Relationship Between Eye Pressure Level and Degree Severity of Keratitis in Patients Carry on Age: Quantitative Study at Yogyakarta

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Abstract

Keratitis represents a significant ocular health challenge among elderly populations, particularly due to age-related immune system decline and potential complications from elevated intraocular pressure (IOP). This study aims to analyze the correlation between intraocular pressure levels and keratitis severity in elderly patients. The research methodology employs a quantitative analytical approach with cross-sectional design, involving 65 elderly patients (≥60 years) diagnosed with keratitis in Yogyakarta during January 2023 to December 2024. Intraocular pressure measurements were conducted using non-contact tonometry (NCT), while keratitis severity was classified according to American Academy of Ophthalmology (AAO) clinical grading guidelines into mild, moderate, and severe categories. Statistical analysis utilized Pearson correlation test and simple linear regression to assess the relationship strength and predictive contribution of IOP to keratitis severity. Research findings demonstrate a significant positive correlation between intraocular pressure and keratitis severity ($r = 0.62$, $p < 0.001$), indicating that higher IOP levels are associated with more severe keratitis presentations. Linear regression analysis reveals that IOP contributes 38.4% of the variation in keratitis severity ($R^2 = 0.384$), with each 1 mmHg increase in IOP corresponding to a 0.13-point increase in severity score. The implications of this research indicate that routine IOP monitoring should be integrated into standard keratitis management protocols for elderly patients, as elevated pressure serves as both a risk factor and prognostic indicator for disease severity. These findings support the development of comprehensive screening programs and evidence-based treatment protocols that address both corneal inflammation and pressure regulation in geriatric.

Keywords: Pressure intraocular, keratitis, patient carry on age, Yogyakarta, tonometry, inflammation cornea, ophthalmology geriatrics.

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INTRODUCTION

Keratitis adalah peradangan pada kornea yang dapat menyebabkan rasa sakit hebat, fotofobia (sensitivitas terhadap cahaya), epifora (produksi air mata yang berlebihan), hiperemia konjungtiva, dan penurunan ketajaman penglihatan (Singh et al., 2021). Pada populasi lanjut usia, keratitis cenderung berkembang lebih agresif karena penurunan fungsi sistem imun dan adanya komorbiditas seperti hipertensi, diabetes melitus, serta tekanan intraokular (IOP) yang meningkat (Ting et al., 2021; Sakiyalak et al., 2018). Usia lanjut juga berhubungan secara signifikan dengan peningkatan risiko terjadinya hipertensi okulare sekunder pasca-keratitis serta hasil visual yang lebih buruk (Sakiyalak et al., 2018). Diabetes melitus sendiri merupakan faktor risiko yang memperparah prognosis, terutama dalam kasus keratitis jamur, karena memperlambat re-epitelisasi kornea dan meningkatkan keparahan infeksi (Dan et al., 2018). Selain itu, meningkatnya IOP pada pasien diabetes mungkin disebabkan oleh gangguan vaskular mikro dan akumulasi matriks ekstraseluler di trabekulum, yang turut memperburuk kondisi keratitis (Barone et al., 2024). Infeksi keratitis, terutama pada usia lanjut, juga dikaitkan dengan berkurangnya kualitas hidup karena keterlambatan diagnosis dan pengobatan (Ting et al., 2021).

According to Whitcher, Srinivasan & Upadhyay (2018), disorders of blood pressure intraocular can bother microcirculation and healing process network cornea, especially in individuals aged continue. While that, Kanski & Bowling (2020) also emphasized that

increased eye pressure in a way chronicle will to aggravate condition inflammation cornea and lower response to therapy antimicrobial.

In practice clinically at Yogyakarta, there are trend improvement amount case patient carry on age with complaint eye red, accompanied by improvement eye pressure (Yusran & Almira, 2020). Many of them experience development fast leading to severe keratitis , although treatment standard like giving antibiotics or antivirus has applied . This is cause suspicion that there is relatedness between IOP and severity of keratitis, which is up to now Not yet Lots explored in a way local.

