ORIGINAL ARTICLE

Corneal Transplantations in the Czech Republic in 2012

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SUMMARY

Objective: To determine the frequency of corneal transplantations in the Czech Republic in 2012, the percentage representations of the different types of surgeries and main indications for corneal transplantation.
Methodology: All clinics performing the corneal transplantations were asked to complete a questionnaire about the number of corneal transplants, types of surgeries and indications for such procedures. The obtained data were compared with the annual report of corneal banks for the year 2012.
Results: Data for 465 transplantations were analyzed, it represents 92, 8 % of all corneas issued by the corneal tissue banks. The most common indication for corneal transplantation (regardless of type) was bullous keratopathy (40 % of cases), then keratoconus and other ectatic diseases (19,1 %) and endothelial dystrophy (16,1 %). The most common type of translation was penetrating keratoplasty (50,75 %), then posterior lamellar keratoplasty (44, 95 %) and anterior lamellar keratoplasty (4,3 %).
Conclusion: Acquired data confirm increasing proportion of lamellar transplantations among all corneal keratoplasties, especially posterior lamellar keratoplasty. This approach probably affects indications, for which keratoplasties are made. Keratoplasties are indicated significantly due to endothelial corneal dystrophies such as bullous keratopathy and other endothelial dystrophies. Keratoconus represents approximately 20 % of indications to corneal transplantation.

Key words: corneal transplantation, penetrating keratoplasty, lamellar keratoplasty

Čes. a slov. Oftal., 70, 2014, No. 6, p. 224–227

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INTRODUCTION

Corneal transplantation is the oldest clinically performed allotransplantation. The first successful operation of this type was performed by Zirm in Olomouc in 1905 (18). Keratoplasty still remains the most common type of performed transplantation in human medicine. Nevertheless, the number of operations, indication criteria and also the method of performed corneal transplantation changes over time. In the literature we can see pronounced differences in different countries worldwide. There are large differences primarily between economically developed and developing countries. The authors provide information on the data obtained relating to corneal transplantation in the Czech Republic in 2012.

METHOD

The data was taken from two sources. Basic information about the number of operations, types of performed keratoplasty procedures and indications for the individual types of procedures were obtained from individual ophthalmological workplaces in the Czech Republic. In November 2013 a questionnaire was sent out to a total of 23 workplaces which regularly or occasionally perform corneal transplantations. The second source of information was annual reports from 2012 from facilities which prepare and distribute donated corneas (Eye tissue bank OTB01 at the Královské Vinohrady University Hospital (OTB) an the National Tissue Centre in Brno (NTC)); as well as the annual report from the Transplantations Co-ordination Centre (TCC). The NTC also sent a completed questionnaire, in which it specified the number of corneas it had supplied and used within the Czech Republic. The information obtained from both sources was analysed and mutually compared.

RESULTS

Of 23 addressed workplaces, 22 responded (96%). Five workplaces stated that in 2012 they had not performed a single corneal transplantation. We processed the provided data from 17 workplaces into summary statistics. A total of 465 corneal transplantations were performed at these facilities in 2012. The operations were performed by 27 surgeons. Three workplaces performed more than 50 transplants per year, at these workplaces an average of at least 1 transplantation per week was performed. In total 261 transplants were performed at the three centres with the highest rates of operations, which represents 56.13% of the total number. A further 6 workplaces performed more than 24 transplants per year, and transplants here are therefore performed at an average of at least 2 per month. In total 172 transplantations were performed at these 6 workplaces, i.e. 37% of the total number. In the remaining 8 centres, corneal transplantation is performed rather occasionally, on average less than one transplant per month, and in total 32 transplantations were performed here, which represents 6.9% of the total number of transplantations performed (graph 1).
As regards the type of transplantation, in 236 cases (50.75%) this concerned penetrating keratoplasty (PKP),

