INTERDISCIPLINARY MANAGEMENT OF ISCHEMIC OPTIC NEUROPATHY: OPHTHALMOLOGY, INTERNAL MEDICINE, AND NEUROLOGY IN SARDJITO HOSPITAL

THESIS

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RATIFICATION PAGE

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Obtaining a Bachelor of Medicine Degree
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STATEMENT PAGE

I hereby declare that this thesis contains no work that has ever been submitted for the award of a degree at any university, and to the best of my knowledge, it also does not contain any work or opinion that has been written or published by others, except those which are clearly referred to in this manuscript and cited in the list of references.

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FOREWORD

Praise and gratitude to the presence of Allah SWT who has bestowed His grace and blessings upon the author so that the author was given the opportunity to complete the final assignment entitled "Interdisciplinary management of Ischemic Optic Neuropathy: Ophthalmology, Internal Medicine, and Neurology in Sardjito Hospital".

The author realizes that without the help and support of various parties in the preparation of this final assignment, the author cannot complete this final assignment properly. Therefore, on this occasion, the author would like to thank the following parties:

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Yogyakarta

31 January, 2025

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CHAPTER I INTRODUCTION

A. Background

Ischemic optic neuropathy, also referred to as vascular optic neuropathy, is a condition caused by insufficient blood supply to the eye and reduced oxygenation to the optic nerve leading to damage to the optic nerve fibers. The impaired circulation causes a variety of vision-related complications, most notably vision loss. The vision loss is typically rapid in onset and occurs without accompanying pain. Inadequate blood supply results from different etiologies, including atherosclerosis, embolic phenomena, vasculitis, and compression of the blood supply.

Vascular optic neuropathy is classified into two primary types, which are anterior ischemic optic neuropathy (AION) and posterior ischemic optic neuropathy (PION). AION is further categorized into two subtypes, arteritic anterior ischemic optic neuropathy (AAION) and non-arteritic anterior ischemic optic neuropathy (NAION). The etiologies of these optic neuropathy types vary due to differences in pathophysiology. NAION, the more prevalent form, is often associated with common risk factors such as hypertension, diabetes, stroke and hyperlipidemia. In contrast, AAION stems from inflammation and thrombosis of the arteries, usually associated with Giant Cell Arteritis or GCA.

The vast majority of AION cases are non-arteritic. NAION affects between 2.3 and 10.3 per 100,000 people annually, making it the leading cause of acute optic

neuropathy among those over the age of 50. Men and women are almost equally affected, with the average age of symptom onset ranging from 57 to 65 years (Cestari, 2004)

In Indonesia, however, there is a lack of data on the prevalence of ischemic optic neuropathy. Although ischemic optic neuropathy was not among the top five main causes of vision loss in Indonesia, it is a potential complication arising from several common health conditions, including stroke, vascular diseases, and hyperlipidemia.

Data from the Institute for Health Metrics and Evaluation (IHME) in 2019 show that stroke is the leading cause of death in Indonesia, accounting for 19.42% of total deaths (Hikmareza, 2024) According to the 2018 Basic Health Research (Riskesdas), the prevalence of stroke in Indonesia increased by 56%, rising from 7 per 1,000 population in 2013 to 10.9 per 1,000 people in 2018 (Setyopranoto 2022). Additionally, the International Diabetes Federation (IDF) reported that in 2021, 10.8% of the adult population in Indonesia were living with diabetes. The increasing prevalence of both stroke and diabetes underscores the growing burden of vascular diseases in Indonesia, which can lead to further complications, including vascular optic neuropathy.

The diagnosis of NAION primarily relies on identifying optic edema with a cup-to-disc ratio of 0.2 or less. Patient-reported symptoms during anamnesis, often demonstrate the functional impact of reduced visual acuity and visual field defects, but there is typically no pain involvement. Several treatment strategies have been

attempted, however none have been proven to be effective; surgical interventions, such as optic nerve head decompression via vitrectomy have shown to be potentially harmful with minimum benefits. Thus, the only ongoing and most preferred intervention to treat NAION, AION, and PION is through a high dose corticosteroid injection. One study revealed that intravitreal injections of bevacixumac, a monoclonal antibody that targeting vascular endothelial growth factor (VEGF), combined with triamcinolone (a corticosteroid) to treat NAION, resulted in poor outcomes. Another treatment involved is subcutaneous injections of Rph201, an isolated botanical extract derived from gum mastic.

As for the prognosis of NAION, vision tends to worsen gradually over two weeks and then remain stable over time. However, several studies have reported that a minority (13% to 42.7%) of patients show a significant improvement in visual acuity. Without treatment, 54-95% of patients with GCA experience vision loss, typically within four months. Corticosteroid therapy significantly reduces this rate to approximately 13%. However, visual recovery in the affected eye is generally poor, with an improvement rate of 15-34%. Despite treatment, 9-17% of patients still experience worsening visual acuity (Atkins, 2010). This highlights the importance of early and accurate diagnosis as well as prompt treatment, given the rapid progression of the disease, to maximize chances of preserving or improving vision.

Although the exact treatment is still unclear, addressing vascular risk factors that contribute to the pathogenesis of NAION and AAION can be improved with a few lifestyle modifications. Thus, this should be managed by the interprofessional

team, including endocrinologists, general practitioners, neurologists, and ophthalmologists; all working together to provide comprehensive care. Healthcare providers play a crucial role in patient education and follow-ups, ensuring that patients understand their treatment plans and monitoring their progress. Specialists that are included should collaborate closely, sharing updates on issues or concerns that may arise during the course of care allowing for timely adjustment in the treatment plan.

B. Problem Formulation

Despite the increasing prevalence of vascular diseases in Indonesia there is a lack of comprehensive studies examining the effectiveness of interdisciplinary management in improving visual outcomes for patients with vascular optic neuropathy.

C. Study Objective

1. General objectives:

1.1. This study was intended to evaluate the effectiveness of interdisciplinary management in diagnosis and treatment of ischemic optic neuropathy according to the visual outcomes

2. Specific objectives:

2.1. To compare visual acuity between patients managed by a single specialist and those under interdisciplinary care in RSUP Sardjito Yogyakarta

2.2. To evaluate the intervention done to the patients from ophthalmology, internal medicine, and neurology specialists

2.3. To identify communication barriers in interdisciplinary teams managing ischemic optic neuropathy in RSUP Sardjito Yogyakarta

2.4. Strategies suggestions to enhance interdisciplinary collaboration in clinical practice for better patient outcomes in RSUP Sardjito Yogyakarta

D. Research Benefits

1. **Academic**

This study aims to fill the existing research gap regarding the interdisciplinary management of ischemic optic neuropathy. By analyzing patient outcomes based on single-specialist versus interdisciplinary care, this research provides valuable insights into the role of collaborative approaches in optimizing diagnosis and treatment strategies.

2. **Clinical**

The study seeks to provide evidence-based recommendations for healthcare providers to enhance interdisciplinary collaboration and improve patient care. By evaluating the impact of coordinated management among opthalmologists, internists, and neurologists, the findings will support the development of best practices for managing ischemic optic neuropathy more

effectively.

