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## Weather and Blindness Meteorological Changes Impact on a Potentially Blinding Disease

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### Abstract:

*Last decades revealed a high tendency of increased frequency of the extreme weather phenomenon. This fact made us look for the impact of meteorological changes on acute glaucoma. Our study included a number of 174 cases of patients, presented in Ophthalmology Department from Constanta Emergency Hospital, between 2005 and 2013. The phase's survey offers the advantage of synthetically vision on the situation of all meteorological factors, and the opportunity to study glaucoma during stable or changing weather. We noticed that weather changes have an obvious role in generating acute glaucoma.*

**Key words:** Meteorological changes, phase, acute glaucoma

### Introduction

During the last decades, the study and prediction of the weather have been much improved, due to permanent technical progress.

Thus, the revelation of correlations between meteorological factors and health state can be evaluated more

and more precisely, providing us ways to better control chronic diseases evolutions and ways to better prevent some acute and severe conditions, such as acute glaucoma [1, 2, and 3].

Moreover, the last decades tendency of increased frequency of the extreme meteorological phenomenon brought to our attention the idea of studying the impact of weather changes on acute glaucoma. In fact, the role of weather parameters in angle closure glaucoma have already been revealed in some studies [4, 5, and 6]. Under such circumstances, we worked to see the situation for Constanta region, by studying the cases of acute glaucoma which occurred during the 2005-2013 period.

## **Material and methods**

Last decades revealed a tendency of increased frequency of the extreme meteorological phenomenon.

This trend made us look for the impact of weather changes on acute glaucoma.

The acute onset, with severe symptoms, which force the patients to address to a hospital very soon, provided us the opportunity of knowing precisely the weather aspects of the onset time.

The acute glaucoma is defined as an extreme high intraocular pressure, which results from a sudden adherence of the iris to the corneoscleral trabeculum, followed by sudden increase of the outflow resistance for the aqueous humor [7].

Our study included a number of 174 cases of patients, presented in Ophthalmology Department from Constanta Emergency Hospital, between 2005 and 2013.

In order to characterize and measure weather in a generally accepted way [8], we used the classification proposed by Ungeheur/Tromps in 1970, which includes 6 types of weather:

- Phase 1: relatively nice weather, the sky sometimes cloudy, sometimes sunny; temperature and humidity variations within normal limits, pressure increases slightly; the wind is cool and dry, refreshing human organism;
- Phase 2: nice weather, clear sky, pressure slightly decreases; temperature and humidity have important variations from night to day; light wind. This phase is associated with a pleasant heat sensation;
- Phase 3: very nice weather, weak foehn, low pressure, temperature increases much over the limit of biological comfort. It's associated with unpleasant feeling, generating mainly migraines;
- Phase 4: represents the start of weather changing, stormy clouds are quickly developing, pressure diminishes while temperature stays relatively high and humidity is increasing, these are the main aspects of the warm front. The weather is perceived as suffocating and uncomfortable;
- Phase 5: weather in full changing; the cold front is penetrating, with decreasing air temperature, cumulus cloudy sky, high humidity and moderate to strong wind. Uncomfortable cold feeling[9];
- Phase 6: weather is improving. Less cloudy, pressure and temperature slowly and constantly increasing, humidity low enough and wind progressively weaker. Perceived as pleasantly cold.

## **Discussions**

The phase's survey offers the advantage of synthetically vision on the situation of all meteorological factors, and the opportunity to study glaucoma during stable or changing weather.

The annual distribution was relatively balanced: 17 cases in 2005 and 2006, 26 cases in 2007 and 2008, 23 cases in

2009, 24 cases in 2010, 19 cases in 2011 and 20 cases in 2012 and 45 cases in 2013.

The study of the relationship between the number of glaucoma crises and the type of meteorological phase during 8 years revealed obvious picks of distribution in phase 5 (most of cases), nearly followed by phase 4 and less phase 3.

Acute glaucoma almost didn't occur during phase 1 (1 single case in 8 studied years!) and it was very rare in the phases 2 and 6.

