

## Investigation of the Factors Affecting the Positivity of the Transplant Result

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**Abstract:** The most common cause of failure of the corneal transplant is the rejection by the host immune system for which there are several factors. This study was conducted in order to determine the factors influencing on the positivity of the corneal transplant in Imam Khomeini Hospital of Urmia during the years 2013 and 2014. Also, regarding the importance of the corneal transplant surgery, we tried to study the amount of referring for the corneal transplant surgery and investigate it during the years of 2010-2014 and then make predictions through modeling for the coming year. In this cross-sectional study, all patients who during the years 2010-2014 referred to this hospital for corneal transplant surgery were studied. By using the questionnaire, we collected the needed information and analyzed the data by the SPSS Software (the logistic regression) and the models of time series (ARIMA). This study was done on 2014 patients who had been exposed to corneal transplant surgery by doctor diagnosis. The multivariate inferential statistics of findings showed a significant relation between age and gender of the patient requesting corneal transplant on the one hand and selection of the ultimate result of transplant on the other; finally, the age and gender of the patient requesting corneal transplant was entered to model. Also, the time series study was done for 52 months. Finally, the mean of transplant patients referring to this hospital in the next 12 months (2015) has been predicted to be equal to 7/3 case per month. This prediction was estimated by using the model  $\{\mu \neq 0$  and ARIMA (1, 1) $\}$ . Variables of age and gender of patients requesting corneal transplant surgery were recognized as the factors affecting the ultimate result of transplant. The results of studying the time series show a reduction in referring to Imam Khomeini Hospital of Urmia for cataract surgery, although, this reduction is not so considerable.

**Key words:** Corneal transplant, patients, time process, prediction, surgery

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### INTRODUCTION

Corneal transplant is the most common type of allogeneic transplant in the world. The first successful corneal transplant surgery took place in the world (1906) over 100 years ago (Vejdovsky and Heinc, 1957). The above surgery has been proposed as one of the most successful types of tissue transplant in the world (Hovding, 1999). There are several methods for corneal transplant. The first method used for type of transplant was the penetrating keratoplasty method and from indications of this method are the corneal dystrophy, infectious keratitis and keratoconus (Galvis *et al.*, 2013). Since, the invention of posterior lamellar methods, these methods have been chosen for patients suffering from endothelial disease, due to better results (Galvis *et al.*, 2013). Since, its emergence up today, the development in the field of micro-surgery, immunology, pharmacology,

preservation and maintenance centers of the corneal tissue has caused to increase the successful ratio of the corneal transplant (Lowers *et al.*, 1995). There are many reports about the causes of corneal transplant in developing and developed countries (Cosar *et al.*, 2002; Cursiefen *et al.*, 1998; Liu and Slomovic, 1997; Chen *et al.*, 2001; Dandona *et al.*, 1997; Sony *et al.*, 2005). Visual recovery after transplant surgery had a direct relationship with the transplant cause and this fact has been proven in several studies (Edwards *et al.*, 2002; Maeno *et al.*, 2000). The causes of corneal transplant surgery are slightly different in different parts of the world. In Colombia between 2004 and 2011, the most indications for keratoplasty were respectively as follow: keratoconus, stromal opacity, infectious keratitis (Galvis *et al.*, 2013). In Iran, keratoconus has been announced the most common cause of this transplant (Javadi *et al.*, 1996). Corneal transplant is the most common organ transplant in the city

of Urmia. Today in majority of university centers of the country, the penetrating corneal transplant takes place inclusively for the corneal different problems (Nili *et al.*, 2001).

Due to geographical conditions of West Azerbaijan Province and living conditions of people and the lack of any statistics related to age and form of corneal transplant surgery in this area and similar geographic region of the country, the patients who were hospitalized in Imam Khomeini Hospital with a diagnosis of corneal transplant were studied. In this study we, tried to identify the factors affecting the acceptance or rejection of corneal transplant surgery in patients by using the collected information from these patients. Next, given the importance of above transplant we tried to study the trend of the volume of referring individuals for corneal transplant surgery during the past years and make prediction, after modeling, its trend for next year. As a result, the officials of this hospital can offer prospectively the appropriate policies for better services to this range of patients. In this study, the information of 2014 patients has been investigated in 2013 and 2014, while the study of time series has been conducted from the middle of 2010 until late 2014.