This research aims to improve patient outcomes by optimizing diagnostic and treatment protocols. By identifying key factors influencing visual prognosis and assessing the benefits of interdisciplinary management, the study contributes to the development of more effective clinical interventions, ultimately reducing vision loss and improving quality of life for affected patients.

E. Study Originality

Table 1. Study Originality

No.	Study Title	Design and method	Result	Difference
1.	Patient Clinical Outcomes in Standalone versus a Combined Ophtalmology-rheumatology Uveitis Clinic (Bing X Ross et a;., 2022)	The study used a before after comparison of patients seen at a standalone clinic vs a combined opthalmology rheumatology "uveitis clinic" examining real worlc clinical outcomes.	Retrospective analysis cohort. Patients managed in the combined uveitis clinic had better clinical outcomes compared to before integration. Suggesting that integrated care model improved patient result	Uveitis patients were used as the subject of the study
2.	Multidisciplinary Management with Granulocyte Colony Stimulating Factor in Compressive Optic Neuropathy: A prospective Interventional Study.	Prospective interventional study was conducted on patients with compressive optic neuropathy. All eligible patients were managed by multidisciplinary consisting opthalmologists, neurologists, and neurosurgeons. Patients received early administration of Granulocyte Colony Stimulating Factor (G-CSF) as adjunct neurogenerative therapy.	Patients receicving multidisciplinary management, rarly G-CSF showed significant improvement in visual acuity and visual field outcomes compared with their baseline status. The study concludes that multidisciplinary care enhances recovery in optic neuropathy associated with compression	Therapy used is G-CSF as an adjunct therapy, subjects used were compressive optic neuropathy rather than optic neuropathy associated with comorbids.
3.	Traumatic Optic Neuropathy: Update on Management (Sivakumar RR et al., 2023)	Literature review, that provide a comprehensive overview of current knowledge including definitions pathophysiology, and management strategies.	Diagnosis of patients can be made based on signs and symptoms, then it can be ruled out by imaging modalities, VEP, and ERG. The most effective treatments for traumatic optic neuropathy have been steroids and decompression surgery	The study design used in this reasearch is literature review. Emphasis on the controversies and recent updates in traumatic optic neuropathy

			\	
4.	Transcriptomic Analysis Reveals that Granulovyte Colony-Stimulating Factor triggers a Novel signaling Pathway (TAF9-P53-TRIAP1-CASP3) to Protect Retinal Ganglion Cells after Ischemic Optic Neuropathy (Tsai RK et al., 2022)	Experimental design using a rat model of anterior ischemic optic neuropathy to investigate the neuroprotective effects of granulocyte colony stimulating factor (GCSF) on retinal ganglion cells. The study utilized transcriptomic analysis to identify the expressed genes following optic nerve infarction and GCSF treatment.	The findings demonstrated that GCSF modulates a novel signaling pathway involving TAF9, P53, TRIAP1 and CASP3 to regulate RGC survival after optv nerver infarction. Specifically, TAF9 was identified as a key element in modulating theTP53- TRIAP-CASP3 axis influencing RGC death and survival.	The study design used in this research is experimental design using ras as the model. Emphasis on biomolecular mechanism of ION.

CHAPTER II

A. Literature Review

1. Ischemic optic neuropathy

Optic neuropathy is a condition where the optic nerve, which transmits visual signals from the eye to the brain, becomes damaged, resulting in impaired vision. This damage can result from factors such as reduced blood flow, inflammation, physical trauma, or abnormalities caused by various underlying conditions such as autoimmune diabetes, diabetes, or high blood pressure. A specific form of this condition, known as vascular optic neuropathy, or more commonly referred to as ischemic optic neuropathy, occurs when the blood flow to the optic nerve is compromised, leading to insufficient oxygen and nutrient delivery. This will result in a transient or permanent vision impairment. Depending on the severity of the blood flow obstruction, the resulting damage can range from mild to severe and the vision loss may be temporary or irreversible. Ischemic neuropathy is categorized into two types, which are anterior ischemic optic neuropathy and posterior ischemic optic neuropathy. Anterior ischemic neuropathy is further classified into arteritic anterior optic neuropathy (AION) and non-arteritic anterior optic neuropathy (NAAION).

Ischemic optic neuropathy is the most common optic nerve disorder in patients over 50 years of age and is generally classified into anterior ischemic optic neuropathy (AION) and posterior ischemic optic neuropathy (PION), with AION being far more prevalent than PION. AION is subdivided into arteritic (AAION) and NAAION forms. NAION is the most frequent cause of optic

neuropathy in adults over 50, with a prevalence in the United States ranging from 2.3 to 10.2 per 100,000 people. NAION is less common in Black populations, likely due to their tendency to have larger cup-to-disc (C/D) ratios, while it is most common in Caucasians, who have smaller optic nerve cups. The small C/D ratio or "crowded disc" is found in 80-90% of NAION patients, and this anatomical feature is one of the most significant risk factors for optic neuropathy (Raizada, 2022).

2. Non-Arteritic Anterior Ischemic Optic Neuropathy

2.1 Definition of NAAION

NAAION is considered a multifactorial disorder, because the cause of acute ischemia of the optic nerve head (ONH) results from a combination of local and systemic risk factors. Over 70% of patients have pre-existing risk factors such as older age, male, and cardiovascular or cerebrovascular diseases, which significantly increase their risk for events like stroke or heart attack. NAION patients have been found to have a 3.35 times greater risk of ischemic stroke compared to similar populations without NAION.

NAAION is generally caused by circulatory insufficiency of the optic nerve head which leads to a localized edema in the axons of the optic nerve. The scleral canal, however, is a narrow passage for the optic nerve to pass. The edema of the optic nerve will result in a compartment syndrome, where the optic nerve edema is propagated by affecting the neighboring axons. This will eventually cause ischemia and apoptosis of the axons. If this condition is left untreated, the optic disc will undergo atrophy and the patient may experience visual field defects. The etiology of NAAION is multifactorial, such as hypertension, diabetes, sleep apnea,

atherosclerosis, and certain medications. Additionally, smoking and cardiovascular diseases will also increase the risk. Although optic nerve head blood flow has its autoregulation, the precipitating factors may impair the autoregulation, resulting in oxygen deprivation and insufficient nutrient supply. Specifically speaking, conditions like systemic hypertension, arteriosclerosis, vasospasm, and certain medications will release vasoactive substances as a response to ischemia which will worsen the ischemic conditions.

2.2 Diagnosis of NAAION

Upon ophthalmoscopy, the appearance of optic edema is common in the acute phase of NAAION. The edema is typically hyperemic and rarely pallid, unlike AAION which is the opposite. Peripapillary splinter hemorrhage is common and this could differentiate from the diagnosis of optic neuritis visual acuity severity varies, however, a hand motion level of visual acuity is rare. If not treated promptly may persist due to compartment dyndrome. Visual field may continue to get worse due to the nerve fiber bundle defects. NAAION causes less severe visual defect than AAION due to less evere neuronal damage from the cerebral venous disease (Cestari, 2024).