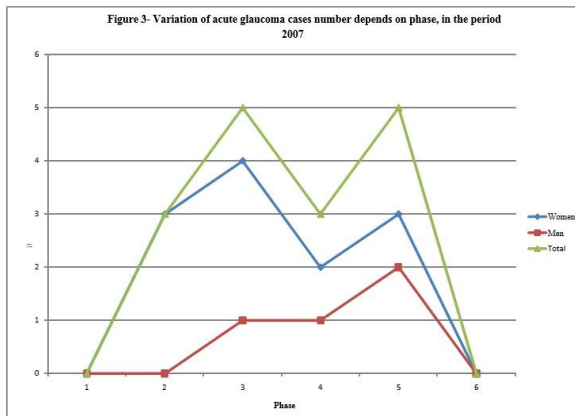
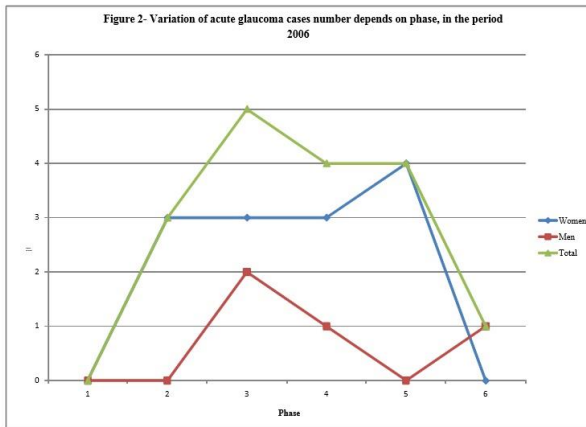
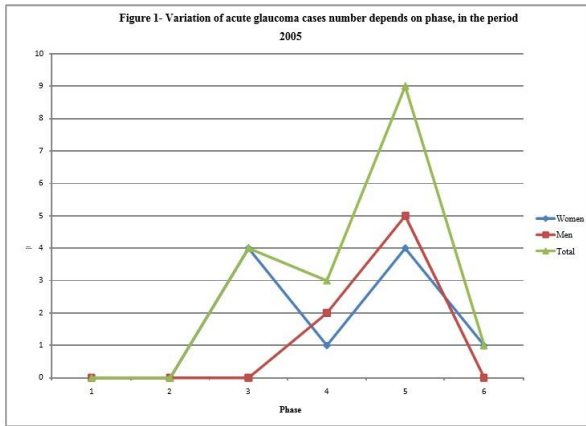
It was also noticed a slight difference on genders: men were almost constantly predisposed at acute glaucoma during phase 5 and women mostly during phases 4 and 3.

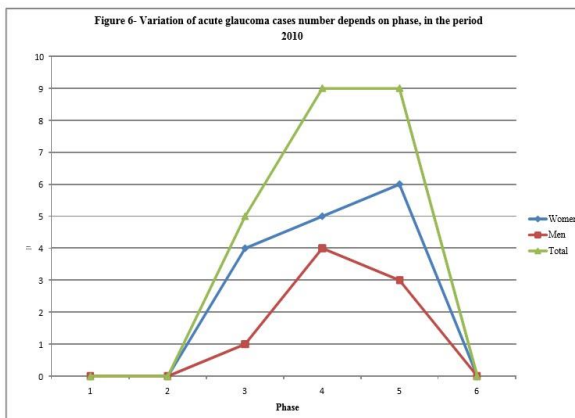
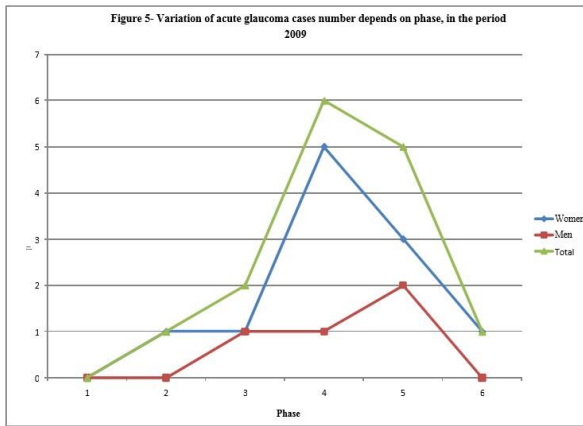
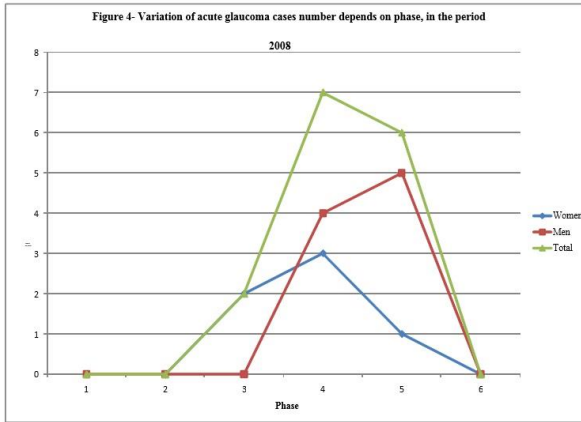
Thus we could conclude that cold front penetration is the most responsible for acute glaucoma, followed by warm front penetration and less by the weather with temperatures over biological comfort limit.

