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Research Article

Relationship between Age at Onset and Axial Length in Macular Hole

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Abstract

Purpose: To study the correlation between age at onset and axial length in patients with idiopathic macular hole (MH).

Methods: This retrospective study included the medical records of 328 consecutive patients (346 eyes) who underwent vitrectomy for MH at Toho University Sakura Medical Center between January 2012 and May 2017 (121 men, 207 women; mean age, 67.6 ± 7.5 years). We classified patients into 5 groups: all MH cases, cases in which preoperative post-vitreous detachment did not occur (PVD- cases, 265 eyes), cases in which preoperative PVD occurred (PVD+ cases, 81 eyes), cases in which high myopia was excluded (axial length longer than 26.0 mm or refractive error lower than -6 D, 307 eyes), PVD- cases in which high myopia was excluded (249 eyes). We evaluated correlations between age at onset and axial length in the 5 groups.

Results: The correlations between age at onset and axial length were -0.277 in all MH cases, -0.305 in PVD- cases, -0.313 in PVD+ cases, -0.158 in cases in which high myopia was excluded, -0.180 in PVD- cases in which high myopia was excluded. Age at onset and axial length showed a negative correlation in all groups ($P < 0.05$).

Conclusion: Age at onset and axial length showed a negative correlation in MH. Notably, a significant correlation was shown in cases that included high myopia and in PVD+ cases.

Keywords: *Macular Hole; Axial Length; Age; High Myopia; Vitreous Detachment*

Abbreviations

MH: Macular Hole; PVD: Post-Vitreous Detachment; OCT: Optical Coherence Tomography

Introduction

Idiopathic macular hole (MH) often occurs in elderly women and leads to central vision loss, visual distortion, and scotoma [1]. The etiology of MH is speculated to primarily occur due to vitreofoveal traction; this has been determined by detailed scanning with optical coherence tomography (OCT) in recent years [2-6]. Additionally, the age at onset of post-vitreous detachment (PVD) corresponds to the degree of myopia: stronger myopia is associated with younger age at the onset of PVD [7,8]. Regarding the relationship between MH and axial length, there has been evidence for a negative correlation between age at onset and axial length in cases of MH (stage 3, 4) [9]. However, there have been few reports regarding the relationship between age at onset and axial length in cases of MH. The current study retrospectively analyzed the relationship between age at onset and axial length in cases of MH, including stage 1b and 2 MHs.

Materials and Methods

This retrospective study included the medical records of 328 consecutive patients (346 eyes) who underwent axial length measurement for vitrectomy for MH at Toho University Sakura Medical Center during the period between January 2012 and May 2017 (121 men,

207 women; mean age, 67.6 ± 7.5 years). The axial length in all cases was measured by IOL Master. All cases were full-thickness MH, diagnosed by OCT. Types of MH were classified according to the Gass system [2]. The current study included stages 1b, 2, 3 and 4. Traumatic MH and cases with preexisting surgery were excluded. Because we suspected that the age at onset of MH was related to PVD and high myopia, we classified cases into 5 groups: all MH cases, cases in which preoperative post-vitreous detachment did not occur (PVD- cases), cases in which preoperative PVD occurred (PVD+ cases), cases in which high myopia was excluded (axial length longer than 26.0 mm or refractive error lower than -6 D), and PVD- cases in which high myopia was excluded.

The presence of PVD was confirmed by preoperative OCT and staining of the vitreous cortex by triamcinolone acetonide during vitrectomy.

PVD- cases included 265 eyes of 254 patients (95 men, 159 women; mean age, 67.5 ± 7.0), PVD+ cases included 81 eyes of 77 patients (28 men, 49 women; mean age, 68.1 ± 9.0), cases in which high myopia was excluded comprised 307 eyes of 295 patients (110 men, 185 women; mean age, 68.4 ± 7.0), and PVD- cases in which high myopia was excluded comprised 249 eyes of 241 patients (90 men, 151 women; mean age, 68.0 ± 6.5). We evaluated the correlation between age at onset and axial length in the 5 groups. We also evaluated the correlation between age at onset and axial length in male cases (128 cases) and female cases (218 cases). All statistical analyses were performed using SPSS statistical software (version 24.0, SPSS, Inc., Chicago, IL, USA).