2.3 Management of NAAION

2.3.1 Action on Thrombosis

Aspirin and other anti-platelet agents: Notably, there is a controversy on the pathogenesis of NAION, whether or not it includes thrombo-embolic occlusive disorder since hypotensive is a preferably approved etiology by many experts. According to some studies, there is no evidence from studies demonstrating small

vessel occlusion in NAION patients, thus, acute management with aspirin does influence on visual outcomes. However, aspirin may be prescribed for patients' comorbidities relating to vasculopathy risk factors. However, aspirin may be beneficial when It is due to embolism thrombolytic: One case report has shown the use of high-dose urokinase and stellate ganglion block has resulted in a satisfying outcome for disc edema and resolution of optic nerve ischemia.

2.3.2 Action on Blood Vessels

Several underlying conditions in NAION such as generalized hypotension, vasospasm, failure of autoregulation, nocturnal hypotension and sleep apnea. While pressor agents (norepinephrine) the principle of norepinephrine is improvement of optic nerve head perfusion pressure. Studies have suggested it may benefit for those with normotensive NAION patients, however, it can potentially worsen the ischemic condition due to its vasoconstricting nature. Heparin-induced extracorporeal LDL/ Fibrinogen precipitation. The use of heparin-induced extracorporeal LDL (HELP) will remove fibrinogen, LDL, cholesterol, and triglycerides from the blood, which is thought to enhance blood flow properties.

2.3.3 Steroids

2.3.3.1 Systemic corticosteroids

Corticosteroids have been hypothesized to improve disc edema through the decrease of capillary permeability and enhance blood flow to restore its function. Several studies have shown that initial treatment using prednisolone 80 mg improved visual acuity and visual field. However, the limitation of these studies are

the non-randomized nature and selection bias in patients with vascular comorbidities.

2.3.3.2 Intravitreal Triamcinolone

The rationale for intravitreal triamcinolone goes the same way for systemic steroids. Though in terms of side effect intravitreal triamcinolone is generally localized and avoids systemic complications, it carries the risk of increasing intraocular pressure which will worsen the optic nerve condition.

2.3.3.3 Optic Nerve Decompression Surgery:

The Ischemic Optic Neuropathy Decompression Trial, a randomized, single-blind, multicenter trial sponsored by National Eye Institute have proved the benefit and risk ratio for optic nerve decompression surgery is unfavorable due to its post-surgical complications (Atkins, 2013).

3. Arteritic Anterior Ischemic Optic Neuropathy

3.1 Definition of AAION

AAION, accounting for 5-10% of AION cases, is caused by inflammation and the thrombosis of the short posterior ciliary arteries (SPCAs), which arise from the ophthalmic artery, leading to optic nerve head infarction. It typically affects patients over 70 years old. The most common etiology is associated with systemic vasculitis, particularly giant cell arteritis. In AAION, the vision loss is severe, with 70% of patients experiencing visual acuity of less than 20/200 and 20% losing all light perception.

Arteritic Anterior ischemic optic neuropathies (AAION) are caused by inflammation and then followed by the thrombosis of the short posterior ciliary

arteries (SPCA), small branches that branch from the ophthalmic arteries. Some studies may also have reported the involvement of immune cells like macrophages and T-cells recruited by dendritic cells residing in the blood vessels. This will result in a rapid onset of unilateral vision loss, decreased visual acuity, and visual field. While, the etiology of AION may be similar to NAION, which are hypertension, nocturnal hypotension, diabetes mellitus, atherosclerosis, and a small cup disc ratio.

3.2 Diagnosis of AAION

Ophthalmoscopy examination may demonstrate the optic nerve looking swollen and pale (chalky optic disc), retinal cotton wool spots located at the posterior pole, and sometimes obstruction occur on the central retinal artery. However, the cup and the disc of the fellow eye remain normal.

AAION Ocular manifestation may be characterized by a rapid onset of unilateral vision loss, decreased visual acuity, and visual field defect. The systemic symptoms that associated with GCA include headache, tenderness of the temporal arteries, jaw claudication (pain in the jaw during chewing or speaking), which is the most specific symptom for this condition (Lee, Swisher, and Reyes, 2024).

3.3 Therapy of AAION

3.3.1 Steroids

Early treatmet with high-dose systemic corticosteroids is critical. For the first three days, patient is expected to be managed with intravenous methylprednisolone at 1 g/day in severe cases. However, in comparison between oral and intravenous, the evidence is still debatable in AAION diagnosed with GCA etiology.

3.3.2 Monoclonal Antibodies

Tocilizumab is one of the most effective non-corticosteroid therapy for AAION patients by down regulating the acute phase reactions. However, further research is needed to ensure there is no confounding variables (Badla, 2024)

4. Posterior Ischemic Optic Neuropathy

4.1 Definition of PION

PION is less common than AION, but it has some significant implications. It usually affects patients with atherosclerotic risk factors or those undergoing spinal surgery. The posterior segment of the optic nerve consists of the branched into the intraorbital, intracanalicular, and intracranial parts. Each of these segments receive blood supply from multiple branches and arterial sources, so the pathology of PION does not have to be confined to a specific artery or location. There are three classifications of PION, which include non-arteritic PION, arteritic PION, and perioperative PION. Non arteritic PION may be associated with comorbidities such as diabetes, hypertension, atherosclerosis, and impaired autoregulation mechanism. While arteritic PION is linked to GCA, affecting the posterior ciliary arteries (PCA). While any general surgical procedure has the potential to lead to perioperative PION, spinal surgery is ofe of the the most frequent causes, typically presenting as bilateral. In spinal surgeries, factors such as the use of the Wilson frame, intentional hypotension to reduce intraoperative blood loss and general anesthesia in the prone position have been identified as potential risk factors.

4.2 Diagnosis of PION

The occurrence of sudden vision loss, visual field defect and changes in optic disc, which may initially appear normal on ophthalmoscopy but develop into

optic disc pallor within 6-8 weeks. This may collectively indicate PION. Furthermore, in cases where vision loss occurs shortly after non-ocular surgical procedure, strongly suggests a diagnosis of perioperative PION (Kini and Panneerselvam, 2024).

There are usually no ocular abnormalities aside from rapid afferent pupillary defect (RAPD). Visual acuity in non arteritic PION can range widely, with some maintaining relatively good sight while others experience severe vision loss. Although central visual defects are both common in arteritic or non-arteritic pION

4.3 Management of PION

4.3.1 Steroids

Early treatment with high-dose systemic corticosteroids is critical. For the first three days, the patient is expected to be managed with intravenous methylprednisolone at 1 g/day in severe cases. However, in comparison between oral and intravenous, the evidence is still debatable in AION diagnosed with GCA etiology.

