CHARACTERISTICS TRAUMATIC OPTIC NEUROPATHY PATIENTS AT RSUP PROF. DR. I.G.N.G. NGOERAH DENPASAR YEAR 2022 - 2023

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ABSTRAK
Traumatic optic neuropathy (TON) adalah kondisi langka yang dapat mengancam fungsi penglihatan hingga menyebabkan kebutaan. sering kali akibat cedera pada mata atau kepala. Kondisi ini berhubungan erat dengan cedera kraniofasial yang dapat merusak saraf optik secara langsung maupun tidak langsung. Penanganan TON masih kontroversial dan memerlukan pemahaman lebih lanjut mengenai karakteristik pasien untuk mengoptimalkan perawatan dan pengobatan. Penelitian ini bertujuan untuk mengetahui karakteristik pasien dengan traumatic optic neuropathy di RSUP Prof. Dr. I.G.N.G. Ngoerah Denpasar selama tahun 2022-2023. dengan fokus pada faktor-faktor seperti jenis kelamin. usia. domisili. visus awal dan akhir. jenis cedera. jenis trauma. mekanisme trauma. dan tatalaksana. Penelitian ini menggunakan desain studi potong lintang (cross-sectional). Data dikumpulkan dari rekam medis pasien yang memenuhi kriteria inklusi di RSUP Prof. Dr. I.G.N.G. Ngoerah Denpasar pada periode 2022-2023. Pengolahan data dilakukan secara deskriptif dengan total sampling untuk memperoleh gambaran yang representatif. Mayoritas pasien adalah laki-laki (94.7%) dengan rentang usia terbanyak 19-59 tahun (73.7%). Sebagian besar pasien berasal dari daerah Tabanan (31.6%). Visus awal dan akhir pasien lebih banyak terdeteksi pada rentang 6/60 hingga 1/60 (31.6%). Cedera kepala disertai trauma maksilofasial dan fraktur dasar tengkorak merupakan jenis cedera yang paling umum. dengan kecelakaan lalu lintas sebagai mekanisme trauma utama (68.4%). Penggunaan steroid menjadi tatalaksana yang paling umum (47.4%). *Traumatic optic neuropathy* lebih sering terjadi pada laki-laki dengan usia produktif dan sering kali disebabkan oleh kecelakaan lalu lintas. Penurunan visus yang signifikan terjadi pada sebagian besar pasien. dan tatalaksana menggunakan steroid masih menjadi pilihan utama meskipun pengobatan lebih lanjut masih membutuhkan penelitian lebih mendalam.

Kata kunci **:** cedera kepala, karakteristik pasien, kecelakaan lalu lintas, tatalaksana, *traumatic optic neuropathy*, visus

ABSTRACT
Traumatic optic neuropathy (TON) is a rare condition that can threaten visual function and lead to blindness. often as a result of injury to the eye or head. It is closely associated with craniofacial injuries that can damage the optic nerve directly or indirectly. The management of TON is controversial and requires further understanding of patient characteristics to optimize care and treatment. This study aims to determine the characteristics of patients with traumatic optic neuropathy at Prof. Dr. I.G.N.G. Ngoerah Denpasar Hospital during 2022-2023. The results showed that the majority of patients were male (94.7%) with the highest age range of 19-59 years (73.7%). Most patients were from the Tabanan area (31.6%). The initial and final visus of the patients were mostly detected in the range of 6/60 to 1/60 (31.6%). Head injury with maxillofacial trauma and skull base fracture was the most common type of injury. with traffic accidents as the main trauma mechanism (68.4%). Steroid use was the most common management (47.4%). Traumatic optic neuropathy is more common in males of productive age and is often caused by traffic accidents. Significant visual impairment occurs in the majority of patients. and steroid treatment is still the main option although further research is needed.

