
Productive Cough <8 weeks	3 (3)	97 (97)
Shortness of Breath at Rest	3 (3)	97 (97)
Shortness of Breath (Normal Activities)	24 (24)	76 (76)

Table 6. Other symptoms (Last Two Weeks)

	Yes n (%)	No n (%)
Fatigue	22 (22)	78 (78)
Headache	17 (17)	83 (83)
Fever	6 (6)	94 (94)
Weight Loss	3 (4)	97 (97)
Change in Appetite	2 (2)	98 (98)
Changes in Breathing	5 (5)	95 (95)
Taking Lung Medication/s	5 (5)	95 (95)

Table 7. Diffuse parenchymal lung disease patterns on chest X-ray

		No. of participants, % (N=100)
DPLD Presence	Present	39 (39)
	Absent	61 (61)
*DPLD Patterns	Opacities	55 (55)
	Lucencies	2 (2)

**multiple patterns*

Table 8. Specific DPLD patterns

		n (%)
DLPD Patterns	Atelectasis	2 (2)
	Segmental and Lobar Opacities	5 (5)
	Multiple ill-defined Opacities	7 (7)
	Diffuse Airspace Opacities	2 (2)
	Fine Reticular Opacities	27 (27)
	Coarse Reticular Opacities	10 (10)
	Diffuse Fine Opacities	0 (0)
	Solitary Pulmonary Nodule	0 (0)
	Multiple Nodule and Masses	2 (2)
	Hyperlucent Thorax	2 (2)
	Solitary Lucent Defect	0 (0)
	Multiple Lucent Defects	0 (0)
	None	61 (61)
Other Findings	Crowding of Lung Markings due to Hypoaeration	9 (15.4)
	Probable Pulmonary TB	4 (6.84)
	Pleural Thickening	3 (5.1)
	Probable Pleural Effusion	1 (1.7)

Table 9 shows positive associations (RR>1) between DPLD and several factors: employment duration over five years, lack of PPE use, daily exposure to hair iron steam for more than an hour, presence of respiratory symptoms and chemical exposure exceeding five hours per day.

Other characteristics tested for association with having DPLD patterns are listed in Table 10.

The factor that has a statistically significant relationship with DPLD based on logistic regression is those with positive respiratory symptoms (Table 11)

Discussion

Hairdressers and DPLD

A notable proportion of hairdressers (39%) who participated in this study exhibited diffuse parenchymal lung disease (DPLD) patterns on plain chest X-ray. Among the patterns identified, the most common is fine reticular opacities (69.23%) followed by coarse reticular opacities (25.64%). Reticular opacities on chest X-ray is a collection of interlacing net-like linear opacities[8] The most common cause is a chronic progressive scarring of the pulmonary interstitium or an idiopathic pulmonary fibrosis (IPF).[9] Inhalation of specific gasses, fumes and vapors may account for 26% of cases of IPF.[10] The finding is consistent with a case control study which suggested that hairdressing, along with other occupational exposures, has a potential risk for IPF.[11]

This study examined how hairdressers' working circumstances affect DPLD. The data show that 82.05% had worked for over five years. This suggests that hairdressers with long working experience may have structural lung problems (RR>1). DPLD pattern is also positively associated with not using PPE at work, such as face masks. The associations are not well-established in the present literature, thus future longitudinal studies may study these possible DPLD risk variables to strengthen the assumption.

Interestingly, this study found that those who are exposed to salon vapors for more than five hours per day and those with exposure to steam from hair iron for more than an hour daily appeared to have an increased risk of developing DPLD patterns on chest X-ray (RR>1). Hair ironing is usually done after application of rebonding and brazilian keratin treatment agents, as well as after hair coloring, to fix the agent and style the hair. Two things can be

Table 9. Positive associations with DPLD patterns

Characteristic	With DPLD Pattern	Without DPLD Pattern	RR	p-value
>5 Years Employed	32	43	1.524	0.1929
No	7	18	(0.8286 to 3.116)	
Not Using PPE	5	0	2.794	0.0041
Using PPE	34	61	(1.521 to 3.721)	
>1hr Hair Iron Steam Exposure	21	18	1.723	0.0333
No	15	33	(1.043 to 2.895)	
Respiratory Symptoms	19	20	1.486	0.1111
No	20	41	(0.9118 to 2.399)	
>5hrs Salon Vapors Exposure	30	44	1.1712	0.5941
No	9	17	(0.6454 to 2.125)	

Table 10. Other characteristics associated with having DPLD patterns

Characteristic	With DPLD Pattern	Without DPLD Pattern	RR	p-value
Female	23	34	1.084	0.7498
Male	16	27	0.6656 to 1.809	
Hair color	13	20	1.015	0.9548
No	26	41	0.5899 to 1.661	
Rebond	12	15	1.202	0.4972
No	27	46	0.6931 to 1.948	
Shampoo	6	6	1.333	0.4050
No	33	55	0.6481 to 2.234	
Blow Dry	4	6	1.029	0.9455
No	35	55	0.4191 to 1.930	
Brazilian Blowout	4	14	0.5206	0.1070
No	35	47	0.2050 to 1.123	
Fumes from Chemicals	32	51	0.9363	0.8400
No	7	10	0.5432 to 1.869	
Steam from Hair Iron	21	21	1.611	0.0550
No	18	40	0.9899 to 2.632	
Air from Blower	24	30	1.363	0.2265
No	15	31	0.8297 to 2.299	
>1hr Exposure	36	51	1.793	0.2070
No	3	10	0.7779 to 5.182	
Smoking	17	28	0.9444	0.8207
No	22	33	0.5708 to 1.537	

Table 11. Logistic regression of selected factors

Factors	OR	95% CI	p-value
>5 Years Employment	1.60	-0.5746 to 1.5203	0.3762
>5 hrs Salon Vapors Exposure	0.93	-1.1244 to 0.9714	0.8862
>1 hr Hair Iron Steam Exposure	1.21	-0.7291 to 1.1143	0.6821
With Respiratory Symptoms	5.19	0.3122 to 2.9818	0.0156

inferred from this result: 1) the steam from hair iron produces the actual respiratory damage or 2) ironing the hair after application of chemicals may result in chemical reactions which aggravate formation of toxic gasses. The stimulus for DPLD is generally believed to be inhalation of inorganic gasses. This toxin exposure injured the pulmonary parenchyma leading to recruitment and activation of inflammatory and immune responses and fibroblast recruitment, hence fibrosis.[12]

Hairdressers and Respiratory Symptoms

Some of the hairdressers reported experiencing shortness of breath at rest and during normal activities (27%), as well as frequent throat irritation (15%). Among those with respiratory symptoms, almost half exhibited DPLD patterns on chest X-rays, with positive relationship on logistic regression. This finding aligns with another study that found respiratory symptoms, such as shortness of breath, to be significantly more common in hairdressers than in a reference group.[13] The same study also reported a significant reduction in lung function parameters—including vital capacity, FVC and FEV1—in hairdressers, supporting another notable observation from chest X-rays: 15% of participants showed hypoaerated lungs, evident as crowding of lung markings.

Conclusion

The findings of this study indicate that the prevalence of diffuse parenchymal lung disease among hairdressers is 39%, which corresponds to a similar prevalence rate of 39% for respiratory symptoms within this population. The primary factor most strongly associated with diffuse parenchymal lung disease is the presence of respiratory symptoms. Additionally, the analysis identified other factors with statistically significant positive associations, including the non-use of personal protective equipment (PPE) and the inhalation of steam from hair iron. While the duration of employment and daily exposure exceeding five hours were also correlated with the disease, these associations did not reach statistical significance.

Recommendation

According to this study's data, salons can improve employee safety and decrease the occurrence of diffuse parenchymal lung disease by implementing these recommendations:

Employers must mandate the use of personal protective equipment to reduce the risk of respiratory symptoms and related pulmonary diseases.

Implement frequent training sessions to inform staff about the hazards inherent in their work environment, especially about the inhalation of steam during hair ironing procedures over one hour and other potentially detrimental tools.

Salons must track employee exposure durations and contemplate instituting procedures to restrict daily exposure to hazardous situations, especially for hairdressers over five hours.

Regular health screenings for personnel displaying respiratory symptoms should be instituted to enable early detection and intervention for diffuse parenchymal lung disease.

References

1. Kifjak D, Leitner J, Ambros R, Heidinger BH, Milos R-I, Beer L, et al. Chest radiography findings in diffuse parenchymal lung diseases. Der Radiologe 2022 Jan 7;62(2):130–9. doi:10.1007/s00117-021-00955-8
2. Antoine MH, Mlika M. Interstitial Lung Disease. 2023 Jul 31. In: StatPearls [Internet] Treasure Island (FL): StatPearls Publishing; 2024 Jan–.
3. Dzamatira D. Patterns of lung parenchymal disease on chest radiographs - a sport-themed pictorial. Radiopaedia.org. 2022 Jul 16; doi:10.53347/rid-96777
4. Kim I, Lee H, Kang BH, Lee DH, Nam YH, Roh MS, et al. Chronic obstructive lung disease after ammonia inhalation burns: A report of two cases. Kosin Med J 2022 Dec 31;37(4):354–60. doi:10.7180/kmj.22.004
5. Maneli MH, Smith P, Khumalo NP. Elevated formaldehyde concentration in "Brazilian keratin type" hair-straightening products: a cross-sectional study. J Am Acad Dermatol 2014 Feb;70(2):276-80. doi: 10.1016/j.jaad.2013.10.023. Epub 2013 Dec 9.
6. Tesfaye S, Hamba N, Gerbi A, Negeri Z. Occupational formaldehyde exposure linked to increased systemic health impairments and counteracting beneficial effects of selected antioxidants. Alexandria J Med 2021 Jan 1;57(1):157–67. doi:10.1080/20905068.2021.1926172
7. Moscato G, Pignatti P, Yacoub M-R, Romano C, Spezia S, Perfetti L. Occupational asthma and occupational rhinitis in hairdressers. Chest 2005 Nov;128(5):3590–8. doi:10.1378/chest.128.5.3590
8. Hansell DM, Bankier AA, MacMahon H, McLoud TC, Müller NL, Remy J. Fleischner Society: Glossary of terms for thoracic imaging. Radiology 2008 Mar;246(3):697–722. doi:10.1148/radiol.2462070712
9. Oikonomou A, Prassopoulos P. Mimics in chest disease: Interstitial opacities. Insights into Imaging 2012 Dec 18;4(1):9–27. doi:10.1007/s13244-012-0207-7

10. Blanc PD, Annesi-Maesano I, Balmes JR, Cummings KJ, Fishwick D, Miedinger D, et al. The occupational burden of nonmalignant respiratory diseases. An official american thoracic society and european respiratory society statement. Am J Respir Crit Care Med 2019; 199:1312–34. doi: 10.1164/rccm.201904-0717ST
11. Kathy B. Baumgartner, Jonathan M. Samet, David B. Coultas, Christine A. Stidley, William C. Hunt, Thomas V. Colby, James A. Waldron, Collaborating Centers. Occupational and Environmental Risk Factors for Idiopathic pulmonary fibrosis: A multicenter case-control study. Am J Epidemiol 2000; 152(4): 15 August 2000, Pages 307–15, https://doi.org/10.1093/aje/152.4.307
12. Weinberger SE, Cockrill BA, Mandel J. Principles of pulmonary medicine. Philadelphia, PA: Elsevier; 2024.
13. Heibati B, Jaakkola MS, Lajunen TK, Ducatman A, Bamshad Z, Eslamizad S, et al. Occupational exposures and respiratory symptoms and lung function among hairdressers in Iran: A cross-sectional study. Int Arch Occup Environ Health 2021 Jan 18;94(5):877–87. doi:10.1007/s00420-020-01645-z

Practice patterns on the non-surgical management of intermittent exotropia among members of the Philippine Society of Pediatric Ophthalmology and Strabismus: a cross-sectional study

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Abstract

Objective Intermittent exotropia (IXT) is the most common form of strabismus that warrants standardized management for better and predictable outcomes. Currently there are no preferred practice guidelines on the non-surgical management of IXT. Among the aforementioned methods, orthoptics is the most favored by optometrists and ophthalmologists based in China and Israel. However, consensus statements on the use of such modality are yet to be established. This study aimed to identify preferred non-surgical management strategies for intermittent exotropia (IXT) among members of the Philippine Society of Pediatric Ophthalmology and Strabismus (PSPOS).

Methods The survey collected data on respondent and patient demographics, perceived causes of IXT, clinical course, and management preferences. Incomplete responses were excluded, and data were analyzed using frequency distribution and the Fisher test.

Results Forty of 54 (74%) PSPOS members participated, predominantly from urban settings (34 respondents). Most IXT cases were children aged 4 to 11 years. The proportion of pediatric patients was not significantly influenced by respondents' age (p=0.1628) or practice region (p=0.451). Twenty-one (52.5%) respondents cited fusion defects as the primary cause of IXT. While twenty-one noted an unpredictable course, 14 identified it as a progressive course. Overminus lenses were preferred for younger patients (1-4 years), with an increasing preference for orthoptics in older age groups (5 to>18 years). Pediatric ophthalmologists aged 30 to 40 years (p=0.005) and those with 1 to 5 years of experience (p=0.020) favored overminus lenses for 5-10-year-olds. Preference for overminus lenses was stronger outside the NCR (p=0.044). Furthermore, 90% of respondents said surgery shouldn't be performed at diagnosis, and 42.5% of respondents were against it for younger ages.

Conclusions The findings revealed a strong preference for overminus lenses among PSPOS members, with increasing use of orthoptics for older patients. Factors influencing management decisions included respondent age, practice region, and perceptions of IXT's cause and course. Future randomized controlled trials are essential to evaluate non-surgical interventions and develop comprehensive treatment guidelines.

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Intermittent exotropia (IXT) is the most common form of strabismus that warrants standardized management for better and predictable outcomes.[1] IXT can lead to possible loss of stereopsis and amblyopia

since the development of the visual cortex requires the transmission of a sharp image as a stimulus.[2] Amblyopia is particularly debilitating since it involves a decrease in vision that, if not treated early enough, becomes permanent even if the ocular pathology is removed later on in life.[3]

While extraocular muscle surgery is an option for addressing ocular misalignment, non-surgical alternatives are initially considered due to the general risks associated with surgery, including infection, severe inflammation, potential under correction, consecutive esotropia, and the risk of retinal detachment[4,5]. The use of non-invasive modalities such as prisms, over minus lenses, orthoptic exercises, and part-time patching allows for more accurate diagnosis, quantification of the amount of deviation and prevention of amblyopia.[4,5]

Currently there are no preferred practice guidelines on the non-surgical management of IXT.[6] Among the aforementioned methods, orthoptics is the most favored by optometrists and ophthalmologists based in China and Israel.[4,7] However, consensus statements on the use of such modality are yet to be established. This study aimed to survey the practice patterns of the Philippine Society of Pediatric Ophthalmology and Strabismus (PSPOS) members in managing intermittent XT through an online survey. The PSPOS is an organization of fellowship-trained pediatric ophthalmologists, with a current membership of 54 professionals practicing across the Philippines. This study may aid in streamlining existing management strategies. Additionally, such findings may serve as a practical guide for general ophthalmologists and trainees lacking access to pediatric ophthalmology consultation.

Methods

This study was approved by the Ethics Review Committee of the UERMMMCI Research Institute for Health Sciences (RIHS ERC Code: 1695/H/2024/062). The authors conducted a cross-sectional, questionnaire-based study among pediatric ophthalmologists and strabismologists across the Philippines through PSPOS to examine the preferred nonsurgical methods for managing intermittent exotropia. Through the PSPOS Viber conversation group, a link to the informed consent was shared, outlining the goals, methods, and data security protocols of the study. All of the 54 PSPOS members were asked to take part in the research. Although some participants were permitted to select 'other' if the options did not align with their preferences, all participants were obliged to respond to it. Participants were prompted before moving on to the next portion if a question remained unanswered. The survey questions were adapted from a survey conducted in China, with modifications and additions made by the investigators of this study[4]. Prior consent for the use of these questions was obtained. The final list of questions was evaluated by eight pediatric ophthalmology fellows in training under PSPOS member consultants. Only questions with a mean acceptance rating of 80% or higher were included in this study.

The finalized survey questions were categorized into demographics, practice characteristics, clinical opinions, and preferences. An electronic questionnaire was administered via www.kwiksurveys.com.

To be included in the study, respondents must have access to an electronic device and internet connection and must have consented to participate in the survey. Responses were excluded if the respondent did not complete the online survey.

The demographics, characteristics of their practice, clinical opinions, and preferences were presented using descriptive statistics. Subgroup analysis was done looking into participant's age in years (31-40, 41-50, 51 and above), years of practice (1-5, 6-10, 11-15, greater than 15 years), region of practice, practice profile. The Fisher test with a significance p-value of 0.05 was used to determine significant differences in opinion between subgroups.