**MATERIALS AND METHODS**

This study was a cross-sectional study of patients who were exposed to corneal transplant surgery in the Imam Khomeini hospital. Therefore, all patients who have referred to this hospital during the years of 2013 and 2014 were studied. First 2 weeks after surgery a result of positivity or negativity of the surgery was recorded in patients' medical file and then during 2 years again patients have been admitted to hospital or contacted with them and a certain consequence of surgery has been determined for above patients. There corded variables for each patient are as follows: the medical team performing the surgery, being or not being covered by insurance on the side of patient, type of disease and mode of surgery (normal or emergency), type of surgery (penetrating keratoplasty, lamellar keratoplasty, deep anterior lamellar keratoplast, descemets stripping automated endothelial keratoplasty, tectonic), type and characteristics of requested tissue, place of residence of patient (urban or rural), result of the surgery after 2 weeks, the age and gender of the donor, age and gender of patient requesting

the corneal transplant surgery. The first aim of this study was to introduce the characteristics of this type of patients by using the descriptive statistics and in the next step to identify the factors that are effective in the ultimate result of the corneal transplant surgery. In the study of the time series of the volume of conducted surgeries the corneal transplant was taken place in Imam Khomeini Hospital of Urmia during the 52 months; the data were collected from the hospital's eye center and corneal transplant surgery monthly in the period of August 2010 to December 2014 and the relationship between the volume average of conducted surgeries in the field of corneal transplant in each month was investigated by analyzing the time series of Autoregressive Identifying-Moving Average (ARIMA1). In the end, the prediction for the next 12 months was provided. Finally, by using a questionnaire we collected data and analyzed them by using the SPSS Software (logistic regression) and Minitab.

**RESULTS**

This study is a cross-sectional investigation on 2014 patients who have been exposed to a corneal transplant surgery by diagnosis of a specialist. The results of the descriptive statistics indicate that 51.6% of this research population have been comprised of women and 48.4% of the remaining of the men. The great number of patients referring for corneal transplant surgery was those whose kind of disease has been reported to be corneal leukoma, about 28.6%. According to report, also the type of surgery of 80% of referring patients was Penetrating Keratoplasty (PK); 82.4% of the performed corneal transplant surgeries in this hospital were successful and the remaining 17.6% without a result. The 20.9% of 17.6% whose ultimate result were not successful, includes those of 2013 and 14.6% those of 2014. Also, 67% of individuals were urban and 33% of them rural.

According to Table 1, the multivariate inferential statistics of findings showed a significant relationship between age and gender of the patients requesting the corneal transplants surgery on the one hand and selection of the ultimate result of transplant on the other but there was not observed any significant relationship between the medical team performing the surgery, being or not being covered the requesting patient by

Table 1: Estimation of the logistic regression model for identifying factors affecting the final results of corneal transplant surgery

| Estimation variable | Variables | SE    | Wald  | df | p-values | Exp(B) | 95% CI for exp(B) |        |
|---------------------|-----------|-------|-------|----|----------|--------|-------------------|--------|
|                     |           |       |       |    |          |        | Lower             | Upper  |
| Gender              | 1.258     | 0.626 | 4.034 | 1  | 0.045    | 3.519  | 1.031             | 12.011 |
| Age                 | -0/032    | 0/016 | 4.139 | 1  | 0.042    | 0.968  | 0.939             | 0.999  |
| Constant            | 2.8       | 1.034 | 7.331 | 1  | 0.007    | 6.447  |                   |        |

Table 2: Estimation of maximum likelihood for the parameters of the model ARIMA (1,1) with a y-intercept  $\mu$  of size of corneal transplant surgery

| Parameters | Estimation | standard deviation | t-values | p-values | Lag |
|------------|------------|--------------------|----------|----------|-----|
| MU         | 7.1374     | 0.2891             | -3.22    | <0.002   | 0   |
| MAI, I     | -0.8800    | 0.3558             | -2.47    | <0.017   | 1   |
| Arl, I     | -0.9310    | 0.4512             | 15.82    | <0.001   | 1   |

insurance, code of the disease and the mode of surgery (normal or emergency), type of surgery, type and characteristics of the requested tissue, the residence of requesting individual (urban or rural), result of the surgery after 2 weeks, the ultimate result of the surgery, age and gender of the donor on the one hand and the ultimate result of corneal transplant surgery on the other. Finally, the variables of age and gender of patient requesting the corneal transplants surgery was entered into the model.