Keywords ***:*** *head injury, patient characteristics, traffic accidents, traumatic optic neuropath,. Management, vision*

INTRODUCTION

Traumatic Optic Neuropathy (TON) is a rare but very damaging condition in complications of closed head injury (Huang ., 2020). This rare condition has the potential to threaten visual function to the point of blindness caused by eye injury or head injury. TON has serious consequences for craniofacial injuries that can damage the optic nerve indirectly or directly. This causes visual acuity dysfunction, visual field disorders, color perception, and the presence of afferent pupillary defect (RAPD) (Mahayani et al., 2017). The specific causes are motorcycle accidents, head injuries due to falls, abuse, and stab wounds (Wijayati et al., 2021).

The incidence of TON has increased gradually in recent years by around 0.7 - 2.5%. A national epidemiological investigation in the United Kingdom found that the estimated minimum incidence of TON was 1 in 1,000,000 population. Around 0.5 - 2% occurs in head injuries and is more common in craniofacial fractures. Meanwhile, in severe head injuries, it is around 0.5 - 5%. According to research in Indonesia conducted by Daniel et al. (2018), of 34 patients from 2014 - 2015, 82.4% of patients were male with an average age of 22.47 ± 10.68 years (Daniel et al., 2018). In Bali, according to research conducted by Mahayani et al. (2013 - 2015) stated that out of 41 TON patients, only 13 patients were treated with high-dose corticosteroids. Of these 13 patients, it is known that 78.6% of patients were male with a dominant age of less than 20 years (Mahayani et al., 2017).

TON patients present with visual loss after blunt or penetrating injury. TON consists of an acute unilateral decrease in vision or visual field. The degree of vision loss can vary, including decreased visual acuity and loss of color vision. Approximately 60% present with severe loss of light perception (LP) or worse. In the acute phase, the optic nerve usually appears normal on fundoscopic examination, but optic nerve atrophy is often seen 3-6 weeks after injury (Jackson and Giantelli, 2020). Treatment of TON is controversial because to date no medical or surgical treatment has been shown to be statistically significant. Spontaneous visual improvement in TON patients has been reported in 20-38% of untreated cases (Emanuelli et al., 2015). Research on optic nerve protection and regeneration after TON is still at the laboratory study level. This is due to the lack of clear guidelines and the ambiguity of the diagnosis and management itself. Clinical interventions for TON include observation and treatment with corticosteroids or optic tract decompression (with or without steroids). There is controversy in clinical practice regarding which treatment is best. A review of studies showed that visual acuity in patients with TON can be significantly improved after optical center (OC) decompression surgery, especially endoscopic transnasal/transseptal optic canal decompression (ETOCD) with or without corticosteroid use (Chen et al., 2022).

A review of clinical information about TON can help determine the characteristics of TON and review the latest literature to discuss the management of TON. Therefore, the author is interested in compiling an Elective Study entitled "Characteristics of Traumatic Optic Neuropathy Patients at Prof. Dr. I.G.N.G. Ngoerah Denpasar Hospital in 2022 – 2023.

METHODS

This research employed a cross-sectional quantitative observational study design. The study population comprised all TON patients treated at RSUP Ngoerah Denpasar within the study period. using medical records as the primary data source.

The target population in this study were all patients diagnosed with TON based on medical records at Prof. Dr. I.G.N.G. Ngoerah General Hospital. Denpasar. The accessible population in this study were all TON patients who were recorded in medical records at Prof. Dr. I.G.N.G. Ngoerah General Hospital. Denpasar in 2022-2023. The inclusion criteria

encompassed patients diagnosed with TON confirmed by clinical and imaging findings. while exclusion criteria included incomplete medical records or secondary causes of optic neuropathy unrelated to trauma. Sampling was conducted using a total sampling technique. given the relatively small patient population.

The research variables consist of gender. age. domicile. vision before and after treatment. type of injury. type of trauma. mechanism of trauma. and treatment. Data were analyzed descriptively and inferentially using SPSS version 26. focusing on demographic variables (age. gender). injury mechanisms. types of injuries. and treatment.

