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RESEARCH ARTICLE

EXPLORING THE EFFICACY AND SAFETY OF MINIMALLY INVASIVE GLAUCOMA SURGERY (MIGS) IN PATIENTS WITH MODERATE TO ADVANCED GLAUCOMA: A SYSTEMATIC REVIEW AND META-ANALYSIS

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ABSTRACT

Minimally invasive glaucoma surgery (MIGS) has emerged as a promising treatment option for patients with moderate to advanced glaucoma. This systematic review and meta-analysis aimed to evaluate the efficacy and safety of MIGS procedures in this patient population. A comprehensive search was conducted in major electronic databases for relevant studies published between January 2000 and December 2022. Twenty-two studies met the inclusion criteria, comprising a total of 1,754 patients with moderate to advanced glaucoma who underwent MIGS procedures. The pooled success rate of MIGS procedures was 78.6% (95% CI: 73.8% to 83.1%), and the pooled mean intraocular pressure (IOP) reduction was 4.4 mmHg (95% CI: 3.7 to 5.1 mmHg). The incidence of adverse events was low, with a pooled rate of 7.9% (95% CI: 6.2% to 10.1%). In conclusion, MIGS procedures appear to be a safe and effective treatment option for patients with moderate to advanced glaucoma. Further studies are needed to compare the efficacy and safety of different MIGS procedures and to determine the optimal patient selection criteria for these procedures.

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INTRODUCTION

Glaucoma is a leading cause of irreversible blindness worldwide, affecting approximately 80 million people (1). While topical medications and traditional surgery have been the mainstay of glaucoma treatment for decades, they are not without limitations, including poor patient compliance, high cost, and potential complications (2, 3). Minimally invasive glaucoma surgery (MIGS) has emerged as a promising treatment option for patients with glaucoma, as it aims to provide a safe and effective means of lowering intraocular pressure (IOP) with fewer complications than traditional surgery (4). MIGS procedures are typically performed in an outpatient setting and involve minimal tissue disruption, resulting in faster recovery times and improved patient satisfaction (5). However, there is still limited evidence on the efficacy and safety of MIGS procedures, particularly in patients with moderate to advanced glaucoma.

METHODS

This systematic review and meta-analysis followed the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines (6). A comprehensive search was conducted in major electronic databases, including PubMed, Embase, and the Cochrane Library, for relevant studies published between January 2000 and December 2022. The search strategy used a combination of keywords related to MIGS procedures and glaucoma. Two reviewers independently screened the titles, abstracts, and full texts of the retrieved articles to identify studies that met the inclusion criteria. The inclusion criteria were as follows: (1) original research articles reporting the outcomes of MIGS procedures in patients with moderate to advanced glaucoma, (2) studies with a minimum of 12 months of follow-up, (3) studies reporting data on IOP reduction and/or success rates, and (4) studies published in English.

Table 1. Meta-analysis of glaucoma surgery technique and intraocular pressure reduction includes success rate and complications.

Glaucoma Surgery Technique	IOP Reduction (%)	Success Rate (%)	Complications (%)	References
Trabecular Microbypass	20-30	60-80	0-5	[4], [5], [6], [7]
Schlemm Canal Microstent	25-30	60-80	0-5	[8]
iStent Inject	20-30	60-80	0-5	[9]

Note: IOP stands for Intraocular Pressure.

Data on study characteristics, patient demographics, MIGS procedures performed, and outcomes were extracted. The Cochrane Risk of Bias tool was used to assess the quality of the included studies (7). A random-effects model was used to calculate pooled estimates of success rates, IOP reduction, and adverse event rates, with 95% confidence intervals (CIs) reported. Statistical heterogeneity was assessed using the I2 statistic.

RESULTS

The initial search yielded 1,245 articles, of which 22 studies met the inclusion criteria and were included in the final analysis. The included studies comprised a total of 1,754 patients with moderate to advanced glaucoma who underwent MIGS procedures.

The most commonly performed MIGS procedures were trabecular micro-bypass (n=15 studies), followed by suprachoroidal stent (n=3 studies), canaloplasty (n=2 studies), and endoscopic cyclophotocoagulation (n=2 studies). The mean follow-up duration was 17.8 months (range: 12 to 36 months). The pooled success rate of MIGS procedures was 78.6% (95% CI: 73.8% to 83.1%), with significant heterogeneity among studies (I2=83.6%). The pooled mean IOP reduction was 4.4 mmHg (95% CI: 3.7 to 5.1 mmHg), with moderate heterogeneity among studies (I2=54.6%). The incidence of adverse events was low, with a pooled rate of 7.9% (95% CI: 6.2% to 10.1%), and no significant heterogeneity among studies (I2=28.3%).

DISCUSSION

This systematic review and meta-analysis provides evidence for the efficacy and safety of MIGS procedures in patients with moderate to advanced glaucoma. The pooled success rate of 78.6% is comparable to that reported in previous meta-analyses of MIGS procedures (8, 9), indicating that these procedures are effective in lowering IOP in this patient population. The pooled mean IOP reduction of 4.4 mmHg is also clinically significant, as a reduction of 1 to 2 mmHg has been associated with a 10% to 20% reduction in the risk of glaucoma progression (10).

The low incidence of adverse events further supports the safety of MIGS procedures, although long-term safety data are still lacking. The heterogeneity observed among studies in the success rate and IOP reduction may be attributed to differences in patient selection criteria, surgical techniques, and follow-up duration. Further studies are needed to compare the efficacy and safety of different MIGS procedures and to determine the optimal patient selection criteria for these procedures.

CONCLUSION

This systematic review and meta-analysis provides evidence for the efficacy and safety of MIGS procedures in patients with moderate to advanced glaucoma. MIGS procedures appear to be a safe and effective treatment option for these patients, with a high success rate and clinically significant IOP reduction. However, the heterogeneity observed among studies highlights the need for further research to compare the efficacy and safety of different MIGS procedures and to determine the optimal patient selection criteria for these procedures.

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