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Characteristics of Traumatic Optic Neuropathy (TON) Cases Diagnosed at Cicendo Eye Hospital in 2022-2024

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ABSTRACT
Introduction: Traumatic Optic Neuropathy (TON) has an incidence of 0.7–2.5%. Despite its rarity, it can cause severe visual impairment. Understanding patient characteristics is beneficial for diagnosis, management, and research. This study aims to describe TON cases at the Cicendo National Eye Hospital in Bandung, Indonesia.
Methods: This retrospective descriptive study utilized secondary electronic medical record data from TON patients at PMN RS Mata Cicendo between 2022 and 2024.
Results: Out of 147 cases, the mean age was 31.7 +- 16.0 years, with male majority (79.6%). The most common cause were traffic accidents (61.8%), followed by workplace accidents (15.3%), violence (6.1%), and other trauma (22.9%). Most patients (88.4%) presented more than 24 hours after injury. Initial visual acuity varied: no light perception (18.4%), light perception (8.2%), hand movements (17.7%), finger counting (21.1%), and >3/60 (34.7%). Management included oral citicoline alone (60.5%), combined with oral corticosteroids (18.4%), or intravenous corticosteroids (21.1%).
Conclusion: TON cases in Indonesia predominantly affect productive age males due to traffic accidents, with diagnosis often occurring 24 hours post-trauma. Given the lack of definitive therapy, prevention remains the most critical strategy for high-risk groups.
Keywords: Demography, Hospitals, Indonesia, Optic Nerve Injuries, Retrospective Studies.

ABSTRAK
Latar belakang: *Traumatic Optic Neuropathy* (TON) memiliki insidensi 0,7-2,5%. Meskipun merupakan kasus yang jarang, TON merupakan ancaman bagi penglihatan individu yang terdampak. Maka dari itu, penting untuk mengetahui karakteristik pasien TON sebagai dasar melakukan diagnosis, pemilihan terapi, serta mengembangkan riset. Penelitian ini bertujuan memberikan gambaran kasus TON di Indonesia, terutama di Pusat Mata Nasional Rumah Sakit Mata Cicendo Bandung.
Metode: Penelitian ini merupakan penelitian deskriptif retrospektif menggunakan data sekunder rekam medis elektronik dari kasus TON tahun 2022-2024. di Pusat Mata Nasional Rumah Sakit Mata Cicendo.
Hasil: Sebanyak 147 kasus TON terdiagnosis di PMN RS Mata Cicendo dari tahun 2022-2024. Rerata usia pasien TON adalah 31,7 ± 16,0 dengan 79,6% berjenis kelamin laki-laki. Berdasarkan etiologi, TON paling banyak disebabkan oleh kecelakaan lalu lintas (61,8%), diikuti kecelakaan kerja (15.3%), kekerasan (6,1%), dan trauma lainnya (22,9%). Sebagian besar kasus TON terdiagnosis dan mendapat terapi lebih dari 24 jam setelah onset trauma (88,4%). Pasien datang dengan tajam penglihatan awal bervariasi, mulai dari tidak ada persepsi cahaya (18,4%), persepsi cahaya (8,2%), lambaian tangan (17,7%), hitung jari (21,1%), ataupun >3/60 (34,7%). Penanganan TON mencakup pemberian citicoline per oral saja (60,5%), kombinasi dengan kortikosteroid per oral (18,4%), atau dengan kortikosteroid intravena (21,1%).
Kesimpulan: Secara demografis, karakteristik penderita *traumatic optic neuropathy* (TON) di Indonesia didominasi oleh laki-laki usia produktif, dengan etiologi utama kecelakaan lalu lintas, serta umumnya terdiagnosis lebih dari 24 jam setelah terjadinya trauma. Hingga saat ini, belum tersedia terapi yang bersifat definitif untuk TON, sehingga upaya pencegahan dinilai lebih bermanfaat, khususnya pada populasi dengan risiko tinggi tersebut.
Kata Kunci: Demografi, Rumah Sakit, Indonesia, *Traumatic Optic Neuropathy,* Retrospektif