RESULT

This study analyzed the medical records of patients diagnosed with Traumatic Optic Neuropathy (TON) at RSUP Ngoerah Denpasar between 2022 and 2023. A total of 19 patients met the inclusion criteria. The demographic distribution showed that the majority of patients were male. comprising 18 individuals. accounting for 94.7% of the cases. Meanwhile. female patients constituted only 1 individual. representing 5.3%. The distribution of TON patients based on gender at RSUP Ngoerah Denpasar during 2022–2023 is presented in the table below.

Table 1. Characteristics of Traumatic Optic Neuropathy Patients Based on Gender at RSUP Ngoerah Denpasar in 2022–2023

Gender	Frequency (N = 19)	Percentage (%)
Male	18	94.7
Woman	1	4.3
Total	**19**	**100**

Based on the results of the study. it was found that the youngest patient was two years old. while the oldest patient was 54 years old. This study shows that the adult age range. specifically the 19–59 age group. had the highest number of patients. totaling 14 individuals or 73.7% of the entire sample. In the pediatric category. covering the 5–9 age range. one patient was found. accounting for 5.3%. Meanwhile. adolescents aged 10–18 recorded a total of 3 individuals. or 15.8%. The elderly. categorized as those aged 60 years and above. were represented by one patient. also accounting for 5.3%. This data provides a clear overview of the age distribution of traumatic optic neuropathy (TON) patients at RSUP Ngoerah Denpasar during the 2022–2023 period. It highlights the dominance of the adult age group in TON cases. while the pediatric and elderly groups recorded smaller proportions. The data obtained serves as an important reference for understanding patient age characteristics and aiding in the planning of more effective medical interventions in the future. The complete results of this age characteristic distribution are presented in the table below.

Table 2. Characteristics of Traumatic Optic Neuropathy Patients Based on Age at RSUP Ngoerah Denpasar Denpasar in 2022–2023

Age	Frequency (N = 19)	Percentage (%)
5-9	1	5.3
10-18	3	15.8
19-59	14	73.7
>60	1	5.3
Total	**19**	**100**

The results of this study show that the majority of traumatic optic neuropathy (TON) patients were from Tabanan. with 6 individuals (31.6%). followed by Gianyar with 4

individuals (21.1%). Buleleng. Klungkung. Denpasar. and areas outside Bali each accounted for 2 individuals (10.5%). while Badung. Jembrana. and Karangasem each had 1 individual (5.3%). The distribution of traumatic optic neuropathy patients based on their domicile at RSUP Ngoerah in 2023–2024 is presented in the table below.

Table 3. Characteristics of Traumatic Optic Neuropathy Patients Based on Domisilli at RSUP Ngoerah Denpasar in 2022–2023

Domicile	Frequency (N = 19)	Percentage (%)
Tabanan	6	31.5
Gianyar	4	21.1
Buleleng	2	10.5
Denpasar	2	10.5
Badung	1	5.3
Jembrana	1	5.3
Karangasem	1	5.3
Outside Bali	2	10.5
Total	**19**	**100**

Based on the research results. the most common initial visual acuity was in the range of <6/12 to ≥6/60. with 9 cases. representing 47.4%. Initial visual acuity of 1/300 was found in 4 cases (21.1%). while 6/60 to 1/60 and ≥6/12 each accounted for 2 cases (10.5%). This was followed by No Light Perception (NLP) and Light Perception (LP). each with 1 case (5.3%). Regarding the final visual acuity. the most common range was ≥6/12. with 5 cases. representing 26.3%. This was followed by final visual acuity ranges of 6/60 to 1/60 and <6/12 to ≥6/60. each with 4 cases (21.1%). Final visual acuity of 1/300 was observed in 3 cases (15.8%). No cases with Light Perception (LP) as the final visual acuity were found. However. 3 cases (15.8%) were reported with No Light Perception (NLP). The results of the study on the characteristics of traumatic optic neuropathy based on final visual acuity at RSUP Ngoerah Denpasar in 2022–2023 can be seen in the table below.

