Tiny Eyes, Big Breakthrough: Long Term Outcomes of Paediatric Tube Surgery

Hussain Aluzri[1], Shayan Samroo[2], Jay Richardson[1], Velota CT Sung[1]

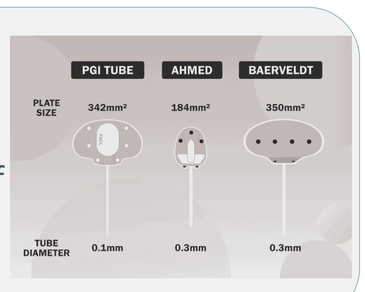
[1]Birmingham and Midland Eye Centre, Sandwell and West Birmingham Hospital, NHS Trust, UK
[2]Birmingham NHS Foundation Trust, Birmingham, United Kingdom.

BMEH 200 years Established 1823

THE MIDLAND OPHTHALMOLOGICAL SOCIETY

Introduction

- Childhood glaucoma has distinct etiologies which require surgical intervention in the predominant of cases[1]
- Tube shunt is an established surgery in the management of (refractory) Paediatric Glaucoma[2]
- This study is the longest followed-up cohort to date



Objective

To evaluate the long-term (14-years) outcomes of Glaucoma Drainage devices in the management of a complex and heterogenous cohort of Paediatric Glaucoma .

Methods

- Retrospective case series predominantly in a single centre with ≥4 year follow-up (Median follow up of **14.46 years, range (4.5-23 years)**
- **Primary outcome** was surgical success as per WGA Guideline
- **Secondary outcomes** were: IOP, BCVA, NOM, further procedures, complications

Population
- Children/ Adolescent (Age <19 years)
- **82** eyes of **61** patients
- 13/11/2000 - 31/12/2013

Two Tertiary Centre:
- **81**- Birmingham Midland Eye Centre
- **1**- Moorfield's Hospital

Consecutive cases series
- Predominantly one Surgeon- VS but includes PK, and PS
- 81 alive at final follow-up

Follow-up:
- Range: 4.5 – 23 years
- Median: 14.46 years

Type of Tube
- Baerveldt: 63 eyes (76.8%)
  - 250: 14 eyes
  - 350: 9 eyes
  - Unknown 41 eyes
- Molteno 19 eyes (23.2%)

Pre-Operative Demographics & Surgical Parameters

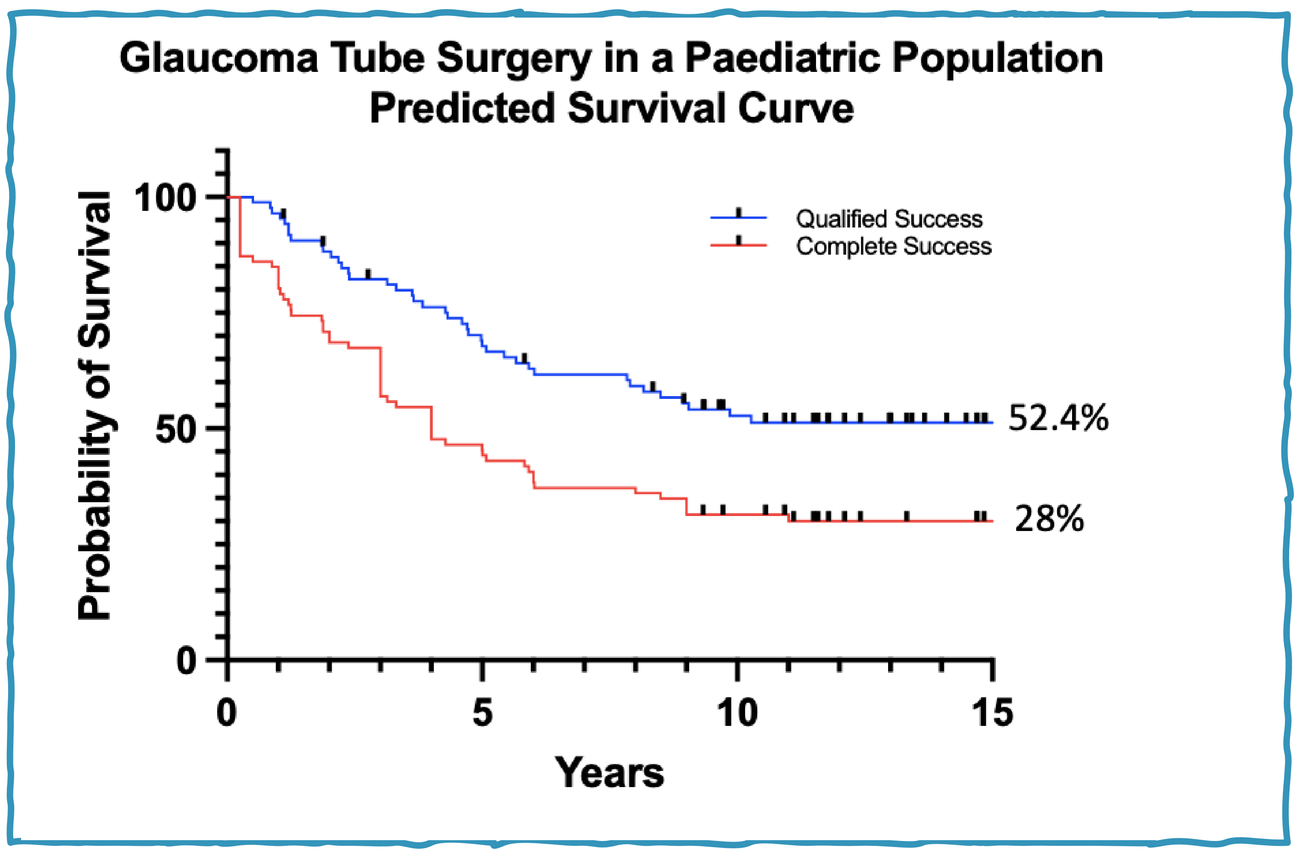
Type of glaucoma (WGA consensus)	
Primary Congenital Glaucoma	12 (14.6%)
Juvenile Open-angle Glaucoma.	2 (2.43%)
Glaucoma following cataract surgery	19 (23.2%)
Glaucoma associated with acquired conditions (uveitis, trauma, oil)	20 (24.4%)
Glaucoma associated with non-acquired systemic disease or syndrome	19 (23.2%)
Glaucoma associated with non-acquired ocular anomalies	10 (12.2%)

