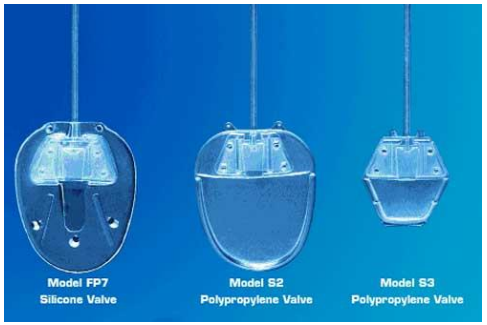

Ahmed Valve Glaucoma Surgery Outcome In Young Children Less Than 2 Years

By
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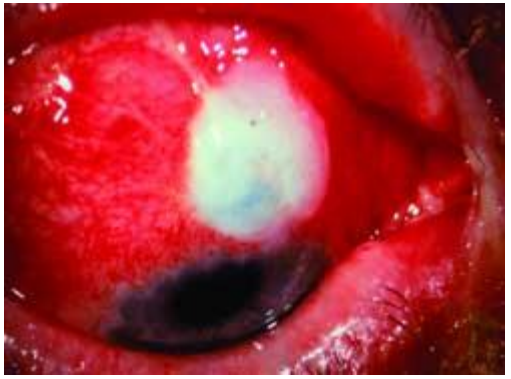
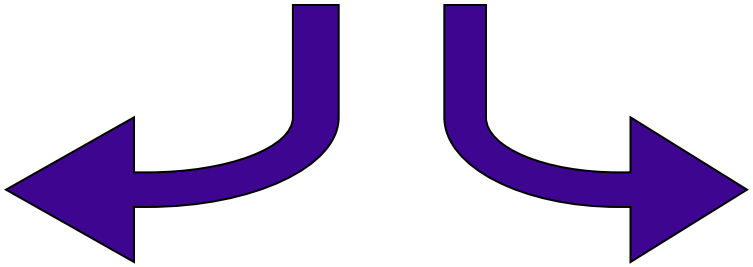
- Pediatric glaucoma is a challenging , potentially blinding disease ,which is often refractory to medical treatment. ***Morad et al 2003***
- Treatment is typically surgical ,unlike adult glaucoma management where medications are usually initiated before moving on to surgical treatment. ***Englert et al 1999***
- Goniotomy & trabeculotomy have a 50% to 77% success rate . But many will require other forms of surgical therapy to achieve adequate control of the intraocular pressure. ***Coleman et al 1997***

- Trabeculectomy , first described in 1967 , has met a limited success in pediatric glaucoma patients , with reported success rate varying widely from 37% to 85% depending on the patient population & series. ***Englart et al 1999***
- MMC was first introduced as an agent in 1983 , but its application was not popular until 1991. Since that time , it increased the success rate of trabeculectomy to about 67% to 100%. ***Beck et al 2003***



- Tube-shunt procedures have shown encouraging results in the treatment of refractory pediatric glaucoma , but have also been associated with a relatively high rate of complications.
- Hypotony , choroidal effusion , tube malposition , cataract & retinal detachment are common complications of these procedures. ***Djodeyre et al 2001***

GDD

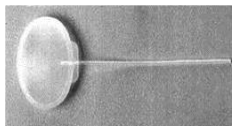
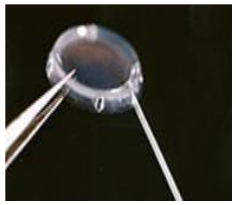


Valved

Contain internal mechanism to control the outflow of the aqueous humor. They drain once threshold IOP is reached thus preventing hypotony. Each device had different flow restriction method.

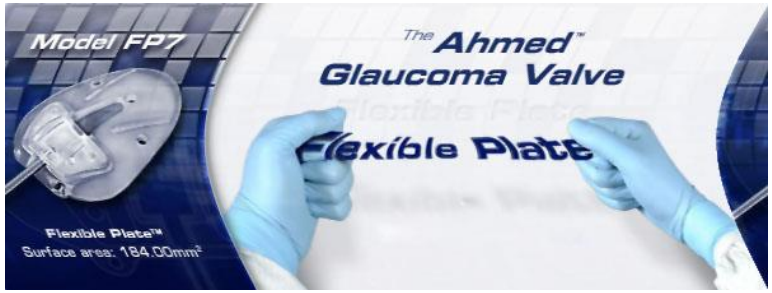
Non valved

Do not contain a mechanism within the device to restrict the aqueous outflow. They relay of fibrous bleb formation on the end plate which will provide sufficient resistance to outflow & control of IOP is established.