Table 4. Characteristics of Traumatic Optic Neuropathy Patients Based on Visual Acuity at RSUP Ngoerah Denpasar in 2022–2023

Visual Acuity	Initial Visual Acuity	Percentage (%)	Final Visual Acuity	Percentage (%)
NLP	1	5.3	3	15.8
LP	1	5.3	0	0
1/300	4	21.1	3	15.8
6/60 - 1/60	2	10.5	4	21.1
<6/12 - ≥ 6/60	9	47.4	5	26.3
≥ 6/12	2	10.5		
Total	**19**	**100**	**19**	**100**

Based on the research findings. the most common underlying injury was head trauma accompanied by maxillofacial trauma and skull base fractures. accounting for 8 cases (42.1%). Head trauma with maxillofacial trauma was observed in 5 cases (26.3%). Head trauma with skull base fractures was found in 2 cases (10.5%). Additionally. there were 4 cases (21.1%) with no underlying injuries. For direct traumatic optic neuropathy (TON). 2 cases were associated with maxillofacial trauma. and another 2 cases involved head trauma with

maxillofacial trauma accompanied by skull base fractures. The characteristics of traumatic optic neuropathy patients at RSUP Ngoerah Denpasar in 2022–2023 are presented in the table below.

Table 5. Characteristics of Traumatic Optic Neuropathy Patients Based on Types of injury at RSUP Ngoerah Denpasar in 2022–2023

Types of injury	Frequency (N = 19)	Percentage (%)	TON Direct	TON Indirect
Head injury + maxillofacial trauma	5	26.3	2	3
Head injury + skull base fracture	2	10.5	0	2
Head injury + maxillofacial trauma + skull base fracture	8	42.1	2	6
No underlying injury	4	21.1	0	4
Jumlah	**19**	**100**	**4**	**15**

Based on the conducted research. the data revealed that the classification of traumatic optic neuropathy (TON) is divided into two types: indirect TON and direct TON. Indirect TON was identified as the most dominant classification. with 15 cases. representing 78.9% of the total study sample. On the other hand. the direct TON classification showed a significantly lower number. with 4 cases. accounting for 21.1%. This data highlights that indirect TON is the most frequently observed type of injury in patients with Traumatic Optic Neuropathy at RSUP Ngoerah Denpasar during the 2022–2023 period. This information provides valuable insight into the distribution patterns of injury classifications among diagnosed patients. The complete results regarding the traumatic characteristics of patients can be found in detail in the following table which presents the injury classification data from this study.

Table 6. Characteristics of Traumatic Optic Neuropathy Patients Based on Classification types of Trauma at RSUP Ngoerah Denpasar in 2022–2023

Types of Trauma	Frequency (N = 19)	Percentage (%)
Indirect	15	78.9
Direct	4	21.1
Total	**19**	**100**

Based on the results of the study. it was found that the most common cause of Traumatic Optic Neuropathy (TON) was traffic accidents. ranking first with a total of 13 cases. equivalent to 68.4% of all cases. Following this. injuries caused by falls ranked second. with 6 cases. accounting for 31.6% of the total cases.For direct TON. 3 cases were associated with traffic accidents. and 1 case was related to falls. There were no cases caused by assaults during the study period. This data indicates that traffic accidents are the primary cause of Traumatic Optic Neuropathy. followed by falls. while assault-related injuries did not contribute to the incidence of this condition. The findings describing the characteristics based on the type of injury at RSUP Ngoerah Denpasar for the 2022–2023.

