Indications of keratoplasty:
a retrospective study in a University Hospital

Indicações de ceratoplastia: estudo retrospectivo em um Hospital Universitário

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ABSTRACT

Objective: To describe the demographic-epidemiological profile and indications of keratoplasty at the University Hospital Santa Terezinha of Joaçaba (SC) from october 2006 to april 2011. **Methods:** The records were obtained from the files of the Eye Center Belloto Stock of Joaçaba (SC), where the patients were accompanied before and after keratoplasty. The data analyzed were city of origin, age, gender, ethnicity and indication of keratoplasty. **Results:** The medical records of 85 patients were analyzed, who underwent 100 keratoplasties. As to the origin, 79% of patients were in the region of the Midwest and the rest from other regions of Santa Catarina. The average age of patients was 38 ± 17.61 years, ranging from 13 to 87 years. As the gender, male prevalence was 57.6%. The white race was declared by 94.1% of patients and 5.9% for mixed. The indications for keratoplasty were keratoconus in 51 (51%) eyes, regraft in 15 (15%), leucoma post-herpes in 13 (13%), bullous keratopathy after cataract surgery in 6 (6%), corneal dystrophy in 5 (5%), leucoma after penetrating trauma in 4 (4%), bacterial ulcer unresponsive to medical treatment in 3 (3%) and other causes in 3 (3%). Of the 100 keratoplasties performed, 98 (98%) were penetrating and 2 (2%) lamellar. **Conclusion:** The study concluded that the profile of patients undergoing keratoplasty was characterized as a population of young caucasians, with a slight male predominance, and the four most common indications for keratoplasty were keratoconus, regraft, post-herpes leucoma and bullous keratopathy after cataract extraction.

Keywords: Corneal transplantation/epidemiology; Corneal diseases/surgery; Retrospective studies

RESUMO

Objetivo: Descrever o perfil demográfico-epidemiológico e as indicações de ceratoplastia no Hospital Universitário Santa Terezinha de Joaçaba/SC no período de outubro de 2006 a abril de 2011. **Métodos:** Os prontuários foram examinados no Centro Oftalmológico Belloto Stock de Joaçaba (SC) e os pacientes foram acompanhados antes e depois da ceratoplastia. Os dados analisados foram cidade de origem, idade, gênero, etnia e indicação da ceratoplastia. **Resultados:** Foram analisados os prontuários de 85 pacientes em que foram realizadas 100 ceratoplastias. Quanto à origem, 79% dos pacientes provinham da região do Meio-Oeste e os demais de outras regiões de Santa Catarina. A média de idade foi de 38 ± 17,61 anos, variando de 13 a 87. Quanto ao gênero encontrou-se prevalência do sexo masculino em 57,6%. A etnia branca foi declarada por 94,1% dos pacientes e a parda por 5,9%. As indicações de ceratoplastia foram ceratocone em 51 (51%) olhos, retransplante em 15 (15%), todos pacientes provenientes de outros serviços, leucoma pós-herpes em 13 (13%), ceratopatia bolhosa pós-facectomia em 6 (6%), distrofia corneana em 5 (5%), leucoma pós-trauma perfurante em 4 (4%), úlcera bacteriana sem resposta ao tratamento clínico em 3 (3%) e outras causas em 3 (3%). Das 100 ceratoplastias realizadas 98 (98%) foram penetrantes e 2 (2%) lamelares anteriores profundas. **Conclusão:** O estudo concluiu que o perfil dos pacientes submetidos à ceratoplastia caracterizou-se como jovem, de etnia branca, com predominância do sexo masculino e as quatro principais indicações de ceratoplastia foram ceratocone, retransplante, leucoma pós-herpes e ceratopatia bolhosa pós-facectomia.

Descritores: Transplante de córnea/epidemiologia; Doenças da córnea/cirurgia; Estudos retrospectivos

INTRODUCTION

Brazil has one of the largest public programmes for organ and tissue transplants of the world[1], and keratoplasty is the most frequently performed transplant. From January to June 2008, 8365 organ and tissue transplants were performed in Brazil, of which 6207 (74.2%) were keratoplasties with a 90% success rate[2].

It is estimated that approximately 39 million people are blind and 246 have low vision worldwide. Eighty percent of these cases are believed to be preventable or treatable. The main causes of blindness in the world are cataract, glaucoma, age-related macular degeneration, corneal opacities, diabetic retinopathy, trachoma, and children's eye diseases[3]. Corneal opacities are thus among the major causes of blindness and their aetiology is variable, including infections, inflammatory conditions, and degenerative diseases. The prevalence of these diseases varies depending on the country and the population as a result of different public health and socio-economic conditions.