Results

Strabismologist Profile and Practice Profile

Of the 54 current PSPOS members invited to participate, 40 members responded (74.1%). The respondents' ages ranged from 30 to 80 years. The majority were female (65%), and most (85%) practiced in metropolitan areas, with 21 (52.5%) respondents indicating they spent more time in the city than in the province. In terms of regional distribution, 25 (62.5%) respondents practiced in the National Capital Region (NCR), followed by Region IV-A (Calabarzon) and Region III (Central Luzon). Most respondents had been practicing as strabismologists for one to five years. Intermittent exotropia (IXT) affected between 20% and 50% of the individuals they treated and

most IXT patients were between the ages of 4 and 11 (Table 1).

Intermittent Exotropia: Etiology

The factors that respondents considered as the main cause of IXT are shown in Table 2. Of the 40 respondents, 21 (52.5%) considered fusion mechanism defects as the main cause of IXT. Notably, eight (20%) were uncertain of the cause and two (5%) respondents chose the "other" options which they identified as multifactorial and genetic causes.

Natural Course Without Intervention

There were 21 (52.5%) who believed that IXT could be progressive, stable, or improve over time, while 14 (35%) believed the condition was solely progressive. Only a few considered the disease to be stable (12.5%), and none believed it would improve spontaneously (Table 3).

Non-surgical Management

As shown in Tables 4 and 5, 12 (30%) respondents preferred using the same nonsurgical management

Table 1. Demographics of respondents and patients

		Frequency (n=40)	Relative Frequency
Gender	Male Female	14 26	35% 65%
Age	31-40 41-50 51 above	12 19 9	30% 47.5% 22.5%
Years in practice	1 - 5 6 -10 11 - 15 >15	13 10 8 9	32.5% 25% 20% 22.5%
Percent of practice in urban areas	<5% 6 - 10% 11 - 20% 21 - 50% 51 - 100%	6 3 2 8 21	15% 7.5% 5% 20% 52.5%
Percent of practice dealing with pediatric patients	6 -10% 11 - 20% 21 - 50% 51 -100%	7 3 7 23	17.5% 7.5% 17.5% 57.5%
Percentage of patients with IXT in a month	<5% 6 -10% 11 -20% 21 - 49% 50 -100%	2 4 16 14 4	5% 10% 40% 35% 10%
Place of Practice	NCR Region IV-A Region III Region V Region VI Region VII Region X	25 5 3 2 2 2 1	62.5% 12.5% 7.5% 5% 5% 5% 2.5%
Age group when IXT is diagnosed	4 -11(School Age) 11 - 18 (Adolescent)	39 1	97.5% 2.5%

method across all age groups while 28 (70%) chose different methods depending on the child's age. Among these, seven (17.5%) selected overminus lenses as their preferred method, while two (5%) preferred observations, two (5%) chose part-time patching, and one (2.5%) opted to correct refractive errors based on the specific refractive situation. Of the 12 respondents, eight frequently use overminus lenses, 2 use part-time patching, 1 uses botulinum injection, and 1 prefers observation.

Tables 4 and 5 are the preferences per age group of the remaining 28 respondents. For the ages 1 to 4yo, 15 out of 28 (53.6%) preferred overminus lenses and considered it as effective management, this was followed by observation and part time patching. Their choice was they saw good compliance with these methods and that the provision of a good retinal image was essential for this age group. Three of the respondents chose to provide unadjusted refraction and one mentioned enforcing the reduction of gadget use as an option to lessen the likelihood of furthering the development of high refractive error.

For the age group of 5-10 years, 12 out of 28 participants (42.9%) identified overminus lenses as the most effective option for them, while 14 participants (50%) selected it as the most frequently used choice. A total of 8 participants (28.6%) and 6 participants (21.4%) out of 28 identified orthoptics as the most effective and most frequently used options, respectively. The primary objectives for this age group were to establish a clear vision, prevent amblyopia, and to improve the deviation. Overminus glasses was chosen as the preferred management in 12 (42.9%) of 28 and frequently used in 10 (35.7%) of 28 for the age group of 11-18. A greater percentage chose orthoptics for this group, with 8 (28.6%) and 9 (32.1) choosing it for most effective and most frequently used respectively (Table 4).

For patients older than 18 years old, an equal number of respondents chose overminus and orthoptic exercises, with 9 choosing it as most effective and 8 choosing it as most frequently used.

Subsequently, the respondents were asked if supplemental treatment was needed and what their choice of management was. Eighteen out of 40 (45%) chose orthoptic exercises as the most frequent option followed by part time patching (22.5%) as seen in Table 6.

Timing of Surgery

The respondents were asked regarding the choice of early surgery to gain superior sensory outcomes based on these timings: (a) surgery at a younger

Table 2. Factors that practitioners considered as the main cause of intermittent exotropia

Factors	Response (N=40), No (%)
Defects of fusion mechanism	**21 (52.5%)**
Defects of other cortical mechanisms	5 (12.5%)
Abnormality of extraocular muscles	4 (10%)
Uncertain	8 (20%)
Other (Inheritance, Mixed)	2 (5%)

Table 3. The clinical course of the natural course of intermittent exotropia without intervention

Timing of surgery	Response	No (%)
Progressive	14	35%
Stable	5	12.5%
Improve	0	0%
Each of the above is possible	21	52.5%
Total	**40**	**100%**

Table 4. Most effective non-surgical options for patients with intermittent exotropia

Interventions	Any age (N=12)	1-4yo (N=28)	5-10yo (N=28)	11-18yo (N=28)	>18yo (N=28)
Overminus lenses	7(58.3%)	15 (53.6%)	12(42.9%)	12(42.9%)	9(32.1%)
Part-time patching	2(16.7%)	4 (14.3%)	1(3.57%)	1(3.57%)	1(3.6%)
Observation	2(16.7%)	4 (14.3%)	4(14.3%)	4	4(14.3%)
Orthoptic exercises	0(0%)	2 (7.1%)	8(28.6%)	8	9(32.1%)
Prisms	0(0%)	0(0%)	0(0%)	0(0%)	1(3.6%)
Botulinum toxin A injection	0(0%)	0(0%)	0(0%)	0(0%)	1(3.6%)
Others	1((0%)	3(10.7%)	3(10.7%)	3	3(10.7%)

Table 5. Non-surgical options for patients with intermittent exotropia

Interventions	Any age (N=12)	1-4yo (N=28)	5-10yo (N=28)	11-18yo (N=28)	>18yo (N=28)
Overminus lenses	8(66.7%)	15(53.6%)	14(50%)	10(35.7%)	8(28.6%)
Part-time patching	2(16.7%)	4(14.3%)	1(3.6%)	1(3.6%)	1(3.6%)
Orthoptic exercises	0(0%)	1(3.6%)	6(21.4%)	9(32.1%)	8(28.6%)
Observation	1(8.3%	5(17.9%)	4(14.3%)	5(17.9%)	4(14.3%)
Botulinum toxin A injection	1(8.3%)	0(0%)	0(0%)	0(0%)	0(0%)
Prisms	0(0%)	0(0%)	0(0%)	0(0%)	4(14.3%)
Others	0(0%)	3(10.7%)	3(10.7%)	3(10.7%)	3(10.7%)

Table 6 Supplementary treatment for patients with intermittent exotropia

Interventions	Any Age
Orthoptic exercises	18(45%)
Part-time patching	9(22.5%)
Overminus lenses	6(15%)
Prisms	2(5%)
Observation	2(5%)
Others (Surgery)	3(7.5%)

age; (b) surgery within the critical period or time when stereopsis is susceptible (around 3-6 months)[8] (c) surgery at initial IXT diagnosis; and (d) surgery while the severity of IXT increases in terms of either angle of exodeviation or control of exodeviation or stereoacuity. Seventeen (42.5%) respondents disagreed with the idea of surgery at a younger age while 13 (32.5%) agreed and 10 (25%) were uncertain (Table 7). Thirty-nine out of 40 (97.5%) said that surgery would be done when the deviation worsened while 28 out of 40 (70%) agreed that surgery should be done at the critical period and. On the other hand, 36 out of 40 (90%) disagreed that surgery would be done at the time of diagnosis or shortly after.

The percentage of pediatric patients seen by respondents was not influenced by age (p = 0.1628) or region of practice (p = 0.451). Additionally, the duration of practice and the age of the respondent did not demonstrate an impact on their preferred nonsurgical management approach. Given the variation in preferences across regions, the authors examined the relationship between the practice region and the perceived primary cause of IXT. No significant difference was observed between the NCR region and the other regions (p = 0.764). Respondents aged 30 to 40 years (p= .005), who have between 1 and 5 years of pediatric ophthalmology practice (p= 0.020), demonstrated a preference for the use of overminus lenses for patients in the 5–10-year age group. A comparison of the combined regions to the National Capital Region revealed a significant preference for the use of overminus lenses among children aged 1-4 years in the other regions (p= 0.044). A difference in preference for NCR was noted, with some individuals choosing to observe while others engaged in part-time patching as the initial management approach. For respondents outside NCR, the utilization of overminus lenses continued to dominate among various age groups, accounting for 60%, 66.67%, and 60% for the ages of 5-10 years, 11-18 years, and over 18 years, respectively. A preference for the use of overminus lenses was observed among individuals who attributed the primary cause of IXT to abnormalities in extraocular muscles or defects in the fusion mechanism across the age groups of 5 to 10 years (p= 0.008), 11 to 18 years (p= 0.008), and those older than 18 years (p= 0.041). Respondents who viewed IXT as progressive or capable of development in either direction also demonstrated a preference for overminus lenses for children aged 1 to 4 years (p= 0.025).

Discussion

Non-surgical Management

In this study, the authors focused on presenting clinical opinions of pediatric ophthalmologists rather than provide a practice pattern or a consensus. Ophthalmologists of the PSPOS considered overminus lenses as the most effective non-surgical management option for all age groups and used them most frequently in their practice in the management of IXT. A majority viewed IXT as having an unpredictable course and tended to prefer employing initially non-surgical methods.

This study showed respondents' preference for overminus lenses and part time patching in the younger age groups (1 to 4year old) with a proportionate increase in tendency to use orthoptics for progressively older age groups (5 to >18 year old). The present study is aligned with research conducted in the UK, which indicated that these two methods were favored among individuals aged one to three.[9] In an Israeli survey on practice patterns, 57% of pediatric ophthalmologists were noted to be using overminus lenses.[10] In addition, the Pediatric Eye Disease Investigator Group

Table 7. Respondents' opinions regarding timing of surgery for intermittent exotropia

Timing of surgery	Agree	Disagree	Uncertain
Surgery while the severity of IXT increases (angle of deviation, control, stereoacuity)	39 (97.5%)	0 (0%)	1 (2.5%)
Surgery within the critical period	28 (70%)	6 (15%)	6 (15%)
Surgery at a younger age	13 (32.5%)	17(42.5%)	10 (25%)
Surgery at initial IXT diagnosis	0 (0%)	36 (90%)	4 (10%)

(PEDIG), a collaborative network of ophthalmologists and optometrists conducting clinical research on childhood eye disorders, including strabismus and amblyopia, found that patients on overminus lenses gained improved distance exotropia control.[11]

Several studies have supported the use of orthoptics in older age groups. An analysis of pooled success rates showed that orthoptics demonstrated the highest success among non-surgical approaches for IXT notwithstanding the study's limitation due to the absence of a standardized definition of success.[12] A study conducted in Hong Kong demonstrated that orthoptic exercises were taught to a group of 117 children with intermittent exotropia (IXT), indicating that this management strategy is widely recognized in the region.[13] An Israeli survey on practice patterns revealed that 66% of respondents, including optometrists and ophthalmologists, expressed a preference for orthoptic exercises.[10] According to a cross-sectional survey in China, orthoptic exercises were the most popular and widely used approach to managing IXT.[4]

Orthoptic activities were preferred by Chinese ophthalmologists and by Israeli optometrists and ophthalmologists in a practice pattern survey.[4,10] In contrast, a survey study conducted by the American Association for Pediatric Ophthalmology and Strabismus (AAPOS) showed that 48% of the respondents rarely or never used non-surgical interventions.[4,14] Of those who did use non-surgical measures, part-time patching (46%) was the most used followed by minus lenses (34%). The authors assumed that the preference for non-surgical options observed in our study was attributed to the prohibitive cost and limited government subsidy for surgery and hesitancy of caregivers to proceed with surgery.

Etiology and Progression of IXT

Generally speaking, it is yet unknown how effective each nonsurgical technique is in comparison to the others.[15] The preference for overminus lenses over alternative non-surgical solutions was not obtained from the authors' survey. The respondents' perception that IXT is a condition brought on by a fusion defect was supported by the selection of overminus lenses. Overcorrecting minus lenses promote accommodative convergence and aid in exodeviation control, as detailed in a prior study.[16] The authors hypothesized that the Philippines' poor health-seeking behavior, particularly by the underprivileged populations, and the difficulties of enforcing compliance are additional factors.[17] Given the unpredictable weather in the nation, overminus lenses provide a simpler option to increase compliance, with follow-ups potentially occurring every six to twelve months.

Surgical Timing

The timing of surgery for IXT has been a topic of discussion and its role in achieving superior sensory outcomes.[18] In the authors' survey, 90% of the respondents believed that surgery for IXT should be avoided on initial diagnosis and only 32.5% agreed with the view that surgery should be done in younger age groups. This finding suggests that most of the practitioners would opt for non-surgical options initially. This is similar to findings in a study in China where only a minority agreed to surgery at initial diagnosis (23%) and surgery for younger age groups (19%).[4] This may be due to a noted incidence of small angle esotropia following surgery on young children.[16]

Strengths

This study had several strengths. First, the questionnaire covered demographics, practice characteristics, and clinical opinions to assess practitioners' strabismus management views. Second, ophthalmologists and trainees helped write the survey questions, improving their content validity. Verification with practitioners allowed for expert feedback and refinement. Thirdly, participant anonymity and voluntary participation may have improved response honesty and reliability.

Limitations

This study was limited by the response rate (74.1%) failing to sample the entire population of PSPOS members. No previous surveys of this population were found. However, this study is likely to be a good representation since response rates were higher than previous studies on IXT practice preferences[4,10] and we saw that the regional distribution of respondents in the study mirrored the distribution of ophthalmologists in the Philippines.[19] Like all surveys, reported opinions

may vary from actual behavior. Even though the most common approach was requested, recall bias may still exist. Since our survey only asked about the "most frequent" option, we could not determine the real frequency of each management approach. Part of this questioning was to keep the questionnaire brief.

Conclusion

In conclusion, this study showed that overminus lenses was the preferred non-surgical management for all age groups. But for 18 years and older, orthoptics use and overminus lenses were equally preferred. Factors that affected the decision to do non-surgical management included age of the respondent, region of practice and the perceived cause and course for IXT. Given the high prevalence of IXT in studies and present data, the authors' findings proposed that future randomized controlled trials be conducted to determine effectiveness of nonsurgical interventions and to establish treatment guidelines for IXT.