4.3.2 Monoclonal antibody

Tocilizumab is one of the most effective non-corticosteroid therapy for AAION patients by down-regulating the acute phase reactions. However, further research is needed to ensure there are no confounding variables

5. Interdisciplinary Team

5.1 Definition of Interdisciplinary Team

The World Health Organization defines a team as a group of two or more individuals who interact dynamically, independently and adaptively towards a common goal and who have been assigned to a specific role to perform at a specified time. In healthcare, a team is often formed to offer innovative solutions for clinical issues

Interdisciplinary, multidisciplinary, and transdisciplinary are terms that often used interchangeably; however, these terms differ from one another. Interdisciplinary team is a group of health care professionals from different specialties working together to address a patient's concerns and needs. Interdisciplinary teams often involve collaborative problem-solving consisting of methods and approaches that are based from each discipline creating a harmonious integration to fix patient problems . Unlike multidisciplinary, this term is often used to describe multiple professions working together but within their discipline independently. In short, interdisciplinary rely on expert opinion from each discipline, which then aims to achieve the patient's goal. While the transdisciplinary team takes it into another level of wider perspective, it integrates natural, social, and health sciences beyond the disciplinary perspective. The four main goals of interdisciplinary focus on enhancing the quality of care, imprving health status, reducing healthcare costs, and increasing job satisfaction among healthcare professionals (Tchounwu and Banfi, 2023).

5.2 Role of Internist in Ischemic Neuropathy Management

Since ischemic neuropathy is strongly associated with vascular risk factors like hypertension, hypercholesterolemia, diabetes mellitus, cardio and cerebrovascular disease, this indicates management relating to vascular and generic diseases might be needed. This may include maintaining blood pressure and blood glucose at a normal level. Certain medications like statins may optimize cholesterol level and preventing further damage to the vascular. Furthermore, lifestyle modification encouragement by internists is also crucial such as smoking cesation, healthy diet, regular physical activity, and others. Moreover, current medications taken by patients may also increase the risk fo ischemic neuropathy, it is crucial for internists to collaborate with ophthalmologists regarding drugs that potentially lead to the worsening of ischemic neuropathy. Certain drugs for erectile dysfunction (sildenafil, vardenafil, and tadalafil) and heart medications (like amiodarone) have been suspected to increase the risk of NAION.

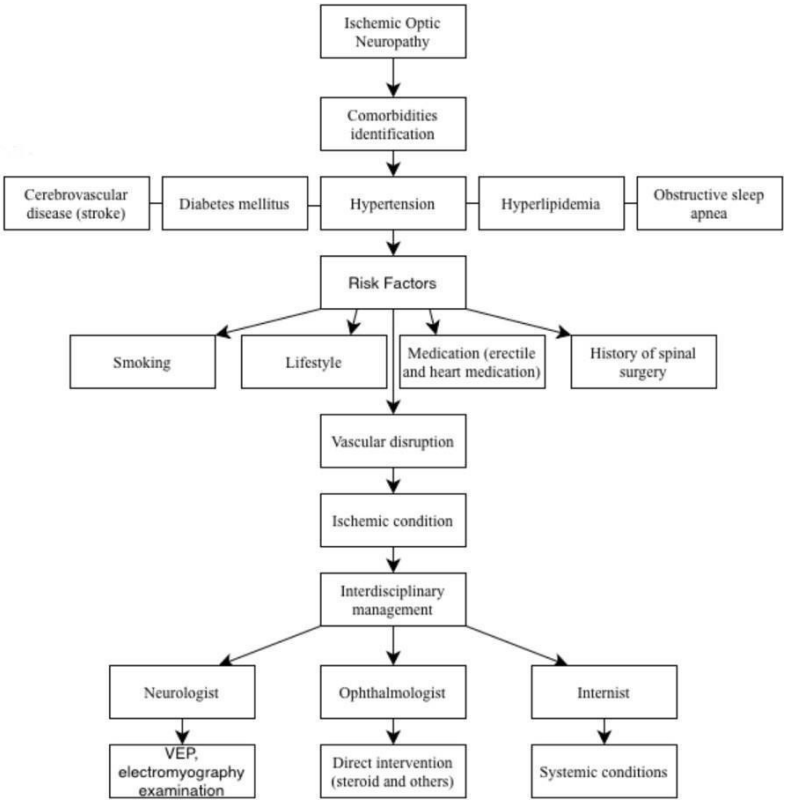
5.3 Role of Neurologist in Ischemic Neuropathy Management

Neurologists focus more on the neurological aspects of ischemic optic neuropathy, mainly to rule out the diagnosis or identify neurological conditions that may mimic or coexist with ischemic optic neuropathy. Conditions like ischemic monomelic neuropathy (IMN) and ischemic optic neuropathy may be overlooked to by one another. Thus, confirming the diagnosis by conducting electromyographic studies. Supportive examination such as visual evoked potentials (VEP) is also helpful in assessing the visual pathway from the retina to the cortex. This will be

beneficial in determining the prognosis and the progression of the patient's condition. Along with internists and ophthalmologists, neurologists work closely together to ensure comprehensive management of patients with ION.

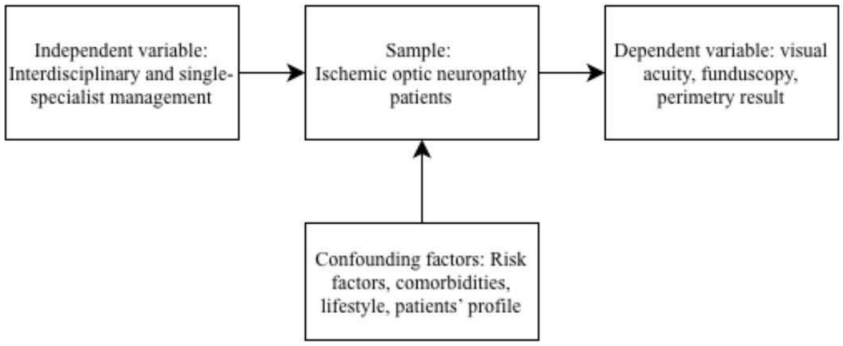
B. Theoretical Framework

Figure 1. Theoretical Framework



C. Conceptual Framework

Figure 2. Conceptual Framework



CHAPTER III RESEARCH METHOD

A. Study Design

This study will utilize a retrospective cohort, examining data from patients diagnosed with vascular optic neuropathy. This research will be analyzed through medical records of patients that are diagnosed with ischemic or vascular optic neuropathy caused by their comorbidities.

Procedure:

1. Data collection through medical records

Data will be obtained from medical records of patients diagnosed with ischemic optic neuropathy caused by their comorbidities. The patients will be selected through consecutive sampling method where every patient who meets the inclusion criteria during a specified period is included in the study. The data will be obtained from medical records available in the polyclinic computer in Dr. Sardjito Hospital over the past five years. The expected medical records' data will include patients' type of ischemic optic neuropathy, age, gender, optic neuropathy comorbidities, interventions done between by single

specialist and patients with multiple specialists like from the internist to treat the underlying disease.