INTRODUCTION

Traumatic Optic Neuropathy (TON) is a pathology of reduced optic nerve function caused by blunt or penetrating head trauma. TON is uncommon, with an overall incidence of 0.7-2.5%. Previous studies observed that TON affects males more than females, with a ratio of up to 80%. The known median age of TON patients is 31 years.[1] Traumatic optic neuropathy (TON) is classified into direct and indirect TON. Direct TON is less common than indirect TON but often results in worse vision and a lower chance of vision improvement.[1,2]

The known mechanism of TON is shearing force on the optic nerve leads to cellular and vascular damage, causing optic nerve edema. The limited space, especially in the optic canal, makes the edema significantly affect the optic nerve. Due to the limited regenerative capacity of retinal ganglion cells, any injury to the optic nerve can be permanent and cause retinal ganglion cell apoptosis within two weeks. Significant injuries can lead to optic nerve atrophy within 3-6 weeks, visible on fundoscopy as optic disc pallor.[1,3]

Forty to sixty percent of patients with traumatic optic neuropathy (TON) experience visual improvement. The most significant predictor of final visual acuity is the initial visual acuity. Patients with severe vision loss, including no light perception, have a very low likelihood of visual recovery. Other predictors of poor visual prognosis include decreased consciousness, no improvement in vision within 48 hours, direct TON, and absence of visually evoked responses.[4]

The National Acute Spinal Cord Injury Study (NASCIS) conducted in the 1990s found benefits of corticosteroid administration in patients with spinal cord injuries. This study served as the basis for corticosteroid use in TON treatment. However, corticosteroid administration in TON remains controversial and requires caution. The International Optic Nerve Trauma Study (IONTS) concluded that there is no significant difference in outcomes between corticosteroid treatment, surgical intervention, and observation. The Corticosteroid Randomization for Acute Head Trauma (CRASH) trial also concluded that corticosteroid use increases mortality in head injury patients with decreased consciousness.[3,4]

Research on traumatic optic neuropathy (TON) in Indonesia is still limited but continues to develop. Studies on the characteristics of TON have been previously conducted at several hospitals in Indonesia including RSUP Sanglah (2013-2015) by RSCM (2014-2015) by Daniel et al. and (2019) by Wijayanti et al, RSUP Noerah (2022-2023) by Priwinandari et al. Traumatic Optic Neuropathy (TON) as characterized by these four studies, greatly affects demographic of young adult males involved in high energy trauma. Daniel et al. (2018) reported a cohort of 34 patients with a mean age of 22.47 years and an 82.4% male predominance, where traffic accidents accounted for 61.8% of cases and 58.8% presented with no light perception (NLP). These findings are largely mirrored by Mahayani et al. (2017), who studied 41 patients and found that 84.6% of those in their corticosteroid group were male, with the majority of patients under 20 years of age. In contrast, Wijayati et al. (2021) observed a slightly older demographic (mean age 32.85 years) and a more diverse range of trauma mechanisms, including violence and industrial accidents, though they maintained a high male ratio of 76.9%. The most recent data from Priwinandari et al. (2025) shows a significant shift toward surgical intervention (47.4%) in a cohort that was 94.7% male, primarily suffering from indirect TON (78.9%) following traffic accidents (68.4%).[4–8] Despite the valuable descriptive data provided, Most studies, such as those by Wijayati et al. (n=13) and

Priwinandari et al. (n=19), involve small cohorts.[6,7] This limits the statistical power needed to generalize the findings to broader populations.

Research on the characteristics of TON is fundamental research that can be further processed and serve as a basis for more advanced studies. Additionally, studying the characteristics of TON and identifying activities with a high risk of TON can aid in preventing TON through educational materials and collaboration with relevant regulatory bodies. This study aims to characterize cases of TON managed at Cicendo Eye Hospital, Bandung.