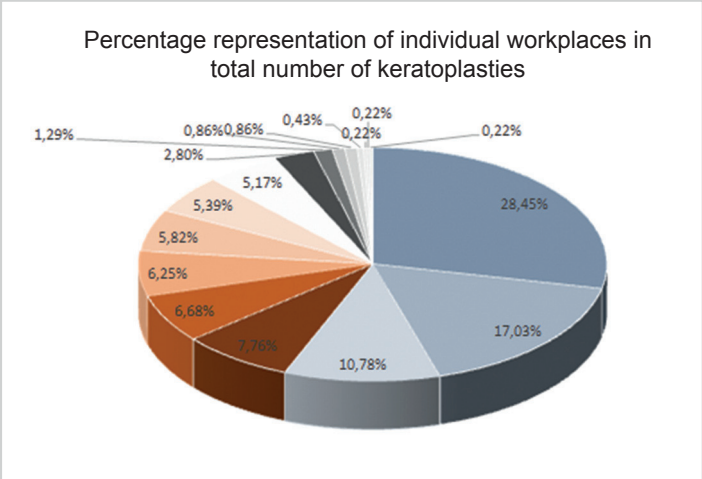
in 20 cases (4.3%) anterior lamellar keratoplasty (ALK) and in 209 cases (44.95%) posterior lamellar keratoplasty (PLK). Of the PLK type, in the case of 55 patients a DSAEK (Descemet's stripping automated endothelial keratoplasty) type operation was performed, in 60 cases this concerned a DMEK (Descement's membrane endothelial keratoplasty) type lamella, and in 94 cases a hybrid lamellar of the DMEK-S type (Descement's membrane endothelial keratoplasty with stromal rim) (graph 2). PKP was performed in all the observe workplaces (100%), ALK at 7 workplaces (41%) and one of the types of PLK at 10 workplaces (59%). DSAEK type operations were performed at 6 workplaces, DMEK at 4 workplaces and DMEK-S at one workplace.

The most common diagnosis for which corneal transplantation was performed was bullous keratopathy, with a total of 186 transplants, i.e. 40%. The second most common indication was keratoconus and other ectatic disorders – 89 operations, 19.1%. The third most commonly stated indication was endothelial dystrophy – 75 operations, 16.1%. 47 eyes were operated on due to corneal cataracts (10.1%). Of the less frequent indications were corneal dystrophy (3.4%), ulcer (2.8%), trauma (1.9%), rejection or re-PKP (1.3%) herpetic keratitis (1.1%) and others (4.1%) (table 1).

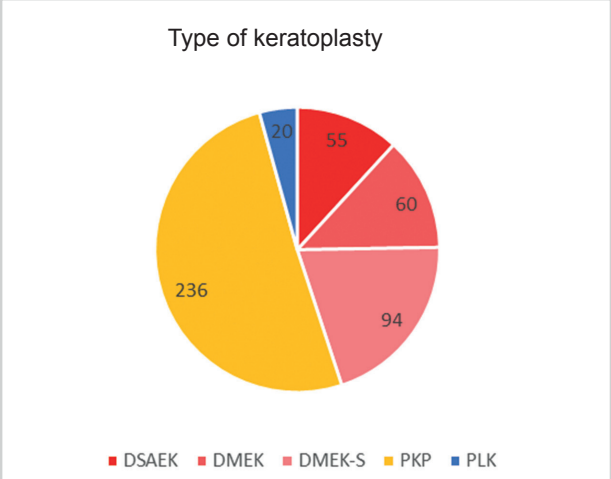
If we evaluate the indications divided according to the individual types of transplantations, the most common diagnosis for which PKP was performed is keratoconus – 75 transplants (31.8% of a total number of 236 PKP procedures). This is followed by leukoma of the cornea – 45 PKP (19%) and bullous keratopathy – 44 PKP (18.6%). Other less common indications included corneal ulcer (5.5%), corneal dystrophy (5%), injury to cornea (3.8%) Fuchs' dystrophy (3.4%), re PKP or rejection (2.5%), herpetic keratitis (2.1%) and other (8%) (table 2). The main indication for the performance of ALK was keratoconus, or ectasia of the cornea – 14 operations (70% of a total number of 20), followed by corneal dystrophy (20%) and corneal cataracts (10%) (table 3). The indications for the performance of one of the types of PLK were bullous keratopathy – 142 operations (68% of a total number of 197 PLK) and Fuchs' endothelial dystrophy or other types of endothelial dystrophy – 67 operations (32%) (table 4).

