

# Traumatic glaucoma mimicking primary open angle glaucoma

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## Research article

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## **Abstract**

Backgrounds To retrospectively analyze the clinical and ocular features in eyes with traumatic glaucoma misdiagnosed as primary open angle glaucoma (POAG). Methods We reviewed nineteen eyes with traumatic glaucoma misdiagnosed and collected their ocular and supplementary examination results. Results The outpatient age was  $47.1 \pm 12.8$  years old. The traumatic history was from 1 to 40 years. The history of hand or stone was present about 21.1% of patients, followed by balls (15.8%) and wooden stick (15.8%). The peak IOPs were  $33.0 \pm 10.6$  mmHg. Iridodialysis was seen in 2 patients. Trabecular pigmentation grade more than 3 was noticed in 15 patients. Angle recession was found in all patients. No patient was found lens location and fundus damage. Conclusions Patients with long traumatic history, mild ocular signs and insidious symptoms were more likely to be misdiagnosed. It might be more prudent to diagnose as POAG while there was significant difference in the condition of both eyes.

## **Background**

Glaucoma is characterized by retinal ganglion cell degeneration, alterations in optic nerve head topography, and associated visual field (VF) loss. It was known as a group of diseases, not a single disease. It was divided into many types, including in primary, secondary and developmental glaucoma. Primary open angle glaucoma(POAG) is one of the most common type<sup>1</sup>.

Usually, POAG was easily diagnosed by the characterizations, such as wide angle, elevated intraocular pressure(IOP) and glaucomatous optic nerve damage. When thinking about POAG, it is important to exclude cases of secondary glaucoma, including in steroid-induced glaucoma, cases of intermittent IOP increase (e.g. uveitis), pigmentary glaucoma (in older people) and others<sup>2</sup>.

In certain conditions, due to the characteristic glaucomatous cupping and visual field defects even if different types of glaucoma, the secondary glaucoma was misdiagnosed as POAG, especially traumatic glaucoma. Some previous reports described several special cases but not common clinical parameters. We sought to investigate the most common traumatic glaucoma conditions that may be misdiagnosed as POAG to assist handling the differential diagnosis when evaluated by a glaucoma specialist.

## **Materials And Methods**

This single-center, retrospective study was to analyze the clinical and ocular features in eyes with traumatic glaucoma misdiagnosed as primary open angle glaucoma. This study was conducted according to the tenets of the Declaration of Helsinki. The institutional review board for clinical research of Tongren Eye Center of Tongren hospital approved the study. All the patients provided written informed consent after they had received a detailed description of the injection procedure. All patients in our study were previously thought as POAG in other hospitals but diagnosed as traumatic glaucoma presenting to the center from July 2017 to August 2018. The diagnosis of traumatic glaucoma was made by 3

experienced glaucoma specialists based on clinical examinations and ancillary exams, such as perimetry, retinography, UBM and gonioscopy examination.

## Results

This study included in total 19 patients. Out of them, 16(84.2%) were males and 3(15.8%) were females. The male to female ratio was 16:3 (Table 1).

The outpatient age was from 24~65 ( $47.1 \pm 12.8$ ) years old. The traumatic history was from 1 to 40 years. 6 patients suffered from ocular trauma before 18 years old, 5 in 19 to 30 years old, 6 in 31 to 40 years old and 2 over 50 years old. Only one patient could not review his traumatic age because of so long history. The left eye ratio to right eye was 10:9.

All patients in this study suffered from closed globe injury, the history of hand or stone was present about 21.1% of patients, followed by trauma while playing with toy including in balls (15.8%) and followed by wooden stick (15.8%).(Table 1)

The peak IOPs were  $33.0 \pm 10.6$  mmHg, ranged from 22~60mmHg. Iridodialysis was seen in 2 patients. Trabecular pigmentation grade more than 3 was noticed in 15 patients. Angle recession (Fig. 1 and Fig. 2) was found in all patients. 14 of them appeared angle recession more than 180°.

No patient was found lens location. Cataract appeared in 17 patients. No patient was seen fundus damage except for glaucomatous neuropathy.

During the investigation, 5 of them underwent surgery because of IOP uncontrolled by drugs, and the other still admitted to drugs.