The study protocol for this retrospective, observational, comparative study was reviewed and approved by the ethics committee at Toho University Sakura Medical Center (approval number No. S18002). All study conduct adhered to the tenets of the Declaration of Helsinki and written informed consent was obtained from all subjects. Consent was obtained after the study design and participation risks/benefits were explained using the Toho University Sakura Medical Center website, in accordance with the guidelines for clinical research established by the Japanese Ministry of Health, Labour and Welfare.

Any and all private patient information was excluded from the database and use of this anonymous data was approved by the Institutional Review Board without the need to seek additional consent for the use of data for research.

Results

In all MH cases, the average axial length was 24.03 ± 1.70 mm and the age at onset was 67.6 ± 7.5 years old. In PVD- cases, the average axial length was 23.72 ± 1.29 mm and the age at onset was 67.5 ± 7.0 years old. In PVD+ cases, the average axial length was 25.02 ± 2.37 mm and the age at onset was 68.05 ± 8.98 years old. In cases in which high myopia was excluded, the average axial length was 23.52 ± 0.98 mm and the age at onset was 68.4 ± 7.0 years old. In PVD- cases in which high myopia was excluded, the average axial length was 23.58 ± 1.01 mm and the age at onset was 68.0 ± 6.5 years old. In male cases, the average axial length was 24.38 ± 1.49 mm and the age at onset was 69.3 ± 7.3 years old. In female cases, the average axial length was 23.84 ± 1.79 mm and the age at onset was 66.5 ± 7.3 years old. Correlations between age at onset and axial length were -0.277 in MH all cases, -0.305 in PVD- cases, -0.313 in PVD+ cases, -0.158 in cases in which high myopia was excluded, -0.180 in PVD- cases in which high myopia was excluded, -0.3368 in male cases, and -0.3058 in female cases. The difference in correlation between age at onset and axial length was not significant between male and female cases (P = 0.7585) (Figure 1-7). Age at onset was significantly negatively correlated with axial length in all groups (P < 0.05) (Table).