2. Data Processing and Data Analysis

Data analysis and processing for this study will assess data normality using the shapiro-Wilk or Kolmogorov-Smirnov test. Normally distributed continuous varaibles will be analyzed using a t-test, while non-normally distributed data will use the Mann-Whitney U test. Categorical variables will be examined with the chi-square or Fisher's exact test. Visual outcomes between interdisciplinary and single-specialist management will be compared using appropraite tests based on data distribution. Logistic regression will determine if interdisciplinary care improves vissual outcomes. All analyses will be conducted using IBM SPSS Statistics Software.

B. Study Time and Setting

Time : October-November 2025

Setting : Dr. Sardjito Hospital

C. Study population

Inclusion criteria:

1- Patients diagnosed with ischemic optic neuropathy in RSUP dr Sardjito, in the last five years

2- Patients diagnosed with the presence of one or more systemic comorbidities known

to affect vascular health

3- Patients who received either single specialist management (ophthalmology alone) or interdisciplinary care
4- Patients who received care within the past five years.

Exclusion criteria

1- Patients diagnosed with optic neuropathies unrelated to vascular causes
2- Patients who had undergone major ocular surgeries

Sample Size:

This is a case series study with a sample size of 30 cases with inclusion and exclusion criteria that are already mentioned above.

D. Data collection tools

The sampling method that will be used is consecutive sampling where every patient who meets the inclusion criteria during a

specified period is included in the study. The data will be obtained from medical records available in the polyclinic computer. The data will them be organized in Microsoft excel and will further analyze through SPSS computer.

E. Study variable

Independent variable:

Type of management whether it is single specialist management (only

ophthalmologist) or interdisciplinary management

Dependent variable:

Visual outcomes (visual acuity, fundoscopy result, visual field perimetry testing) and patients' condition improvement

F. Operational definition

Table 2. Operational Definition

Variable	**Definition**
Interdisciplinary management	Collaborative approach to patient care in which professionals from different healthcare disciplines (from ophthalmology, neurologist, and internist divisions).
Ischemic optic neuropathy	Patient presented with damage optic nerve due to vascular insufficiency measured by visual acuity, fundoscopy findings, and eye perimetry test.

Visual acuity	Vision sharpness level at a specific distance measured using Snellen chart, finger counting, hand wave, and light perception. Which then expressed in a continuous numeric format using LogMAR.
Fundoscopy findings	Examination of the optic nerve and signs of ischemia.
Eye perimatry	Test to measure visual field loss using Humphrey visual field result.
Comorbidities	Pre-existing medical conditions contributing to ION which will be assessed through medical records.
Systemic treatment	Medication or intervention targeting the underlying comorbidities.
Localocular treatment	Direct treatment for ischemic optic neuropathy.
Observational management	Evaluation of the improvement or progressiveness of patients' condition.

G. Study Plan

The study plan of this study are as follows:

1. Preparation phase

- Collecting references and writing the research proposal, including background, literature review, and expected outcomes
- Presenting the proposal to receive feedback and make necessary revisions
- Submitting the ethical clearance to the Ethical Committee of FK-KMK Gadjah Mada University to ensure compliance with research ethics.

2. Implementation phase

- Data collection by observing to the sample that fulfils the inclusion and exclusion criteria and already given intervention in Sardjito Hospital

3. Reporting phase

Reporting the result of observation in a case series, then arranging the discussion, conclusion and acknowledgement based on the study findings.

H. Stastistical Analysis

The statistical analysis will be structured into several classifications, such as the type of data and the normality of the data distribution, which then will be assessed using the Shapiro-Wilk test or Kolmogorov-Smirnov test. If the $p > 0.05$, the data is normal. Continuous variables like age, baseline visual acuity, result of visual acuity test (presented in LogMar), IOP and visual field tests will be expressed as mean and standard deviation or t-test if the result is normally distributed. If it is non-normally distributed, it will be reported using the median or Mann-Whitney u test. While the categorical variables such as gender and type of ischemic optic neuropathy will be displayed as frequencies and percentages using the Chi-square or Fisher's exact test. To compare the outcomes between the two groups, interdisciplinary and single

specialist with visual outcome as the primary parameter. As for evaluating the visual acuity change and perimetry, independent t test will be used if the data is parametric. If not parametric, mann whitney test will be used instead. While perimetry outcomes will be analysed using chi-square or Fisher's exact test.

Since this study compares visual improvement between single- specialist and interdisciplinary management, logistic regression is used to calculate the odds ratio. Odds ratio will help in determining the direction of an association if interdisciplinary management increases the likelihood of visual improvement compared to single specialist care. Statistical analysis will be conducted using the IBM SPSS Statistics Software.

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I. Ethical Consideration

The research will be conducted once ethics approval have been issued from the ethics committee of the Faculty of Medicine, Public Health and Nursing, Gadjah Mada University. The study will adhere to confidentiality agreements and ensure that only the aggregated data will be reported in the final analysis. The collected data will not incude patient identity including name, date of birth, address, medical record number, and number of hospital staff.

CHAPTER IV
RESULT AND DISCUSSION

A. Result

A total of 30 patients were included in this study comprising 12 patients managed by a single specialist and 18 patients managed through interdisciplinary care (table 3).

Table 3. Demographic Characteristics of Research

Category	**Single Specialist (n= 12)**	**Interdisciplinary (n=18)**	**total (n = 30)**	p
Age (years, mean + SD)	61.08 + 8.96	58.00 + 11.39	59.23 + 10.43	0.406
Gender				
Male	6 (50.0)	12 (66.7)	18 (60)	0.833
Female	6 (50.0)	6 (33.3)	12 (40)	
Comorbidities				0.516
Hypertension	8 (53.3)	7 (46.7)	15	
Dyslipidemia	1 (50.0)	1 (50.0)	2	
Diabetes Mellitus	2 (40.0)	3 (60.0)	5	
Mixed Comorbidities	0	3 (100.0)	3	
Stroke	1 (25.0)	3 (75.0)	4	
Metabolic Syndrome	0	1 (100.0)	1	

The mean age in the interdisciplinary group was 58 ± 11.39 years. The overall age of all subjects was 59.23 ± 10.43 years, with an age range approximately 40 to

82 years. Prior to conducting the comparative test, homogeneity of variances was assessed using Levene's test, which showed no significant difference in variance between the groups ($F = 0.712$; $p = 0.406$). Thus, the assumption of equal variances was considered fulfilled; allowing for the use of the standard independent samples t-test. Based on the result of the independent samples t-test, demonstrated no statistically significant difference between the two groups ($t(27.12) = 0.828$; $p = 0.415$; 95% CI of the difference = -4.56 to 10.73).

Regarding gender distribution, there were 18 male patients (60%) and 12 female patients (40%) across both groups. In the single specialist group, male and female patients were equally distributed (6 males (50%) and 6 females (50%)), whereas in the interdisciplinary group, the proportion of males was higher (12 males (66.7%)) compared to females (6 females (33.3%)).

In terms of comorbidities the most common comorbidity observed in this study was hypertension (53.3%) in single specialist group and (46.7%) in the interdisciplinary group. Dyslipidemia and diabetes mellitus were similarly distributed across groups. Mixed comorbidities,, stroke history, and metabolic syndrome were observed only in the interdisciplinary group, suggesting a tendency toward more complex systemic profiles. However, chi square analysis showed no statistically difference in comorbidity distribution between groups ($p = 0.516$).