## Discussion

Ocular trauma is one of the most common causes of acquired blindness in children. There are about 1.6 million people blind due to eye injuries; in addition to this, 2.3 million are having low vision bilaterally and 19 million represent unilateral visual loss, making eye trauma the most common etiology of unilateral blindness<sup>3,4</sup>. Eye injuries measure about 8%~14% of the total childhood injuries<sup>5,6</sup>. Previous studies showed higher incidence of eye injuries in males<sup>5,7,8</sup>. In our results, 16 of 19 patients were males, far more than females. The majority of patients (12 of 19, 63.2%) were less than 30 years old.

Previous study reported stones (20%) and sticks (9%) were the most common etiologic agent for both sexes, usually in children 4 years old or older<sup>9</sup>. In our study, stones (21.1%) and hands (21.1%) were the most common etiologic agent. Despite of different age range, the results about agent were no difference.

The definition of traumatic glaucoma sometimes vague. Any post-trauma raised intraocular pressure (IOP) more than 21 mm Hg post-trauma which may be acute or chronic in onset, and blunt or penetrating in nature, in children less than 12 years of age supplemented with/without establishment of

glaucomatous optic neuropathy on visual field testing wherever possible is the acceptable definition. However, some children were found elevated IOP near to 21 mmHg in early stage of eye trauma. No follow-up was indicated until severe visual loss happened after several years even tens of years. Because the period was so long, the traumatic history was ignored by physicians, patients or their parents<sup>10</sup>.

Two peak incidences of glaucoma after trauma have been reported, less than 1 year and at least 10 years after trauma<sup>11</sup>. A 3.4% incidence of glaucoma after ocular contusion has been reported during a 6-month follow-up<sup>12</sup> and up to 10% during the 10 years after trauma<sup>13</sup>. In our study, glaucoma in almost all patients (13 of 19) was detected beyond 10 years after trauma. It was different from the peak duration in previous results. It suggested the manifestation in them was more insidious so that it was difficult to be felt by patients compared with common traumatic glaucoma.

In general, the traumatic glaucoma was disturbed by POAG because their similar wide angle, optic disc and visual field damage. Especially in this study, no appearance of fundus damage and lens location relative to trauma was seen. Additionally, most of patients had ocular trauma before several years, even more than 30 years. When they were diagnosed as glaucoma, they could not retrospect the history and automatically informed their doctors because they did not realize the relationship, especially trauma happened in childhood in some patients. Therefore, it is extremely important to inquire them history in details and seek some signs relative to ocular trauma when monocular POAG was diagnosed.

In previous study, the incidence of angle recession after eye trauma ranges from 20 to 94%. A total of 5 to 20% of patients with traumatic angle recession will go on to develop glaucoma. The possibility of developing glaucoma in an eye with angle recession appears to be related to the extent of angle recession. If more than 180° of the anterior chamber angle is involved, there is a greater chance of subsequently developing glaucoma.<sup>10,14</sup> In this study, angle recession happened in all patients. Similar to other studies, more than 180° of the anterior chamber angle is involved in most of these patients (14 of 19). The peak IOPs and the severity of glaucomatous neuropathy were related to the extent of angle recession.

The large amount of misdiagnosed traumatic glaucoma was because systematic and comprehensive examinations weren't performed. In our observation, while one eye showed typical glaucomatous optic neuropathy and visual field damage, another eye was normal in all patients. It suggested maybe they suffered from other types of glaucoma because POAG usually involved in binocular and other similar eye diseases or systemic diseases should be excluded before diagnosis. Furthermore, 7 patients appeared sphincteric tears and 2 patients had iridodialysis. Unfortunately, these typical features were not noticed. Gonioscopy is the fundamental part of eye examination. It is needed to evaluate the condition of anterior chamber angle, and to note other pathological conditions. The fundamental drawbacks of gonioscopy are physician compliance and patient discomfort<sup>15</sup>. An earlier study has revealed that 50% of optometrists and ophthalmologists do not perform gonioscopy in clinical diagnosis<sup>16</sup>. Nonetheless, gonioscopy is the clinical reference standard because it is able to make note of significant pathological

findings by allowing the observation of angle structures using a cost-effective instrument<sup>17</sup>. In this study, all patients could be easily differentiated from POAG by gonioscopy.