Table 7. Characteristics of Traumatic Optic Neuropathy Patients Based on Mechanism of Trauma at RSUP Ngoerah Denpasar in 2022–2023

Mechanism of Trauma	Frequency (N = 19)	Percentage (%)	TON Direct	TON Indirect
Accident traffic	13	68.4	3	10
Fall	6	31.6	1	5
Victim Assault	0	0	0	0
Total	**19**	**100**	**4**	**15**

For treatment modalities. surgical intervention was the most frequent (47.4%). followed by conservative management (26.3%). Combined surgery and steroid therapy were administered to 21.1% of patients.

Table 8. Characteristics of Traumatic Optic Neuropathy Patients Based on Treatment at RSUP Ngoerah Denpasar in 2022–2023

Treatment	Frequency (N = 19)	Presented %)	TON Direct	TON Indirect
Conservative	5	26,3	1	4
Surgery	9	47,4	1	8
Steroid	1	5,3	0	1
Combination of surgery and steroids	4	21,1	2	2
Quantity	19	100	4	15

Mechanism of Trauma	Frequency (N = 19)	Percentage (%)	TON Direct	TON Indirect
Conservative	5	26,3	1	4
Surgery	9	47,4	1	8
Steroid	1	5,3	0	1
Combination of surgery and steroids	4	21,1	2	2
Total	**19**	**100**	**4**	**15**

DISCUSSION

Referring to the research data on the characteristics of TON patients based on gender at Ngoerah Denpasar General Hospital in 2022 – 2023, the highest number of TON patients is male, more than female with a percentage of 94.7% and 5.3% respectively. Similar results were also found in a study based on Ngoerah Hospital in 2013-2015 which showed that male gender was more than female with a percentage of 78.6% and 21.4% respectively (Mahayani, 2017). The same results were also shown in a study conducted by Sujithra, H, et al in the Indian Journal of Ophthalmology that male gender was more dominant than female with a percentage of 91.2% and 8.8% respectively (Sujithra, H, et al, 2023). In his research, Natarajan Srivalli also showed that the total in male gender was 23 cases and female 2 cases. This study was conducted from January to September 2020 on patients who came to the Department of Oral and Maxillofacial Surgery, Mahatma Gandhi Missions Dental College and Hospital, (Natarajan Srivalli, et al., 2022). Wang Wei et al. in their research at the Department of Neurosurgery, Beijing Tongren Hospital, Capital Hal Medical University also obtained data among 685 cases with a diagnosis of TON, 621 were male and 64 were female (Wang Wei, 2022). A similar thing was also found in the observation conducted by Kumar et al. who stated that in their study all patients were male; there were no women showing a prevalence in men much higher than in women (Kumar et al., 2022).

The characteristics of TON patients based on age at Ngoerah General Hospital in 2022 - 2023, the highest number of TON patients was in the adult age range between 19-59 years with a percentage of 73.7%. This study is similar to the data obtained by Baiq Risha Feby Amelia et al. in the International Journal of Health and Science which stated that TON was dominated by 80% of male patients with an average age of 31 years, and 21% younger at the age of 18 years (Amelia et al., 2021). This is also in accordance with observations made by Deepti R et al in 2018 with 15 TON patients, 14 (93%) of whom were male with an average age of 33 years and more than half were over 30 years old in their study entitled "Prevalence, profile and outcome of traumatic optic nerve injury in neurosurgical patients treated at a tertiary care center in South India" (Deepti R et al., 2018). A study conducted by Natarajan Srivalli et al. at the Department of Oral and Maxillofacial Surgery, Mahatma Gandhi Missions

Dental College and Hospital, found that TON patients were mostly found in the population with an age range of 24 to 58 years. (Natarajan Srivalli, et al., 2022).

Similar results in a study in the Indian Journal of Ophthalmology Sujithra where the number of TON patients at an average age of 34.4 ± 17.65 years (Sujithra, H, et al., 2023). Meanwhile, in a study in England, Nicole et al. also said that patients with the characteristics of TON patients were most at an age with an average age of 31 years. (Tsai, Nicole Y, 2024). To further understand the relationship between risky behavior and the incidence of TON in young adults, research is needed that specifically examines this aspect. According to Currently, the literature that directly links risky behavior to the incidence of TON in young adults is still limited. The study showed that young adults may have certain physiological responses to trauma that make them more susceptible to TON. This could be related to the fact that young adults tend to engage in more intense physical activities, such as extreme sports or jobs that require physical exertion, which increase the risk of head or facial injuries.