Baseline Parameters, n=82	
BCVA (LogMAR ± SD)	0.76 ± 0.61
Pre-Operative IOP (mmHg ± SD)	31.27 ± 7.6
Glaucoma Medications (Mean ± SD)	4.27 ± 1.0
% on Acetazolamide	32.9%
Cup-to-disc Ratio	0.70 ± 0.19

Patient Demographics (n=82)	
Mean Age (years)	9.02±5.5
Range	0.64-18.98
Gender, n (%)	
Male	39 (47.6%)
Female	43 (52.4%)
Study Eye, n (%)	
Left	43 (52.4%)
Right	39 (47.6%)
Ethnicity, n (%)	
Asian	29 (35.4%)
Afro-Carribean	5 (6.1%)
White	47 (57.3%)
Unknown	1 (1.2%)
Glaucoma Type, n (%)	
Primary	14 (17.1%)
Secondary	68 (82.3)

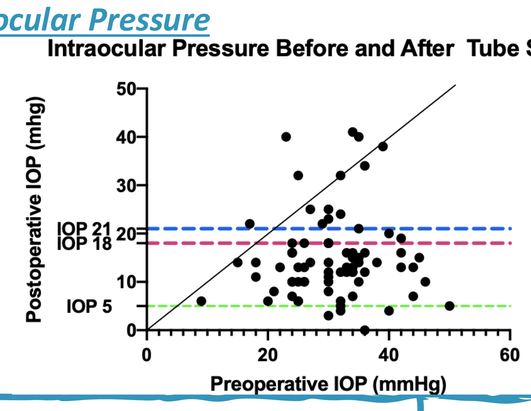
- **76.9% eyes had prior glaucoma surgery/ laser**
- 85.4% eyes had prior ocular surgery
- Average of 1.7 Glaucoma operations in each eye (range 0-6) prior to tube