Product	Material		Model	Image	Surface area	Valve/non valve	Single Quadrant	Special featore
	Plate	Tube						
Ahmed implant	Polyprop-ylene	Silicone	S1		364mm	Valved	Yes	Silicone elastomer membrane valve
			S2		184mm			
			S3		96mm			
	Silicone		FP7		184mm			
Krupin	Silicone	Silastic			180mm	Valved	Yes	Slit-valve at tube distal end
Molteno	Polyprop-ylene	Silicone	Single plate		135mm	Non Valved	Yes	Single or double plate
			double plate		270mm		No	
Baerveldt	Silicone	Silicone	BG-103		250mm	Non Valved	Yes	Barium impregma-ted
			BG-101		350mm			

- The Ahmed glaucoma valve implant was approved by the FDA in November 1993 & because of the potential advantages, it was used in children since 1992. Initial reports suggest that success rates in children were similar to that in adults & it showed encouraging results in refractory pediatric glaucoma. ***Wilson et al 2000***

AGVI



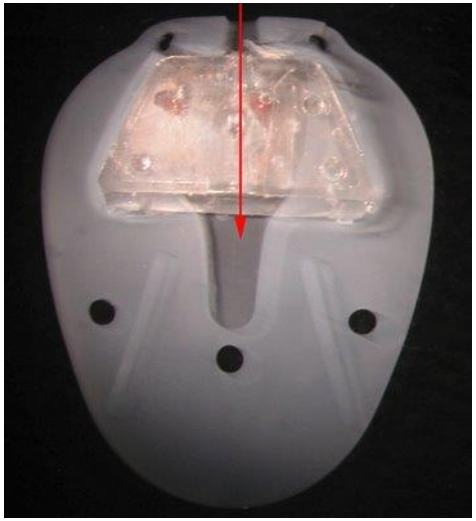
Polypropylene plate

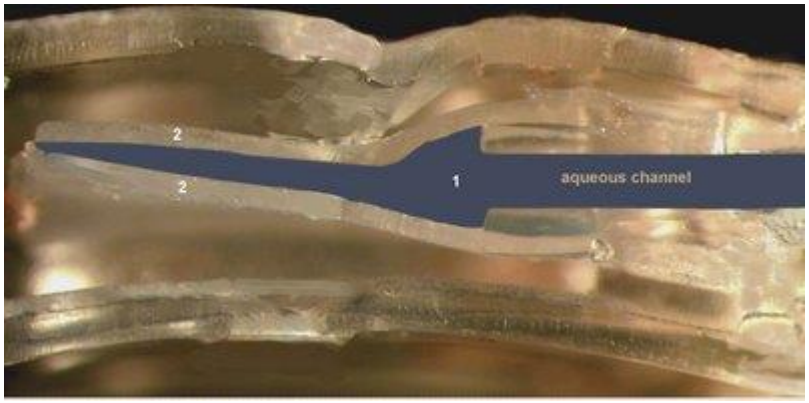
- Rigid
- Less biocompatability .
- More inflammation
- Increase the thickness of the pseudocapsule
- ↑ IOP

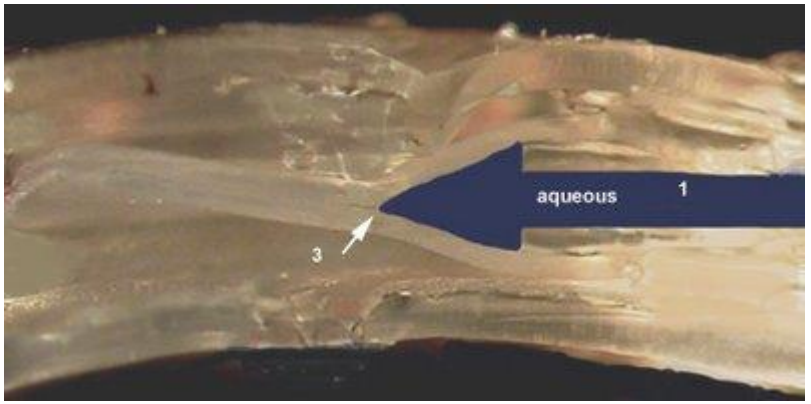
Silicone plate

- Flexible
- More biocompatability.
- Less inflammation
- Reduce the thickness of the pseudocapsule
- Lower long-term IOP

- The leaves of the valves are relatively long and indicated by number 2. When the pressure in the anterior chamber is high, the valve leaves separate creating an open valve as depicted. When the pressure is low the leaves of the membrane have natural elasticity that keeps them together.







Purpose & Design

Purpose: To evaluate the outcome of Ahmed glaucoma valve implant in young children less than 2 years.

Design: Retrospective study.

Patients & Methods

After obtaining permission from KKESH review board, we retrospectively review the charts of young children who underwent Ahmed glaucoma valve implant in KKESH from January 1995 through December 2005.