References

1. Govindan M, Mohney BG, Diehl NN, Burke JP. Incidence and types of childhood exotropia: a population-based study. Ophthalmology 2005 Jan;112(1):104–8. doi:10.1016/j.ophtha.2004.07.033.
2. Lavrich JB. Intermittent exotropia: continued controversies and current management. Curr Opin Ophthalmol 2015 Jul;26(5):375–81. doi:10.1097/ICU.0000000000000188.
3. Xu M, Zheng F, Peng Y, Wang C, Lou J, Yu H, et al. Effects of orthoptic therapy in children with intermittent exotropia after surgery: study protocol for a randomized controlled trial. Trials 2022;23(1):289. doi:10.1186/s13063-022-06246-4.
4. Wu Y, Peng T, Zhou J, Xu M, Gao Y, Zhou J, et al. A survey of clinical opinions and preferences on the non-surgical management of intermittent exotropia in China. J Binocul Vis Ocul Motil 2021 Oct–Dec;71(4):167–74. Epub 2021 Aug 27.
5. Pathai S, Cumberland PM, Rahi JS. Prevalence of and early-life influences on childhood strabismus: findings from the Millennium Cohort Study. Arch Pediatr Adolesc Med 2010;164:250–7.
6. Blair K, Cibis G, Gulani AC. Amblyopia. [Updated 2022 Dec 26]. In: StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing; 2023 Jan–. Available from: https://www.ncbi.nlm.nih.gov/books/NBK430890/.
7. Hardesty HH, Boynton JR, Keenan JP. Treatment of intermittent exotropia. Arch Ophthalmol 1978;96(2):268–74. doi:10.1001/archopht.1978.03910050136006.
8. Fawcett SL, Wang Y & Birch EE. The Critical Period for Susceptibility of Human Stereopsis. Investigative Ophthalmology & Visual Science 2005; 46(2): 521. https://doi.org/10.1167/iovs.04-0175
9. Buck D, Powell C, Cumberland P, Davis H, Dawson E, Rahi J, et al.; Improving Outcomes in Intermittent Exotropia Study Group. Presenting features and early management of childhood intermittent exotropia in the UK: inception cohort study. Br J Ophthalmol 2009 Dec;93(12):1620–4. doi:10.1136/bjo.2008.152975. Epub 2009 Jul 15.
10. Barnett-Itzhaki G, Friehmann A, Barnett-Itzhaki Z, Ela-Dalman N. Diagnosis and management practice patterns among pediatric ophthalmology personnel in Israel. J Binocul Vis Ocul Motil 2019;69(1):34–41. doi:10.1080/2576117x.2019.158155.
11. Chen AM, Erzurum SA, Chandler DL, Holmes JM, Wallace DK, Arnold RW, et al. Overminus lens therapy for children 3 to 10 years of age with intermittent exotropia: a randomized clinical trial. JAMA Ophthalmol 2021;139(4):464–76. doi:10.1001/jamaophthalmol.2021.0082.
12. Coffey B, Wick B, Cotter S, Scharre J, Horner D. Treatment options in intermittent exotropia: a critical appraisal. Optom Vis Sci 1992;69(5):386–404. doi:10.1097/00006324-199205000-00008.
13. Kwok JJSW, Wong GY, Choy BN, Chan CW, Lai WW. The natural course of intermittent exotropia over a 3-year period and the factors predicting the control deterioration. Sci Rep 2016;6:27113. doi:10.1038/srep27113.
14. Romano PE, Wilson MF. Survey of current management of intermittent exotropia in the USA and Canada. In: Campos EC, editor. Strabismus and Ocular Motility Disorders: Proceedings of the Sixth Meeting of the International Strabismological Association Surfers Paradise, Australia, 1990. UK: Macmillan Education 1990; 391–6.
15. Hatt SR, Gnanaraj L. Interventions for intermittent exotropia. Cochrane Database Syst Rev 2013;(5):CD003737. doi:10.1002/14651858.CD003737.pub3.
16. Caltrider N, Jampolsky A. Overcorrecting minus lens therapy for treatment of intermittent exotropia. Ophthalmology 1983;90(10):1160–5. doi:10.1016/S0161-6420(83)34412-2.
17. Kawi J, Fudolig M, Serafica R, Reyes AT, Sy F, Leyva EWA, Evangelista LS. Health information sources and health-seeking behaviours of Filipinos living in medically underserved communities: Empirical quantitative research. Nurs Open 2024 Mar;11(3):e2140. doi: 10.1002/nop2.2140.
18. Richard JM, Parks MM. Intermittent exotropia: surgical results in different age groups. Ophthalmology 1983 Oct;90(10):1172–7. doi:10.1016/S0161-6420(83)34410-9.
19. Tan RJ, Singson RMC, Rondaris MVA. Distribution of ophthalmologists in the Philippines. ResearchGate 2023. doi:10.13140/RG.2.2.24281.08803.

Knowledge, attitude and practices of college students in a public university on microplastics and its health effects: a cross-sectional study

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Abstract

Background Microplastics pose a significant environmental and health threat, yet the understanding and response of young adults to this issue remain underexplored. There is an increasing amount of microplastics in our environment and as the numbers grow, the danger that comes with it is still not fully understood. This study aimed to explore the knowledge, attitudes, and practices (KAP) of young adults in Muntinlupa, particularly students of a public university regarding microplastics and their health implications.

Methods Employing a quantitative cross-sectional design, the research targeted college students aged 18 and older.

Results Findings revealed that while students were knowledgeable about microplastics—particularly their harmful effects on health—attitudes and practices related to plastic disposal and recycling could be improved. Although the majority engaged in proper garbage disposal, only 41.5% consistently separated plastic waste from biodegradable materials. However, a weak positive correlation between knowledge and attitudes was observed, suggesting that increased awareness may enhance positive attitudes toward reducing microplastic pollution.

Conclusion These results suggest that while students are aware of microplastics and generally responded positively, there remains a gap in the translation of knowledge into practices, highlighting the need for enhanced educational interventions.

Key words: Microplastics, knowledge, attitudes, and practices, young adult

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The increasing concern on the prevalence of global plastic use has been a rampant issue over the past years as these products do not completely decompose but only turn into very small particles called microplastics. Microplastics can be found everywhere and have been detected in drinking water, livestock, and air that humans breathe[1,2,3]. In humans, microplastics have been detected in blood, urine,

semen, breast milk, and in organs such as the lungs, placenta, testicles, bone marrow and most recently in the brain which showed plastic accumulation levels 20 times that of other organs[4].

In 2023, the estimated daily plastic consumption in the Philippines was estimated at around 163 million plastic sachets with only 28% being recycled and the remaining 72% were left to be degraded resulting in an increasing number of microplastics[5]. The presence of microplastics suspended in the ambient air in Metro Manila was found with the highest concentrations above Mandaluyong City and Muntinlupa[3]. With the increasing level of microplastics deposited in the environment every year, there is an urgent need to study microplastics. The research can raise concerns and awareness regarding microplastics as they are a problem in the community which has potentially major impacts in the future.[6] It can serve as the foundation for future activities or programs advocating for the lessened use of plastics in the community.

To date, there is a paucity of research in the Philippines regarding the knowledge and awareness of Filipinos in relation to microplastics and its possible health impacts. With this, the study focused on determining the relationship of knowledge, attitude, and practices (KAP) of students from a public university regarding microplastics and their health effects, specifically (a) to determine the level of knowledge of students regarding microplastics and its health effects, (b) to determine the attitude of students regarding microplastics use, (c) to determine the practice of students regarding microplastics use, (d) to correlate the knowledge and the practices of students on microplastics, and (e) to correlate the practices and attitudes of students on microplastics.

Methods

This study was approved by the UERM RIHS Ethics Review Committee (RIHS ERC Code: 1691/C/2024/058). A cross-sectional design was utilized and an online questionnaire was used to collect the data from the eligible, 18 years and older college students of a public university, to evaluate their knowledge, attitudes and practices regarding the use of microplastics and its effects on their overall health. The students should also reside in that city.

The students were chosen for this study because the city has one of Metro Manila's highest microplastic concentrations. As a public university, its varied student body offered a variety of perspectives and experiences that could inform the study. Purposive sampling was used in this investigation.

The survey questionnaire included questions derived from earlier studies, along with additional questions developed by the researchers.[7,8] Before distribution, these supplementary questions were validated. The questionnaire was structured with an initial section that encompassed profiling questions and informed consent. Demographic data collected include age, course, sex and current year level. The subsequent section was divided into three distinct parts. The initial section comprised five questions designed to evaluate participants' understanding of microplastics. The second part comprised six questions aimed at examining participants' attitudes towards microplastics. The final section comprised seven questions pertaining to practices associated with microplastics. The options available for each question included 'Strongly Disagree', 'Disagree', 'Undecided/ Neutral', 'Agree' and 'Strongly Agree'. This section ought to analyze individuals' perceptions and practices regarding microplastics.

Ten questions on a five-point Likert scale assessed knowledge of microplastics. All responses on each item were tallied according to its frequency. Responses categorized as Strongly Disagree was assigned a weight of 1, Disagree was assigned a weight of 2, Undecided/Neutral was assigned a weight of 3, Agree was assigned a weight of 4, and Strongly Agree was assigned a weight of 5. Weighted mean was computed for each item together with the standard deviation to assess which statements they were knowledgeable about. An overall mean and standard deviation were computed based on the scores for each item. Respondents were classified as "knowledgeable" regarding microplastics and their health effects if their overall mean scores were 3 or above, and as "not knowledgeable" if their scores fell below 3.

With regards to the attitude of participants regarding microplastics, 5 questions with five-point Likert's scale were utilized. Weighted mean, and standard deviation were computed for each item and as well as the overall scores for the attitude questions. Respondents were categorized as having "good attitude" on microplastics and their health effects if the overall mean score was 3 or above, while "poor attitude" if scores were below 3.

Lastly, the practice level of participants towards microplastics was determined where the weighted mean below 3 are considered as "poor practice" while a score of 3 and above meant "good practice".

Descriptive analysis was utilized to summarize participants' socio demographic characteristics, knowledge on microplastics and its health effects, attitude towards microplastics, and perception to prevent increased microplastic exposure.

Results

Demographics

A total of 429 responses were collected but only 424 participants were eligible and completed the study. Shown below is the demographics of the population. Out of the total number of respondents, 55% are female. The 20-year-olds made up about a quarter of the total respondents. Majority were second- and third-year students (Table 1).

The largest group of respondents, making up 30.4%, were BS Criminology students followed by Bachelor in Elementary Education students, who represented 19.3% of the respondents (Figure 1).

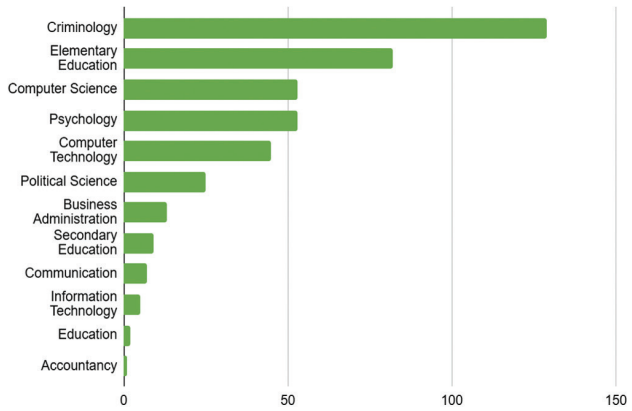

Figure 1. Degree program of participants

Knowledge on Microplastics

The sample was "knowledgeable" with a mean knowledge score of 3.41. More than half of participants agreed that microplastics are "tiny pellets made of plastics and small pieces formed during the breakdown of plastics" and "synthetic polymers used in cosmetic products. When given claims about microplastics' common sources, such as being dissolved in water, only 38.7% agreed while the majority were undecided to disagree. In response

Table 1. Demographics of participants.

Participants	Frequency	Percentage (%)
Male	191	45
Female	233	55
Age		
18	44	10.4
19	89	21
20	104	24.5
21	81	19.1
22	46	10.8
23	24	5.7
24 and older	36	8.5
Year level		
1st year	51	12
2nd year	192	45.3
3rd year	158	37.3
4th year	22	5.2
5th year and above	1	0.2
Total	424	100

to "microplastics cannot be found on food", 36% disagreed, 20.3% were undecided, and 43.6% agreed. Finally, 45.3% agreed that "microplastics can be found on the air that we breathe".

On the health effects of microplastics, 44.8% agreed that "microplastics do not accumulate in internal organs" while 25.9% were undecided. Majority (66.2%) agreed that "disorders of the immune system are one of the effects of microplastics". When given a statement that "microplastics can be detected in our blood", there were 37.5% that agreed while 32.1% were undecided. Lastly, 62.5% agreed that "microplastics can cause cancers in the long run" but there were still 27.6% that were undecided on this statement (Table 2).

In the "knowledgeable" group, 366 out of 424 respondents were included, while the "non-knowledgeable" group consisted of only 58 respondents. A significant difference was observed between the mean scores of the "knowledgeable" and "non-knowledgeable" groups (Table 3).

Table 3. Knowledge scores of the group

	N	Mean	Standard deviation	p value
Knowledgeable	366	3.53	0.37	P = <0.001*
Non-knowledgeable	58	2.65	0.27	

*T Test

Attitude on Microplastics

The sample's mean attitude score was 3.74, indicating "Good Attitude." The majority (61.4%) said that they were less concerned about where plastic waste ended, which is related to 84.2% of participants agreeing that "I want to learn more about microplastics". Finally, 62.3% denied contributing to microplastic contamination (Table 4).

Table 5 shows a substantial difference between the sample's "good attitude" and "poor attitude" averages.

Table 2. Knowledge on microplastics

	Strongly Disagree n (%)	Disagree n (%)	Undecided n (%)	Agree n (%)	Strongly Agree n (%)
Microplastics are tiny pellets made of plastics and small pieces formed during breakdown of plastics.	15 (3.5)	11 (2.6)	61 (14.4)	209 (49.3)	126 (29.7)
Microplastics are synthetic polymers used in cosmetic products.	17 (4.0)	48 (11.3)	120 (28.3)	181 (42.7)	58 (13.7)
Microplastics are soft polymers of various shapes that dissolve in water.	39 (9.2)	129 (30.4)	90 (21.2)	111 (26.2)	53 (12.5)
Plastic marine debris will eventually become Microplastics.	17 (4.0)	40 (9.4)	127 (30.0)	175 (41.3)	60 (14.2)
Microplastics CAN NOT BE found in food.*	54 (12.7)	99 (23.3)	86 (20.3)	103 (24.3)	82 (19.3)
Microplastics are present in the air that we breathe.	45 (10.6)	58 (13.7)	126 (29.7)	147 (34.7)	45 (10.6)
Microplastics DO NOT accumulate in internal organs.*	25 (5.9)	97 (22.9)	110 (25.9)	118 (27.8)	72 (17.0)
Microplastics can be detected in our blood.	49 (11.6)	73 (17.2)	136 (32.1)	126 (29.7)	33 (7.8)
Disorders of the immune system are one of the health effects of Microplastics.	22 (5.2)	33 (7.8)	86 (20.3)	205 (48.3)	76 (17.9)
Microplastics can cause cancers in the long run.	12 (2.8)	29 (6.8)	117 (27.6)	175 (41.3)	90 (21.2)

*These statements are negatively-framed thus reverse scoring where the disagree scores were put on the agree and vice-versa was utilized to find out the accurate overall mean score of the data.

Table 4. Attitude of participants towards microplastics

	Strongly Disagree n (%)	Disagree n (%)	Undecided n (%)	Agree n (%)	Strongly Agree n (%)
I am less concerned about where plastic waste generated ends.*	40 (9.4)	79 (18.6)	44 (10.4)	130 (30.7)	130 (30.7)
I am NOT willing to tell my family and friends about the issue of Microplastics in my city.*	18 (4.2)	24 (5.7)	51 (12.0)	142 (33.5)	189 (44.6)
I am willing to participate in the cleanup efforts of Microplastics in my community.	12 (2.8)	22 (5.2)	52 (12.3)	175 (41.3)	162 (38.2)
I am willing to encourage the government to work on the issue of Microplastics in my city.	13 (3.1)	11 (2.6)	44 (10.4)	171 (40.3)	184 (42.4)
I want to learn more about Microplastics.	12 (2.8)	14 (3.3)	38 (9.0)	156 (36.8)	201 (47.4)
I live a lifestyle that may contribute to Microplastic pollution.*	98 (23.1)	166 (39.2)	93 (21.9)	46 (10.8)	17 (4.0)

*These statements are negatively-framed thus reverse scoring was utilized to find out the accurate overall mean score of the data

Table 5. Attitude scores of the group

	N	Mean	Standard deviation	P value*
Good Attitude	397	3.82	0.49	p-value <0.001
Poor Attitude	27	2.62	0.38	

*Mann-Whitney

Practices on Microplastics

About 59.7% of respondents said they always disposed of garbage properly. As shown, 41.5% reported they always segregated their plastic garbage from other biodegradable products. For plastic usage, 31.1% of respondents said they generally used reusable takeout containers and 42.7% said they always do. Eco-friendly substitutes were used by 66.5% of respondents. A third of respondents occasionally would bring recyclables when buying food outside, while half always did. The remaining 14.3% never/rarely brought the stuff. About half of respondents chose products with less packaging and participate in community plastic waste reduction programs (Table 6).

The sample's "good practices" and "poor practices" mean differences are considerable (Table 7).

Correlation Between Knowledge, Attitudes and Practices

Knowledge on microplastics and attitude towards microplastics has a significant but weak relationship. There was a weak relationship between knowledge and practice towards microplastics, and attitude and practices towards microplastics but they were not statistically significant (Table 8).

Discussion

Knowledge on Microplastics

The participants understood microplastics. They responded with the highest weighted mean to "Microplastics are tiny pellets made of plastics and small pieces formed during breakdown of plastics", demonstrating they understood microplastics are degradation products. This matches the criteria of

Table 6. Practices on microplastics

	Strongly Disagree N (%)	Disagree N(%)	Undecided N(%)	Agree N(%)	Strongly Agree N(%)
I dispose garbage in the right place.	5 (1.2)	4 (0.9)	45 (10.6)	117 (27.6)	253 (59.7)
I choose products with less packaging.	4 (0.9)	28 (6.6)	163 (38.4)	125 (29.5)	102 (24.1)
I bring recyclable items when buying food outside.	14 (3.3)	48 (11.3)	143 (33.7)	100 (23.6)	118 (27.8)
I use eco-friendly substitutes.	4 (0.9)	27 (6.4)	107 (25.2)	140 (33.0)	142 (33.5)
I use reusable container(s) in takeaways.	6 (1.4)	21 (5.0)	82 (19.3)	132 (31.1)	181 (42.7)
I separate my plastic waste from other biodegradable products.	5 (1.2)	22 (5.2)	107 (25.2)	111 (26.2)	176 (41.5)
I participate in activities to reduce plastic waste in my community.	19 (4.5)	70 (16.5)	123 (29.0)	91 (21.5)	120 (28.3)

Table 7. Practices scores of the group

	N	Mean	Standard deviation	Standard error mean		p-value*
Good practices	397	4.0150	0.57192	0.2888	1	<0.0001
Poor practices	32	2.5029	0.44722	0.07905		

* Mann Whitney U-test

Table 8. Pearson correlation of knowledge, attitude, and practices

	Knowledge	Attitude	Practice
Knowledge_		0.315**	0.059
Attitude	0.315**		0.062
Practice	0.059	0.062	

**Correlation is significant at the 0.01 level (2-tailed)

"secondary microplastics," which are generated by UV radiation from sunlight wave action and wind abrasion[9]. Microplastics are synthetic polymers in cosmetics and marine debris, according to participants.