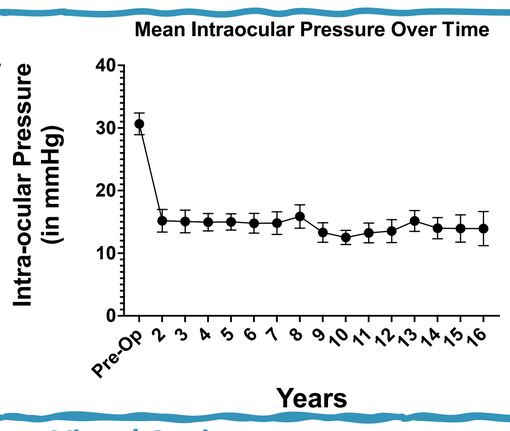
Primary Outcome



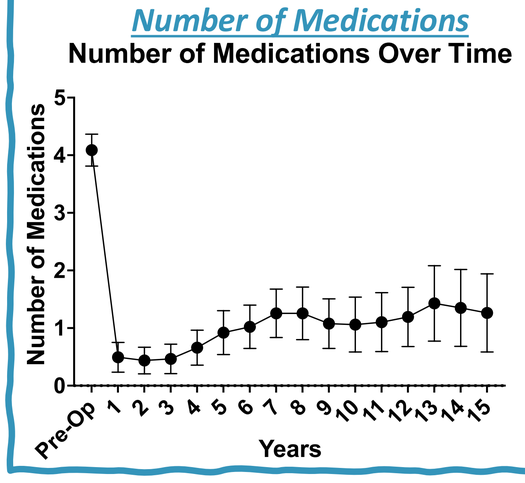
Secondary Outcomes

Intraocular Pressure

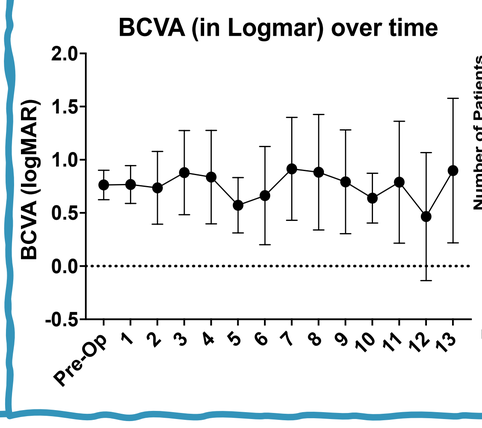


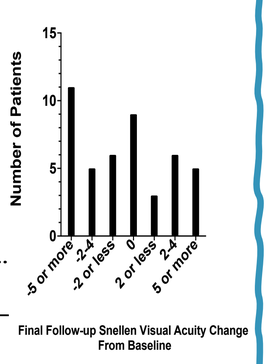


Number of Medications



Visual Acuity





Failure and Complications

Failure

Failure on final followup (average of 14.6 years) was **47.6%** (39 eyes of 29 patients)

Average time to failure: **4.15 years ± 3.89 (48.5 months)** Median of 2.85 years

Number and Type of tubes that failed:
- **Baerveldt**: 26 (41.3% of total Baerveldt)
- **Molteno**: 13 (68.4% of total Molteno)

Further Glaucoma Procedure for All Failures:	**23**
Cyclodiode	**12**
Tube	**4**
Trabeculotomy (GATT)	**3**
Iridectomy	**4**

Primary Reason for Failure, (n=39)	
Further Glaucoma Procedure:	11(28.2%)
Cyclodiode	7
Tube	2
Trabeculotomy (GATT)	2
Inadequate IOP Control:	9 (23.1%)
>21 mmHg	8
<20% IOP Reduction	1
Hypotony	5(12.8%)
NPL	6(15.4%)
Endophthalmitis:	4(10.3%)
Endogenous	1
Exogenous	3

Complications and Safety Profile

- **14.6%** of patients required a corneal transplant

Retinal Detachment	7 (8.5%)
Hypotony (requiring intervention)	27(32.9%)
CMO	8 (9.8%)
Post Op Ptosis Squint	1 (1.2%)
Choroidal Detachment	9 (12.2%)
Corneal Decompensation	12 (14.6%)
Band Keratopathy	7 (8.5%)
Phthisical	5 (6.1%)

Repositioning of Tube	9
Trimming of Tube/Shortening	25
Supramid	
Removal	33
Adjustment/ Trimming	13
Reinsertion/repositioning	4
Suture Advancement	1
Corneal Operation	
PK	6
Amniotic Membrane Transplant	4
DSAEK	2
Bleb Revision	10
Needling with 5-FU	12
Flushing	6
Phaco + Lens Implant	12
Lensectomy	5
Tying Off Tube	
Partial	12
Total	3
Untying	3
Healon GV, Viscoelastic Injection &	26
AC reformation Autologous Blood	3

Conclusion

In a complex cohort of Paediatric Glaucoma Patients with high baseline IOP over median of 14.5 years:

Complete success occurred in **28.0% of cases**

Qualified success occurred in **52.4% of cases**

Failure Rate:
- 32.6% after 10 years
- **47.6%** at final final follow-up (Median 14.5 years)
- Average of 4.28 years to failure (Median of 2.85 years)

Longest Follow-up duration and size of patients with tube shunts in Paediatric Glaucoma in Literature

References:

1)Amini, H., Razeghinejad, M.R. & Esfandiarpour, B. Primary single-plate Molteno tube implantation for management of glaucoma in children with Sturge-Weber syndrome. *Int Ophthalmol* **27**, 345–350 (2007).
2)Autrata R, Helmanova I, Oslejskova H, Vondracek P, Rehurek J. Glaucoma Drainage Implants in the Treatment of Refractory Glaucoma in Pediatric Patients. *European Journal of Ophthalmology*. 2007;17(6):928-937.
3)Geddie SJ, Feuer WJ,Lim KS, et al. Treatment outcomes in the primary tube versus trabeculectomy study after 5 years of follow-up.*Ophthalmology*. 2022; **129**: 1344-1356
4)Chen TC, Chen PP, Francis BA, Junk AK, Smith SD, Singh K, Lin SC. Pediatric glaucoma surgery: a report by the American Academy Of Ophthalmology. Ophthalmology. 2014 Nov;121(11):2107-15. doi: 10.1016/j.ophtha.2014.05.010. Epub 2014 Jul 24. PMID: 25066765.
5)Jacobson A, Besirli CG, Rohrsack BL. Outcomes of Baerveldt Glaucoma Drainage Devices in Pediatric Eyes. J Glaucoma. 2022 Jun 1;31(6):468-477. doi: 10.1097/IJG.0000000000001970. Epub 2021 Dec 21. PMID: 34930876; PMCID: PMC9148673.