In conclusion, we suggested that patients with long traumatic history, mild ocular signs and insidious symptoms were more likely to be misdiagnosed. It might be more prudent to diagnose as POAG while there was significant difference in the condition of both eyes. We should always remind ourselves that glaucoma was a group of complex and diverse diseases with similar characteristics, and pay attention to clues for differential diagnosis.

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## Declarations

### Availability of data and materials

The datasets used and/or analyzed during the current study are available from the corresponding author on reasonable request.

### Ethics approval and consent to participate

This study followed the tenets of the Declaration of Helsinki and was approved by the Ethics Committee of Beijing Tongren Hospital (No. 2017003). Written informed consent was obtained from all subjects.

### Consent for publication

Not applicable in this study.

### Competing interests

The authors declare that they have no competing interests.

### Tables

**Table 1 Demographic Data of 19 Patients With Traumatic Glaucoma Misdiagnosed as POAG**

Characteristic	Traumatic Glaucoma
<b>Age, mean(SD)</b>	47.1±12.8
<b>Sex, No. M:F</b>	16:3
<b>Trauma to diagnosed interval(years)</b>	1~40
<b>Type of trauma, No.(%)</b>	
Toy (including in ball)	3(15.8%)
Hand	4(21.1.)
Stones	4(21.1.)
Wooden stick	3(15.8%)
Tire explosion	1(5.3%)
Firecracker	2(10.5%)
Head injury	1(5.3%)
Others	1(5.3%)

**Table 2 Anterior Segment Findings in Patients in this Study**

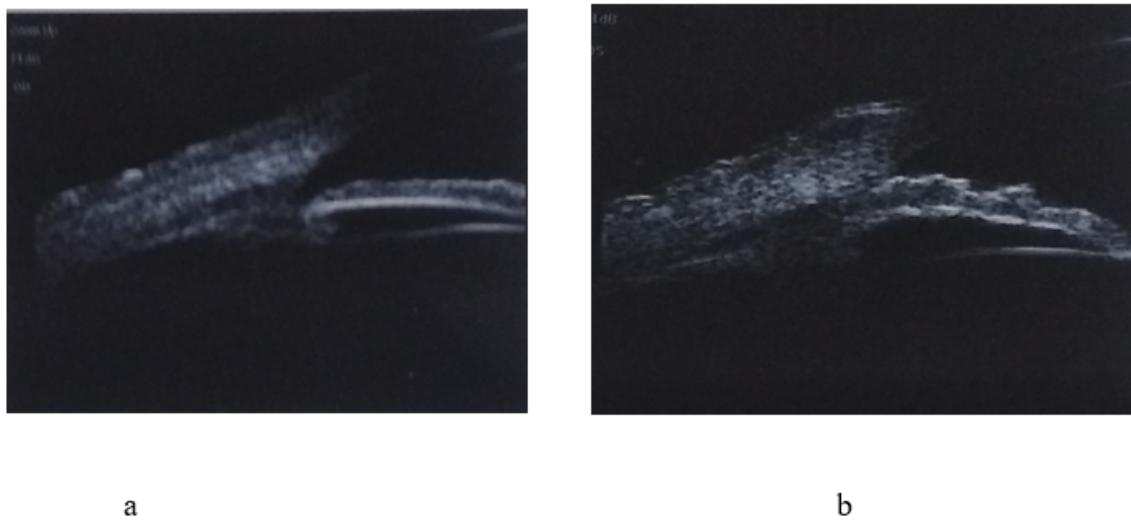
<b>Signs</b>	
<b>Visual acuity</b>	FC~54/60
<b>Peak IOP, mmHg, mean(SD)</b>	33.0±10.6
<b>Anterior segment features</b>	
Sphincteric tears	7
Iridodialysis	2
Trabecular pigmentation grade≥3	15
Angle recession<180°	5
Angle recession>180°	14
<b>Lenticular features</b>	
Cataract	17

## Figures



**Figure 1**

Gonioscopic appearance of an eye with traumatic glaucoma. Angle recession with trabecular pigmentation, peripheral iris adhesion and iridodialysis were investigated.



**Figure 2**

Results of ultrasonographic biomicroscopy of the anterior chamber angle showing the presence of an angle recession in traumatic glaucoma. Comparison the traumatic glaucoma eye(a) and the contralateral eye(b).