Profile of glaucoma surgical and laser procedures in Alberta from 2003 to 2018

Glaucoma is the leading cause of irreversible blindness worldwide and increases in prevalence with age across all ethnic groups.[1] The volume of various glaucoma procedures may fluctuate with disease prevalence, introduction of new therapies, changes in practice patterns, and number of surgeons. Evaluating trends in different glaucoma procedure utilization rates is critical for health policy planning. Given the recent introduction of micro-invasive glaucoma surgery (MIGS), prior studies have not assessed its influence on the volume of different glaucoma procedures. We aim to evaluate trends in the yearly number of common glaucoma surgical and laser procedures performed in Alberta from 2003 to 2018.

Methods

We conducted a retrospective, population-based analysis. The yearly number of all glaucoma-related procedures claimed under the Alberta Health Care Insurance Plan from 2003 to 2018 were obtained using health service codes. These data reflect all paid claims to physicians for services provided to Alberta residents. Specifically, we were interested in the following procedures: trabeculectomy, glaucoma drainage device implantation, MIGS, laser trabeculoplasty, ciliary body ablation, surgical iridectomy, iridoplasty, and laser peripheral iridotomy. Research ethics board approval was not required for this study.

Estimates of Alberta's annual population, stratified into 5-year age groups, were obtained from Statistics Canada.[2] To estimate the number of individuals with glaucoma in Alberta each year, we applied a primary open-angle glaucoma (POAG) prevalence curve developed by Tuck and Crick to provincial population data.[3] This model is a composite of 11 major epidemiological prevalence surveys in Western nations and is controlled for population age. The yearly number of procedures per 1000 persons with POAG were then calculated.

Results

From 2003 to 2018, the population in Alberta increased over 30% and the median age of Albertans increased from 35.3 to 36.9 years. The proportion of the population older than 65 years increased from 10.3% to 12.8%. Correspondingly, the prevalence of glaucoma was estimated to increase from 0.51% to 0.60%. The number of ophthalmologists increased 23% from 88 to 108, and rates of all glaucoma-related procedures increased 4-fold during this period (Table 1). Trends of specific glaucoma surgical and laser procedures performed each year are illustrated in Figure 1. Rates of glaucoma drainage device (GDD) implantation increased 3-fold from 2007 to 2010 and stabilized thereafter. All glaucoma operations, except laser, remained relatively stable from 2003 to 2009 and rose thereafter until 2014, potentially reflecting the billing of MIGS procedures under pre-existing codes before the introduction of its individual code. After the introduction of separate ab-externo and ab-interno procedure codes in 2014, both trabeculectomy and MIGS rates increased more than 60% from 2014 to 2018. Trabeculectomies and MIGS accounted for 41% and 34% of all glaucoma-related surgeries, respectively. Anterior chamber laser rates increased 6-fold from 2004 to 2014. After the introduction of separate laser trabeculoplasty (LT) and laser peripheral iridotomy (LPI) codes in 2014, LTs increased 35% and LPIs increased 194% over the subsequent four years. Ciliary body ablation rates increased 19-fold from 2004 to 2018.

Discussion

In Alberta, trabeculectomy remains the most commonly performed glaucoma surgical procedure and accounts for 41% of glaucoma-related surgeries in Alberta. This is similar to trends in Ontario and the UK where rates of trabeculectomies remained stable from 2002 to 2012.[4,5] In addition, there was a 3-fold increase in GDD implantation rates from 2003 to 2018, similar to trends in other Canadian provinces.[5-7] In Ontario, GDD implantation increased more than 5-fold from 2005 to 2012 and accounted for 33% of filtration procedures in 2012.[5] These trends indicate a potential shift in surgeon preference toward drainage devices compared with trabeculectomies.

A trend was noted towards increasing rates of MIGS and ciliary body ablation procedures, suggesting a shift toward less invasive procedures. MIGS has become the second most commonly performed glaucoma surgical procedure. Currently, Alberta and Quebec are the only two provinces in which separate MIGS billing codes exist. As a result, prior published studies have not assessed MIGS procedures as a separate entity, but instead as part of the broader category of tube shunt procedures. Although there is no published data specifically examining the rate of MIGS surgeries in Quebec, Kansal et al. evaluated trends in glaucoma filtration procedures as a surrogate index for MIGS surgeries.[8] Similar to our data, they found that all glaucoma filtration surgeries declined from 2003 to 2008, and then rose until 2014. These procedures then decreased, coinciding with the introduction of MIGS billing codes in 2014. However, in Quebec, all glaucoma filtration surgeries steadily declined from 2003 to 2016 while GDD implantation rose during that period. Given a separate MIGS billing code was only introduced in 2015, it is possible these data do not yet reflect the trend seen in Alberta.