Inclusion criteria were:

- Age 2 years or younger at time of surgery.
- Completed 24 months of regular follow-ups.
- No previous drainage device surgery.

42 eyes of 36 patients were analyzed in this study.

Patients & Methods

Definitions:

Success:

- IOP ≤ 22mmHg with or without antiglaucoma medications.
- No additional glaucoma surgeries.
- No visually devastating complications.

Failure:

- IOP > 22mmHg for 2 follow-ups despite full antiglaucoma medications.
- AGVI explanted.
- Needed further glaucoma surgery.
- Developed visually devastating complications.
- Hypotony (IOP < 5mmHg).

Results

Variables

Mean age SD (months)	
At time of surgery	11.83 (5.63)
Gender (n= 42 eyes)	
Male	22 (52.4%)
Female	20 (47.6%)
Diagnosis	
Congenital glaucoma	28 (66.7%)
Aphakic glaucoma	5 (11.9%)
Peter Anomaly	5 (11.9%)
Sturge-Weber syndrome	1 (2.4%)
Aniridia	1 (2.4%)
Congenital Rubella	1 (2.4%)
Steroid-induced glaucoma	1 (2.4%)
Medications (preoperative)	
0	1 (2.4%)
1	1 (2.4%)
2	16 (38.1%)
3	17 (40.5%)
4	7 (16.7%)

Non-Glaucoma surgery (n=6 patients)	
• Lens Aspiration with Anterior vitrectomy	5 (11.9%)
• PKP	1 (2.4%)
Glaucoma surgery frequency	
• Goniotomy	1 (2.4%)
• Trabeculotomy	10 (23.8%)
• Trabeculectomy	3 (7.1%)
• Trabeculectomy + MMC	15 (35.7%)
• Trabeculectomy + Trabeculotomy	1 (2.4%)
• CPC	5 (11.9%)
• Trabeculectomy + Trabeculotomy + MMC	17 (40.5%)
No previous surgery	3 (7.1%)
Preoperative:	
• IOP	33.5 (± 8.6)
• Medications	2.67 (± 0.87)

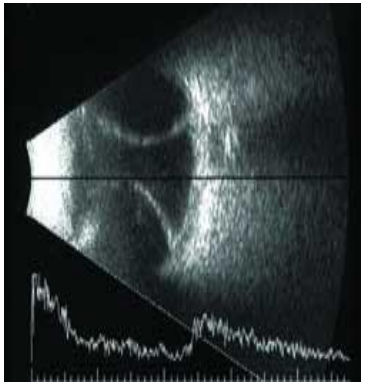
Antimetabolite MMC	
Used	20 (47.6 %)
Not used	22 (52.4 %)
Implant model	
S1	6 (14.3 %)
S2	25 (59.5 %)
FP7	11 (26.2 %)
Site of implant	
Superotemporal	35 (83.3 %)
Superonasal	5 (11.9 %)
Inferotemporal	1 (2.4 %)
Inferonasal	1 (2.4 %)
Conjunctival flap	
Fornix-based	33 (78.6 %)
Limbal-based	9 (21.4 %)
Size of needle	
23G	42 (100 %)
Tube placement	
Anterior chamber	41 (97.6 %)
Posterior chamber	1 (2.4 %)
Patch graft	
Sclera	7 (16.7 %)
Dura	20 (47.6 %)
Pericardium	15 (35.7 %)
Paracentesis	
Yes	33 (78.6 %)
No	9 (21.4 %)
Anterior chamber reformation	
Yes	10 (23.8 %)
No	32 (79.2 %)

Surgical Methods

Month	IOP(± SD) MMHg	% of reduction (± SD) Compared to baseline
Baseline preop	33.52 (±8.62)	
Postoperative:		
One month	12.62 (± 6.64)	59.80% (23)
3 month	19.33 (± 8.73)	39.56% (30)
6 months	17.79 (±8.04)	44.32% (27.44)
9 months	17.90 (± 8.98)	43.36% (30.20)
12 months	19.52 (±8.17)	38.33% (32.04)
24 months	20.05 (± 9.72)	36.36% (34.90)