Most of the respondents did not know microplastics came from food, drink, or the air. Studies have shown that microplastics are present in a variety of food sources, including fish sold at wet markets and bodies of water and most especially in suspended atmospheric microplastics (SAMPs) at high levels in the respondents' city.[5,10] Lack of information about microplastic sources may increase exposure. This suggests that microplastic awareness and expertise in our country are lacking.

Participants agreed that microplastics can cause cancer. Microplastics may boost cell migration and metastasis, which promotes tumor growth, according to a study.[11] Similar to a study that found

microplastics produce an inflammatory response, causing respiratory symptoms as coughing, sneezing, and dyspnea, participants agreed that microplastics can cause immune system illnesses. Since participants were not from healthcare-related courses, they were unsure if these compounds might be detected in the blood and accumulate in key organs.[12] However, recent studies have revealed microplastics in the lungs, blood and brain, where they may cause oxidative stress, inflammation and other health concerns.[13]

Attitudes on Microplastics

On the other hand, attitudes are considered a vital determinant of behavior because they affect the intention of a person to act or affect the action itself.[14] The overall mean attitude score of participants indicated that they have a good attitude towards microplastics as it involved self-awareness and proactive behavior regarding their impact on the environment and health of microplastic pollution. Participants in this study wanted to learn more about microplastics similar to a previous study that showed that students were typically interested in identifying the current shortcomings and effects of their education on attitudes towards plastic pollution.[15] Moreover, there was generally a good response from the students towards the control of plastic pollution as exemplified by their concern about where the generated plastic waste ended which is similar to a previous study where those living around Lagos Lagoon, a polluted lagoon in Nigeria, were also concerned with the ecological impact of not knowing where the generated plastic waste ended.[16] This study's respondents were also concerned that their lifestyle may have contributed to microplastic pollution as seen in a study in Arizona where students were willing to change their lifestyle by using biodegradable bags for shopping and reject plastic bags.[17]

The students demonstrated readiness to raise awareness, engage in cleanup efforts, and encourage the government to address microplastic pollution. These results are consistent with a previous review article.[17] A high percentage of the participants showed willingness to discuss microplastics with their family and friends, indicating an awareness of the issue within the community. However, in a study done in Shanghai, it was found that lack of public knowledge and awareness was one of the major difficulties one might encounter in reducing microplastic pollution. This finding shows the importance of deepening the public's understanding and awareness regarding the issue to be able to influence their willingness to take action.[18] Encouraging the government to address microplastic pollution, on the other hand, indicates the awareness of the respondents that political decision-makers and communicators have an impact on the issue at hand, which is why government officials must empower the community to take action and make informed decisions that may contribute to reducing microplastic pollution.[19]

Practices on Microplastics

The overall practice score of these students indicated that they exercised good practices towards the use of plastics. From the responses, it was observed that most of the participants practiced disposing garbage in the right place, however, fewer participants mentioned that they always practice waste segregation of plastic waste from biodegradable products. A study suggested that waste segregation practices are affected by four factors, namely, recycling bin accessibility, waste segregation information, waste segregation incentives, and waste segregation reminders. In addition to this, participants were also shown to have good practice towards using eco-friendly substitutes and reusable materials.[20] Aside from knowledge and attitudes, a study on Western and Asian consumers emphasized that there were cultural differences which may have impacted consumers' behavior towards sustainable options. In Asian culture, consumers' motivations influence their consumption of reusable containers.[21] Moreover, in the current study, the participation of the students to activities to reduce plastic waste in the community was a representation of good practice. These activities included disposal of garbage in the right place, use of products with less packaging, use of recyclable items when buying food, use of eco-friendly substitutes, use of reusable containers, separation of plastic waste from biodegradable, and participation in plastic waste reduction in the community. Reduction is defined as one of the preferred ways in solid waste management as it decreases the toxicity of waste. At the same time, it reduces costs attributed to cleaning up wastes.[22]

Relationship Between Knowledge and Practices on Microplastics

A study in Poland among university students, focused on the knowledge and awareness of microplastic contamination among consumers, particularly those with higher education levels.[23] Their findings are consistent with our findings, as it highlighted that while participants were generally aware of microplastics in water, their knowledge about its presence in other areas was limited. Despite growing awareness, this knowledge did not translate directly to behavioral change for the following possible reasons: 1) insufficient knowledge, 2) perceived inefficacy of individual action, 3) lack of feasible alternatives and 4) economic constraints. This was supported by a review that showed that there was a gap between increasing knowledge and effective action regarding microplastics due to the challenges of consumer behavior, particularly the lack of accessible and affordable alternatives to plastic products.[24]

Contrary to the results obtained, a study performed in Malaysia among its residents showed that individuals who have good knowledge about plastic pollution and its harmful effects also did good practices such as recycling and purchasing fewer plastic products. Additionally, it showed that the level of education and age were predictors of good practices.[25]

One other intervening factor could be the level of perception. Another Malaysian study found that the predictive factor of good practice was the level of perception which is indirectly influenced by a person's knowledge level of the problem. They suggested that the higher level of knowledge a person has about microplastics enabled one to have a better perception of its health implications eventually leading to better practices in preventing microplastic contamination. Although knowledge in itself could make people be aware of the issue and act accordingly, it would not change the person's willingness to act. They suggested that the incorporation of one's knowledge and information is key to helping lessen the microplastic problem.[26]

Relationship Between Attitudes and Practices on Microplastics

Practice and attitudes of students towards microplastics were weakly correlated, though not statistically significant. This finding was similarly seen in a Nigerian study.[15] There is a need to probe regarding how they think and behave concerning microplastics and the actions that they are doing to prevent increased exposure to microplastics. It is possible that other intervening factors influence the student's attitudes and practices.

Other possible intervening factors are sociodemographic factors. In a study among Malaysian adults, they found out that age, gender, educational level and even marital and employment status have a relationship with perception level about microplastic contamination in the human body.[26] Their study revealed that females had more good and moderate behavior than males. These sociodemographic factors were shown to have a positive relationship with the level of practice. Although these factors were not directly explored in this study, they may have influenced the attitudes and practices of students regarding microplastics, as reflected in the results.

Individuals with a background in environmental sciences were seen to be more likely to use reusable plastic.[25] This aligns with a study in Europe where a positive correlation between education in environmental discipline and sustainable behavior was observed.[26] Similarly, a Malaysian study noted that while people generally have favorable attitudes toward recycling, they often lacked the motivation to act on it. Factors such as convenience, social norms, moral values, environmental awareness and access to recycling facilities played a crucial role in determining recycling behaviors, regardless of demographics, such as education, gender, income or age.[27]

A study done in Europe determined that respondents between the ages 18 and 25 and 36 and 45 were more likely to choose products with less plastic.[28] Consumer behavior toward plastic reduction was seen to be impacted by the availability of alternatives, cost, convenience, habits and accessibility. Educational background has been seen to significantly increase the likelihood of reducing single-use plastics, with more educated individuals exhibiting higher engagement in plastic recycling.

In summary, the findings showed that this study's respondents were generally knowledgeable about the definition and presence of microplastics and exhibited positive attitudes and practices related to their environmental and health impacts. However, there is insufficient evidence to indicate significant correlations between "knowledge and practices" or "practices and attitudes" regarding microplastics,

likely due to sample limitations. Nonetheless, a weak positive relationship between "knowledge and attitudes" suggests that students with greater knowledge of microplastics and their effects may be more inclined to adopt favorable attitudes, including promoting awareness and reducing exposure.

The study is limited to assessing the knowledge, attitudes, and practices on microplastics among college students from one university. Specifically, it focused on the student's general awareness of microplastics and exposure, their potential effects on health, and behaviors related to their use and disposal. It did not incorporate direct observations.

The study was confined to college students of just one city, which may not reflect the experiences and awareness levels of students residing in other regions. The study's purposeful sample of 424 students may not fully represent the student population. Data collection relied on self-answered questionnaires, which made the findings susceptible to response bias. Finally, this study aimed to educate people about microplastics. Partnering with NGOs or LGUs would boost this advocacy and improve microplastic understanding, attitudes and practices.

References

1. Danopoulos E, Twiddy M, Rotchell JM. Microplastic contamination of drinking water: a systematic review. Mukherjee A, editor. PLoS One 2020 Jul 31;15(7):e0236838. doi: 10.1371/journal.pone.0236838.
2. Wu J, Jiang Z, Liu Y, Zhao X, Liang Y, Lu W, Song J. Microplastic contamination assessment in water and economic fishes in different trophic guilds from an urban water supply reservoir after flooding. J Environ Manage 2021 Dec;299:113667. doi: 10.1016/j.jenvman.2021.113667.
3. Yale Environment 360. Microplastics found in human brains [Internet] 2024 [cited 2024 Dec 9]. Available from: https://e360.yale.edu/digest/microplastics-human-brains
4. Pustadan R. The growing threat of microplastics and plastics [Internet]. National Research Council of the Philippines 2023 [cited 2024 Dec 9]. Available from: https://nrcp.dost.gov.ph/the-growing-threat-of-microplastics-and-plastics/
5. Romarate RA 2nd, Ancla SMB, Patilan DMM, Inocente SAT, Pacilan CJM, Sinco AL, Guihawan JQ, Capangpangan RY, Lubguban AA, Bacosa HP. Breathing plastics in Metro Manila, Philippines: presence of suspended atmospheric microplastics in ambient air. Environ Sci Pollut Res Int 2023 Apr;30(18):53662-73. doi: 10.1007/s11356-023-26117-y. Epub 2023 Mar 2.
6. Mubin AN, Arefin S, Mia MS, Islam ARMT, Bari ABMM, Islam MS, Hossain MS, Rahman MA. Managing the invisible threat of microplastics in marine ecosystems: lessons from coast of the Bay of Bengal. Sci Total Environ 2023 Sep 1;889:164224. doi: 10.1016/j.scitotenv.2023.164224.
7. Zhao X, Zhou Y, Liang C, Song J, Yu S, Liao G, Zhao Y. Airborne microplastics: occurrence, sources, fate, risks and mitigation. Sci Total Environ 2022 Nov;854:159943. doi: 10.1016/j.scitotenv.2022.159943.
8. Moon D, Wang HH, Hao N. Consumer behavior in choosing microplastic-contaminated seafood across different countries: the role of cultural and attitudinal factors. Econ Anal Policy [Internet] 2023 Jun 1 [cited 2023 Nov 14];78:290–306. Available from: https://www.sciencedirect.com/science/article/abs/pii/S0313592623000292
9. Shen M, Song B, Zhu Y, Zeng G, Zhang Y, Yang Y, Wen X, Chen M. Removal of microplastics via drinking water treatment: current knowledge and future directions. Chemosphere 2020 Jul;251:126612. doi: 10.1016/j.chemosphere.2020.126612.
10. Osorio ED, Tanchuling MAN, Diola MBLD. Microplastics occurrence in surface waters and sediments in five river mouths of Manila Bay. Front Environ Sci 2021;9:719274. doi:10.3389/fenvs.2021.719274.
11. Brynzak-Schreiber E, Schögl E, Bapp C, Cseh K, Kopatz V, Jakupec MA, Weber A, Lange T, Toca-Herrera JL, del Favero G, Wadsak W, Kenner L, Pichler V. Microplastics role in cell migration and distribution during cancer cell division. Chemosphere 2024;353:141463. doi:10.1016/j.chemosphere.2024.141463.
12. Wright SL, Kelly FJ. Plastic and Human Health: A Micro Issue? Environ Sci Technol 2017 Jun 20;51(12):6634-6647. doi: 10.1021/acs.est.7b00423. Epub 2017 Jun 7. Available from: https://doi.org/10.1021/acs.est.7b00423
13. Campanale C, Massarelli C, Savino I, Locaputo V, Uricchio VF. A detailed review study on potential effects of microplastics and additives of concern on human health. Int J Environ Res Public Health [Internet] 2020 Feb 13;17(4):1212. Available from: https://www.mdpi.com/1660-4601/17/4/1212
14. Fischer ARH. Perception, attitudes, intentions, decisions, and actual behavior. In: Emilien G, Weitkunat R, Lüdicke F, editors. Consumer perception of product risks and benefits. Cham (Switzerland): Springer International Publishing; 2017. p. 303–17. Available from: https://doi.org/10.1007/978-3-319-50530-5_17
15. Hammami MBA, Mohammed EQ, Hashem AM, Al-Khafaji MA, Alqahtani F, Alzaabi S, Dash N. Survey on awareness and attitudes of secondary school students regarding plastic pollution: implications for environmental education and public health in Sharjah City, UAE. Environ Sci Pollut Res Int 2017 Sep;24(25):20626-33. doi: 10.1007/s11356-017-9625-x. Epub 2017 Jul 15.

16. Omoyajowo K, Raimi M, Waleola T, Odipe O, Ogunyebi A. Public awareness, knowledge, attitude, and perception on microplastics pollution around Lagos Lagoon. Ecol Saf Balanced Use Resour 2022 Feb 7;2(24):35–46. Available from: https://esbur.com.ua/en/journals/tom-25-2-2021/gromadska-obiznannist-znannya-stavlyennya-ta-spriynyattya-shchodo-zabrudnyennya-mikroplastikom-navkolo-laguni-lagos
17. Tang KHD. Attitudes towards plastic pollution: A review and mitigations beyond circular economy. Waste [Internet] 2023 Jun 1;1(2):569–87. Available from: https://www.mdpi.com/2342832
18. Deng L, Cai L, Sun F, Li G, Che Y. Public attitudes towards microplastics: Perceptions, behaviors and policy implications. Resour Conserv Recycl [Internet] 2020 Dec 1;163:105096. Available from: https://www.sciencedirect.com/science/article/pii/S0921344920304134
19. Pop V, Ozunu A, Petrescu DC, Stan AD, Petrescu-Mag RM. The influence of media narratives on microplastics risk perception. PeerJ [Internet] 2023 Nov 2;11:e16338. Available from: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC10625762/
20. Sin-Yee T, Sheau-Ting L. Attributes in fostering waste segregation behaviour. Int J Environ Sci Dev 2016;7(9):672–5. Available from: https://doi.org/10.18178/ijesd.2016.7.9.860
21. Ertz M, Huang R, Jo MS, Karakas F, Sarigöllü E. From single-use to multi-use: Study of consumers' behavior toward consumption of reusable containers. J Environ Manage 2017 May;193:334–44. Available from: https://doi.org/10.1016/j.jenvman.2017.01.060
22. Ugwu CO, Ozoegwu CG, Ozor PA, Agwu N, Mbohwa C. Waste reduction and utilization strategies to improve municipal solid waste management on Nigerian campuses. Fuel Commun [Internet] 2021 Dec;9:100025. Available from: https://www.sciencedirect.com/science/article/pii/S2666052021000182
23. Oleksiuk K, Krupa-Kotara K, Wypych-Slusarska A, Glogowska-Ligus J, Spychala A, Slowinski J. Microplastic in food and water: Current knowledge and awareness of consumers. Nutrients 2022 Nov 17;14(22):4857.
24. Munhoz DR, Harkes P, Beriot N, Larreta J, Basurko OC. Microplastics: A review of policies and responses. Microplastics [Internet] 2023 Mar 1;2(1):1–26. Available from: https://www.mdpi.com/2673-8929/2/1/1
25. Chin KK, Mahanta J, Nath TK. Knowledge, attitude, and practices toward plastic pollution among Malaysians: implications for minimizing plastic use and pollution. Sustainability 2023;15(2):1164. doi:10.3390/su15021164.
26. Yusuf SN, Elias SM. Knowledge, perception and practice towards microplastic contamination in human body among community in Ampang, Selangor and the associated sociodemographic factors Malays J Med Health Sci [Internet] 2023 Nov 4 [cited 2024 Feb 8];19:56–70. Available from: https://web.p.ebscohost.com/ehost/detail/detail?vid=0&sid=b1784572-8bd2-4641-ad9a-8420fa1b17ae%40redis&bdata=JnNpdGU9ZWhvc3QtbGl2ZQ%3d%3d#AN=174455222&db=asn
27. Afroz R, Rahman A, Masud MM, Akhtar R. The knowledge, awareness, attitude and motivational analysis of plastic waste and household perspective in Malaysia. Environ Sci Pollut Res Int 2016 Nov 3;24(3):2304–15.Filho WL, Salvia AL, Bonoli
28. A, Saari UA, Voronova V, Klõga M, Kumbhar SS, Olszewski K, De Quevedo DM, Barbir J. An assessment of attitudes towards plastics and bioplastics in Europe. Sci Total Environ 2021 Feb 10;755(Pt 1):142732. doi: 10.1016/j.scitotenv.2020.142732. Epub 2020 Oct 6.