From the information obtained from the suppliers of corneas, we determined that a total of 501 grafts were issued for the purposes of transplantation in 2012, of which OTB 01 issued 342 grafts and NTC issued 159 grafts. The difference between the number of issued grafts and the number of performed transplantations stated by the individual eye centres is therefore 36, which represents 7.2% of the total number of corneas used. In the case of these corneas we did not succeed in determining their method of use or the indication for operation. For this reason these corneas were not included in the total evaluation.

From the annual "Summary of Activity of Tissue Banks" issued by the TCC it ensues that the number of performed transplantations within the territory of the Czech Republic has not changed markedly in recent years. In 2007 a total of 512 corneas were issued for the purposes of transplantation, in 2008 237, in 2009 529, in 2010 622, in 2011 518 and in 2012 542 (table 5) (5-10).



Graph 1 Percentage representation of individual workplaces in total number of keratoplasties in 2012



Graph 2 Number of individual types of performed keratoplasties

Table 1 Overview of surgical diagnoses for corneal transplantations (all types)

Surgical diagnosis	Number of transplantations	% representation
Bullous keratopathy	186	40%
Keratoconus, ectasia	89	19.1%
Endothelial dystrophy	75	16.1%
Corneal cataract	47	10.1%
Dystrophy	16	3.4%
Ulcer	13	2.8%
Trauma	9	1.9%
Rejection, re-PKP	6	1.3%
Herpetic keratitis	5	1.1%
Other	19	4.1%
Total	465	100%

DISCUSSION

The number of performed transplan-

Table 2 Overview of surgical diagnoses for penetrating corneal transplantations

Surgical diagnosis	Number of transplantations	% representation
Keratoconus	75	31.78%
Corneal cataract	45	19.07%
Bullous keratopathy	44	18.64%
Ulcer	13	5.51%
Dystrophy	12	5.08%
Trauma	9	3.81%
Endothelial dystrophy	8	3.39%
rePKP	6	2.54%
Herpetic keratitis	5	2.12%
Other	19	8.05%
Total	236	100%

Table 3 Overview of surgical diagnoses for anterior lamellar keratoplasty

Surgical diagnosis	Number of transplantations	% representation
Keratoconus, ectasia	14	70.00%
Dystrophy	4	20.00%
Cataracts	2	10.00%
Total	20	100%

Table 4 Overview of surgical diagnoses for posterior lamellar keratopathy

Surgical diagnosis	Number of transplantations	% representation
Fuchs, endothelial dystrophy	67	32.06%
Bullous keratopathy	142	67.94%
Total	209	100%

Table 5 Overview of activities of tissue banks in years 2007-2012

	Number of taken corneas (including full bulbs)	Number of unused corneas	Number of issued corneas	Number of corneas exported outside CZ	Number of corneas used in CZ
2007	1394	276	886	374	512
2008	1314	182	855	618	237
2009	1226	392	859	330	529
2010	1181	416	813	191	622
2011	791	143	573	55	518
2012	986	323	667	125	542
Average	1148.7	288.7	775.5	282.2	493.3

tations on average per capita in the Czech Republic in 2012 was 465/10 500 000, which represents approximately 4.43 to 100 000 of the population. The nationwide data on the number of performed transplants in other countries is published rather sporadically, and as a result the frequency of performed keratoplasty procedures is difficult to compare with the data from other countries. In Australia 1482 operations were performed in 2012 (1), with a population of 21 000 000 this represents 7.06 transplants per 100 000 of the population. In the United Kingdom, according to data from the National Health Service Blood and Transplant in 2008/2009, 2551 keratoplasty procedures (4) were performed, which with a population of 63 180 000 represents a frequency of 4.04/100 000 of the population.