4.2 Visual Acuity

The mean baseline visual acuity of the affected eye did not differ significantly between the single specialist group (mean 1.43 ± 1.07 LogMAR) and the interdisciplinary group (mean 1.34 ± 0.84 LogMAR), p = 0.792. This indicated both groups had comparable initial severity. The comparison of visual acuity improvement (ΔVA) between the two management groups showed that the interdisciplinary group has a better improvement compared to single specialist group, though it is not statistically significant as already shown in table 4.

The comparison of visual acuity improvement (ΔVA) between the two management groups showed that the interdisciplinary group has a better improvement compared to single specialist group, though it is not statistically significant.

Clinically, the interdisciplinary group demonstrated a more meaningful improvement in visual acuity (Δ Visual Acuity = –0.192), approaching a two line gain on the Snellen chart, which is generally regarded as a noticeable functional improvement for patients. In contrast, the single specialist group showed a much smaller change (Δ Visual Acuity = –0.067), equivalent to less than one line of vision, thus not clinically significant.

Table 4. Baseline Visual Acuity (Before Intervention) and Comparison of Visual Acuity

	Single specialist (Mean ± SD)	**Interdisciplinary (Mean ± SD)**	**p**
Baseline of Visual Acuity	1.4342 ± 1.0670	1.3411 ± 0.8425	0.764
Improvement of Δ Visual Acuity AFFECTED	-0.0673	–0.192	0.439

The single specialist group showed a minimal improvement in visual acuity with a mean change of 0.0740 ± 0.39. this was not statistically significant (p = 0.566) and corresponds to less than one Snellen line indicating that the improvement is not clinically meaningful.

In contrast, the interdisciplinary group demonstrated a greater improvement, with a mean change of 0.2078 ± 0.40. this improvement was statistically significant (p = 0.042) and corresponds to a approximate gain of two Snellen lines, suggesting a clinically meaningful enhancement in visual function.

Table 5. Pre-Post Comparison of the Affected Visual Acuity

	Single Group (Mean ± SD)	**Interdisciplinary Group (Mean ± SD)**
Visual Acuity (before)	1.2460 ± 0.85	1.3441 ± 0.84
Visual Acuity (after)	1.1720 ± 0.89	1.1333 ± 0.87
Δ Visual Acuity	0.0740 ± 0.39	0.2078 ± 0.40
p-value	0.566	0.042

4.4 Intraocular Pressure

At baseline, the mean intraocular pressure (IOP) of the right eye (OD) in the single specialist group was 17.33 + 5.05 mmHg which was slightly higher than the mean IOP of 14.79 + 4.66 mmHg in the interdisciplinary group as shown in table 7.

Table 6. Baseline in Ischemic Optic Neuropathy patients

IOP	Single specialist (n =12)	Interdisciplinary (n = 18)	p
IOP OD (Before)	17.33 ± 5.05	14.79 ± 4.66	0.050
IOP OS (before)	14.00 ± 3.89	14.29 ± 3.12	0.785
IOP OD (after)	13.67 ± 1.86	13.46 ± 1.54	0.951
IOP OS (after)	13.17 ± 1.32	13.46 ± 1.54	0.842

Although statistically non-significant, the difference indicates a tendency for patients in the single specialist group to present with higher baseline intraocular pressure, suggesting a potentially greater initial disease burden or delayed referral pattern for the left eye (OS), both groups exhibited nearly identical baseline IOP values (14.00 + 3.89 mmHg vs 14.29 + 3.12 mmHg), with no statistically significant difference (p = 0.785)

Intraocular pressure analysis revealed a decrease in mean IOP in both eyes across both groups after treatment. Within the single-specialist group. TIO OD decreased by 3.67 mmHg (17.33 -> 1317); however, these reductions were not statistically significant (0.113 and 0.652). In the interdisciplinary group, IOP OD decreased from 14.9 to 13.46 mmHg and IOP OS from 14.29 to 13.46 mmHg, also showing no significant difference (p > 0.05).

Table 7. Pre-Post Comparison of IOP in Ischemic Optic Neuropathy Patients

Variable	Time Point	Single Specialist (Mean ± SD)	Interdisciplinary (Mean ± SD)	p
IOP OD	Before	17.33 ± 6.28	14.79 ± 3.93	0.050
IOP OD	After	13.67 ± 2.42	13.55 ± 3.05	0.951
IOP OS	Before	14.00 ± 5.62	13.77 ± 3.63	0.785

IOP OS	After	13.17 ± 3.25	13.46 ± 2.82	0.842

While both groups demonstrated favorable clinical trends, the magnitude of IOP reduction was greater in the single-specialist group, although the interdisciplinary group showed more balanced bilateral control, suggesting the comprehensive multidisciplinary management may stabilize ocular pressure more consistently.

Table 8. Comparison of Improvement IOP in Ischemic Optic Neuropathy Patients

	Single specialist (Mean ± SD)	**Interdisciplinary (Mean ± SD)**	**p**
ΔIOP OD	–3.67 ± 4.68	–1.79 ± 3.35	0.046
ΔIOP OS	–0.83 ± 4.26	–2.58 ± 3.38	0.898

There was a statistically significant difference in the reduction of intraocular pressure in the right eye (p = 0.046), with the single-specialist group showing a greater mean reduction (ΔIOP OD = –3.67 ± 4.68 mmHg) compared to the interdisciplinary group (ΔIOP OD = –1.79 ± 3.35 mmHg). For the left eye, both groups showed comparable reductions in IOP without statistically significant differences (p= 0.898).

4.5 Fundoscopy

4.5.1 Improvement

At base line most patients showed normal fundoscopic appearance in both eyes. In the right eye, normal fundus appearance was observed in 75% of the single

grou[and 77.8% of the interdisciplinary group (0.860). In the left eye, 83.3% of the single group and 77.8% of the interdisciplinary group were normal (p = 0.709). After the intervention, the percentage of normal fundoscopic findings increased in both groups. For the right eye, 70% of patients in single group and 88.2% in the interdisciplinary group were normal (p = 0.561).

Although, the differences were not statistically significant (p > 0.05), the interdisciplinary group consistently demonstrated higher improvement rates in fundoscopic recovery, indicating a better clinical trend compared to single-specialist

4.6 Management and Therapy

A majority of patients (79.2%) did not receive local ocular therapy, while only 20.8% were given at least one form of local ocular treatment. Among those who receive it, 8.3% underwent two or more local interventions.

Demonstrated in table 11. There was no statistically significant association between local ocular therapy and visual acuity improvement in the affected eye.

Table 9. Improvement of VA by local ocular therapy

Local Ocular Therapy	n	improved	Not improved	p
0 (no local ocular therapy)	19	8 (42.1%)	11 (57.9%)	0.324
1 (steroid injection)	1	1 (100%)	0 (0%)	

2 (IOP lowering agents)	2	2 (100%)	0 (0%)
3 (symptomatic therapy)	2	1 (50%)	1 (50%)`

Although improvement appeared numerically higher in groups receiving steroid injection or IOP-lowering agents, these categories contained very small sample sizes, leading to violation of Chi-Square assumptions (75% of cells with expected count <5). Therefore the relationship should be interpreted with caution, and no meaningful association can be concluded.