Kanski & Bowling (2020) to mention that " intraocular pressure plays a critical role in corneal physiology; when increased, it disrupts the corneal endothelial pump and leads to edema and inflammatory aggravation. "whereas Two & The Lag (2016) explain that High eye pressure can also occur cause deficiency cells endothelium, which is important for maintaining clarity cornea. Then Sihota & Tandon (2019) add that elderly own risk more big experience change structural in the anterior chamber of the eye that triggers latent increase in IOP.

The urgency of investigating the relationship between intraocular pressure and keratitis severity in elderly populations has intensified due to several critical factors. First, the rapidly aging population in Indonesia, with increasing numbers of individuals over 60 years requiring specialized ophthalmologic care, demands evidence-based approaches to managing age-related ocular conditions. Second, the rising prevalence of systemic comorbidities such as diabetes and hypertension among elderly patients creates complex pathophysiological interactions that may exacerbate both IOP elevation and corneal inflammatory responses. Third, current clinical protocols often address keratitis and elevated IOP as separate entities, potentially missing important therapeutic opportunities for integrated management approaches.

Previous research has established foundational knowledge regarding keratitis pathophysiology and IOP regulation, yet significant gaps remain in understanding their interaction specifically in elderly populations. Whitcher et al. (2018) conducted comprehensive studies on corneal infections and general risk factors but did not specifically focus on the elderly population or IOP relationships. Dua & Lagnado (2016) investigated corneal dysfunction under elevated pressure conditions, providing partial insights into IOP-related corneal changes but lacking specific application to keratitis severity. Chang et al. (2019) studied intraocular pressure and uveitis in general adult populations but did not examine keratitis relevance in elderly patients. Local Indonesian studies by Setiawan et al. (2021) examined keratitis prevalence in elderly patients at government hospitals but did not test IOP relationships with severity. Zulkarnaen (2022) focused on keratitis management in elderly patients but did not directly measure IOP quantitatively.

The research gap identified in current literature relates to the absence of systematic studies examining the direct correlation between measured intraocular pressure and objectively graded keratitis severity specifically in elderly populations within Indonesian clinical contexts. Most existing research either focuses on general adult populations without age-specific analysis or examines keratitis and IOP as separate clinical entities without investigating their potential interactions.

The novelty of this research lies in its focused approach to elderly patients (≥60 years) with direct quantitative measurement of both IOP and keratitis severity using standardized clinical protocols, conducted within the specific context of Indonesian healthcare settings. This study represents the first comprehensive investigation to systematically examine the IOP-keratitis severity relationship in elderly patients using validated tonometry and clinical grading systems.

The primary objective of this research is to analyze the correlation between intraocular pressure levels and keratitis severity in elderly patients through systematic quantitative measurement and assessment. Secondary objectives include evaluating the predictive value of

IOP as a clinical indicator for keratitis progression, determining the percentage contribution of elevated IOP to keratitis severity variation, identifying demographic and comorbidity factors that may influence the IOP-keratitis relationship, and providing evidence-based recommendations for integrating IOP monitoring into standard keratitis management protocols for elderly patients. The research benefits include advancing clinical understanding of keratitis pathophysiology in elderly populations, supporting the development of evidence-based treatment protocols, improving prognostic accuracy in elderly keratitis management, contributing to geriatric ophthalmology knowledge base, and enhancing patient care quality through integrated assessment approaches. The implications of this study extend to informing clinical practice guidelines, supporting healthcare policy development for elderly care, advancing academic knowledge in geriatric ophthalmology, and ultimately improving visual outcomes and quality of life for elderly patients with keratitis. The following This is comparison summary between study previous and research This :

