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Commentary Open Access

Commentary: Three-year Outcomes of Trabeculectomy and Ahmed Valve Implant in Patients with Prior Failed Filtering Surgeries

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Background

Glaucoma is the leading cause of irreversible blindness in the world and defines a group of diseases which show progressive optic neuropathy (PON).[1,2] PON specific to glaucoma is characterized by progressive degeneration of retinal ganglion cells and corresponding changes in the optic nerve head.[2] The common method to treat glaucoma is to decrease intraocular pressure (IOP); both medical and surgical options are avaliable.[2] Over the years, several surgical procedures have been developed to treat glaucoma, with trabeculectomy as one of the surgeries reserved for more advanced glaucoma.[3] Trabeculectomy has a variable success rate dependent on many patient factors such as race, age, systemic and ocular comorbidities, and previous ocular surgeries as some of the more common factors.[4,5] Trabeculectomy fails in up to 20% of patients who undergo their first trabeculectomy and in up to 50% in patients who undergo their second trabeculectomy, with variable increases in success rates when combined with antifibrotic use.[6,7]

When trabeculectomy fails, patients may need to undergo a second surgical procedure which could be a repeat trabeculectomy or a tube shunt implantation. Tube shunt implants are another viable surgical option to treat glaucoma. The two most common tube shunt implants are the Ahmed valve and the Baerveldt implant.[8] In 2012, the Tube Shunt vs. Trabeculectomy (TVT) study found that after a failed trabeculectomy, repeat trabeculectomy with mitomycin-C (MMC) showed significantly more failure rate at 5-years of follow-up compared to placement of the Baerveldt implant.[9] Failure, which was more frequent in the trabeculectomy with MMC group, was defined as needing additional glaucoma surgery. Interestingly, IOP and number of medications at 5-years follow-up was found to be the same in both groups.[9] When comparing the two tube shunts, a study in 2016 confirmed the superiority of outcomes in primary Baerveldt implant vs Ahmed valve placement for glaucoma, such that the Baerveldt group had a lower failure rate, and better IOP on fewer medications over a 5-year follow up.[8] However, to our knowledge, no study has compared the surgical outcomes of Ahmed valve versus trabeculectomy with MMC in cases of previous failed trabeculectomy. Thus, in 2020, we conducted a study which evaluated the three-year surgical outcomes of a repeat trabeculectomy with MMC versus an Ahmed valve implantation in glaucoma patients with prior failed trabeculectomy. Our study also chose to focus on Ahmed valves, rather than Baerveldt implants, because of practice preference at our institution.

Summary

The authors of this article chose to study the three-year postoperative success rates of 120 patients (125 eyes) who underwent a repeat trabeculectomy with MMC (65 eyes) or an Ahmed valve implantation (60 eyes) after a prior failed trabeculectomy. The majority of patients in both groups had a diagnosis of primary open-angle glaucoma, with no statistically significant difference between the types of glaucoma represented in each group (p=0.48). The difference in length of time between the primary trabeculectomy and the secondary procedure was also not statistically significant. The repeat trabeculectomy with MMC was performed an average of 18.62 months after the primary trabeculectomy while the Ahmed valve placement occurred an average of 19.71 months after the primary trabeculectomy (p=0.79). Three-year measurements of visual acuity, IOP, and the number of IOP-reducing medications prescribed to patients were compared for both procedures. The LogMAR mean ± standard deviation of baseline best corrected visual acuity (BCVA) was 0.89 ± 0.82 and 1.13 ± 0.94 in the Trabeculectomy with MMC and Ahmed valve groups, respectively, and not statistically significant ($p > 0.05$). When looking at the LogMAR BCVA, neither a repeat trabeculectomy with MMC nor the Ahmed valve showed any statistically significant differences between baseline BCVA and all follow up visits in either group ($p \geq 0.05$). Analysis of the IOP data further showed that either operation after a prior failed trabeculectomy significantly reduces the baseline IOP at the three-year postoperative mark ($p < 0.05$). The reduction from the baseline IOP was similar for both groups; 42.21% for the repeat trabeculectomy with MMC group and 43.12% for the Ahmed valve group ($p \geq 0.05$). Lastly, there was no significant decrease between the baseline number of IOP-reducing medications for either group at three-year follow up ($p \geq 0.05$).