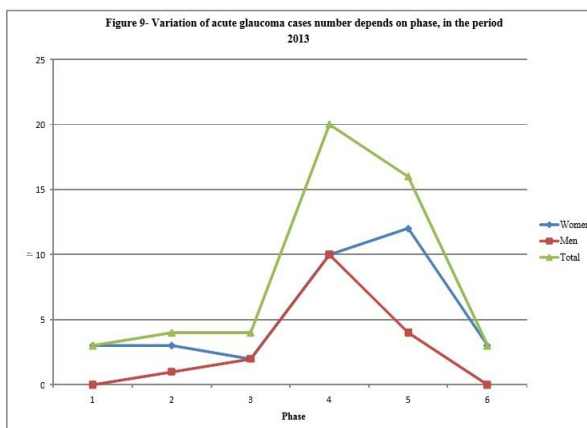
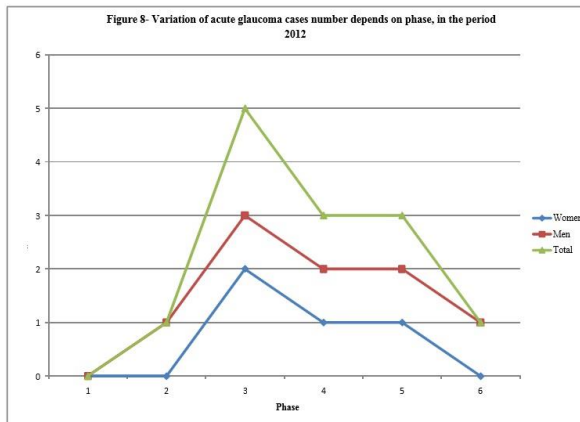
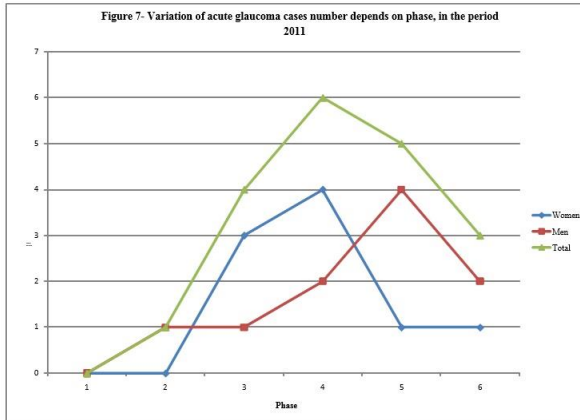
Penetration of cold front may cause acute glaucoma onset by different mechanisms:

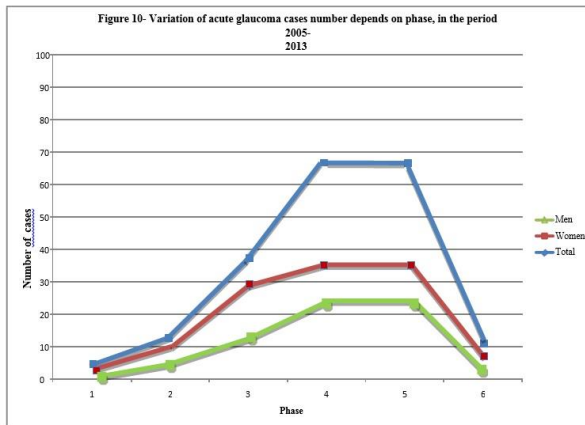
- Diminishes transmission on a sympathetic pathway, thus reducing light reflexibility and determining midriasis and angle closure;
- Increases general metabolism, including ciliary processes metabolism, cold weather also increases aqueous humor production.

In case of penetration of warm front, the only mechanisms known until now capable to explain acute glaucoma onset are vasodilation and hypophisar antidiuretic hormone hyper secretion. Thus, parasympathetic hypertonia followed peripheral vasodilation would cause uveal congestion, known as responsible for angle closure and acute glaucoma.









The weather with temperatures over biological comfort limit-phase-3 would cause acute glaucoma by same mechanisms as warm fronts.

Cold fronts are more dangerous in causing acute glaucoma in men, and warm fronts and higher temperatures are more dangerous in women.

The study of the relationship between the number of acute glaucoma cases and different meteorological parameters revealed some significant aspects:

- The obvious predominance in female gender, probably related to higher autonomic nervous system lability;
- Positive tendencies concerning the relationship between acute glaucoma cases and minimal, average, maximal, 1 p.m. temperatures [10, 11, 12];
- Non-significant correlation of acute glaucoma cases with temperature amplitude;
- Positive correlation of acute glaucoma with atmospheric pressure;
- Negative correlation of acute glaucoma with sunshine duration [13, 14].
- Negative tendencies of correlation between acute glaucoma and Thom and Miss coefficients.



## Conclusion

During stable weather periods, acute glaucoma doesn't occur or is isolated. Thus, weather changes have an obvious role in generating acute glaucoma.

Studying and predicting weather, especially nowadays, when climate is changing, might provide us ways to better prevent acute glaucoma.

The revelation of dangerous weather elements, associated with improving weather predictions, would create the capability of real meteor prophylaxis in glaucoma, transforming a potentially blinding disease into an avoidable condition.

## Disclosure

The authors declared no competing interest.

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