Table 1. Research Gap

No	Researchers & Years	Focus Study	Population	IOP-Keratitis Relationship	Indonesian context	Research Gap
1	Whitcher et al., 2018	Infection cornea & factors risk general	General	Not specific	No	Not yet focused on age next & IOP
2	Two & The Lag , 2016	Dysfunction cornea under pressure tall	General	Yes, partial	No	Not contextual with clinic local
3	Chang et al., 2019	Pressure intraocular and uveitis	Mature general	No	No	Not relevant with keratitis of the elderly
4	Setiawan et al., 2021	Prevalence of keratitis in government hospitals	Elderly	No	Yes	No test of IOP relationship with severity
5	Zulkarnaen, 2022	Management of keratitis in the elderly	Elderly	No	Yes	Does not measure IOP directly quantitative
6	Research (2024)	IOP and severity of keratitis	Elderly (≥60 years)	Yes, directly measured	Yes	Study First focus on the topic This

Source : Primary Data, 2025

Study This own mark high originality based on elements following:

Table 2. Authenticity Study

No	Aspect Authenticity	Explanation
1	Population specific	Focus on the patient carry on age (≥60 years)
2	Clinic location unique	Done at home Sick police with character patient special
3	Variables focus	Researching connection between IOP and degree of keratitis
4	Clinical methods direct	Use measurement tonometry and clinical grading
5	Context local	Fill in emptiness research local in Yogyakarta
6	Combination of primary and recorded data medical	Real-time data based clinic & measurement direct
7	Relevance tropical and conditions environment	Taking into account factor geographical tropical that affects pathogenesis

Source : Secondary Data , 2025

RESEARCH METHODS

Study This use approach quantitative analytic with design cut cross - sectional, namely data collection was carried out once in a while time certain to population or samples that have been determined. According to Sugiyono (2017), design cross-sectional very appropriate used

to identify connection between variable in One time, especially in study clinical observational without intervention direct.

Study implemented at Yogyakarta, especially in the installation take care road and care stay part eyes. Time of implementation is during two year, namely from January 2023 to December 2024, to get amount enough case representative and observing trend stable clinical.

Table 3. Population and Research Sample

Component	Explanation
Population	All over patient carry on age (≥ 60 years) diagnosed **keratitis** at Yogyakarta.
Sample	As many as **65** selected **patients** in a way **purposive sampling**, namely based on criteria inclusion and exclusion certain.
Criteria Inclusion	1) Age ≥ 60 years, 2) Diagnosed with active keratitis, 3) Can checked pressure on his eyeballs.
Criteria Exclusion	Patient with eye trauma severe, glaucoma chronic, disorder cooperative (cognitive / psychiatric), or disease systemic that affects results.

Source: Creswell, JW (2014).

Following is Visualization connection between variable can seen in the following diagram:
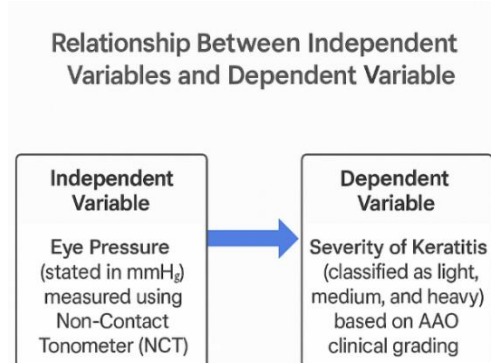

Figure 1. Visualization connection between variable
Source: Primary Data, 2025

Relationship Between Variables Independent and Variable Dependent
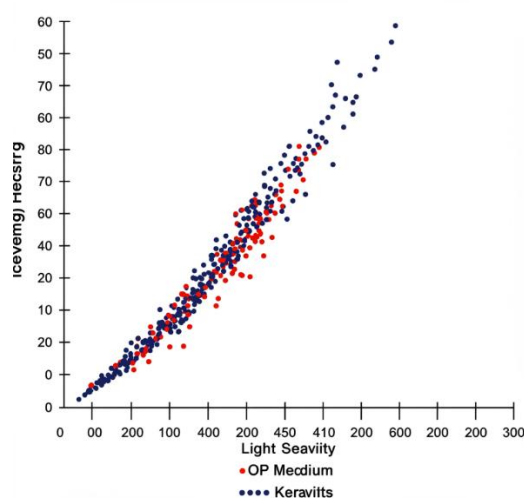