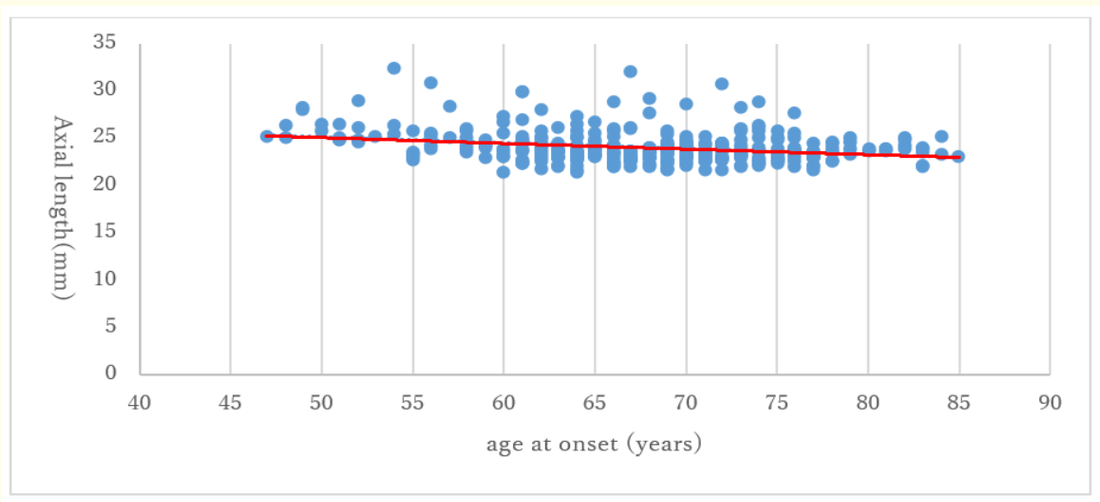

Figure 1: *Correlation between age of onset and axial length in all MH cases.*

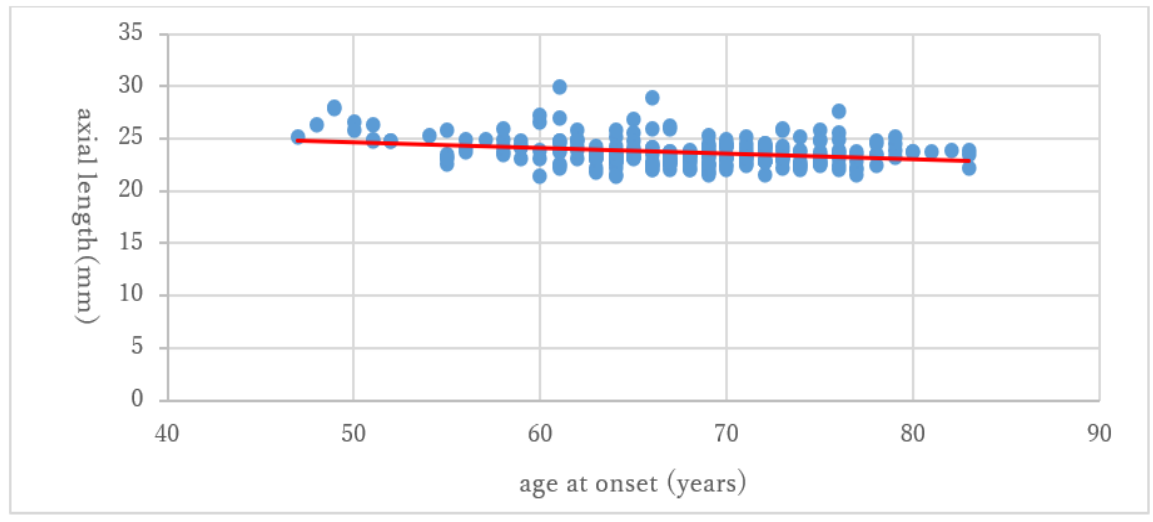

Figure 2: *Correlation between age of onset and axial length in PVD- groups.*

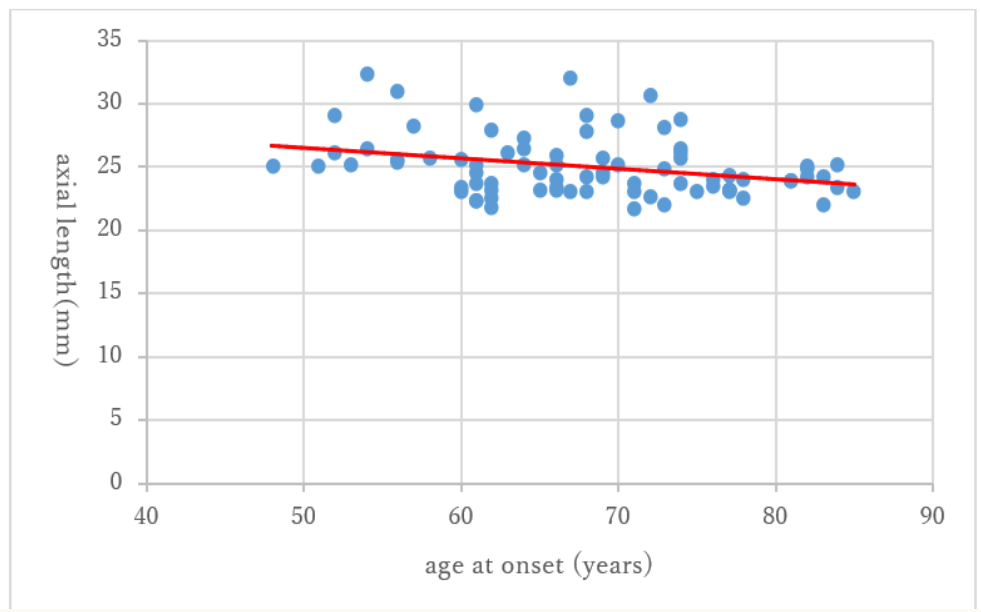

