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Relationship between Operation Duration and Light Intensity with Eye Fatigue in First Operation Assistant Nurses in Banten Province

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ABSTRACT

Eye fatigue in surgical assistant nurses can be caused by prolonged near vision and exposure to high-intensity surgical light. This study evaluates the relationship between duration of surgery and light intensity with eye fatigue. This research method was cross-sectional, with a population of 44 nurses at Banten Province Regional Hospital, Serang City Regional Hospital, and Dr. Drajat Prawiranegara Regional Hospital. The sample was selected using a purposive sampling method. The instruments are a lux meter and an eye fatigue questionnaire. The prevalence of eye fatigue was 18.2%. The results showed that there was no significant relationship between the duration of surgery and eye fatigue (P=0.6) and there was a significant relationship with light intensity (P=0.06). Light intensity was significantly related to eye fatigue, while duration of surgery was not.

Keywords : Eye Fatigue, Duration of Operation, Light Intensity, Nurse Assistant 1 Operation

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INTRODUCTION

Eye fatigue, characterized by discomfort around or above the eyes, is caused by excessive and prolonged contraction of the ciliary muscles when focusing on an object. Symptoms include pressure, itching, irritation, difficulty maintaining focus, redness, dryness, and headaches in the frontal and occipital regions. Prolonged near-vision activities often trigger eye fatigue.[1]

Globally, the World Health Organization (WHO) reported that around 2.2 billion individuals faced vision health issues in 2023, with a significant portion occurring among workers.[1] According to the International Labour Organization (ILO) and International Agency for the Prevention of Blindness (IAPB), 13 million people experienced work-related vision problems in 2023.[2] Research by Jasna et al. in 2018 found that 70.6% of workers suffered from eye fatigue.[3] Similarly, Dzohzua reported that 92.6% of ophthalmologists experienced eye fatigue, linked to occupational risks such as computer interaction, surgery, and long working hours.[1]

Nationally, operating rooms present significant hazards and risks for eye diseases and vision disorders. Surgical procedures require continuous mental and visual concentration, which reduces blink frequency and increases tear film evaporation, potentially leading to dry eyes. This is influenced by the duration of surgeries, ranging from 42 to 504 minutes. Low humidity, cold air, and airborne pollutants in operating rooms further exacerbate eye problems. [4] Long-term exposure to operating lamp light received by surgical assistant nurses will also cause eye fati gue. [5] This phenomenon is supported by the results of research by Rohmawati et al which found a relationship between work duration and eye fatigue.[6]

Locally, lighting in operating rooms is crucial for surgical procedures. International standards recommend a minimum illumination of 1000 lux for general operating room lighting.[7] The Indonesian Ministry of Health Regulation No. 7 of 2019 stipulates that general operating room lighting should be 300–500 lux, with operating table lighting at 10,000–20,000 lux.[8] Traditional surgical lights provide focused, high-intensity illumination beneficial for surgery but can cause glare, obscure surgical details, and reduce contrast. In the short term, this can lead to eye fatigue, manifesting as mild pain, headaches, and sensitivity around the eyes. [9] Prayoga's research indicated a significant relationship between light intensity and eye fatigue among medical personnel.[10]

Continuous exposure to high-intensity light in operating rooms can cause eye fatigue in surgeons. Long-term exposure to unmodulated light sources can lead to permanent photochemical damage, impairing

the eye's ability to protect the retina. A meta-analysis found that over 25% of surgeons reported eye fatigue as an occupational health hazard.[7]

Eye fatigue in workers can reduce productivity and quality of life, causing long-term issues like eye pain, corneal epithelial cell damage, conjunctival hyperemia, and decreased visual acuity. The visual feedback process involving the vestibular system and somatosensory networks can also be disrupted.[11] Operating room assistant nurses, particularly first assistant nurses, are at high risk of eye fatigue due to the need to adapt to varying lighting conditions during surgeries.[4] The continuous accommodation required by their eye muscles due to these lighting variations can lead to rapid eye fatigue.[12]

Previous studies have addressed eye fatigue in workers and ophthalmologists, the relationship between light intensity and eye fatigue in inpatient medical staff, and the relationship between lighting and eye fatigue in open operating rooms. However, no studies have specifically examined the relationship between operation duration and light intensity with eye fatigue among first assistant operating nurses.

This study aims to analyze the relationship between operation duration and light intensity with eye fatigue among first assistant operating nurses.

METHODS

This research is an observational analytic study using a cross-sectional design. Data collection was conducted from January to April 2024 in several hospitals in Banten Province, including RSUD Provinsi Banten, RSUD Kota Serang, and RSUD dr. Drajat Prawiranegara Kabupaten Serang. The independent variables were operation duration and light intensity, while the dependent variable was eye fatigue level. Primary data were collected using a lux meter and eye fatigue was assessed through interviews with a validated questionnaire.[13] The target population included all first assistant operating nurses in the hospitals, with a sample of 40 selected using purposive sampling. Data were managed manually, analyzed with SPSS 27.0 using univariate and bivariate (Chi-Square) analyses, and confidentiality was ensured. Ethical approval was obtained, with the clearance number provided.

RESULTS

Based on the research results, the distribution of respondent characteristics was obtained as follows:

Table 1. Characteristics of Respondents

Variable	Distribution	
	n	%
Age		
< 45 years	40	90,9
≥ 45 years	4	9,1
Gender		
Male	36	81,8
Female	8	18,2
Working period		
≤ 3 years	27	61,4
> 3 years	17	38,6
Refractive eye disorders		
Yes	7	15,9
No	37	84,1

In table 1, the characteristics of respondents from a total of 44 respondents are explained. The majority of respondents were under 45 years old and male (81.8%). Respondents who have worked for more than 3 years are only 38.6% of the total population. Most respondents did not have eye refractive errors (84.1%).