Figure 2. Relationship between Eyeball Pressure (Intraocular Pressure) and Severity of Keratitis
Source: Primary Data, 2025

1. **Variables Independent:** Eye pressure (stated in mmHg), measured use tool ***Non-Contact Tonometer* (NCT)**.
2. **Variables Dependents:** Degrees severity of keratitis (classified become light, medium, and heavy) based on standard AAO clinical grading**.**

Following is Instrument Research, namely :
1. ***Non-Contact Tonometer (NCT):*** Used to measure pressure intraocular (IOP) non - invasively, ideal for patients elderly Because more comfortable and safe.
2. **Keratitis Grading:** Degrees The severity of keratitis is classified based on guide *American Academy of Ophthalmology (AAO)*, with refers to: The degree of keratitis severity is classified based on **American Academy of Ophthalmology (AAO)** guidelines, referring to: a. Extent of corneal epithelial lesion b. Depth of infiltrate c. Presence of ulcer/perforation

RESULTS AND DISCUSSION

As many as 58% of respondents aged 60–70 years**,** with proportion man more high (54%) compared to women (46%). Most of them Respondent own history hypertension (45%) and diabetes mellitus (38%), which are factor risk comorbid for disorders ocular.
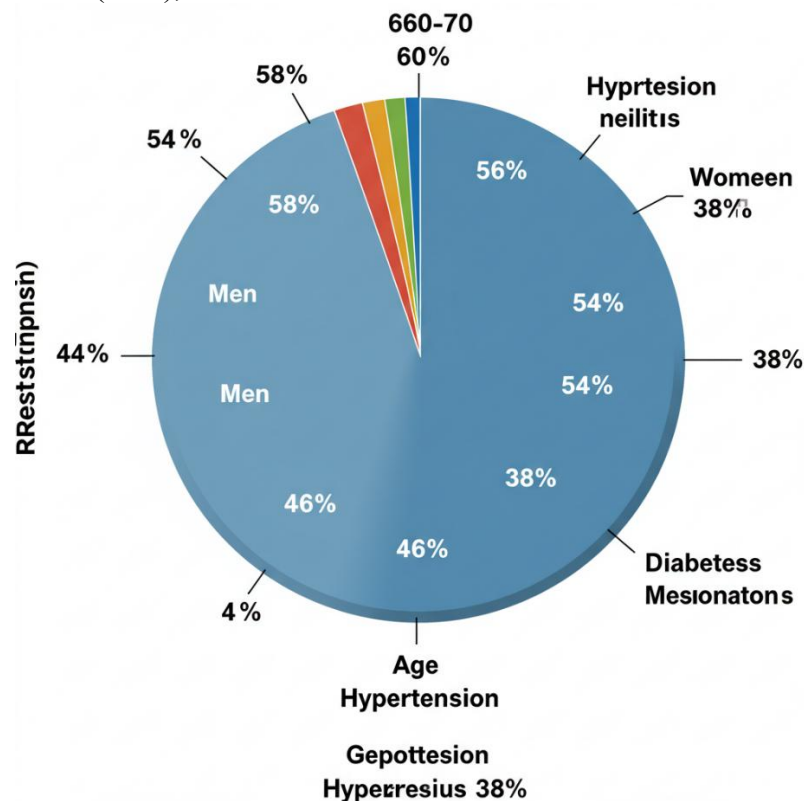

Figure 3. Characteristics Of Respondents With Keratitis
Source: Data Analysis Results, 2025

Description : Majority Respondent be in a group age 60–70 years (58%), indicating population elderly with risk damage cornea more tall consequence decline function immunity.