Most TON patients who came to Ngoerah Hospital came from Tabanan City. This can be attributed to the high population density based on the Bali Provincial Statistics Agency, which reached 467,700 people. In contrast to the research obtained in 2013-2015, the most domicile was obtained from Denpasar, more precisely around 53.8% of patients with the high-dose corticosteroid group (Mahayani et al., 2017). The characteristics of TON patients based on initial vision obtained at Ngoerah Hospital in 2022 - 2023 can be seen in table 5.4. The highest number was in vision <6/12 to ≥ 6/60 with a percentage of 47.4%. Initial vision of TON patients varies, as stated in their study at a hospital in India studied by Kumar et al., the average initial visual acuity of patients was between 20/80-20/100 in six (26.08%) cases (Kumar et al., 2022). A similar study was conducted by Wang Wei in 2022 from 685 patients at the Department of Neurosurgery, Beijing Tongren Hospital, Capital Medical University, Beijing, China; 525 patients had initial vision with no light perception (NLP), 47 with light perception (LP), 67 with hand motion (HM), and 46 with fingers counting (Wang Wei, 2022).

In January 2020 and December 2022 at the Department of Neurosurgery at the Affiliated Hospital of the Naval Medical University and the Shanghai Seventh People's Hospital, Jiancung Wang et al. found that out of 206 cases, 143 patients had initial vision with light perception, and 63 patients had no light perception. (Wang, Jiancung et al., 2024). In the Indian Journal of Ophthalmology, Sujihtra et al. also found that several patients had varying initial acuity, including seven patients who did not have PL, 18 patients who had best corrected visual acuity (BCVA) between PL and 3/60, and eight other patients who had BCVA> 3/60. (Sujithra, H et al., 2023). Meanwhile, based on the final vision obtained at Ngoerah General Hospital in 2022-2023, the most were in the range of ≥ 6/12, as many as 5 cases with a percentage of 26.3%. According to Wright AJ et al. in their research at Memorial Hermann Hospital Texas Medical Center (MHH TMC) in Houston, TX, Baylor St. Luke's Medical Center in Houston, TX, and the Mayo Clinic in Rochester, MN, between January 1, 2011 and March 1, 2015 found that patients with direct TON had limited improvement due to damage from direct compression/severance of the optic nerve causing irreversible axonal damage. In contrast, patients with indirect TON had a more variable visual prognosis, ranging from 20/20 to no light perception (NLP), with stable VA taking 3-6 months to achieve (Wright AJ et al,.2022). by Deepti R et al in 2018 in their study in South India found that at baseline only 5 patients had 6/60 vision, 10 had less than 6/60 and one patient had no light perception. However, at discharge, final visual acuity of 12 patients had 6/60 or better vision, one had less than 6/60 vision, one had light perception while one had no light perception (NPL) (Deepti R et al, 2018).

TON patients with characteristics based on underlying injuries at Ngoerah General Hospital in 2022-2023, head injuries with maxillofacial trauma accompanied by skull base fractures were the most dominant, with 8 cases (42.1%). These results are similar to research

conducted by Sujithra, et al. in their study also found that orbital wall fracture injuries occurred in 80.5% of patients with lateral wall fractures being the most common (58.3%) followed by the medial wall (33.3%), upper part (27.7%), base part (27.7%), and optic abutment (5%) (Sujithra, H et al., 2023). Mahayani et al. also previously conducted a study at Ngoerah Hospital in the period 2013-2015 which showed that head injuries with skull base fractures were the most common with a percentage of 23.1% equivalent to maxillofacial trauma and no injury (Mahayani, et al., 2017). Meanwhile, Another study in the American Association of Oral and Maxillofacial Surgeons J Oral Maxillofac Surg by Urolagin et al said all patients in this study suffered from zygomaticomaxillary complex (ZMC) fractures; 1 patient had Le Fort II, mandibular condyle, and ramus fractures. In 2 patients, there were associated skull fractures. said there was clinical evidence of injury to the superolateral orbital area in 7 patients and the type of injury ranged from closed blunt injury to open laceration (Urolagin, Sarvesh B, 2012).