Out of 28 valid cases, 71.4% of patients received at least one type of systemic therapy. The majority (32.1%) received one systemic treatment, followed by 21.4% who received two types of systemic therapy and 14.3% who received three. The most frequently used systemic treatments included corticosteroids, vascular medications, and diabetes management drugs. This finding reflects the multidisciplinary approach emphasizing systemic vascular and inflammatory control in ischemic optic neuropathy.

Table 10. Improvement from Systemic Therapy

Sytemic Therapy	n	improved	Not improved	p
0 (no systemic therapy)	8	4 (50%)	4 (50%)	
1 (methylprednisone)	4	3 (75%)	1 (25%)	
2 (hypertension medication)	9	(100%)	0 (0%)	0.700
3 (diabetes medication)	2	1 (50%)	1 (50%)	
4 (combination)	4	1 (50%)	1 (50%)	
5 (vit b complex)	1	1 (100%)	0 (0%)	

Improvement rates varied across systemic therapies. However, Pearson's Chi Square did not demonstrate a statically significant association between systemic therapy category and visual acuity improvement of the affected ya ($x^2(5) = 3.000$, $p=0.700$). these results indicate that No. particular systemic management category waas associated with better or worse likelihood of VA improvement

B. Discussion

Ischemic optic neuropathy (ION) is a vision threatening condition caused by impaired perfusion to the optic nerve, resulting in sudden and often irreversible visual loss. It includes AION and PION, with NAION being the most common subtype. NAION is strongly associated with systemic vascular comorbidities such as hypertension, DM, dyslipidemia, stroke, and anatomical predisposition like a small cup to disc ration. In contrast AAION is most frequently linked to inflammatory vasculitis, especially GCA. In Indonesia although data is limited, increasing burden of vascular disease highlights importance of early diagnosis.

This research uses retrospective cohort design analysing medical records of ION patients treated over the 5 past years in Dr. Sardjito Hospital. Visual acuity, IOP, fundoscopic findings and systemic treatment patterns were compared between patients managed by ophthalmologists alone and those treated collaboratively with other specialists..

This study compared the outcomes of patients with ischemic optic neuropathy managed by single specialist opthalmologic care and interdisciplinary care. The demographic characteristics and baseline visual acuity were comparable, allowing valid clinical comparison. The interdisciplinary care showed greater numerical improvement in visual acuity and fundoscopic findings, although the differences were not statistically significant. However clinically speaking, it is equivalent to almost two Snellen lines of improvement in the interdisciplinary group, which reflects a clinically relevant gain in visual function. These trends

reflex the pathophysiology of ION which is heavily influenced by systemic vascular factors such as hypertension, diabetes, and dyslipidemia – conditions more effectively addressed through interdisciplinary care. Meanwhile, IOP changes though statistically significant only in the single interdisciplinary care, were clinically less relevant since IOP is not primary mechanism of injury in ION. Overall the interdisciplinary group demonstrated more favorable clinical trends that align with the systemic and multifactorial nature of the disease.

The findings support the hypothesis that interdisciplinary management offers meaningful clinical advantages, even if not statistically proven in this sample size. The involvement of internists ensures optimization of vascular risk factors, neurologist contribute to ruling out neurovascular mimickers and investigate systemic ischemic risks, factors that single specialist care cannot address. The lack of statistical significance is likely attributable to limitations inherent in the retrospective design including the small sample size, variability of disease onset, and heterogeneity of severity. Nevertheless the consistent direction of improvement observed in visual acuity, optic disc appearance, and systemic stabilization suggests that interdisciplinary care may provide more holistic and effective management model for ION. The division into to groups (single specialist and interdisciplinary) was applied because this study aimed to compare the effectiveness of two management patterns for NAION that already occur naturally in clinical practive at Dr. Sardjito General

Hospital. In real world settimg, some patients are managed solely by an ophthalmologist while others received shared care involving ophthalmologist, internist, and neurologist. Since this is a retrospective study the researcher did not assign patients to groups; instead , the study observed outcomes based on existing management patterns documented in medical recors, therefore, having two groups is essential to answer the research objective of evaluating visual acuity improvement whether it differs between two approaches. In patients initially managed only by an ophthalmologist referral to other disciplines should occur whenever systemic involvement is suspected or when clinical features exceed the scope of single specialist management. Although patients in the single specialist care also had vascular risk factors, referral decisions were not determined solely by the presence of comorbidities. Many patients were considered stable already controlled elsewhere, or not urgent enough to trigger interdisciplinary evaluation at the time of presentation. Referral is generally initiated only when systemic risk factors are uncontrolled, when atypical or severe optic neuropathy features are present, or when there is clinical suspicion require broader medical evaluation.

CHAPTER V
CONCLUSION AND RECOMMENDATION

A. Conclusion

This study explored visual outcomes in patients with ischemic optic neuropathy managed either by a single specialist or through an interdisciplinary approach. The findings indicate that both groups began with comparable levels of visual impairment in the affected eye. Although the improvement in visual acuity did not differ significantly between the two management models, the interdisciplinary group demonstrated a consistently more favorable numerical trend.

This suggests that involvement of multiple specialties may offer clinical advantages, particularly in complex cases requiring coordinated care. Overall, patients showed meaningful improvement in visual acuity from baseline to follow-up, reflecting the effectiveness of clinical management irrespective of group assignment. While the differences were not statistically definitive, the interdisciplinary model exhibited a positive direction of outcomes that is clinically relevant, corresponding to nearly a two-line improvement on the Snellen chart, indicating a clinically meaningful enhancement of visual function

B. Limitations

This study has several limitations that should be considered in interpreting the results. The retrospective design relied heavily on the completeness and accuracy of medical records, which varied across patients. Sample size was relatively small limited, especially within treatment subgroups, restricting the ability to detect small but potentially important differences. Patients also presented with diverse systemic comorbidities, each requiring different therapeutic strategies, making it challenging to isolate the effects of specific systemic or ocular treatments. Follow-up intervals

were not uniform, which may have influenced the magnitude of visual improvement documented. Additionally, some patients lacked standardized visual or structural examinations, such as OCT or consistent perimetry, which limited deeper analysis of disease progression

C. Suggestion

Future studies would benefit from prospective data collection with standardized follow-up schedules and more uniform examination techniques. Larger sample sizes are needed to better evaluate the potential advantages of interdisciplinary management and to allow more detailed analysis of specific treatment modalities. Further research should also explore long-term outcomes and the role of coordinated care pathways, particularly in patients with multiple systemic risk factors. In clinical practice, early collaboration between ophthalmologists, internists, and neurologists may still be encouraged, given the positive clinical trends observed in this study. Improved documentation and comprehensive systemic evaluation may enhance both patient care and future research in ischemic optic neuropathy. In future studies, pros[ective design with predefined criteria for assigning patients into single and interdisciplinary management would minimize bias, ensure equal baseline characteristics , and allow a more accurate evaluation of the true effect of interdisciplinary care on their visual outcomes.