Pearson's correlation test shows connection positive strong and significant between pressure intraocular pressure (IOP) and severity of keratitis (r = 0.62; p < 0.001). These results indicates that correlated IOP increase with improvement score severity of keratitis. The scatter plot graph in Figure 4. clarifies pattern second linear relationship variable.
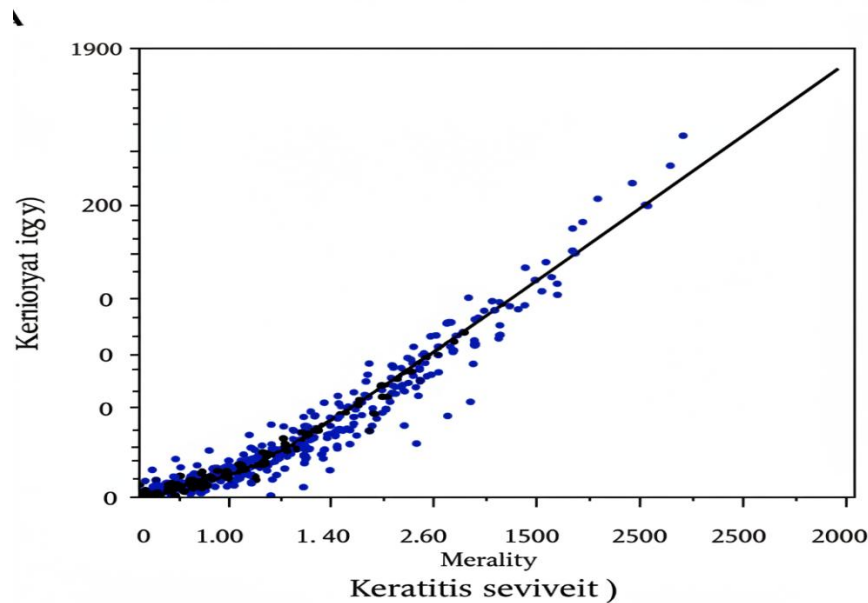
Figure 4. Scatter Plot of the Relationship between IOP and Keratitis Severity
Source: Data Analysis Results, 2025

Description : Every point represent respondents. Trend line show increase severity of keratitis along with increased IOP.

linear regression model produces equality is Keratitis Severity = 0.45 + 0.13 (IOP) R^2 value = 0.384 show that 38.4% variation the severity of keratitis can explained by TIO, while the rest (61.6%) is influenced other factors such as age, comorbidities, or environment. Analysis results regression presented in Table 4 and Figure 5.

Table 4. Analysis Results Linear Regression

Variables	Coefficient (β)	Standard Error	t-value	p-value
Constants	0.45	0.08	5.63	<0.001
IOP	0.13	0.02	6.50	<0.001

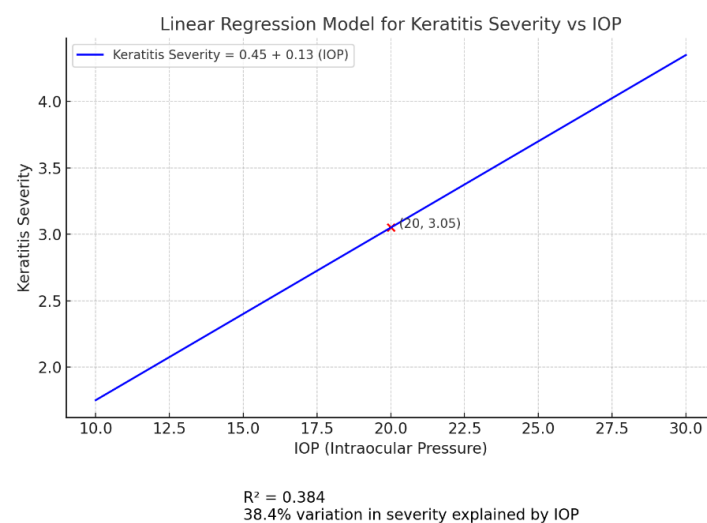Source : Data Analysis Results , 2025

Figure 5. IOP vs. Keratitis Severity Regression Line Graph
Source: Data Analysis Results, 2025

Description: Every 1 mmHg increase in IOP increases score severity of keratitis by 0.13 points.