A correlational study between the degree of digital eye strain and total screen time among medical students

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Abstract

Introduction The COVID-19 pandemic has significantly increased reliance on digital devices for education, leading to heightened concerns about digital eye strain (DES) among students. This study aimed to investigate the association between screen time and the degree of DES among first to third-year medical students at a private medical school from August to September 2023.

Methods An analytical cross-sectional design was employed, involving 194 participants who completed a self-administered questionnaire, including the Computer Vision Syndrome Questionnaire (CVS-Q). Data were analyzed using descriptive statistics and relative risk calculations.

Results The mean daily screen time was 6.94 hours, with 79.38% of participants reporting symptoms of digital eye strain. A significant association was found between screen time and DES, with a positive risk ratio of 1.304 for those spending 4-8 hours on screens compared to those with less than 4 hours.

Conclusion This study highlights the growing prevalence of DES among medical students during the pandemic, emphasizing the need for educational institutions to implement strategies that mitigate screen-related health risks. Recommendations include awareness programs, ergonomic guidelines and regular eye check-ups to promote ocular health.

Key words: Digital eye strain, total screen time, computer vision syndrome, medical students, online learning

Throughout the COVID-19 epidemic, online classes have emerged as a dominant method of education for students. The transition to digital schooling has led to children and young adults averaging at least eight hours daily in front of light-emitting diode (LED) screens. This duration pertains exclusively to online lessons, excluding additional hours spent on leisure activities or supplementary study. The blue light emitted from computer screens and mobile devices presents significant hazards, including discomfort and retinal damage, as high-energy wavelengths in the 380-500 nm spectrum penetrate the eyes.[1] As a result, digital eye strain has become more prevalent, particularly exacerbated during the epidemic. Reports revealed that persons suffering from digital eye strain exhibit several symptoms, including accommodation-related concerns like headaches, ocular discomfort, and blurred vision, alongside dryness-related

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symptoms including foreign body sensation, excessive tearing, burning, itching and erythema.[2]

Prior to the pandemic, the prevalence of digital eye strain varied widely, with reports as low as 5%3. However, the emergence of COVID-19 has led to a staggering increase in digital eye strain among children, with estimates indicating a rise of 50-60%[3]. A recent study found that approximately 50.23% of students reported experiencing mild to severe digital eye strain during the COVID 19 pandemic.[4] Furthermore, other studies have documented a prevalence rate of 69% in adults and 50% in children.[1] These alarming statistics highlight digital eye strain as an emerging public health concern that necessitates further research, especially as online learning remains a primary educational option for many institutions.[5]

This study aimed to investigate the association between screen time and the degree of digital eye strain among first to third-year medical students from a private university from August to September 2023. Specifically, this research aimed to determine the average duration of screen time for online learning among these students; and to measure the degree of digital eye strain within this population using a self-administered questionnaire known as the "Computer Vision Syndrome Questionnaire" (CVS-Q).

Methods

This research has been approved by the Research Institute for Health Sciences Ethics Review Committee (RIHS ERC) under code: 1456/C/2023/028. The authors employed an analytical cross sectional research design to examine the relationship between total screen time and the presence of digital eye strain among participants.

The target population for this study consisted of first to third-year medical students who had access to the internet and were engaged in online learning. Those with current or previous diagnoses of eye problems, as well as those using devices equipped with anti-radiation screens, were excluded from participation.

Using an online sample size calculator for correlation the minimum sample size was 164 participants based on 95% confidence, 80% power and a proportion of 51.6% and 30% for those having DES for >8 hours and <5 hours, respectively, based from a previous study.[6]

Self-administered online questionnaire comprised of demographic Information Questionnaire, an 18-item screen-time questionnaire, and the Computer Vision Syndrome Questionnaire (CVS-Q) were distributed via Google Forms and various social media platforms.

The 18-item screen-time questionnaire categorized screen-based devices into five types: television, TV-connected devices, laptop/computer, smartphone, and tablet. Total screen time for each device was quantified in minutes and further analyzed based on average weekday, weeknight and weekend usage, as well as primary and background use. The CVS-Q comprises 16 symptoms related to digital eye strain and measures symptom frequency using a rating scale of 0-3 (never = 0; occasionally = 1; often/always = 2). Intensity is assessed on a scale of 1-2 (moderate = 1; intense = 2). This questionnaire has sensitivity and specificity rates of 75% and 70.2%, respectively. Rasch analysis confirmed that the 16 items adequately fit the rating scale model, with an internal consistency (Cronbach's alpha) of 0.78 and person separation reliability of 0.69.[7]

Descriptive statistics were employed to summarize the socio-demographic information of respondents. For the screen time questionnaire, both mean and median values were computed to determine total screen time. Responses from the CVS-Q were scored and summarized to measure symptoms of eye strain. To assess the association between total screen time and the degree of digital eye strain , prevalence relative risk calculations were performed.

Results

A total of 194 first to third-year medical students completed the survey. Among these participants, 108 (55.67%) were female, and 86 (44.33%) were male. The mean age of the participants was 23.54 years (SD = 2.41; range = 20-37 years) (Table 1).

The findings indicate that the mean daily screen time among participants averaged 6.94 hours, (sd 3.96 hours). Of the sample, 40 students (15.46%) did not exhibit digital eye strain, while a significant majority, comprising 154 students (79.38%), reported symptoms consistent with digital eye strain (Table 2).

Among the total participants, 44 individuals reported spending more than eight hours in front of a digital screen, while 27 individuals spent less than four hours in front of a digital screen. Furthermore, a majority of participants, specifically 123 individuals, spent between four and eight hours on digital screens (Table 2).

Table 1. Demographic characteristics of first to third – year medical students

Sex	N	Mean Age	Standard Deviation
Female	108	22.50	2.39
Male	86	23.00	2.98
Total	194	23.54	2.41

Table 2. Association between digital screen time and presence of digital strain

Screen Time	Presence of Digital Eye Strain	Absence of Digital Eye Strain	PRR (95% Confidence Interval)	p-value
≤ 4 hours	17	10	1.00 (Ref)	
4.01 - 8.00 hours	101	22	1.304 (1.023 - 1.871)	0.028
> 8 hours	36	08	1.299 (0.974 - 1.886)	0.076

The analysis revealed a statistically significant positive association between spending between four and eight hours in front of a digital screen and the development of digital eye strain (PRR 1.304; p 0.02). For those with more than 8 hours of screen time although there is a positive association, the results are not statistically significant. (Table 2)

Discussion

The increasing reliance on digital devices, particularly during online classes, has led to a significant rise in cases of digital eye strain (DES) among various populations, including children and young adults. Recent studies have highlighted the association between prolonged screen time and the prevalence of DES symptoms, emphasizing the need for awareness and intervention strategies.[2,4,6] Digital eye strain has emerged as a public health concern, particularly during the COVID-19 pandemic, when remote learning became the norm.[5]

Digital Eye Strain (DES) is characterized by a range of visual and ocular symptoms that arise from extended use of digital devices such as computers, tablets, and smartphones. Symptoms include dry eyes, blurred vision, headaches, and neck or shoulder pain. DES is specifically linked to the use of digital screens and encompasses issues like irritation, foreign body sensation and general discomfort associated with screen time.[3]

The mean daily screen time among participants in this study was recorded at 6.94 hours. This aligns with similar studies that reported average daily screen time among medical students ranging from 7 to 11 hours.[8-10]

A significant finding from this study was that 79.38% of participants reported symptoms consistent with digital eye strain. This prevalence is consistent with existing literature that documented rates of DES among medical students ranging from as low as 49% to as high as 92%.[11-13] The wide variability in reported prevalence may be attributed to differences in study methodologies, population demographics, and the specific definitions used for DES.

The findings revealed that those with 4 to 8 hours of screen time had a 1.3-fold elevated risk of developing DES symptoms compared to those with less than 4 hours of screen exposure. Likewise, individuals who spent over 8 hours on screens encountered a 1.29-fold higher risk. These findings align with earlier research that similarly indicated a positive association between elevated screen time and the incidence of DES symptoms.[11,14,15] The exacerbation of these symptoms can be attributed to continuous use of digital devices without breaks—a common practice among medical

students—along with inadequate use of lubricants or artificial tears to alleviate dryness.[16,17]

The ramifications of these findings are significant, highlighting the pressing necessity for educational institutions and healthcare providers to mitigate the risks linked to extended screen usage. Strategies including the implementation of regular breaks during screen usage, the promotion of suitable ergonomics and the encouragement of artificial tear application may alleviate the detrimental effects of digital eye strain.

This study underscores the increasing issue of digital eye strain among first to third-year medical students, especially during the COVID-19 epidemic when online learning has grown widespread. The study reveals a significant association between screen time and the onset of Digital Eye Strain (DES). Students who spent 4 to 8 hours in front of a digital screen were 1.304 times more likely to develop Digital Eye Strain (DES) than those who spent fewer than 4 hours. Although the association is evident, individual variability and other ergonomic interventions—such as keeping an adequate distance from screens and taking regular ocular breaks—may affect the severity of symptoms reported. As dependence on digital devices increases in educational environments, it is essential to create effective measures to protect ocular health and improve general well-being.

Educational institutions should enhance student understanding on the hazards of digital eye strain by offering advise on screen time regulation, ergonomic practices and ocular health. Regular ocular examinations should be advocated to identify and manage pre-existing visual problems that may deteriorate with extended screen exposure. Institutions should encourage ergonomic norms, including maintaining appropriate screen distance, minimizing glare, adhering to suggested eye break times, and providing advice on ideal screen configuration and posture. Finally, pupils ought to be urged to minimize screen time for non-essential activities and engage in offline pastimes to promote improved ocular health.

References

1. Bhattacharya S, Heidler P, Saleem SM, Marzo RR. Let there be light—digital eye strain (DES) in children as a shadow pandemic in the era of COVID-19: a mini review. Front Public Health 2022 Aug 11;10:945082. doi:10.3389/fpubh.2022.945082.
2. Demirayak B, Yılmaz Tugan B, Toprak M, Çinik R. Digital eye strain and its associated factors in children during the COVID-19 pandemic. Indian J Ophthalmol 2022 Mar;70(3):988-92. doi: 10.4103/ijo.IJO_1920_21.
3. Kaur K, Gurnani B, Nayak S, Deori N, Kaur S, Jethani J, Singh D, Agarkar S, Hussaindeen JR, Sukhija J, Mishra D. Digital eye strain—a comprehensive review. Ophthalmol Ther 2022 Oct;11(5):1655-80. doi:10.1007/s40123-022-00540-9. Epub 2022 Jul 9.
4. Mohan A, Sen P, Shah C, Jain E, Jain S. Prevalence and risk factor assessment of digital eye strain among children using online e-learning during the COVID-19 pandemic: Digital eye strain among kids (DESK study-1). Indian J Ophthalmol 2021 Jan;69(1):140-4. doi: 10.4103/ijo.IJO_2535_20.
5. Bhattacharya S, Saleem SM, Singh A. Digital eye strain in the era of COVID-19 pandemic: an emerging public health threat. Indian J Ophthalmol 2020;68(8):1709. doi:10.4103/ijo.IJO_2053_20.
6. Chaturvedi N, Singh P, Bhattacharya M. Screen exposure time and computer vision syndrome in school-age children during COVID-19 era: a cross-sectional study. J Clin Ophthalmol Res 2022 Sep-Dec;10(3):105-9. doi:10.4103/jcor.jcor_157_21.
7. Seguí Mdel M, Cabrero-García J, Crespo A, Verdú J, Ronda E. A reliable and valid questionnaire was developed to measure computer vision syndrome at the workplace. J Clin Epidemiol 2015 Jun;68(6):662-73. doi:10.1016/j.jclinepi.2015.01.023.
8. Liebig L, Bergmann A, Voigt K, Balogh E, Birkas B, Faubl N, Kraft T, Schöniger K, Riemenschneider H. Screen time and sleep among medical students in Germany. Sci Rep 2023 Sep 19;13(1):15462. doi: 10.1038/s41598-023-42039-8.
9. Sahu DP, Taywade M, Malla PS, Singh PK, Jasti P, Singh P, Sharma P, Das M, U M RB, Gupta K. Screen time among medical and nursing students and its correlation with sleep quality and attention span: a cross-sectional study. Cureus 2024 Apr 15;16(4):e58323. doi:10.7759/cureus.58323.
10. Nisar N, Salman R, Farooq S, Sharjeel-Ur-Rehman, Javed A, Farooq A. Screen time and its relation with ophthalmic problems among medical students. Pak J Med Health Sci 2023 Jan;16(12):295. doi:10.53350/pjmhs20221612295.
11. Bhatnagar KR, Dixit SG, Pandey L, Prakash S, Shiromani S, Singh K. Digital eye strain among medical students associated with shifting to e-learning during COVID-19 pandemic: An online survey. Indian J Ophthalmol 2024 Jan 1;72(1):98-104. doi: 10.4103/IJO.IJO_492_23. Epub 2023 Dec 22.
12. Mohammed F, Somasundaran S, Poothatta J. Digital eye strain among undergraduate medical students during the COVID-19 pandemic: a cross-sectional survey. Kerala J Ophthalmol 2021 Sep-Dec;33(3):284-90. doi:10.4103/kjo.kjo_168_20.

13. Malik H. A questionnaire-based study: digital eye strain among undergraduate medical students in a medical college. SJHR-Africa [Internet] 2024 Mar 31 [cited 2024 Dec 16];5(3). Available from: https://sjhresearchafrica.org/index.php/public-html/article/view/1001.
14. Haider I, Iqbal S, Khan A, Ahmed R, Tariq M, Zaman F. Impact of screen time on digital eye strain and visual acuity among medical students in Peshawar, Pakistan. Khyber Med Univ J 2023 Dec;15(4):229-34. doi:10.35845/kmuj.2023.23402.
15. Alamri A, Alamri MM, Rashid FA, Alawashiz AS, Alqahtani FH, Alyami AA, Almathami LA, Alwabel RA, Alqarni EM, Alqahtani AM, Almoghamer H, Alahmari AA. Association between digital device utilization and asthenopia among medical students at King Khalid University. Cureus 2023 Sep 20;15(9):e45621. doi:10.7759/cureus.45621.
16. Mohammed F, Somasundaran S, Poothatta J. Digital eye strain among undergraduate medical students during the COVID-19 pandemic: a cross-sectional survey. Kerala J Ophthalmol 2021 Sep-Dec;33(3):284-90. doi:10.4103/kjo.kjo_168_20.
17. Yasir ZH, Sharma R, Kesarwani D, Gupta S, Gupta K, Leong PL. Digital eye strain and its determinants among medical staff and medical students: a cross-sectional study. D Y Patil J Health Sci 2023;11:12-8. doi:10.4103/dypu.dypu_82_22.

Familial cerebral cavernous malformation in a Filipino family

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Abstract

Cerebral cavernous malformation (CCM) is a type of vascular malformations characterized by the absence of intervening brain parenchyma. Cerebral cavernous malformations are of two forms, sporadic and familial. About 0.4-0.8% of the population are affected as assessed based on Magnetic Resonance Imaging (MRI) findings and postmortem findings. Three genetic mutations have been identified: CCM1, CCM2, CCM3, with an incidence of 40%, 40% and 20%, respectively.

This study presents five members diagnosed with Familial CCM in a Filipino family. A 25-year-old male, from a low socio-economic background, was admitted due to a progressive generalized headache of 2 years' duration, during which multiple brain lesions were observed on MRI. All members of the family became symptomatic before 30 years of age, and four out of the five members underwent surgery. However, molecular genetic testing was not performed as the patient could not afford it. The testing was not covered by the country's insurance system, and it would have been an out-of-pocket expense.

In patients diagnosed with cerebral cavernous malformations, a thorough clinical and family history is warranted accompanied by MRI-GRE (Magnetic Resonance Imaging - Gradient Echo) and MRI T2 help establish final diagnosis. Confirmation with molecular genetic testing should be offered to all members of the family for proper neurological and genetic care.