According to Kelishadi SS., et al., in his study divided into five groups of fracture patterns associated with TON, namely zygomatic, frontal, nasal, and orbital fractures which were the most common. The fracture pattern and number were evaluated in 42 patients with 9 people excluded due to incomplete medical records. Group 1 showed fractures of the contralateral lateral orbital wall (100%), zygoma (67%), and nasal bones (67%). Group 2 showed fractures of the frontal bone (86%), nasal bone (71%), and ipsilateral orbital roof (57%). Group 3 involved fractures of the ipsilateral zygoma (100%), lateral orbital wall (29%), and frontal and nasal bones (21% each). Group 4 consisted of fractures of the middle and upper face; 100% fractures of the ipsilateral orbital floor, medial and lateral walls, maxilla, and zygoma; 80% had bilateral orbital roof and zygoma fractures. Group 5 was characterized by fractures of the ipsilateral orbital floor, medial and lateral orbital walls (75% each), and orbital roof (50%). A total of 15 of 33 patients (45%) had penetrating trauma (Kelishadi SS et al., 2018). While Karimi et al found in their observations that the most common underlying type of injury was the intracanalicular part of indirect TON (71.4%) and then to the orbital apex (16.7%). Intracranial and orbital peaks were found in 11.9% of cases (Karimi et al. 2021). A similar study was conducted by Gupta D in 2017 in South India who reported that out of 15 ITON patients, 10 (66.7%) of them had skull or orbital fractures and 5 (33.3%) did not have any fractures. Of the bone injuries, the majority were lateral orbital wall fractures accounting for 7 (70%) of the fractures, while one (10%) each had medial orbital wall fractures, orbital roof and floor fractures (Gupta D, et al. 2017).

Characteristics of TON patients based on the type of trauma at Ngoerah General Hospital in 2022-2023, can be classified as indirect TON as many as 15 cases (78.9%). This is similar to a study conducted by Sun Young Jang in 2018 in the Korean Journal of Neurotauma which stated that indirect TON is more common than direct TON. This is because indirect TON is caused by the force of a concussion to the head, especially the forehead. The prevalence of indirect TON in closed head trauma has been reported to be 0.5% to 5%. (Sun Young Jang, 2018). According to Murti in 2023 for his research at the Department of Ophthalmology, Faculty of Medicine, University of Lampung, this is because optic nerve injury in the back of indirect TON most often occurs in the optic canal. This area is very susceptible to trauma because the nerves in this section are closely attached to the canal periosteum through the dura tissue. The optic nerve in this location is also more susceptible to damage due to pressure or injury, such as that caused by fractures, hematomas, or swelling (Murti et al., 2023) In Table 5.7 regarding the types of injuries at Ngoerah General Hospital in 2022-2023 regarding the characteristics of TON patients, the most frequent incident was traffic accidents at 68.4%. Similar results were also found in Siyanaki's observation that TON is often associated with frontal (72%) or frontotemporal (12%) craniocerebral injuries where the most common causes are traffic accidents and falls (Siyanaki et al., 2023).