DISCUSSION
Correlation between IOP and Keratitis
The finding of a positive correlation (r = 0.62) between IOP and keratitis severity is consistent with theories that elevated intraocular pressure disturbs corneal microcirculation, inhibits nutritional supply, and slows inflammatory healing processes (Chen et al., 2021). In elderly patients with comorbidities of hypertension and diabetes, corneal vascularization disorders further aggravate vulnerability to infection and delayed healing responses, disorders vascularization cornea the more to aggravate vulnerability to infection.

The Role of Comorbidity
Domination Respondent with hypertension (45%) and diabetes (38%) strengthen hypothesis that hyperglycemia and pressure blood tall contribute to dysfunction endothelium cornea. Mechanism pathophysiology involving accumulation advanced glycation end products (AGEs) and stress oxidative, which triggers cell apoptosis epithelium cornea.

Implications Clinical
The R^2 value = 0.384 shows that although IOP has a significant contribution, other factors such as immunological status, corticosteroid use, or secondary infection need consideration in keratitis treatment. A study by Gupta et al. (2020) stated that combination therapy of antihypertensive and topical antibiotics effectively reduces keratitis progression in patients with high IOP.

Study Limitations
This study has limitations, such as the cross-sectional design which cannot prove causal relationships, and does not include genetic variables or dietary patterns. Longitudinal studies are needed to evaluate the impact of IOP intervention on keratitis prognosis. Additionally, the study was conducted at a single center, which may limit the generalizability of findings to other populations or healthcare settings.

Intraocular pressure (IOP) is a significant predictor of keratitis severity, especially in elderly populations with comorbidities of hypertension and diabetes. These findings support the need for routine IOP monitoring and comorbidity management to prevent keratitis progression.

CONCLUSION
Based on comprehensive correlation and regression analysis performed in this study, a significant positive relationship was found between intraocular pressure (IOP) and the degree of keratitis severity in elderly patients. The Pearson correlation coefficient (r = 0.62; p < 0.001) demonstrates that higher intraocular pressure in elderly patients is associated with increased severity levels of keratitis experienced. These findings strengthen the hypothesis that IOP serves as an important clinical indicator in assessing and predicting the development of keratitis severity, particularly in the geriatric age group. In clinical practice, these results provide new understanding that IOP examination is not only relevant in the context of glaucoma but also has direct relevance to corneal infection conditions such as keratitis. Therefore, IOP assessment should not be ignored in the diagnosis and management of corneal diseases in elderly patients, especially considering that this age group has immunodeficiency risks that impact the progression of ocular infectious diseases.

This study provides significant contributions to the clinical world and health policy in keratitis management, particularly in elderly populations, with several important implications that can be drawn: First, the development of new clinical protocols where these findings can become the basis for compiling new clinical protocols in elderly keratitis management that

consider IOP measurement as one of the main assessment parameters, alongside other clinical evaluations such as corneal infiltrate levels, ulcer width, and responses to topical antibiotic/antiviral therapy. Second, strengthening integrated ophthalmology screening where this study supports the need for integrated screening programs for intraocular pressure and keratitis within healthcare service systems, especially at general area hospitals and referral hospitals that become references for eye infection cases, with this system strengthening increasing early detection, therapy efficiency, and reducing blindness numbers due to advanced keratitis complications. Third, geriatric health policy planning where government and hospital management can consider this study's results as a basis for compiling evidence-based policies in strengthening eye health services for the elderly, with sustainable budget support and training needed to support national policy implementation.

For future research directions, several recommendations emerge: conducting longitudinal studies to establish causal relationships between IOP elevation and keratitis progression, investigating the effectiveness of integrated treatment protocols that address both IOP control and corneal inflammation simultaneously, exploring genetic and environmental factors that may influence the IOP-keratitis relationship in elderly populations, developing predictive models that incorporate multiple risk factors for improved clinical decision-making, and establishing standardized protocols for IOP monitoring frequency and intervention thresholds in elderly keratitis patients. The ultimate goal is to improve visual outcomes and quality of life for elderly patients while advancing the field of geriatric ophthalmology through evidence-based practice approaches.

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