The following is the frequency distribution of the eye fatigue variables for nurse assistant 1, operation duration and light intensity on the operating table.

Table 2. Distribution of Eye Fatigue Events, Operation Duration and Light Intensity

Variable	Distribution	
	n	%
Eye fatigue		
Yes	8	18,2
No	36	81,8
Duration operation		
> average duration	19	43,2
≤ average duration	25	56,8
Light intensity		
> 20.000 lux	27	61,4
≤ 20.000 lux	17	38,6

In table 2, the majority of respondents do not experience eye fatigue (81.8%). The average duration of surgery from all the data obtained was 2.73+1.89 hours, respondents who worked more than the average duration (43.2%) were fewer than respondents who worked less than the average duration (56, 8%). The Ministry of Health sets the standard for lighting on the operating table as 10,000-20,000 lux.[8] Most respondents work with the light intensity on the operating table being more than the standard set by the Ministry of Health, namely more than 20,000 lux (61.4%).

The following is the frequency distribution of the eye fatigue variables for nurse assistant 1, operation duration and light intensity on the operating table.

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Table 3. Statistical Test Results for Characteristics of Respondents with Eye Fatigue

Variable	Eye fatigue				Total		P-Value[f]	OR (95% IK)
	Yes		No					
	n	%	n	%	n	%		
Age								
≥ 45 years old	1	25	3	75	4	100	0,57	1,57 (0,14-17,42)
< 45 years old	7	17,5	33	82,5	40	100		
Gender								
Female	2	25	6	75	8	100	0,62	0,6 (0,97-3,72)
Male	6	16,7	30	83,3	36	100		
Working period								
> 3 years	3	17,6	14	82,4	17	100	1	0,94 (0,19-4,58)
≤ 3 years	5	18,5	22	81,5	27	100		
Refractive eye disorders								
Yes	3	42,9	4	57,1	7	100	0,1	4,8 (0,81-28,15)
No	5	13,5	32	86,5	37	100		

Note:

F: Fisher Test

Based on table 3, it was found that there was no relationship between all respondent characteristic variables and the incidence of eye fatigue (P-Value >0.05). Statistical tests were carried out using the Fisher test because the data did not meet the requirements for carrying out the chi square test, namely that there was an expected ratio <5.

The following are the results of statistical tests to assess the relationship between the duration of surgery and light intensity with eye fatigue in surgical assistant nurses 1 in Banten Province which can be seen in the table below:

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Table 4. Statistical Test Results for Operation Duration and Light Intensity with Eye Fatigue

Variable	Eye fatigue				Total		P-Value[f]	OR (95% IK)
	Yes		No					
	n	%	n	%	n	%		
Duration operation								
> average duration	6	31,6	13	68,4	19	100	0,6	5,3 (0,93-30,2)
≤ average duration	2	8	23	92	25	100		
Light intensity								
>20.000 lux	8	29,6	19	70,4	27	100	0,016*	
<20.000 lux	0	0	17	100	17	100		

Note:

F : Fisher Test

* : Significant relationship

Based on table 4, it was found that there was no relationship between the duration of surgery and eye fatigue in nurse assistant 1. Meanwhile, for the light intensity variable, a relationship was found (P<0.05). However, an OR value was not obtained because none of the respondents who worked with light intensity <20,000lux experienced eye fatigue.

DISCUSSION

The study examined various factors related to eye fatigue among first assistant operating nurses in several hospitals in Banten Province. The majority of respondents were under 45 years old (90.9%), but age was not significantly related to eye fatigue, aligning with previous research findings.[1415] Most respondents were male (81.8%), likely due to the high workload in operating rooms, yet no significant relationship was found between gender and eye fatigue.[14] Similarly, work experience showed no significant relationship with eye fatigue, as experienced nurses may better analyze job risks.[16] Most respondents (84.1%) had no refractive eye disorders, and those with disorders used corrective aids, negating significant impacts on eye fatigue.

The average operation duration was 2.73 ± 1.89 hours, with 56.8% of operations lasting less than the average. Light intensity in operating rooms often exceeded the recommended 20,000 lux, with 61.4% reporting higher levels, causing glare for many nurses. Although the data collection method relied on self-reported questionnaires, it found that 81.8% of respondents did not experience eye fatigue, with glare being the most common symptom (68%). The eye fatigue measurement tool used, the questionnaire, depends on the subjectivity of the respondent.[17] Eye fatigue is reversible, this means that the condition of eye fatigue can recover after adequate rest.[16]

The study found no significant relationship between operation duration and eye fatigue, which may be due to the overall normal work hours (7 hours per day).[18] However, there was a significant relationship between light intensity and eye fatigue, with higher intensity associated with increased fatigue (P-Value = 0.016), consistent with previous studies.[1019] Nurses frequently reported glare and temporary dark vision after operations, which could be due to decreased photosensitive chemicals in the eye from prolonged exposure to bright light.[20]

CONCLUSION

The study concluded that the prevalence of eye fatigue among first assistant operating nurses in Banten Province is 18.2%. The average duration of operations is 2.73 ± 1.89 hours, and the light intensity at operating tables often exceeds the Ministry of Health's standard, with 61.4% of cases above 20,000 lux. There is no significant relationship between operation duration and eye fatigue (P-value = 0.6), but there is a significant relationship between light intensity and eye fatigue among these nurses (P-value = 0.016).

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