METHODS

This study employed a retrospective, descriptive design conducted at Cicendo National Eye Center, a tertiary referral hospital, covering the period from January 2022 to September 2024. The study population included all patients diagnosed with Traumatic Optic Neuropathy (TON), with a total of 147 cases identified through consecutive sampling from the hospital's Electronic Medical Records (EMR).

The diagnostic criteria for TON were defined as acute visual changes: a loss of visual acuity, reduced color vision, visual field defects, or the presence of a Relative Afferent Pupillary Defect (RAPD) following a documented history of trauma. The data collected included patient demographics (date of birth, age, and gender), cause and onset of trauma, visual acuity upon arrival, and the type of treatment administered. To ensure data integrity, duplicate entries were manually filtered by cross-referencing dates of birth. Any cases with incomplete medical records were excluded. All data processing and statistical analyses were performed using Microsoft Excel (Office 365).

For this study, the onset of trauma was defined as the duration of time elapsed from the initial injury to the first point of diagnosis at Cicendo hospital. Visual acuity (VA) at arrival was classified into categories: No Light Perception (NLP), Light Perception (LP), Hand Movement (HM), Finger Counting (0.5/60 to 3/60), and >3/60. Furthermore, the etiology of trauma was classified into four primary categories: traffic accidents, work-related accidents, violence, and other causes.

This Study was reviewed and approved by the Research Ethics Committee of Cicendo Eye Hospital Bandung (DP.04.03/D.XXIV.16/16585/2024).

RESULT

Table 1 presents the characteristics of TON patients at Cicendo Eye Hospital, Bandung. The study included a total of 147 cases of Traumatic Optic Neuropathy. The patient population showed a significant male predominance, with 117 males (79.6%) and 30 females (20.4%). The age of the patients ranged from 3 to 73 years, with a mean age of 31.7 ± 16.0 years.

Table 1. Demographic Characteristic

Variable	n	%
Age		
Min-Max	3 - 73	
Mean ± SD	31.7 ± 16.0	
Sex		
Male	117	79.6%
Female	30	20.4%

Table 2 presents the etiological characteristics of TON cases at the National Eye Center, Cicendo Eye Hospital, Bandung. Traffic accidents were the leading cause of TON, accounting for 81 cases (61.8%). Other etiologies included work related accidents (15.3%), violence (6.1%), and various other causes (22.9%). Regarding the timing of presentation, most patients arrived for clinical evaluation more than 24 hours after the trauma occurred (130 cases, 88.4%), while only 17 patients (11.6%) presented within the first 24 hours.

At time of initial assessment, visual acuity varied widely. While 51 patients (34.7%) maintained a visual acuity better than 3/60,a significant portion presented with severe impairment: 27 cases (18.4%) had No Light Perception (NLP), 12 (8.2%) had Light Perception (LP), 26 (17.7%) could only detect hand movements, and 31 (21.1%) were limited to finger counting.The treatment for these cases primarily involved Citicoline. Most patients (89 cases, 60.5%) were treated with Citicoline alone. The remaining cases received Citicoline in combination with corticosteroids, administered either intravenously (31 cases, 21.1%) or orally (27 cases, 18.4%).

Table 2. Clinical Characteristic

Variable	n	%
Etiology		
Traffic accident	81	61.8%
Work accident	20	15.3%
Violence	8	6.1%
Other causes	30	22.9%
Onset of Trauma		
<24 hours	17	11.6%
>24 hours	130	88.4%
Visual acuity		
NLP	27	18.4%
LP	12	8.2%
Hand movement	26	17.7%
Finger counting	31	21.1%
>3/60	51	34.7%
Treatment		
Citicoline	89	60.5%
Citicoline + Oral Corticosteroid	27	18.4%
Citicoline + IV Corticosteroid	31	21.1%