Key words: cavernous malformation, familial cerebral cavernous malformation, cavernoma

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Cerebrovascular malformations are developmental abnormalities that affect the blood vessels supplying the brain. They include venous malformations, arteriovenous malformations, cavernous malformations, and telangiectasis.[1] The feature that distinguishes them from other types of vascular malformations is the absence of intervening brain parenchyma.[2] Cerebral cavernous malformations are of two forms, sporadic and familial. About 0.4-0.8% of the population are affected as assessed based on MRI findings and postmortem findings.[2,3] Three genetic mutations have

been associated with Familial Cerebral Cavernous Malformation: CCM1, CCM2, CCM3.CCM1, CCM2 and CCM3 denote three distinct genetic variants linked to Cerebral Cavernous Malformation (CCM). These mutations are accountable for the onset of CCM and are situated in three separate genes. The prevalence of these mutations differs among the population, with each mutation associated with particular forms of CCM. The CCM1 mutation, associated with the KRIT1 gene, is the most prevalent, accounting for around 40% of CCM cases. It transpires in the KRIT1 (Krev interaction trapped 1) gene. The CCM2 mutation, associated with the MGC4607 gene, accounts for an additional 40% of CCM instances. The CCM3 mutation, associated with the PDCD10 gene, is the rarest variant, accounting for around 20% of CCM cases. The three mutations are integral to the genetic foundation of CCM and are crucial for its diagnosis. Genetic testing can ascertain the presence of specific mutations in affected people, perhaps guiding treatment approaches and familial counseling.[4]

The familial form of the disease is inherited in an autosomal dominant pattern. It is involved in up to 30% of all cases and is present mostly in Hispanic Americans of Mexico than in other ethnic groups.[5] Patients with multiple lesions constitute 12-20% in sporadic form and more than 50% in the familial form of CCMs.[2] Patients with CCMs may present with seizures, hemorrhage, focal deficits or nonspecific headaches.[6,7] In MRI studies, they appear as mixed signal intensity core with a hypo-intense hemosiderin rim giving the pathognomonic MRI finding of "popcorn-like" masses.[1,8] These lesions are rarely appreciated on angiography and are considered angiographically occult.[9] Few cases have been reported from other racial origins. It is vital to report such case to render awareness, reduce morbidity and perform genetic counseling to diagnosed cases.

Methods

The data were collected from available medical records, patient interview and histopathologic registry. Four out of the five members of this family were operated on. However, only one has been admitted and operated on in this institution. Histopathologic examination of the specimen has been recorded for this case. No molecular genetic testing has been done for all four members diagnosed through histopathologic examinations.

The Cases

Five members of the family were identified with cavernous malformation based on MRI findings. Family pedigree is presented in Figure 1.

Case 1

A 25-year-old male, right-handed, was admitted for the first time due to progressive generalized headache of 2 years duration. The headache was then associated with numbness on the right arm, leg and trunk. MRI T1 sequence (Figure 2) showed shortening while T2 sequence showed prolongation of signal resulting in a "popcorn ball" like configuration with multiple intra-axial nodular foci of varying sizes scattered in the cerebral hemispheres, pons and left cerebral hemisphere. He then underwent surgery and was discharged 7 days postoperatively with noted relief from the headache but still with numbness on the right trunk, arm and leg. Genetic testing has not been done due to financial constraints.

Case 2

A 58-year-old female presented with seizures and was diagnosed with cavernoma through MRI at 19 years old. She underwent surgery abroad which revealed cavernoma.

Case 3

A 55-year-old female presented with seizures of unknown semiology. She was diagnosed radiographically with cavernoma at 20 years old. She refused surgery and is on medications for seizure control.

Case 4

A 27-year-old male, Professional Nurse, presented with severe headache and dizziness, was diagnosed radiographically with Cavernoma at 16 years old; underwent surgery in 2007 which showed Cavernoma. Postoperative MRI showed no recurrence.

Case 5

The proband's grandmother is already deceased. She presented with headache and dizziness at the age of 70. She underwent surgery which showed Cavernoma.

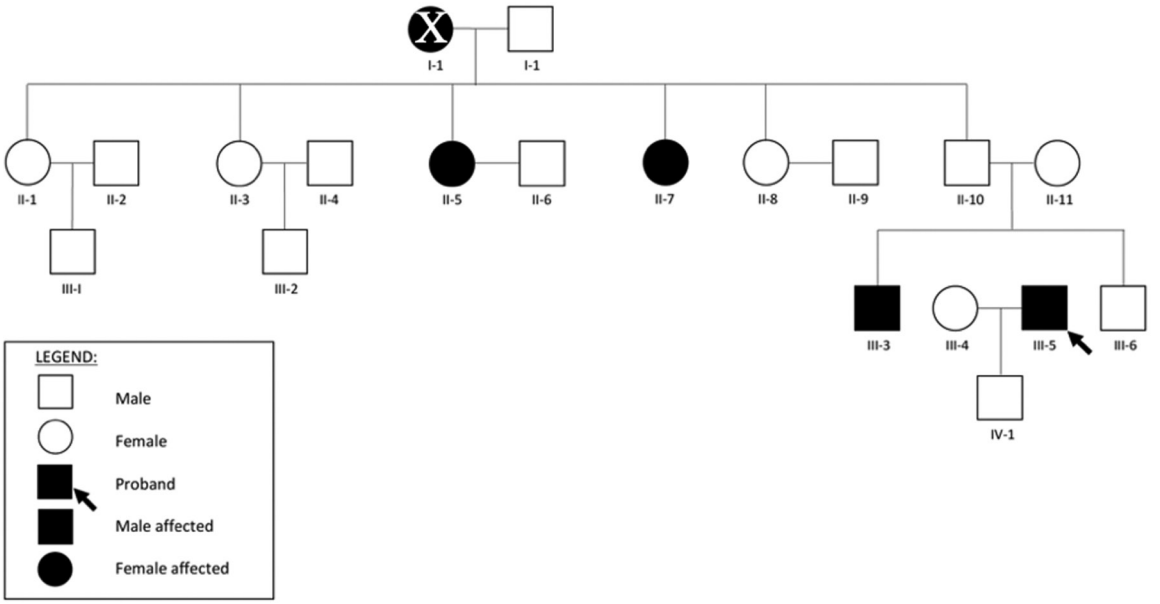

Figure 1. Family pedigree showing five members spanning three generations diagnosed with cerebral cavernous meningioma.

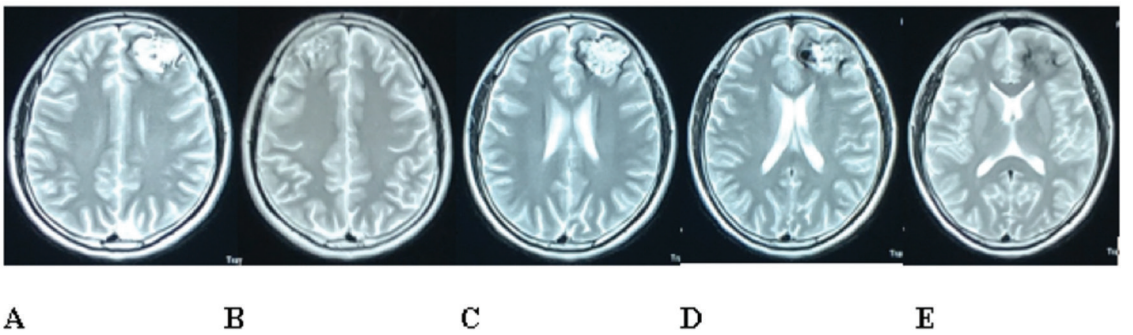

Figure 2. (A-E) MRI (GRE/T2*) showing the presence of multiple areas of hypointense with hyperintense lesions in GRE/T2* sequence indicative of hemosiderin deposition.

Outcome and Follow Up

Not all family members performed periodic MRI examinations for economic reasons. The patient is now seizure-free. All of them are now leading a normal life.

Discussion

Cerebral cavernous malformations are clusters of abnormal capillaries and venules, which periodically bleed with a mulberry appearance grossly and a "popcorn-like" lesion radiographically.[10] Cerebral cavernous malformations are of two forms, sporadic and familial. The familial form of the disease is inherited in an autosomal dominant pattern. It is involved in up to 30% of all cases and is present mostly in Hispanic Americans of Mexico than in other ethnic groups.[5] Three genetic mutations have been associated with Familial Cerebral Cavernous Malformation: CCM1, CCM2, CCM3.[4] CCM1 is located at chromosome locus 7q11-q22 and was the first gene identified in association with the familial form of CCM.[11] CCM1 mutation is involved in 40% of familial CCMs and nearly half will have neurological symptoms before the age of 25 years.[7,12] CCM2 is localized at 7p15-13 and are involved in

up to 40% of familial CCMs. CCM3, localized at 3q25.2-q27, encodes programmed cell death protein 10 (PDCD10).[13] It is the most recently discovered gene involved in familial CCM and are less common than CCM1 or CCM but are most likely to present with hemorrhage and early symptom onset before 15 years of age.[14]

A study among Hispanic Americans showed that 9% of individuals diagnosed with CCM were symptomatic before the age of 10 years, 62-72% between the ages 10-40 years and 19% after the age of 40 years.[15] In this current study, the earliest family member diagnosed was at 16 years and all were symptomatic before 30 years of age. The prevalence of CCM1, CCM2 and CCM3 in families is 40%, 20%, and 40% respectively.[11]

In a study on the natural history of familial cavernous malformations, a total of 59 members from 6 families were studied and results showed the dynamic state of CMMs as seen in changes in the number, size and imaging characteristics of the lesions.[1]

In recent literature, it is advised that incidentally discovered, asymptomatic or no increase in size CCMs should be observed and followed by periodic MR imaging while symptomatic lesions responsible for seizure, progressive neurological deficit, first clinically significant hemorrhage in non-eloquent areas and a second hemorrhage in eloquent areas should be considered for surgical removal.[16,17]

Conclusion

Several conclusions from this case report have been made:

1. Diagnosis of Familial Cerebral Cavernous Malformation requires a detailed patient history, family history, high-quality MRI utilizing gradient-refocused imaging, histopathologic examinations.

2. Diagnosis is confirmed by molecular genetic testing.

3. Repeat periodic MRI for symptomatic cases are recommended for follow-up monitoring. MRI should be offered to family members at risk.

Limitations

Although genetic testing was advised for the patient, however, due to financial constraints, the patient was unable to afford it. Instead, authors focused on highlighting the symptoms, physical findings, and alternative diagnostic methods, including imaging, laboratory results, and clinical observation, which led to the working diagnosis.

References

1. Zabramski JM, Wascher TM, Spetzler RF, Johnson B, Golfinos J, Drayer BP, et al. The natural history of familial cavernous malformations: results of an ongoing study. J Neurosurg 1994;80(3):422-32. doi:10.3171/jns.1994.80.3.0422.
2. Moriarity JL, Wetzel M, Clatterbuck RE, Javedan S, Sheppard J, Hoenig-Rigamonti K, et al. The natural history of cavernous malformations: a prospective study of 68 patients. Neurosurgery 1999;44(6):1166-71. doi:10.1227/00006123-199906000-00003.
2. Washington CW, McCoy KE, Zipfel GJ. Update on the natural history of cavernous malformations and factors predicting aggressive clinical presentation. Neurosurg Focus 2010;29(3):E8. doi:10.3171/2010.5.focus10149.
4. Yadla S, Jabbour PM, Shenkar R, Shi C, Campbell PG, Awad IA. Cerebral cavernous malformations as a disease of vascular permeability: from bench to bedside with caution. Neurosurg Focus 2010;29(3):E4. doi:10.3171/2010.5.focus10121.
5. Labauge P. Familial forms of central nervous system cavernomas: from recognition to gene therapy. Neurochirurgie 2007;53:152-5.
6. Aiba T, Tanaka R, Koike T, Kameyama S, Takeda N, Komata T. Natural history of intracranial cavernous malformations. J Neurosurg 1995;83(1):56-9. doi:10.3171/jns.1995.83.1.0056.
7. Batra S, Lin D, Recinos PF, Zhang J, Rigamonti D. Cavernous malformations: natural history, diagnosis and treatment. Nat Rev Neurol 2009;5(12):659-70. doi:10.1038/nrneurol.2009.177.
8. Simard JM, Garcia-Bengochea F, Ballinger WE, Mickle JP, Quisling RG. Cavernous angioma: a review of 126 collected and 12 new clinical cases. Neurosurgery 1986;18(2):203-10. doi:10.1097/00006123-198602000-00008.
9. Wakai S, Ueda Y, Inoh S, Nagai M. Angiographically occult angiomas. Neurosurgery 1985;17(4):549-54. doi:10.1097/00006123-198510000-00003.
10. Tagle P, Huete I, Méndez J, Villar SD. Intracranial cavernous angioma: presentation and management. J Neurosurg 1986;64(5):720-3. doi:10.3171/jns.1986.64.5.0720.
11. Dubovsky J, Zabramski JM, Kurth J, Spetzler RF, Rich SS, Orr HT, et al. A gene responsible for cavernous malformations of the brain maps to chromosome 7q. Hum Mol Genet 1995;4(3):453-8. doi:10.1093/hmg/4.3.453.
12. Denier C, Labauge P, Brunereau L, Cavé-Riant F, Marchelli F, Arnoult M, et al. Clinical features of cerebral cavernous malformations patients with KRIT1 mutations. Ann Neurol 2003;55(2):213-20. doi:10.1002/ana.10804.

13. Denier C, Goutagny S, Labauge P, Krivosic V, Arnoult M, Cousin A, et al. Mutations within the MGC4607 gene cause cerebral cavernous malformations. Am J Hum Genet 2004;74(2):326-37. doi:10.1086/381718.
14. Denier C, Labauge P, Bergametti F, Marchelli F, Riant F, Arnoult M, et al. Genotype-phenotype correlations in cerebral cavernous malformations patients. Ann Neurol 2006;60(5):550-6. doi:10.1002/ana.20947.
15. Günel M, Awad IA, Finberg K, Anson JA, Steinberg GK, Batjer HH, et al. A founder mutation as a cause of cerebral cavernous malformation in Hispanic Americans. N Engl J Med 1996;334(15):946-51. doi:10.1056/nejm199604113341503.
16. Nagy G, Kemeny AA. Stereotactic radiosurgery of intracranial cavernous malformations. Neurosurg Clin N Am 2013;24(4):583-91.
17 Chalouhi N, Dumont AS, Randazzo C, Tjoumakaris S, Gonzalez LF, Rosenwasser R, et al. Management of incidentally discovered intracranial vascular abnormalities. Neurosurg Focus 2011;31(6):E1. doi:10.3171/2011.9.focus11200.

A case of traumatic intracranial aneurysm in a 6-year-old child following a closed blunt head injury

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Abstract

This is a case of a 6-year-old male who had a motor vehicular accident, who initially presented without neurologic deficit immediately post injury but followed up with seizures and motor weakness. The aim of the study is to review the pathomechanism of traumatic aneurysm in blunt head trauma in pediatric patients.

The initial imaging done revealed a closed, depressed comminuted fracture in the left frontal bone. Three weeks post-injury, he had recurrent generalized tonic clonic seizures and angiogram showed saccular aneurysm of the left A2 with left frontal intracerebral hemorrhage (ICH).

The patient underwent bifrontal craniotomy, clipping of aneurysm and evacuation of the ICH. Treatment options includes endovascular approach, wrapping and trapping the aneurysm. However, there is no single modality indicated for all lesions. Post-operatively, the patient was aphasic with right hemiparesis (2/5). Speech improved the second week after the surgery. Rehabilitation was initiated after admission and unassisted ambulation noted after 2 months. Work up done for other possible causes of aneurysm in the pediatric population revealed unremarkable findings. Mechanism associated with blunt traumatic head injury in the development of aneurysm could be secondary to a shear or rotational injury damaging vessels in close proximity to dura, for instance in this case, close to the falx cerebri.

Key words: Traumatic pediatric aneurysm, blunt head injury

The aim of the study was to review the pathomechanism of traumatic aneurysm in a blunt head trauma in a pediatric patient. As cited by Emir, et al., traumatic intracranial aneurysms (TICA) following closed head injury comprise less than 1% of all cerebral aneurysms and is associated with significant morbidity and mortality rate as high as 50%. They may present with headache acutely or delayed and may even be seen as an incidental finding in imaging studies.[1] A subarachnoid hemorrhage is the most common imaging finding of intracranial aneurysm in both pediatrics and adults. Similar to adult counterparts, pediatric aneurysms can be related to systemic diseases and/or other intracranial pathologies. Other systemic conditions may include Marfan Syndrome, polycystic kidney disease, coarctation of the aorta, and fibromuscular dysplasia. As for adults – acquired conditions such as diabetes mellitus, hypertension, cigarette smoking and hyperlipidemia, are noted risk factors for developing intracranial aneurysm. Pediatric intracranial aneurysm is considered rare and a threatening

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condition. Mortality is high if left untreated and sudden death may ensue with rebleeding. Management approach to these pediatric aneurysms largely differ from that of adults. The aim of the study was to review the pathomechanism of traumatic aneurysm in blunt head trauma in pediatric patients.

The Case

A consent was obtained from the father regarding presentation of the case.