The main indication for the performance of one of the types of keratoplasty in the Czech Republic in 2012 was bullous keratopathy, in a total of 40% of cases. This diagnosis is stated as the most frequent also in studies from Columbia (37.7%) (3), Hungary (28.9%) (11) and Canada (22.1) (12). In studies from other countries also, bullous keratopathy is stated as a very common cause for the performance of keratoplasty – Australia (19.6%) (15), Great Britain (15.8%) (4), Germany (14.6%) (14), New Zealand (14%) (2), Iran (11.7%) (17), Scotland (9.6%) (13) and China (6.6%) (16).

The second most common diagnosis in our study sample was keratoconus (19.1%). In some studies this was stated as the most common cause of transplantation – New Zealand (41.6%) (2), Iran (38.4%) (17), Australia (29.6%) (15), Scotland (28.7%) (13), Germany (25.5%) (14) and Great Britain (21%) (4). In further studies it is also stated as one of the main indications for transplantation – Canada (16.6%) (12), Hungary (14.9%) (11) and Columbia (8.7%) (3). With greater use of the method of corneal collagen cross-linking (CXL) in the treatment of keratoconus, it is possible to expect a smaller percentage representation of this diagnosis in indications for the performance of corneal transplantation in future (3).

Fuchs' dystrophy, which is the third most common indication for the performance of corneal transplantation in our study group (16.1%), is represented with a fair degree of variability in the published studies, from 0.6% in the Chinese (16) and 0.8% in the Iranian study (17) to 19.5% in the British (4) and 21.2% in the German study (14). This is probably linked to the better diagnostic possibilities in some countries, and also to the method of operation. It is possible to expect that with greater use of techniques of posterior lamellar keratoplasty, a reduction of the rehabilitation time and an improvement of the postoperative results, these patients will be indicated for operation earlier, and thus keratoplasty will be performed more frequently for this diagnosis.

Of the other indications, other diagno-

ses as the cause of transplantation in the Czech Republic were reported less frequently (corneal cataract 10.1%, other diagnoses less than 5%). Similar findings are described by studies from countries with developed economies, such as New Zealand – cataracts 4.2% (2), Scotland 2.3% (13), United Kingdom 6.3% (4), Australia 6.7% (15) and Germany 16.5% (14). By contrast, in poorer countries this diagnosis is represented to a considerably larger degree – China 22.5% (16), Iran 16% (17), Columbia 15.7% (3).

Failure of previous keratoplasty, thus re-transplantation, is stated relatively frequently in the studies as the cause of transplantation. For example, in the study from New Zealand this was 17.4% (2), Scotland 19.2% (13), Canada 21.1% (12), Hungary 18.4% (11) and Austrlia 20.3% (15). In our questionnaires, this diagnosis was stated in only 5 cases. There is a high probability that the cause of this is the fact that surgeons as a rule stated the original disorder for which the transplant was performed as the surgical diagnosis.

The lack of uniformity of surgical diagnosis is most probably also the cause of at least part of the difference between the individual studies. It is also a certain weakness of our overview, since the surgical diagnoses were determined by each surgeon entirely individually in the questionnaires. A certain solution would be selection of diagnosis from a clear offer of disorders for which corneal transplantations are performed. We would therefore like to improve the type of questionnaire in future years in order to ensure that the data obtained from the individual workplaces is more uniform.

CONCLUSION

The authors evaluated the obtained data relating to 465 corneal transplantations performed in the Czech Republic in 2012. The most frequent surgical diagnosis was bullous keratopathy, followed by keratoconus and Fuchs' endothelial dystrophy. Approximately half (50.75%) of transplants involved penetrating keratoplasty, in which the main indication was keratoconus. Approximately 44.95% involved one of the types of posterior lamellar keratoplasty, the main indication in this group was bullous keratopathy. A relatively smaller number of procedures concerned anterior lamellar keratoplasty (4.3%).

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