The main indication for corneal transplantation in Brazil is keratoconus, but its prevalence varies across regions and reference centres. The aim of this study was to examine the keratoplasties performed in the transplant department of a University Hospital, describing the demographic and epidemiological profile of patients and the indications for surgery. The study was approved by the Research Ethics Committee of the University of Western Santa Catarina under protocol number 021/2011.

METHODS

This was an observational, descriptive, cross-sectional retrospective study, with data collection from a database. The target population included all patients undergoing corneal transplantation from October 2006 to April 2011.

The medical records of 85 patients were reviewed, totalling 100 eyes. All 100 keratoplasties were performed by one of the authors. No patient was excluded from the study because all records were complete and met the inclusion criteria.

Data collection was done on the records of BellotoStock Ophthalmic Centre, where patients who underwent keratoplasty at University Hospital Santa Terezinha were being followed-up. The Statistical Package for Social Sciences (SPSS) version 13 and R software were used for statistical analysis by calculating the percentage, frequency, mean, standard deviation, Pearson's coefficient of variation (CV), Spearman's correlation coefficient (ñ), confidence level (p-value), and cluster analysis.

RESULTS

All patients lived in the state of Santa Catarina: 26 (79%) lived in the state's Midwest region, where our transplant service is located; 4 (12%) in the Western region; 2 (6%) in the Planalto Serrano region; and 1 (3%) in the Itajaí Valley. Forty-nine (57.6%) patients were male and 36 (42.4%) were female. Mean age was 38.26 years, ranging from 13 to 87 years, with a standard deviation of 17.61 years and the a coefficient of variation of 46.02%. Based on self-identification, 80 (94.1%) patients were white and 5 (5.9%) were mixed-raced. Results are shown in Table 1.

The indications for keratoplasty were keratoconus (51%), retransplantation (15%), post-herpetic leukoma (13%), bullous

Table 1
Profile of patients submitted to keratoplasty from October 2006 to April 2011.

Region of origin(%)		Sex (%)		Race (%)			Age (%)		CV (years)
MW	Other	M	F	White	Mixed-Race	Other	Mean	SD	46,02
79	21	57,6	42,4	94,1	5,8	0	38,26	17,61	

MW: Midwest; SD: standard deviation; CV: coefficient of variation

Table 2

Indications for keratoplasty in patients submitted to corneal transplantation from October 2006 to April 2011

Indication	Total	%
Keratoconus	51	51
Retransplantation	15	15
Post-herpetic leukoma	13	13
Bullous keratopathy after phakectomy	6	6
Corneal dystrophy	5	5
Leukoma after perforating trauma	4	4
Bacterial ulcer unresponsive to treatment	3	3
Other indications	3	3
Total	**100**	**100**

Table 3
Causes for retransplantation.

Causa de Retransplante	Número	%
Irregular astigmatism	7	46
Graft rejection	4	27
Irregularity after refractive surgery	2	13
Endothelial failure after transplantation	1	7
Post-phakectomy	1	7
Total	**15**	**100**

Table 4

Statistical correlation between the indication for transplantation and other variables.

Variables	Coeficiente de Spearman (ρ)	P-Value
Indication for transplantation *vs.* age	0,569	0,000
Indication for transplantation *vs.* sex	0,116	0,250
Indication for transplantation *vs.* race	0,137	0,174
Indication for transplantation *vs.* home town	0,033	0,743
Indication for transplantation *vs.* type of surgery	-0,009	0,927

keratopathy after phakectomy (6%), granular dystrophy (5%), leukoma after perforating trauma (4%), ulcers (3%), and other indications (3%), as shown in Table 2.

The main indication for keratoplasty was keratoconus in 51 (51%) eyes. The mean age of patients was 29.61 ± 13.22 years, ranging from 13 to 87 years. Of the 51 (100%) keratoplasties performed due to keratoconus, 39 (76%) were in different patients and 6 were in both eyes of the same patient, totalling 12 (24%) transplants.

The 3 (3%) indications for keratoplasty classified as "other causes" were: ectasia after radial keratectomy, perforating ulcer in a patient with rheumatoid arthritis, and tectonic transplantation due to descemetocele.

Of the 100 keratoplasties, 98 (98%) were penetrating and 2 (2%) were lamellar. Penetrating keratoplasty was therefore the procedure of choice, and only two eyes were submitted to deep anterior lamellar keratoplasty using the big bubble technique: one with keratoconus and the other with granular dystrophy.