This case involved a 6-year-old male who met developmental milestones prior to the injury and has no known familial comorbidities or previous hospitalizations. Before the injury, the patient excelled academically, shown proficiency in grammar, could read up to ten simple words with clarity, was capable of writing letters and numbers, and could ride a bicycle. He had a motor vehicular accident and following an emergency department consultation, exhibited a favorable condition immediately after the injury. The patient presented with a Glasgow Coma Scale score of 15, exhibiting alertness and no sensory or motor abnormalities; hence, he was monitored and discharged from the emergency room on the same day. At follow up after 4 days, he presented with recurrent seizures and motor weakness. Plain cranial computerized tomography (CT) scan was performed revealing a closed and depressed comminuted fracture in the left frontal bone. He was then admitted for observation and was discharged in apparent good health, with no recurrence of seizures. Eight days post injury, he complained of intermittent bifrontal to diffused headaches. A repeat plain cranial CT scan done revealed minimal interhemispheric subarachnoid hemorrhage, not previously seen on his prior CT scan. Patient was recommended for closed observation but was lost to follow up.

Three weeks post-injury, he had recurrent generalized tonic clonic seizures preceded by severe headache and decreased sensorium necessitating intubation during the emergency room consultation. Post ictus, the patient had eye opening to vigorous tapping, pupils were isocoric and briskly reactive to light, and with right hemiparesis. A cranial CT angiogram scan showed a saccular aneurysm of the left A2 branch aneurysm measuring 0.4cm × 0.4cm with its base measuring 0.27cm in its widest and left frontal intracerebral hemorrhage (ICH) measuring approximately 48 ml in volume (Figure 1 A and B)

The patient underwent bifrontal craniotomy, evacuation of the ICH and clipping of ruptured aneurysm. Post-operatively, the patient remained intubated, noted with right hemiparesis (2/5), was treated for pneumonia and weaned slowly. Post-extubation, the patient was aphasic until the second week after the surgery where the patient was able to speak a few words. Rehabilitation was initiated during admission and the patient was able to ambulate without support after 2 months and speech was comprehensible. Work-up for other possible causes of aneurysm in the pediatric population such as 2D echocardiography, whole abdominal ultrasound and hematologic work up all revealed unremarkable findings.

Discussion

Childhood aneurysms commonly become symptomatic at two periods - from birth to 6 years old and then from 8 years old to adolescence.[2] More commonly, cases seen are within the first 2 years of life although

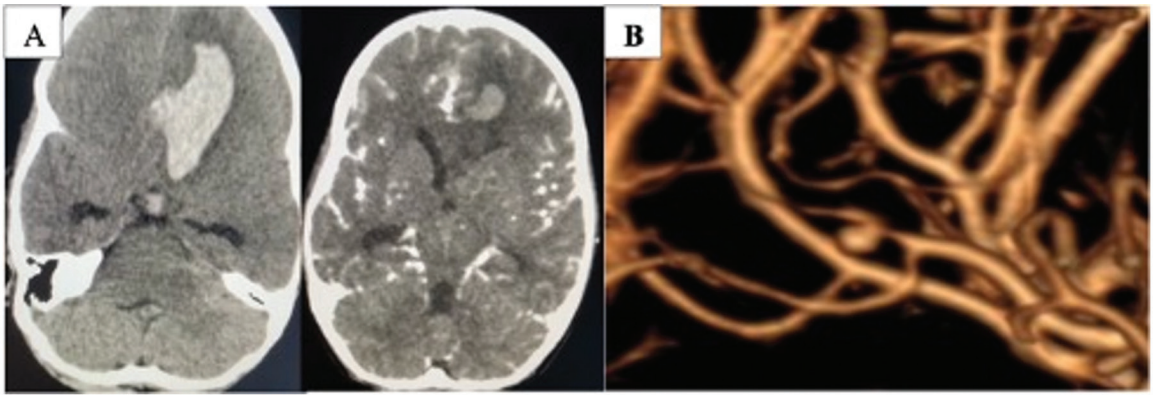

Figure 1. (A) Left frontal intracerebral hemorrhage (B) Saccular aneurysm at the left anterior cerebral artery, A2 segment

the early childhood age group includes newborns to the first 6 months. The incidence in children varies from 1.9% to 4.6%. Increasing trend of diagnosed cases is probably due to better diagnostic tools and heightened clinical suspicion.[1] Traumatic aneurysms can be classified as direct, if from a penetrating injury, or indirect in cases when it is caused by a blunt or closed head injury. The cortical vessels can be involved directly below or near the fractured segments.[2] Some cerebral aneurysms may be secondary to inherited risk factors such as genetic connective tissue disorders that weaken artery walls, polycystic kidney disease, arteriovenous malformations that disrupt blood flow and a history of aneurysm in a first degree family member. Traumatic intracerebral aneurysms are relatively common in childhood in the first 21 days post-trauma or even later.[3] Pediatric aneurysms can also be related to a systemic disease such as atherosclerosis, infection, connective tissue disease, familial syndromes or vascular anomalies due to unrecognized factors during development.[4,5,6] A higher incidence among patients with sickle cell disease was also noted.[5]

There are several theories postulating development of pediatric aneurysms. Traumatic aneurysms usually arise at the skull base or at distal anterior or middle cerebral arteries secondary to direct mural injury or to acceleration-induced shear.[6] They may also develop from the remnants of vascular trunks arising from arterial bifurcations.[2] These saccular aneurysms may arise from the vessel stumps that disappeared when fetal vascular network matured forming into the adult major arterial supply. These vestigial nubbins may form aneurysms over time. On the other hand, a degenerative process can also explain aneurysm development in the pediatric population. Intrinsic defects are considered as causative event predisposing vessel wall disruption hence the failure of repair on these subsequent insults. There are components of both intrinsic defects and insults in the development of aneurysmal disease amongst pediatric population.[2] A balance between these two factors and the compensation and repair for these changes can predict which aneurysm grows, ruptures, or regresses. Iatrogenic aneurysms may also occur with unexpected frequency in childhood and adolescence and they may also present early or late. Hence, any child with head injury who presents with delayed neurologic deterioration should undergo diagnostic imaging.[7] Pediatric intracranial aneurysms differ in comparison to adults in terms of characteristics, presentation and treatment outcomes.[8]

Endothelin receptor type A (EDNRA) gene encodes a receptor activated by endothelin which are responsible for the constriction and dilation of blood vessels. Endothelin-1, which is the primary variant present in vascular smooth muscle cells, is the one triggering EDNRA.[9] This signaling pathway is activated in vascular injuries causing increased in cell proliferation. There is a potential that a diminished activity, or downregulation, of EDNRA signaling might be a precursor to compromised vascular repair mechanisms. When this repair process is not optimized, it could cause vasculature susceptible to aneurysm formation following injuries or disturbances.[10]

In 15 to 25% of children with SAH, focal or generalized seizures can occur and are more common in infants. Seizure rate as the first presenting sign is about 7%. Seizures occurred most frequently in children with giant (25%) and posterior circulation (27%) aneurysms.[2] Once the presence of subarachnoid hemorrhage has been established, a standard, four-vessel cerebral angiogram is suggested for further investigation.

Traumatic aneurysms can be histologically categorized as true, false, or mixed. The most common type is false aneurysms. These aneurysms are typically associated with an acute episode of delayed intracranial hemorrhage with an average time from initial trauma to aneurysm hemorrhage of approximately 21 days.[3] Several mechanisms have been proposed in the formation of traumatic aneurysms, either direct injury to the vessel or via stretching of the vessel closely related to the anatomical location involved by adjacent forces. Infraclinoid carotid and basilar artery aneurysms are commonly associated with basilar skull fractures due to the proximity of these vessels with the skull base.[11,12,13]

The management of pediatric aneurysms is complex and difficult due to their distinct characteristics in contrast to adult cerebral aneurysms. A male predominance was seen, with the internal carotid artery bifurcation being the most prevalent site for the aneurysms.[8] In comparison to adults, pediatric patients exhibit a higher incidence of both posterior circulation and large aneurysms.[14]

Despite a higher incidence of complex aneurysm cases in pediatric patients, there is a good recovery at 6-months follow-up, which was seen in this case.

Post-operatively, the patient was aphasic with right hemiparesis (2/5). Speech improved the second week after the surgery and he was able to ambulate unassisted after 2 months. A favorable outcome of up to 95% is observed following the treatment of both ruptured and unruptured pediatric aneurysms.[15] The endovascular technique, wrapping, and trapping the aneurysm are further therapy possibilities. Nonetheless, no single approach is recommended for all lesions. The recurrence rate of treated aneurysms was 6.7% in the endovascular cohort and 0% in the microsurgical cohort. No de novo aneurysms developed in children, and the pediatric mortality rate was 10.6%.[16]

Conclusion

Traumatic Intracranial aneurysms (TICAs) may progressively grow, cause ICH and deterioration if not detected early. Hence high index of suspicion and aggressive treatment when diagnosed is generally needed. Post-operatively, the patient was aphasic with right hemiparesis (2/5). Speech improved the second week after the surgery. Rehabilitation was initiated after admission and unassisted ambulation noted after 2 months. Work up done for other possible causes of aneurysm in the pediatric population revealed unremarkable findings. Mechanism associated with blunt traumatic head injury in the development of aneurysm could be due to a shear or rotational injury damaging the vessels in close proximity to the dura, for instance in this case, close to falx cerebri.

References

1. Emir AF, Udin N, Othman AK, Salim NN, Saiful Arifin A, Rahman MM, Mohd R. Traumatic intracranial aneurysm (TICA) following closed head injury in children: a case report. JSM Clin Case Rep 2022 Nov;10(2):1204. Available from: https://doi.org/10.47739/2373-9819/1204.
2. Levy ML, Levy DM, Manna B. Pediatric cerebral aneurysm. Updated 2023 Aug 8. In: StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing; 2024 Jan–. Available from: https://www.ncbi.nlm.nih.gov/books/NBK537085/.
3. Livshits IM, Berdinov BF, Musa G, Magomedov I, Askerkhanov A. Traumatic intracranial aneurysms (TICA) in children: a description of two clinical cases of successful treatment and review of literature. Childs Nerv Syst 2022 Nov;38(11):2063–70. Available from: https://doi.org/10.1007/s00381-022-05647-9.
4. Vaicys C, Hunt CD, Heary RF. Ruptured intracranial aneurysm in an adolescent with Alport's syndrome—a new expression of type IV collagenopathy: case report. Surg Neurol 2000 Jul;54(1):68–72. Available from: https://doi.org/10.1016/s0090-3019(00)00253-6.
5. Holmin S, Ozanne A, Zhao WY, Alvarez H, Krings T, Lasjaunias P. Association of cervical internal carotid artery aneurysm with ipsilateral vertebrobasilar aneurysm in two children: a segmental entity? Childs Nerv Syst 2007 Jul;23(7):791–8. Available from: https://doi.org/10.1007/s00381-006-0294-1.
6. Goia A, Garrido E, Lefebvre M, Agid R, Wang H, Wang F. Ruptured intracranial aneurysm in a neonate: case report and review of the literature. World Neurosurg 2020 Aug;140:219–23. Available from: https://doi.org/10.1016/j.wneu.2020.05.018.
7. Ventureyra EC, Higgins MJ. Traumatic intracranial aneurysms in childhood and adolescence: case reports and review of the literature. Childs Nerv Syst 1994 Aug;10(6):361–79. Available from: https://doi.org/10.1007/BF00335125.
8. Kim M, Lee HS, Lee S, Park JC, Ahn JS, Kwon DH, Kwun BD, Park W. Pediatric intracranial aneurysms: favorable outcomes despite rareness and complexity. World Neurosurg 2019 May;125:e1203–16. Available from: https://doi.org/10.1016/j.wneu.2019.01.280.
9. Wang X, Douglas SA, Louden C, Vickery-Clark LM, Feuerstein GZ, Ohlstein EH. Expression of endothelin-1, endothelin-3, endothelin-converting enzyme-1, and endothelin-A and endothelin-B receptor mRNA after angioplasty-induced neointimal formation in the rat. Circ Res 1996 Feb;78(2):322–8. Available from: https://doi.org/10.1161/01.res.78.2.322.
10. Khatri D, Zampolin R, Behbahani M, Kobets A, Lax D, Manwani D, Benitez S, Toma A, Holland R, Brook A, Lee SK. Pediatric brain aneurysms: a review of 1458 brain MR angiograms. Childs Nerv Syst 2023 Nov;39(11):3249–54. Available from: https://doi.org/10.1007/s00381-023-05967-4.
11. Bank WO, Nelson PB, Drayer BP, Wilkins RH, Rosenbaum AE. Traumatic aneurysm of the basilar artery. AJR Am J Roentgenol 1978 May;130(5):975–7. Available from: https://doi.org/10.2214/ajr.130.5.975.
12. Loop JW, White LE Jr, Shaw CM. Traumatic occlusion of the basilar artery within a clivus fracture. Radiology 1964 Jul;83:36–40. Available from: https://doi.org/10.1148/83.1.36.
13. Maurer JJ, Mills M, German WJ. Triad of unilateral blindness, orbital fractures, and massive epistaxis after head injury. J Neurosurg 1961 Nov;18:837–40. Available from: https://doi.org/10.3171/jns.1961.18.6.0837.
14. Mehrotra A, Nair AP, Das KK, Srivastava A, Sahu RN, Kumar R. Clinical and radiological profiles and outcomes in pediatric patients with intracranial aneurysms. J Neurosurg Pediatr 2012 Oct;10(4):340–6. Available from: https://doi.org/10.3171/2012.7.PEDS11455.
15. Huang J, McGirt MJ, Gailloud P, Tamargo RJ. Intracranial aneurysms in the pediatric population: case series and literature review. Surg Neurol 2005 May;63(5):424–32; discussion 432–3. Available from: https://doi.org/10.1016/j.surneu.2004.11.023.
16. Xu R, Xie ME, Yang W, Gailloud P, Caplan JM, Jackson CM, Jackson EM, Groves ML, Robinson S, Cohen AR, Huang J, Tamargo RJ. Epidemiology and outcomes of pediatric intracranial aneurysms: comparison with an adult population in a 30-year, prospective database. J Neurosurg Pediatr 2021 Sep 10;28(6):685–94. Available from: https://doi.org/10.3171/2021.6.PEDS21268.

Pityriasis lichenoides chronica associated with rabies vaccination: a case report

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Abstract

Pityriasis lichenoides (PL) is an inflammatory papulosquamous condition that exists in a continuous spectrum that consists mainly of pityriasis lichenoides et varioliformis acuta and pityriasis lichenoides chronica (PLC). The condition has been reported to erupt in response to infections, radiocontrast media, medications and vaccines. Most case reports on vaccine-related eruption involve the acute PL, hence, this report aimed to present a case presenting with lesions of the chronic variant.

A 21-year-old female presented with multiple erythematous to hyperpigmented ill-defined plaques, some ulceronecrotic, topped with fine scales and excoriations on the upper and lower extremities, periumbilical area and back of 4 months duration, following rabies vaccinations.

Histopathologic findings, including interface dermatitis, parakeratosis, spongiosis, and mixed inflammatory infiltrates, confirmed the diagnosis of PLC. The patient responded well to oral corticosteroids and heliotherapy.

PL is rare and requires additional research. The potential role of vaccination as an etiologic agent represented a crucial area of this investigation. Additionally, heliotherapy should be considered as a viable therapeutic alternative when phototherapy is not feasible.. Further research is needed to elucidate the pathogenesis of PL and establish evidence-based treatment protocols.

Key words: Pityriasis lichenoides chronica, heliotherapy, vaccine, case report

Pityriasis lichenoides (PL) is an inflammatory papulosquamous condition that exists in a continuous spectrum that consists mainly of pityriasis lichenoides et varioliformis acuta (PLEVA) and pityriasis lichenoides chronica (PLC).[1-3] The exact prevalence, incidence, and risk factors of this condition remain unclear, yet it has been reported that the condition is more common in the pediatric age group but can affect all ages. Eruption of cutaneous lesions may be triggered by infections, radiocontrast media, medications and vaccines.[4-5] Although most case reports have demonstrated eruption after vaccination against viral entities, such as measles-mumps-rubella (MMR) and influenza vaccines, there is a recent report on PLEVA following vaccinations against bacterial entities, specifically anti-tetanus and diphtheria.[5] In this case report, the authors aimed to present a case of PLC following vaccination against rabies, including their clinical experience in the diagnosis and treatment.