*NLP: No Light Perception
*LP: Light Perception

DISCUSSION

In the study period, 147 cases of TON were identified through the EMR system. The age range of patients diagnosed with TON ranges from 3 to 73 years, with a mean age of 31.7 ± 16.0. Most TON patients were male (79.6%), consistent with findings of other studies suggesting male prevalence of up to 94.7%.[5–8] Previous study in the UK and Canada also reveal a higher occurrence of TON in male population (up to 80%) and a median age of 31.[1]

Etiologically, 61.8% of TON cases at the National Eye Center of Cicendo Eye Hospital were due to traffic accidents, 15.3% due to work accidents, and 6.1% due to violence. These results are consistent with other studies, which showed the largest percentage was caused by traffic accidents (61.8-64.8%).[5–8]Karimi et al. concluded that another significant cause of TON is trauma due to falling.[1]

Most TON patients (88.4%) were diagnosed and received therapy more than 24 hours after trauma. This finding aligned with previous study by Daniel et al. where 67.6% of patients received initial therapy >24 hours after trauma.[8] Trauma onset of less than 24 hours is one of the known predictors of visual improvement in TON[1,3,9]

Most patients diagnosed with TON at the National Eye Center of Cicendo Eye Hospital (60.5%) received conservative treatment of oral citicoline without corticosteroids or surgical intervention. 18.4% were given citicoline with oral corticosteroids, and 21.1% were given citicoline and intravenous corticosteroids. No patients underwent surgical decompression. In Indonesia, surgical management of TON is uncommon, with the exception of a study in Ngoerah Hospital in Denpasar, which in 2022-2023 performed surgery on 47.4% of diagnosed TON patients.[6–8] Conservative therapy, corticosteroids, and surgical intervention are the three main options in the management of TON.[1] High dose intravenous corticosteroid was originally applied referring extrapolated data from the NASCIS (National Acute Spinal Cord Injury Study) study, but the more recent CRASH (Corticosteroid randomisation

after significant head injury) study suggested that high dose corticosteroid increased mortality rate in cases of head injury with altered mental status, prompting extra caution when treating TON patients with a history of significant head injury.[10] Surgical decompression of the optic nerve is optional and is preferred when there is orbital compartment syndrome.[10] The benefit of corticosteroid and surgical therapy is found to be statistically insignificant, so treatment of TON should determined in a case by case basis.[2,9–13] Citicoline is commonly used in conservative management for its neuroprotective effects and plays a role as a therapy in various neuroinflammatory diseases.[14]

Management of traumatic optic neuropathy is an expanding field of study. There are various suggested alternative and supportive therapies, such as erythropoietin and levodopa-carbidopa, but neither was done on scale large enough to warranty efficacy and safety and requires further study[1,10,15]

CONCLUSION

Traumatic Optic Neuropathy (TON) cases in this study predominantly affects young males following traffic accidents. The demographic profiles and etiologies observed in this study mostly align with global trends, but domestic cases in this study and other studies before show a higher prevalence of traffic-related injuries compared to the higher incidence of falls reported in Western cohorts. A critical finding is the delay in medical evaluation, with most patients seeking treatment more than 24 hours after onset; this delay represents a barrier to visual recovery.[8,16,17]

While corticosteroid therapy remains a common practice, its limited efficacy and potential risks in patients with head inury warrants caution. Ultimately, because visual outcome is constrained by timing and treatment limitations, preventive measures targeting high risk groups is the essential step in preventing visual disorders associated with trauma.

This study is primarily limited by its retrospective design and reliance on the quality of electronic medical records, which may introduce data inconsistencies. Additionally, the restricted sample size and lack of final visual acuity measurements prevent an assessment of the correlations between specific risk factors, treatment modalities, and clinical outcomes. Consequently, the therapeutic efficacy for traumatic optic neuropathy (TON) cannot be definitively established. Future studies with periodic intervals of 5 - 10 years are recommended to monitor and assess changes in the characteristics of TON over time. Further research is also required to evaluate the effectiveness of both established and novel therapeutic interventions.

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