Correlations between variables were assessed using Spearman's coefficient (ñ), which is more significant as it approaches ±1, and the confidence level (p), which is considered significant when equal or lower than 0.005. A significant linear correlation was found only between the variables indication for transplantation and age (ñ=0569), with a good confidence level (p=0.000). Other correlations were not significant (Table 4).

Finally, cluster analysis showed similarity between the following variables: indication for transplantation, type of surgery, race, and sex (Chart 1).

Retransplantation was the indication for keratoplasty in 15 eyes (15%), due to the following causes: irregular astigmatism in 7 eyes (46.6%), irregularities after refractive surgery in 2 (13.3%), graft rejection in 4 (26.6%), endothelial failure after transplantation in 1 (6.6%), and post-phakectomy in 1 (6.6%) (Table 3). All patients submitted to retransplantation had undergone their first procedure in a different service.

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DISCUSSION

This study examined the profile of patients undergoing keratoplasty and the indications for surgery. Most patients came from the Midwest region of the state of Santa Catarina (79%).

Chart 1

Dendrogram of variables.
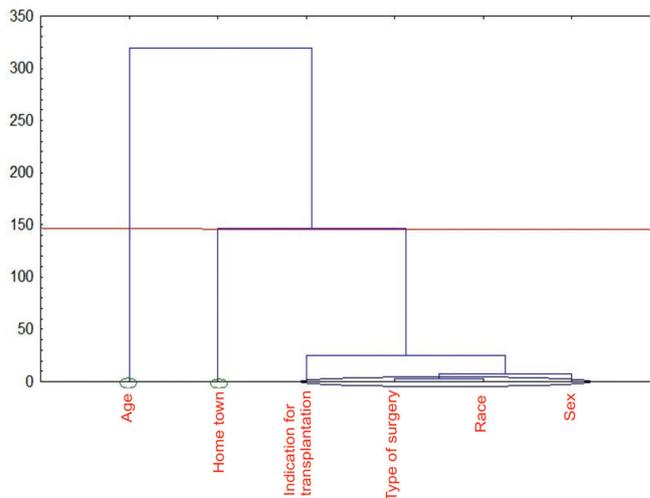
Most patients were male (57.6%). There was no statistical correlation between sex and the indication for corneal transplantation (p=0.250, ñ=0.116). This is in agreement with other Brazilian studies that also found a predominance of males, with 51.28%[4], 53%[5], 59.6%[6], and 55.6%[7]. However, other studies found a predominance of females, with 52.7%[8] and 53.2%[9].

The mean age of patients was 38.26 ± 17.61 years. This is comparable with the mean age of patients transplanted due to keratoconus (34.43 years)[10], which was the main indication for transplantation in our study. Two other studies where keratoconus was also the main indication for keratoplasty found that patients had a comparable mean age: 44[4] and 37 years[6]. The correlation between age and indication for keratoplasty was statistically significant (p=0.000 and ñ=0.569).

With regard to race, 94.1% of patients were white and 5.9% were mixed-raced. This is similar to the demographics of the state of Santa Catarina, which has 6,248,436 inhabitants of whom 83.9% are white, 12.4% are mixed-raced, and the rest belong to other racial groups[11]. There was no statistical correlation between race and indication for corneal transplant (p=0.174, ñ=0.137). However, cluster analysis showed similarity between these two variables. There are regional variations in Brazil with in terms of race. In a study conducted in São Paulo the percentage of white patients was 74.3%[9].

Keratoconus was the leading cause of keratoplasty in our study with 51%. This explains the overall low mean age of 38.26 ± 17.61 years, which decreased to 29.61 ± 13.22 years when considering only patients transplanted due to keratoconus. A study that only included patients with keratoconus found a mean age of 29.5 ± 9.8 years[12].

Studies conducted in Porto Alegre[13,14] and Campinas[4] found that 35.1%, 30.4% and 49.8% of patients, respectively, underwent keratoplasty due to keratoconus. In studies where patients had a mean age higher than 47 years, the proportion of patients with keratoconus was lower, ranging from 10 to 15%[4,9]. Differences in the indications for transplantation can be related to the study period and the location of the service, as there are regional variations in public health conditions and the accessibility of services. A recently-developed procedure to prevent corneal degeneration by keratoconus is corneal

crosslinking, which can halt its progress even after implantation of an intracorneal ring, helping to reduce the demand for transplantation[15]. Improved contact lenses can also help reduce the number of keratoplasties due to keratoconus.