Figure 3: *Correlation between age of onset and axial length in PVD+ groups.*

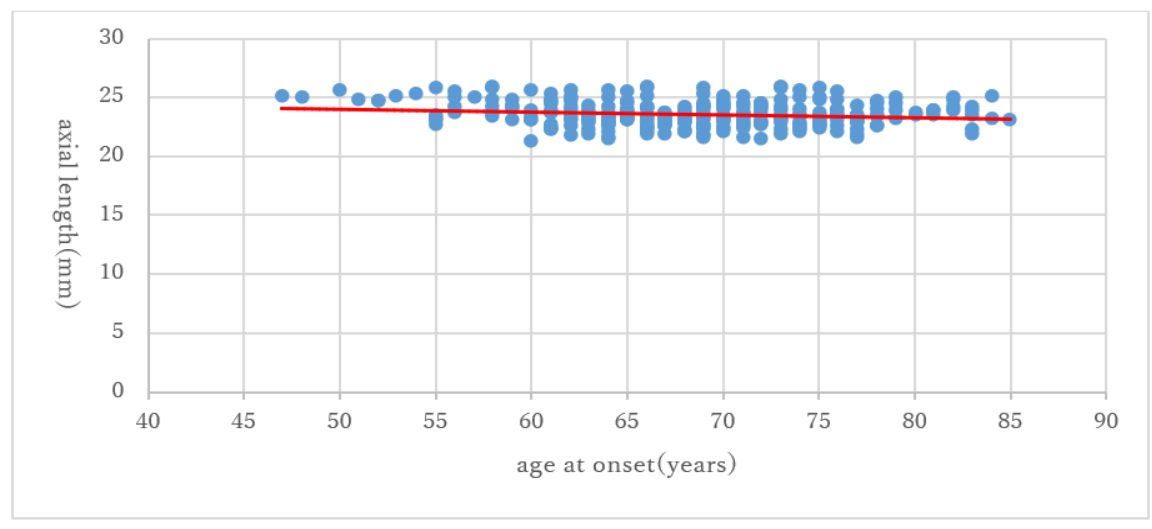

Figure 4: *Correlation between age of onset and axial length in groups excluding high myopia.*

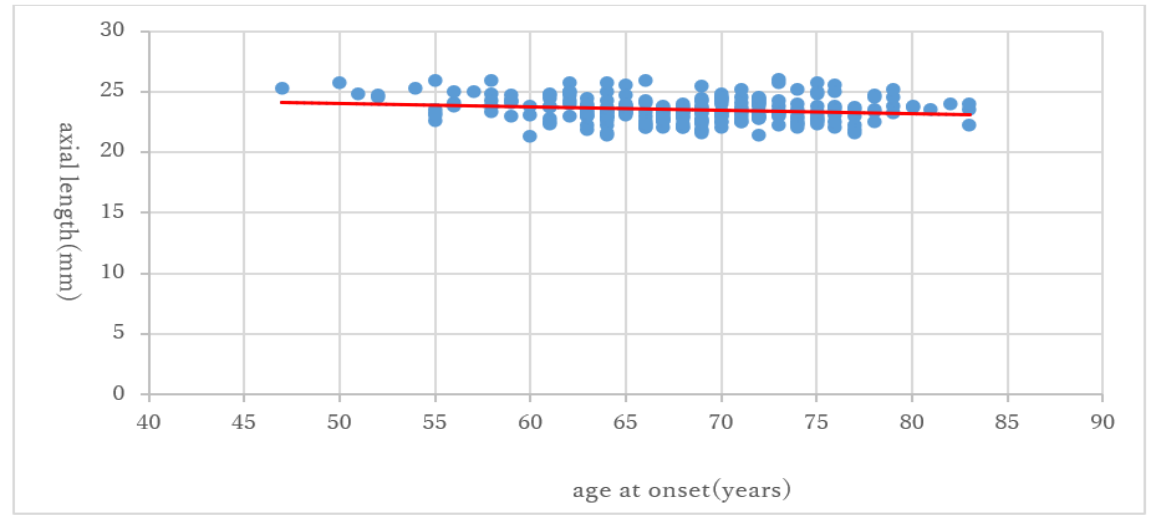

Figure 5: *Correlation between age of onset and axial length in PVD- cases excluding high myopia.*