REFERENCES

Atkins, E.J. *et al.* (2010) *Treatment of nonarteritic anterior ischemic optic neuropathy*, *Survey of ophthalmology*. Available at: https://pmc.ncbi.nlm.nih.gov/articles/PMC3721361/ (Accessed: 17 December 2024).

AW;, C.B. (2006) *Multidisciplinarity, interdisciplinarity and transdisciplinarity in health research, services, education and policy: 1. definitions, objectives, and evidence of effectiveness*, *Clinical and investigative medicine. Medecine clinique et experimentale*. Available at: https://pubmed.ncbi.nlm.nih.gov/17330451/ (Accessed: 17 December 2024).

Badla, O. *et al.* (2024) *Ischemic optic neuropathy: A review of current and potential future Pharmacotherapies*, *Pharmaceuticals (Basel, Switzerland)*. Available at: https://pmc.ncbi.nlm.nih.gov/articles/PMC11510045/ (Accessed: 17 January 2025).

Bendowska, A. and Baum, E. (2023) *The significance of cooperation in interdisciplinary health care teams as perceived by Polish medical students*, *International journal of environmental research and public health*. Available at: https://pmc.ncbi.nlm.nih.gov/articles/PMC9859360/ (Accessed: 17 January 2025).

Cestari, D. (2024) *Non-Arteritic anterior ischemic optic neuropathy (NAION)*, *EyeWiki*. Available at: https://eyewiki.org/Non-Arteritic_Anterior_Ischemic_Optic_Neuropathy_(NAION) (Accessed: 14 January 2025).

Hikmareza, Y. (2024) *Rubber ball grasping therapy to improve muscle strength in patient with ischaemic stroke*. Available at: https://journal.unimma.ac.id/index.php/ADNURS/article/download/11895/5389/https://journal.unimma.ac.id/index.php/ADNURS/article/download/11895/5389/ (Accessed: 17 January 2025).

Kini, A. and Panneerselvam, S. (2024) *Posterior ischemic optic neuropathy*, *EyeWiki*. Available at: https://eyewiki.org/Posterior_Ischemic_Optic_Neuropathy (Accessed: 17

December 2024).

Lee, A.G., Swisher, J. and Reyes, R. (2024) *Arteritic anterior ischemic optic neuropathy (AAION)*, *EyeWiki*. Available at: https://eyewiki.org/Arteritic_Anterior_Ischemic_Optic_Neuropathy_(AAION) (Accessed: 01 January 2025).

Raizada, K. (2022) *Non-Arteritic anterior ischemic optic neuropathy*, *StatPearls [Internet]*. Available at: https://www.ncbi.nlm.nih.gov/books/NBK559045/ (Accessed: 17 December 2024).

Setyopranoto, I. *et al.* (2022) *Awareness of being at risk of stroke and its determinant factors among hypertensive patients in Banyumas, Indonesia*, *Stroke research and treatment*. Available at: https://pmc.ncbi.nlm.nih.gov/articles/PMC9017563/ (Accessed: 17 December 2024).

Shahraki, Kourosh *et al.* (2023) *Arteritic anterior ischemic optic neuropathy (AAION) associated with covid-19 infection: A case report and review of the literature*, *Case reports in ophthalmological medicine*. Available at: https://pmc.ncbi.nlm.nih.gov/articles/PMC10365912/ (Accessed: 01 December 2025).

Wang, M.Y., Brewer, R. and Sadun, A.A. (2020) *Posterior ischemic optic neuropathy: Perioperative risk factors*, *Taiwan journal of ophthalmology*. Available at: https://pmc.ncbi.nlm.nih.gov/articles/PMC7585472/ (Accessed: 17 December 2024).

Wu, K.Y. and Evoy, F. (2023) *Naion: Diagnosis and management*, *American Academy of Ophthalmology*. Available at: https://www.aao.org/eyenet/article/naion-diagnosis-and-management (Accessed: 11 January 2025).

https://pmc.ncbi.nlm.nih.gov/articles/PMC10365912/ (Accessed: 01 December 2025).

Wang, M.Y., Brewer, R. and Sadun, A.A. (2020) *Posterior ischemic optic neuropathy: Perioperative risk factors*, *Taiwan journal of ophthalmology*. Available at: https://pmc.ncbi.nlm.nih.gov/articles/PMC7585472/ (Accessed: 17 December 2024).

Wu, K.Y. and Evoy, F. (2023) *Naion: Diagnosis and management*, *American Academy of Ophthalmology*. Available at: https://www.aao.org/eyenet/article/naion-diagnosis-and-management (Accessed: 11 January 2025).

LAMPIRAN

Lampiran 1. *Surat Ethical Clearance*

MEDICAL AND HEALTH RESEARCH ETHICS COMMITTEE (MHREC)
FACULTY OF MEDICINE, PUBLIC HEALTH AND NURSING
UNIVERSITAS GADJAH MADA – DR. SARDJITO GENERAL HOSPITAL

AMANDMENT APPROVAL

The Ethical Committee of Research in Medical Health, Faculty of Medicine, Public Health, and Nursing, has carefully reviewed the protocol entitled:

Interdisciplinary Management of Ischemic Optic Neuropathy: Ophthalmology, Internal Medicine, and Neurology in Sardjito Hospital

Reference Number of Ethical Approval Letter	:	KE/FK/1655/EC 15 Oktober 2025
Name of Principal Investigator	:	Dissa Vianda Arif
Name of Institution	:	Faculty of Medicine, Public Health, and Nursing Universitas Gadjah Mada

And approved the submitted amendment of document :

Document(s) Approved and version	:	Study Protocol version Amandment 2025
Participating Investigator(s)	:	1. dr. Indra Tri Mahayana, Ph.D., Sp.M. 2. dr. Supanji, Ph.D., M.Kes, Sp.M(K).

Yogyakarta, 19 NOV 2025

Prof. Dr. dr. Sri Sutarni, Sp.S(K).
Panel's Chairperson

P.S: This letter uses signature scan of the panel's chairperson and Secretary of the Ethics Committee. The hardcopy official letter with authority's signature will be issued when it is possible and are kept as an archive of the Ethics Committee	Validation number : 691d698a683f0 (http://komisietik.fk.ugm.ac.id/validasi)

Recognized by Forum for Ethical Review Committees in Asia and the Western Pacific (FERCAP)
17-Nov-25

Lampiran 2. *Study Timeline*

No.	Activity	Month											
		1	2	3	4	5	6	7	8	9	10	11	12
1.	**Preparation**												
	Preparation of research method												
	Preparation of equipment and materials												
	Permission to the hospital												
2.	**Implementation**												
	Sample collection and medical record data												
	Analysis of result												
3.	**Report and evaluation**												
	Data collection and analysis												
	Presentation												
	Submission od the final report												
	Seminar and publication												