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The Case

An otherwise healthy 21-year-old Filipino female student sought consult at the dermatology outpatient

clinic (OPC) due to multiple erythematous to hyperpigmented ill-defined plaques, some ulceronecrotic, topped with fine scales and excoriations on the bilateral upper and lower extremities, periumbilical area, and back of 4-months duration (Figure 1). The patient developed the aforementioned lesions seven days after receiving the third dose of rabies vaccine (Purified vero cell rabies vaccine [Human Biologicals Institute, India]) given for a dog bite. The eruption was associated with incessant pruritus graded 10/10. There were no systemic symptoms. The patient sought consult with a dermatologist who prescribed mometasone furoate lotion to be applied once daily but it only afforded temporary improvement of the itch and a decrease in the number and size of lesions, without complete resolution. One month later, due to persistence of the lesions, unrelenting pruritus, and occasional development of new lesions prompted consultation at this institution. The patient has an unremarkable medical history, with no history of atopy and allergies to food or medication. The primary clinical impression of pityriasis lichenoides chronica was confirmed by histopathological studies which revealed microscopic changes consistent with pityriasis lichenoides and drug reaction. The predominating pattern is subtle vacuolar interface change with parakeratosis, spongiosis, and superficial perivascular infiltrates consisting mainly of lymphocytes, with some neutrophils and eosinophils.

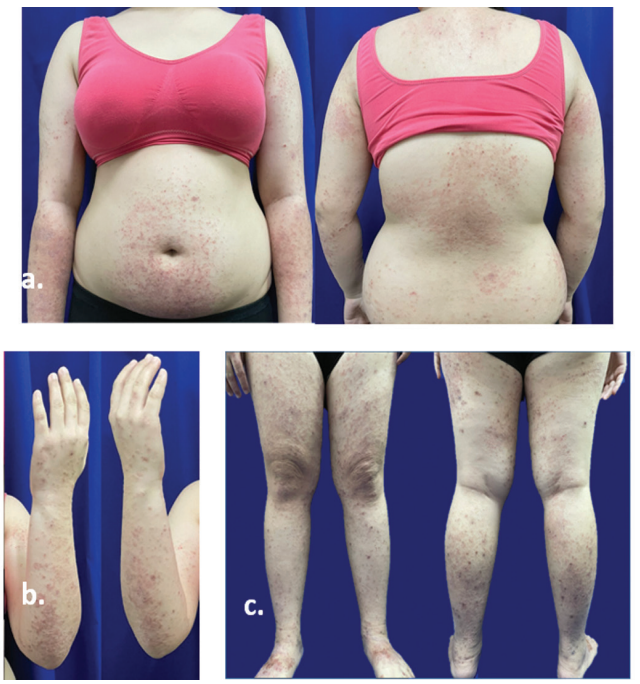

Figure 1. An adult female presented with multiple erythematous to hyperpigmented ill-defined plaques, some ulceronecrotic, topped with fine scales and excoriations on the trunk (a), and upper and lower extremities (b & c).

Oral prednisone was initiated at 0.7mg/kg/day and then slowly tapered over the course of 3 weeks. In the second week of oral prednisone, no new lesions were noted, all existing lesions were flat, hyperpigmented and there was substantial improvement in the hydration of the skin. At this point, both the pruritus and excoriations have already resolved. After 3 weeks on oral prednisone, majority of the lesions on the trunk and extremities have already resolved, with only a few erythematous to hyperpigmented thick plaques topped with scales on the patient's feet. Prednisone was discontinued, and, for the remaining lesions, betamethasone dipropionate ointment was prescribed, and tacrolimus 0.1% ointment, the latter to be applied while on steroid rest. Betamethasone dipropionate was then shifted to clobetasol propionate ointment for another 2 weeks with noted resolution. The patient was also instructed to undergo heliotherapy by exposing the affected areas to midday sun for 10-15 minutes 2-3 times per week throughout the course of treatment. Moreover, nonpharmacologic measures such as the use of emollient and mild soap were also advised and followed with good compliance.

Discussion

PL affects both children and adults, but most reports indicate that it is a predominantly pediatric condition. However, the exact worldwide prevalence in both the general and pediatric populations still remain unknown. While some studies have shown a male predominance, others have stated that there is no male or female predilection.[6] The Philippine Dermatological Society accredited institutions reported 1,363 cases of PL from 2011 to 2021, where 563 (41.3%) are males and 800 (58.7%) are females. Out of 1,363 cases, 267 (19.6%) are pediatric cases (0-18 years old).

Three main pathogenic theories have been proposed for PL: 1) an inflammatory reaction secondary to T-cell dyscrasias, 2) an immune complex mediated hypersensitivity vasculitis, and, the most popular theory, 3) an inflammatory, immunologic response induced by infectious agents and extrinsic antigens, such as drugs and vaccines.[5,7-9] Suggested potential mechanisms for the development of cutaneous reactions from vaccines include a) a type

I or type IV hypersensitivity response oftentimes due to excipients rather than the vaccine antigen. and b) a T-cell mediated skin reaction due to molecular mimicry with a viral epitope.[10,11] Since patient developed lesions after 24 hours post-vaccination, it is possible she developed a Type IV delayed hypersensitivity reaction to an excipient of the rabies vaccine. The administered vaccine contains the excipient thiomersol, which has been reported to cause delayed-type hypersensitivity reactions with a variety of cutaneous manifestations.[12]

A few case reports have been published on PL following vaccination, specifically on MMR, influenza, and double dose diphtheria and anti-tetanus vaccine.[9,13] The onset of eruption ranges from 2-10 days after receiving the dose in both pediatric and adult patients. Among the case reports cited, most of the patients presented with lesions consistent with PLEVA, with only one presenting as PLC. In the aforementioned case report, lesions characteristic of PLC erupted 10 days following MMR vaccination with a clinical course lasting 10 months.[13] The patient reported onset of eruption of her cutaneous lesions a week after receiving the 3rd dose of anti-rabies vaccine.

There have been many reports of cutaneous reactions following COVID-19 vaccination. An evaluation of clinical and histopathologic correlation of the reactions reported in an international registry on COVID-19 vaccine cutaneous reactions resulted to the identification of 13 different categories of biopsy-proven reactions, the most common being vaccine-related eruption of papules and plaques (V-REPP).[10,11] VREPP belongs to a histopathologic spectrum of papulosquamous reactions that demonstrate some degree of spongiosis with or without both prominent interface change and eosinophils, and clinically presents as papulo-vesicular, pityriasis rosea-like and papulosquamous with subtle scales.[10] Interestingly, the histological and clinical features of PLC meet the criteria of VREPP, particularly the third form.

Pityriasis lichenoides chronica is a diagnosis that warrants a high index of suspicion and confirmation by histology.[14] Histopathologic examination of PLC would typically show an interface pattern. The epidermis is parakeratotic and may show acanthosis, spongiosis and focal invasion of lymphocytes and erythrocytes. Classically, a wedge-shaped moderately dense lymphohistiocytic perivascular inflammatory infiltrate that obscures the dermoepidermal junction and extends down to the reticular dermis may be appreciated. On the other hand, PLEVA would show prominent exocytosis and dense and diffuse lymphocytic infiltration along the basal layer with features of vasculitis.[2,4] The patient's biopsy result was consistent with PLC due to the bandlike infiltrate composed of lymphocytes and the absence of vasculitis. The presence of few neutrophils and rare eosinophils is most commonly seen in drug eruptions, which is consistent with our clinical picture being that the eruption was secondary to vaccination.[15]

Thus far, phototherapy is considered to be first-line therapy for PLC, together with medications which include topical corticosteroids and calcineurin-inhibitors, and oral antibiotics, particularly tetracyclines and erythromycin.[4,5,16-17] Second line therapy includes methotrexate and cyclosporine, usually given for fulminant cases.[18] The authors decided to administer oral corticosteroids to the patient because of the severity of the lesions and the significant pruritus. They aimed to commence phototherapy; however, their patient was not receptive to this option during the ongoing COVID-19 pandemic. Instead of phototherapy, their patient was advised to engage in heliotherapy by exposing the affected areas to midday sun for 10-15 minutes, 2-3 times per week during the treatment period. A systematic review on heliotherapy showed that at a frequency of only 10 days per year, 60% of patients achieved almost complete clearance of PLC for at least 2 years of treatment.[18] To target the therapeutic narrowband UVB at 310 nm, heliotherapy must be conducted using midday sun, otherwise, it would be ineffective.[19] The choice of potency of topical corticosteroid is upon the discretion of the physician and no recommendations have been reported. In terms of phototherapy, few uncontrolled and retrospective studies have reported improvement in majority of patients.[16,20] Narrowband UVB treatment requires at least two to three months administered at least thrice in a week to achieve a favorable response.[21]

PLC lesions generally regress over weeks but may be followed by episodes of exacerbations and remissions that can accumulate to a clinical course that can take 1.5-31 months.[4,22] For the patient, the clinical course lasted for more than 1 year. It is also worth noting that in a study done on cutaneous hematologic disorders in children, 4 (7%) out of 51 patients had PLC 3 to 10 years prior to being diagnosed with mycosis fungoides. Consequently, patients with PLC warrant monitoring for new lesions and follow up as needed, due to the low risk of lymphomatous

transformation and evolution to cutaneous T-cell lymphoma.[23]

Conclusion

To the authors' knowledge, this is the first case report documenting PLC developing after antirabies vaccination. To date, no definite algorithm has been established in terms of its treatment. Guided by the recommended first-line and second-line therapies, treatment may vary depending on the extent of the lesions and severity of signs and symptoms, particularly pruritus. Amidst a global pandemic, heliotherapy should not be overlooked as a therapeutic option when patients are not amenable to undergo first-line conventional phototherapy.

References

1. Feola H, Mancinelli MC, Perez-Klala MV, Verea MA. Pityriasis lichenoides chronica: Rapid response after a single cycle of azithromycin therapy. Dermatol Ther 2020 May;33(3):e13303. doi: 10.1111/dth.13303. Epub 2020 Apr 1.
2. Khachemoune A, Blyumin ML. Pityriasis lichenoides: pathophysiology, classification, and treatment. Am J Clin Dermatol 2007;8(1):29-36. doi: 10.2165/00128071-200708010-00004.
3. Zang JB, Coates SJ, Huang J, Vonderheid EC, Cohen BA. Pityriasis lichenoides: Long-term follow-up study. Pediatr Dermatol 2018 Mar;35(2):213-9. doi: 10.1111/pde.13396. Epub 2018 Jan 9.
4. Bowers S, Warshaw EM. Pityriasis lichenoides and its subtypes. J Am Acad Dermatol 2006 Oct;55(4):557-72; quiz 573-6. doi: 10.1016/j.jaad.2005.07.058.
5. Merlotto MR, Bicudo NP, Marques MEA, Marques SA. Pityriasis lichenoides et varioliformis acuta following anti-tetanus and diphtheria adult vaccine. An Bras Dermatol 2020 Mar-Apr;95(2):259-60. doi: 10.1016/j.abd.2019.06.009. Epub 2020 Feb 19.
6. Geller L, Antonov NK, Lauren CT, Morel KD, Garzon MC. Pityriasis Lichenoides in Childhood: Review of Clinical Presentation and Treatment Options. Pediatr Dermatol 2015 Sep-Oct;32(5):579-92. doi: 10.1111/pde.12581. Epub 2015 Mar 26.
7. Filippi F, Patrizi A, Sabattini E, Varotti E, Bertuzzi C, Pileri A. Pityriasis lichenoides triggered by measles-mumps-rubella vaccine injection. J Dtsch Dermatol Ges 2020 Jul;18(7):758-60. doi: 10.1111/ddg.14153. Epub 2020 Jul 12.
8. Gunatheesan S, Ferguson J, Moosa Y. Pityriasis lichenoides et varioliformis acuta: a rare association with the measles, mumps and rubella vaccine. Australas J Dermatol 2012 Nov;53(4):e76-8. doi: 10.1111/j.1440-0960.2011.00781.x. Epub 2011 Jun 13.
9. Gunatheesan S, Ferguson J, Moosa Y. Pityriasis lichenoides et varioliformis acuta: a rare association with the measles, mumps and rubella vaccine. Australas J Dermatol 2012 Nov;53(4):e76-8. doi: 10.1111/j.1440-0960.2011.00781.x. Epub 2011 Jun 13.
10. McMahon DE, Kovarik CL, Damsky W, Rosenbach M, Lipoff JB, Tyagi A, Chamberlin G, Fathy R, Nazarian RM, Desai SR, Lim HW, Thiers BH, Hruza GJ, French LE, Blumenthal K, Fox LP, Freeman EE. Clinical and pathologic correlation of cutaneous COVID-19 vaccine reactions including V-REPP: A registry-based study. J Am Acad Dermatol 2022 Jan;86(1):113-21. doi: 10.1016/j.jaad.2021.09.002. Epub 2021 Sep 10.
11. Yu JN, Angeles CB, Lim HG, Chavez C, Roxas-Rosete C. Cutaneous reactions to inactivated SARS-CoV-2 vaccine and ChAdOx1-S (recombinant) vaccine against SARS-CoV-2: a case series from the Philippines. J Eur Acad Dermatol Venereol 2021 Dec;35(12):e841-5. doi: 10.1111/jdv.17575. Epub 2021 Aug 17.
12. Leventhal JS, Berger EM, Brauer JA, Cohen DE. Hypersensitivity reactions to vaccine constituents: a case series and review of the literature. Dermatitis 2012 May-Jun;23(3):102-9. doi: 10.1097/DER.0b013e31825228cf.
13. Gil-Bistes D, Kluger N, Bessis D, Guillot B, Raison-Peyron N. Pityriasis lichenoides chronic after measles-mumps-rubella vaccination. J Dermatol 2012 May;39(5):492-3. doi: 10.1111/j.1346-8138.2011.01380.x. Epub 2011 Oct 4.
14. Cliff S, Cook MG, Ostlere LS, Mortimer PS. Segmental pityriasis lichenoides chronica. Clin Exp Dermatol 1996 Nov;21(6):464-5. doi: 10.1111/j.1365-2230.1996.tb00163.x.
15. Weyers W, Metze D. Histopathology of drug eruptions - general criteria, common patterns, and differential diagnosis. Dermatol Pract Concept 2011 Jan 31;1(1):33-47. doi: 10.5826/dpc.0101a09.
16. Aydogan K, Saricaoglu H, Turan H. Narrowband UVB (311 nm, TL01) phototherapy for pityriasis lichenoides. Photodermatol Photoimmunol Photomed 2008 Jun;24(3):128-33. doi: 10.1111/j.1600-0781.2008.00350.x.
17. Di Costanzo L, Balato N, La Bella S, Balato A. Successful association in the treatment of pityriasis lichenoides et varioliformis acuta. J Eur Acad Dermatol Venereol 2009 Aug;23(8):971-2. doi: 10.1111/j.1468-3083.2008.03077.x. Epub 2009 Jan 21.
18. Fernández-Guarino M, Aboin-Gonzalez S, Ciudad Blanco C, Velázquez Tarjuelo D, Lázaro Ochayta P. Treatment of adult diffuse pityriasis lichenoides chronica with narrowband ultraviolet B: experience and literature review. Clin Exp Dermatol 2017 Apr;42(3):303-305. doi: 10.1111/ced.13035. Epub 2017 Jan 23.
19. Koo J, Nakamura M. Heliotherapy. In: Norman R, editor. Clinical Cases in Phototherapy. Tampa 2017; 77-80
20. Ersoy-Evans S, Hapa AA, Boztepe G, Sahin S, Kölemen F. Narrowband ultraviolet-B phototherapy in pityriasis lichenoides chronica. J Dermatolog Treat 2009;20(2):109-13. doi: 10.1080/09546630802449088.

21. Takada Y, Irisawa K, Kawada A. Heliotherapy of pityriasis lichenoides chronica. J Dermatol 1977 Jun;4(3):91-4. doi: 10.1111/j.1346-8138.1977.tb01019.x.
22. Sibbald C, Pope E. Systematic review of cases of cutaneous T-cell lymphoma transformation in pityriasis lichenoides and small plaque parapsoriasis. Br J Dermatol 2016 Oct;175(4):807-9. doi: 10.1111/bjd.14605. Epub 2016 Jun 20.
23. Boccara O, Blanche S, de Prost Y, Brousse N, Bodemer C, Fraitag S. Cutaneous hematologic disorders in children. Pediatr Blood Cancer 2012 Feb;58(2):226-32. doi: 10.1002/pbc.23103. Epub 2011 Mar 28.

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Krugman S, Overby LR, Mushahwar IK, et al. Viral hepatitis type B: studies on the natural history and prevention reexamined. N Engl J Med 1979; 300: 101-6.

Nyland LJ, Grimmer KA. Is undergraduate physiotherapy study a risk factor for low back pain? A prevalence study of LBP in physiotherapy students. Retrieved from: http://www.Biomed-central.com/1471-2474/4/22. 2003. [Accessed August 27, 2011].

Rankin J, Tennant PW, Stothard KJ, et al. Maternal body mass index and congenital anomaly risk: A cohort study. Int J Obes 2010; 34(9): 1371-80. Available from: http://ncbi.nlm.nih.gov/pubmed/20368710. [Accessed August 27, 2011].

Books and other monographs

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Adams RD, Victor M. Principles of Neurology. New York: McGraw-Hill; 1981.

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