In this cross-sectional study, regarding time series the volume of corneal transplant surgeries carried out during the above 52 weeks is equal to 192 number. The average volume of the corneal transplant surgery carried out for reported 52 months was equal to 3.69 and the standard deviation is 1.71.

The highest volume of the patients referring to Imam Khomeini Hospital of Urmia in 2014 for transplant was equal to 4 cases per month; on the contrary the lowest average volume of patients referring for corneal transplant surgery in 2012 has been reported to be equal to 3.25 cases per month.

The summary of the results related to the time-series models has been shown in Table 2 along with the parameter estimation by maximum likelihood method and the mentioned significance level for the parameters of above model. According to Table 2, the model of ARIMA (1, 1),  $\mu \neq 0$  becomes finally the following model:

$$t = 1.85395 + -0.9310 y_{t-1} + z_t - 0.8800 Z_{t-1} y$$

The mean of transplant patients referring to this hospital in the next 12 months (2015) has been predicted to be equal to 7/3 case per month with confidence interval of 95% ( $19/0 \pm 7/3$ ). This prediction has been estimated by using the model of  $\{\mu \neq 0$  and ARIMA (1, 1) $\}$ . Based on prediction for the year of 2015 in relation to the previous year (2014), the amount of patient referring to hospital shows 7.5% reduction.

### DISCUSSION

The ratio of women to men referring to the corneal transplant surgery was equal and our population under study is comprised mostly of the patients suffering from the corneal leukoma. Also, the urban individuals accepted for this surgery were higher than villagers and the

percentage of transplant rejection in 2014 compared to 2013 was acceptably lower. Age and gender variables of the patient requesting the corneal transplant surgery was recognized as the factors affecting the positivity of transplant ultimate result. Odds ratio of women to men whose ultimate result of corneal transplant surgery is positive is 3.186. For an increase per unit in the age of patients whose ultimate result of corneal transplant surgery is positive, the odds ratio is equal to 0.968. In the study of Al-Mohaimeed M.M. gender, age and diameter of transplant cornea as a result had not the penetrating corneal transplant (Al-Mohaimeed, 2013); this is opposed to the result of our research. While in the study of Triqui A., the young age for donor was a risk factor for transplant rejection, the high age and history of one-time transplant rejection for the transplant recipient is one of the risk factors of transplant rejection (Trigui *et al.*, 2005). Instudy of Kordic R. also the donor age had no significant effect on the result of the transplant. But in the study of Duman F. the patients who were younger, the amount of transplant success was slightly higher but it had not any obvious significant difference; it is almost similar to our study (Duman *et al.*, 2013). Also in the study of Inoue K. the high age of recipient and mutually lower age of donor, vascularization on the cornea and a long time of surgery were among the risk factors of the transplant rejection in the penetrating keratoplasty (Inoue *et al.*, 2001). In the study of Chu P.Y. that was conducted in Britain, the socio-economic level of patients don't have a significant effect in the result of corneal transplant (Chua *et al.*, 2013). However, in the study of Dandona L. that was conducted in India, due to an increase of the infection risk the low socio-economic level caused to increase the amount of corneal transplant rejection among patients (Dandona *et al.*, 1998). On the other hand, in the study of Bhatti N. the use of bevacizumab drug as the anti-angiogenesis drug caused to improve the results of corneal transplant in patients due to the prevention of neovascularization (Bhatti *et al.*, 2013). Finally with regard to the above descriptions, it is recommended that further researches are conducted for investigating the amount of corneal transplant success regarding the patients' socio-economic level and the use of bevacizumab drug, so that better results are obtained for further improvement in corneal transplant.

### CONCLUSION

The results of studying the time series show a reduction in referring to Imam Khomeyni Hospital of Urmia for cataract surgery, although, this reduction is not so considerable.

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