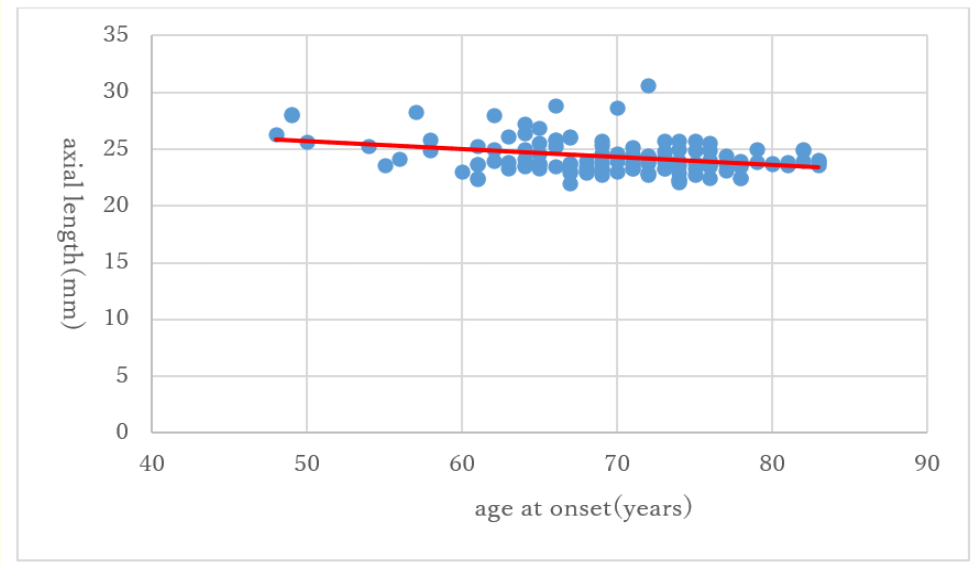

Figure 6: *Correlation between age of onset and axial length in male cases.*

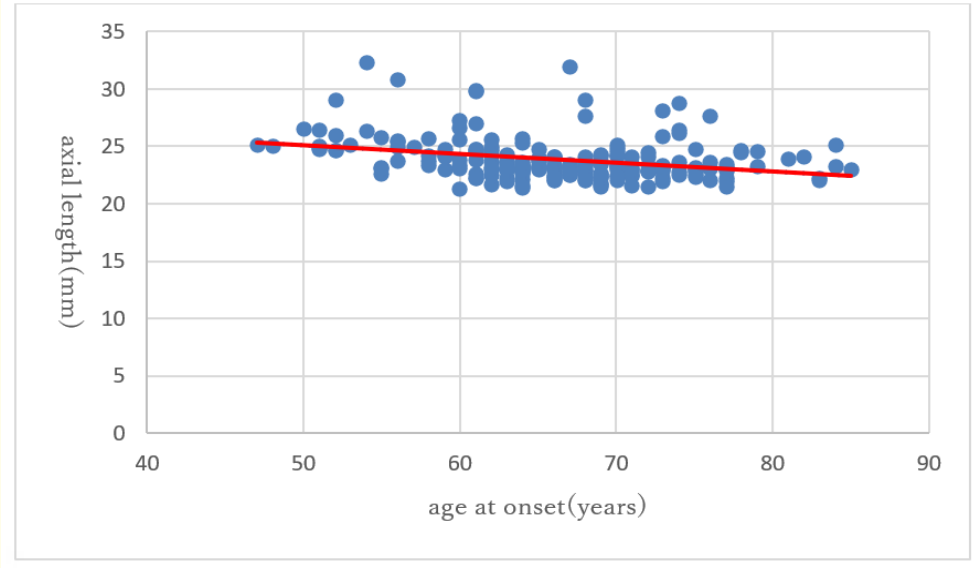

Figure 7: *Correlation between age of onset and axial length in female cases.*

	Age	Axial length	Correlation	95% confidence interval	P value
All cases	67.6 ± 7.5 (47 to 85)	24.03 ± 1.70 (21.36 to 32.30)	-0.2769	(-0.3715 - -0.1766)	< .001
PVD-	67.5 ± 7.0 (47 to 83)	23.72 ± 1.29 (21.36 to 29.86)	-0.305	(-0.4104 - -0.1915)	< 0.001
PVD+	68.1 ± 9.0 (48 to 85)	25.02 ± 2.37 (21.61 to 32.02)	-0.3128	(-0.4972 - -0.1014)	0.0045
High myopia excluded	68.4 ± 7.0 (47 to 85)	23.52 ± 0.98 (21.36 to 25.91)	-0.1576	(-0.2649 - -0.0465)	0.0056
PVD-, high myopia excluded	68.0 ± 6.5 (47 to 83)	23.58 ± 1.01 (21.36 to 25.91)	-0.1803	(-0.2980 - -0.0573)	0.0043
Male cases	69.3 ± 7.3 (49 to 83)	24.38 ± 1.49 (21.98 to 30.59)	-0.3368	(-0.4821 - -0.1734)	0.0001
Female cases	66.5 ± 7.3 (47 to 85)	23.84 ± 1.79 (21.36 to 32.20)	-03058	(-0.4215 - -0.1802)	< 0.0001