Retransplantation (15%) was the second leading cause of keratoplasty. This high rate is explained by the fact that patients who had undergone prior keratoplasty were referred to our service where they had the opportunity to undergo retransplantation sooner. The indications for retransplantation were: irregular astigmatism in 7 (46.6%) eyes, post-refractive surgery in 2 (13.3%), rejection in 4 (26.6%), endothelial failure after transplantation in 1 (6.6%), and post-phakectomy in 1 (6.6%). Other studies found varying rates of retransplantation, some of them similar to our study: 10.1%[4], 9.8%[5] 13.5%[7], 12.8%[9], and 11%[14]. Thanks to improved preservation of corneas, new immunosuppressive drugs, and modifications in surgical techniques, there are now improved prospects for the management of corneal retransplantation. Providing adequate information to patients about their disease and the procedure contributes to therapeutic success, as it promotes adherence to post-operative care and avoids false expectations about the outcome[16].

The third leading indication for keratoplasty was post-herpetic leukoma in 13 eyes (13%). This is higher than in previous studies, which found rates of 0.4%[4], 5.5%[9] and 3.4%[14]. Keratoplasty for post-herpetic leukoma can be avoided if patients receive more efficient anti-viral agents and the population has greater access to health care.

The fourth leading indication for transplantation was bullous keratopathy after cataract surgery in 6 (6%) eyes. This result is similar to another Brazilian study that found 8.4% (fourth leading indication)[4]. The low mean age of patients in this study and the absence of an ophthalmic residency programme in the study hospital can explain the low incidence of the condition. A study on 35 patients with bullous keratopathy after cataract surgery found that 29 (82.9%) of these procedures had been performed by ophthalmology residents[17]. Improved intraocular lenses, better cataract extraction techniques, a lower mean age of transplanted corneas, and increased use of viscoelastic to protect the corneal endothelium can help reduce the incidence of the condition. Recent Brazilian studies found higher rates of bullous keratopathy as an indication for transplantation: 19.9%[5], 21%[6], 16.1%[7] and 14.7%[9].

The fifth leading indication for keratoplasty was corneal dystrophy in 5 (5%) eyes. In our study no keratoplasties were performed due to Fuchs dystrophy, which is a common indication in the USA with rates between 13.4% and 23.8%[9]. This difference can be attributed to the lower availability of corneas in Brazil.

The sixth leading cause of keratoplasty in our study was leukoma after perforating trauma in 4 (4%) eyes. Due to the particular characteristics of different services, this result differs from another Brazilian study that found 16% (second leading indication)[9]. In children this can be the leading indication for keratoplasty[18].

The seventh leading indication for keratoplasty was ocular ulcer in 3 (3%) eyes. Surgery is required to cure a bacterial infection in 3-6% of cases[19]. However, significant variations exist for this indication depending on the region and socio-economic conditions, with studies reporting the following results: 17.7%[4], 21.3%[5], and 34.9%[7]. In children this can be the most frequent indication[4].

The 3 (3%) remaining cases were grouped as "other indications". These cases were grouped separately due of their low incidence and because they are not relevant when compared with other studies. They included: ectasia after radial keratectomy, perforating ulcer, and tectonic transplantation due to descemetocele.

Of the 100 keratoplasties, 98 (98%) were penetrating and 2 (2%) were lamellar. Lamellar surgery is recommended mainly for keratoconus, but its use is gradually decreasing due to improvements in surgical techniques and materials.

As shown in the dendrogram in Chart 1, cluster analysis revealed a homogeneous group of variables consisting of indication for transplantation, type of surgery, race, and sex. Their close location in the chart indicates similarity among these variables.

CONCLUSION

The results of this study showed that patients undergoing keratoplasty in our service came predominantly from the Midwest region of the state of Santa Catarina. The mean age of patients was low because there were many young patients with keratoconus, and the relationship between age and keratoconus as an indication for keratoplasty was statistically significant. There was a predominance of male patients, but it was not statistically significant. With regard to race, most patients self-declared as white, but without statistical significance even though cluster analysis showed similarity between this variable and indications for keratoplasty.

The indications for keratoplasty in descending order of frequency were: keratoconus, retransplantation, post-herpetic leukoma, and bullous keratopathy after cataract surgery, followed by corneal dystrophy, leukoma after perforating trauma, bacterial ulcer unresponsive to medical treatment, and other indications.

The results of this study and the medical literature suggest that, in the future, indications for corneal transplantation could be influenced by several factors such as the development of new methods to preserve corneas and improved ophthalmic surgical techniques and other therapies. The introduction of better contact lenses and new therapies such as corneal crosslinking to prevent the progression of keratoconus will possibly decrease the need for keratoplasty in patients with this condition. Thus, the indications for transplantation and the profile of patients undergoing keratoplasty may change in future studies.

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