Overall success was measured by median survival time and cumulative probability of success, both of which were measured using three different criteria. Criterion 1 defined failure as IOP ≥ 21 mmHg or a less than 20% reduction in IOP from baseline at two visits after 1-month follow-up, IOP ≤ to 5 mmHg at two visits after 1-month follow-up, reoperation, or loss of light perception vision.[10] Criteria 2 and 3 used lower cut-offs to define failure as IOP ≥ 17 mmHg and ≥ 14 mmHg respectively. Eyes that did not fall under any of the three criteria were considered to be a success.[10]

The study found no significant differences between the median survival time, 36 months, for either group using Criterion 1, p=0.41. Likewise, the study found no significant differences in the cumulative probability of success. The cumulative probability of success at 1,2, and 3 years, respectively, was 70.77%, 61.54%, and 52.31% in the trabeculectomy with MMC group and 70%, 63.33%, and 60% in the Ahmed group ($p \geq 0.05$). The only statistically significant difference found between the repeat trabeculectomy with MMC, and Ahmed valve groups was with postoperative complications during the three years of follow-up. The repeat trabeculectomy with MMC group had a significantly higher postoperative wound leakage than the Ahmed valve group ($p < 0.05$).[10]

Commentary/Analysis

When comparing this study to prior research, it is not surprising that our results follow similar trends. In the 2012 study, which compared trabeculectomy with MMC to Baerveldt implants in cases of previously failed trabeculectomy, it was found that both procedures significantly reduced intraocular pressure in glaucoma patients.[9] Our results showed a similar reduction in baseline intraocular pressure at the three-year follow up as this study, albeit slightly lower. Our study shows the reduction from the baseline IOP as 42.21% for the repeat trabeculectomy with MMC group and 43.12% for the Ahmed valve group while the 2012 TVT study shows the reduction from baseline IOP as 49% for the repeat trabeculectomy with MMC group and 46% for the Baerveldt implant group.[10] Although the reduction percentages are slightly different between the studies, both showed a statistically significant reduction from baseline IOP. It would be interestingly to see if further meta-analysis between our study, the TVT study, the Ahmed versus Baerveldt study would show superiority between one of the three procedures.

In contrast to our study, the TVT study in 2012 found that Baerveldt implants had a significantly higher cumulative probability of success compared to a repeat trabeculectomy with MMC.[9] The results show that the cumulative probability of success at three years was 84.9% in the Baerveldt implant group and 69.3% in the repeat trabeculectomy with MMC group, p=0.01.[9] Using the same criterion for cumulative probability of success, our study results showed that the probability of success at three years in the Ahmed valve group versus the repeat trabeculectomy with MMC group was 60% and 52.31%, respectively $p > 0.05$.[10] While both the TVT study and our study showed statistically significant reduction from baseline IOP utilizing the respective tube shunt per study, our study did not find any significant difference in cumulative probability of success between the Ahmed valve versus repeat trabeculectomy with MMC.

The 2016 study comparing both tube shunts found that the Baerveldt implants had a significantly greater reduction in IOP than the Ahmed valves.[8] This may explain why, in our study, the Ahmed valve and repeat trabeculectomy with MMC did not significantly differ in terms of cumulative probability of success.

From this data, it appears that when choosing a second procedure after a prior failed trabeculectomy, there are no statistically significant differences between a repeat trabeculectomy and Ahmed valve implantation except for the increased compilation of wound leakage. However, there is a statistically significant difference between Baerveldt implants and repeat trabeculectomy with MMC. Both tube shut procedures significantly reduced IOP from baseline but had different overall success rates when compared with trabeculectomy with MMC at the three-year postoperative mark. This conclusion is important because it can lead to better informed decisions made by both the physician and the patient when faced with the need to perform surgery after a prior failed trabeculectomy.

There are some limitations to our study. This is a retrospective study and therefore, the authors were dependent on other clinicians and technicians to record the necessary data. Our study was not randomized and while there was no significant difference in clinical demographics of sex, race, diabetes status, hypertension status, phakic versus pseudophakic, or preop IOP between the Trabeculectomy with MMC group versus the Ahmed valve group, our study did have a disproportionate amount of African Americans in total.[10] The location of our institution and non-randomization of our study did subject it to selection bias primarily with the African American race. Therefore, the study outcomes may not be generalized to fit all glaucoma patients because of the specifics of our study's patient population. The data for our study comes from patients who live in a primarily urban and African American community. Despite these limitations, our study is valuable as it assesses Ahmed valves versus repeat trabeculectomy, and we are confident in the results as it matches what we would expect from other studies while allowing us to look at a specific comparison which was not analyzed before.

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