Table: *Correlation between age of onset and axial length.*

All cases: all cases of macular hole; PVD-: Cases in which preoperative posterior vitreous detachment did not occur; PVD+: Cases in which preoperative posterior vitreous detachment occurred; High myopia excluded: cases in which high myopia was excluded (axial length is longer than 26.0 mm or refractive value is lower than -6D); PVD-: High myopia excluded: cases in which preoperative posterior vitreous detachment occurred, but in which high myopia was excluded.

All eyes were divided into 3 groups based upon axial length as follows: high myopia (26 mm and longer), mild and moderate myopia (23.0 - 25.99 mm), and emmetropia and hypertropia (shorter than 23.0 mm). Mean age at onset was 62.03 ± 8.21 years in eyes with high myopia, 67.79 ± 7.73 years in eyes with mild and moderate myopia, and 69.33 ± 5.3 years in eyes with emmetropia and hypertropia.

Additionally, when axial length was averaged by age group, average axial length was 26.53 ± 1.30 mm among patients 40 - 49 years of age (48.2 ± 0.75), 25.32 ± 1.98 mm among patients 50 - 59 years of age (55.13 ± 2.83), 23.87 ± 1.70 mm among patients 60 - 69 years of age (65.02 ± 2.76), 23.77 ± 1.45 mm among patients 70 - 79 years of age (73.56 ± 2.63), and 23.78 ± 0.82 mm among patients 80-89 years of age (82.29 ± 1.36).

Discussion

In the current study, age at onset and axial length were significantly negatively correlated in MH. In particular, a significant negative correlation was present in cases with high myopia and those that were PVD+. The age at onset of PVD may correspond to the degree of myopia: stronger myopia is associated with younger age at onset of PVD [8]. This correlation may contribute to the etiology of MH in patients with PVD.

In a previous study, the correlation between age and axial length was 0.723 in cases of MH (stages 3 and 4) [9]. That correlation was higher than the correlation in the current study; this may be because the rate of stage 4 MH (PVD+) that induced higher correlation among all MH cases was lower due to the inclusion of cases of stages 1 and 2 MH.

In cases with high myopia, age at onset of MH was younger than in other cases; this contributed to a more significant negative correlation between age at onset and axial length in cases that included high myopia. Increasing age was associated with reduction in axial length until 60 years of age in cases of MH; however, after 60 years of age, axial length did not change with respect to age at onset.

In cases of PVD that occurred after 60 years of age, refractive values are hypertropic and emmetropic in many cases [8]; cases in which PVD occurred spontaneously include a low number of hypertropic cases. In the current report, there were few cases with axial length < 23 mm. This may be because the axial length of MH in this study did not substantially change after 60 years of age. Thus, MH might not occur in cases with extremely short axial length.

The correlation between age at onset and axial length was slightly higher in PVD+ cases, for the following possible reasons: in some PVD+ cases, extensive time has passed since the onset of MH, and older individuals may not notice reduction in vision by cataract; thus, the age of MH onset in older people may be more closely evaluated and more likely to correlate with axial length. Axial length in PVD+ cases was longer than in PVD- cases; this may be because PVD easily occurs with longer axial length, which may cause an increased correlation between age and axial length, compared with PVD- cases. In order to assess this speculation, it is necessary to estimate the real age at onset by using MH diameter, because untreated MHs increase in diameter [10].

Conclusions

Age at onset and axial length were negatively correlated in MH. Notably, a significant correlation was present with high myopia and PVD. It is necessary to consider that relatively young MH cases, such as those in their 40s and 50s, may have a long ocular axis, such that it is difficult to perform MH surgery.

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Conflict of Interest

The authors declare no conflicts of interest.

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