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Table 1—Yearly number of glaucoma surgical and laser procedures performed per 1000 persons with primary open angle glaucoma in Alberta from 2003 to 2018

Health service code	Service code description	2003/2004	2004/2005	2005/2006	2006/2007	2007/2008	2008/2009	2009/2010	2010/2011	2011/2012	2012/2013	2013/2014	2014/2015	2015/2016	2016/2017	2017/2018
Surgical procedures																
26.2B	Glaucoma implant procedures with reservoir shunts	7.52	8.18	8.26	6.87	8.09	14.33	23.92	24.75	16.28	17.70	20.70	24.29	23.99	26.99	22.07
26.2A	Glaucoma (all major operations) except laser	118.36	91.71	118.53	103.12	107.85	108.59	152.81	117.87	143.94	156.42	139.45				
26.25B	Trabeculectomy or major revision of trabeculectomy												29.20	28.42	40.07	47.86
26.25A	Repeat trabeculectomy within 28 days	3.37	5.39	6.70	10.76	9.04	10.60									
26.29A	Ab-interno angle surgery (stent, trabectome, or similar) for adult open-angle glaucoma												24.63	26.94	31.60	40.34
Laser procedures																
26.52A	Anterior chamber laser*		37.30	104.07	104.96	109.63	106.80	137.60	146.13	149.19	213.51	224.20	(233.79)	(246.10)	(337.44)	(402.49)
26.52A	Laser peripheral iridotomy												147.72	157.22	234.37	286.99
26.34A	Argon laser trabeculoplasty, selective laser trabeculoplasty, iridoplasty, goniopuncture												86.07	88.88	103.07	115.50
26.98B	Ciliary body ablation		0.87	3.52	3.95	5.25	13.31	14.22	7.78	8.51	8.58	6.17	9.65	11.05	23.65	16.16
26.53	Surgical iridectomy	4.03	7.14	7.43	9.19	9.30	5.56	8.22	10.67	18.18	8.94	7.09	7.74	15.73	5.56	7.02
26.62A	Freeing of angle closure synechiae under gonioscopy	4.87	7.95	11.05	11.57	13.82	9.07	9.21	10.43	6.93	10.87	11.48	11.47	9.32	10.81	7.60
All glaucoma procedures		138.14	158.54	259.56	250.42	262.97	268.25	345.99	317.63	343.03	416.02	409.10	340.76	361.55	476.13	543.55

*Numbers provided in brackets are the sum of procedures billed under 26.52A and 26.34A.

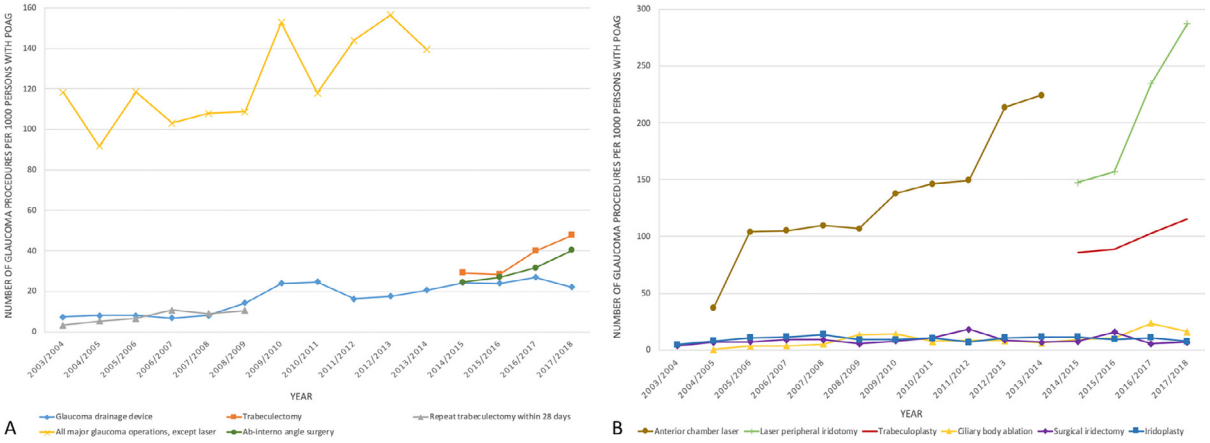

Fig. 1—Surgical (A) and laser (B) glaucoma procedures performed per 1000 persons with POAG from 2003 to 2018. POAG, primary open angle glaucoma.

Limitations

The yearly prevalence of POAG in Alberta was estimated by applying a composite glaucoma prevalence curve developed from multiple population-based surveys.[3] However, the epidemiological studies used for this model included mainly white Caucasian populations from Europe, Australia, and Baltimore. Because the population in Alberta is more diverse including many ethnic groups, and the prevalence of POAG is higher in Blacks and Latinos, our calculated prevalence of POAG may be an underestimate. Furthermore, this model applies only to POAG and does not capture the prevalence of all glaucoma.

A challenge encountered during interpretation of these results is the lack of specificity in health service codes. As all filtration surgery except GDD was billed under "glaucoma (all major operations), except laser" before 2014, it is difficult to comment on rates of trabeculectomy and MIGS separately. Similarly, with laser procedures, an overarching "anterior chamber laser" code was used for both LT and LPI before 2014, despite their application for different glaucoma types. We also recognize the transition of several codes in 2014 as a major limitation of our analysis. These limitations highlight the importance of implementing new billing codes in a timely manner, and the need for additional studies in the future once these codes are established into practice. This will allow us to better understand the role of different glaucoma procedures in disease management. In addition, new codes allow reimbursement to appropriately reflect the intensity associated with newer MIGS procedures and have important cost implications.

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Footnotes and Disclosure

The authors have no proprietary or commercial interest in any materials discussed in this article.