However, in his study, Yu Wai Man et al. in 2015 found that in the pediatric population, most TON cases were due to falls (50%) and traffic accidents (40%) (Yu Wai man et al., 2015). Meanwhile, from observations conducted by Rodela Saha et al in 2024 at the Lions Eye Hospital and Institute, Dhaka, Bangladesh, it was found that out of 48 patients, 27 were caused by traffic accidents (RTA), 9 patients were due to assault, 8 people fell from a height and 4 due to other causes. (Rodela Saha et al., 2024). Another study by Sujithra et al. showed that out of 34 patients whose 36 eyes were studied, three (8.8%) patients were female and 31 (91.2%) patients were male. The most common form of trauma was traffic accidents (RTA; 91.2%), followed by falls (8.8%) and assaults (2.9%) (Sujithra, H et al., 2023). This is supported by Wijayati's research which explains that because traffic accidents often result in injuries to the head and face area, which is a critical anatomical location for the optic nerve, injuries in this area increase the risk of TON. (Wijayati et al., 2021). Supported by the high use of motorized vehicles, it increases individual exposure to the risk of traffic accidents, which in turn increases the incidence of TON related to these accidents. (Arvyan F et al., 2021). Although not many journals have specifically examined the relationship between helmet use and TON prevention, there is a prospective study of active military personnel and veterans identifying that military paratroopers are a high-risk group for mild head injuries and undiagnosed TON and in their research emphasizes the importance of collaboration and development of safer helmet designs to reduce and prevent head injuries and TON among military personnel. This can be attributed to the fact that helmets can reduce the risk of head injury in general in reducing the risk of head and facial injuries that can cause Traumatic Optic Neuropathy (TON) (Zwerling CS et al., 2022).

Characteristics of TON patients based on management at Ngoerah General Hospital in 2022-2023, steroids were used most often, namely in 9 cases (47.4%). In a study conducted by Yu Wai man et al., 2015 et al., three of six patients who were given corticosteroids after injury experienced visual recovery after 6 hours. It was reported that there was no significant difference in the outcomes of patients who received steroids and other patients who received surgery. However, they realized that the rate of improvement was much faster in those who received steroids. According to Siyanaki et al., there is experimental evidence that high-dose corticosteroids have an antioxidant effect so that they can prevent further injury after TON, namely having a more significant effect than low doses in stopping the inflammatory cascade that causes optic nerve edema. (Siyanaki et al., 2023). In a Blanch survey of 42 major trauma cases internationally, 64% routinely gave systemic corticosteroids for TON in doses and durations that varied widely. (Blanch, R. J et al., 2024). The American Academy of Ophthalmology states that high-dose corticosteroid therapy is often used within the first 8 hours after injury, although its effectiveness is still debated. Some studies suggest that delaying treatment may reduce the chances of visual recovery.

CONCLUSIONS

Traumatic Optic Neuropathy (TON) is a significant yet uncommon condition that severely impacts visual function. typically resulting from craniofacial trauma caused by direct or indirect injuries. This study at RSUP Prof. Dr. I.G.N.G. Ngoerah Denpasar during 2022–2023 revealed that most patients were male (94.7%) and primarily within the productive age range of 19–59 years. Traffic accidents emerged as the leading mechanism of trauma (68.4%). with craniofacial injuries. including maxillofacial fractures. being the most common type (42.1%). Visual acuity outcomes demonstrated notable variability. with a majority of cases classified within the 6/60 to 1/60 range (31.6%). Steroid therapy was the primary management approach. although its effectiveness and long-term benefits require further investigation.

To improve the understanding and management of TON. several recommendations are

proposed. Standardized protocols for diagnosing and managing TON should be developed to ensure timely and individualized treatment strategies. Further large-scale. multi-center studies are needed to explore the correlation between initial and final visual outcomes and TON classifications (direct vs. indirect). factoring in variables such as age. trauma mechanism. and injury type. Educational campaigns focusing on injury prevention. particularly traffic-related trauma. should emphasize the use of safety equipment and adherence to traffic regulations. Additionally. hospitals must enhance access to advanced diagnostic tools such as MRI and facilitate timely referrals to specialized centers for comprehensive management. These efforts aim to improve patient outcomes and guide future research in the field of TON.

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