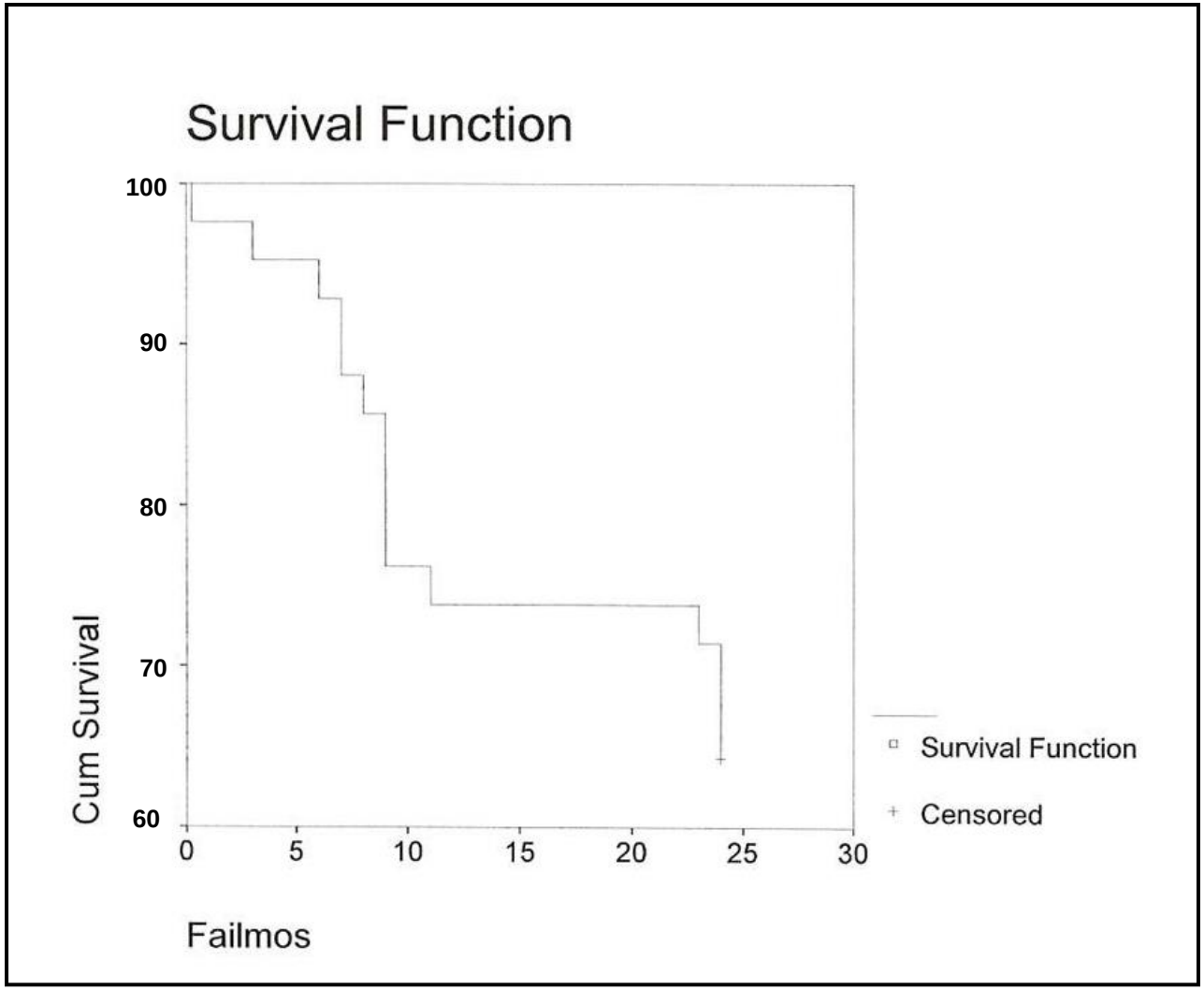
Month	No. of medications (± SD)
Baseline preop	2.67 (+ 0.87)
Postoperative:	
One month	zero
3 months	0.21 (0.56)
6 months	1.02 (1.24)
9 months	1.14 (1.22)
12 months	1.29 (1.24)
24 months	1.45 (1.25)

Complication	No (%)	Group		Model Used
		AGVI+MMC	AGVI	
Choroidal effusion	2 (4.8)	1	1	S1-S2
Corneal-tube contact	2 (4.8)	1	1	S2-FP7
Tenon cyst	1 (2.4)	1	0	S2
Tube exposure	2 (4.8)	1	1	S2-S2
Wound leak	1 (2.4)	0	1	S2
Lens opacity	2 (4.8)	1	1	FP7-FP7
Tube retraction	3 (7.1)	2	1	S2-FP7-FP7
Tube block by iris	1 (2.4)	0	1	S2
RD	3 (7.1)	1	2	S2-S2-FP7
Endophthalmitis	3 (7.1)	1	2	S2-S2-FP7
Hyphema	2 (4.8)	1	1	S2-S2
Fibrous ingrowth	2 (4.8)	2	0	S1-S1
Preceptal cellulites	2 (4.8)	1	1	S2-S2
Suprachoroidal hge	1 (2.4)	0	1	S2
AC shallowing				
-Uniform	1 (2.4)	1	0	FP7
-Iridocorneal touch	1 (2.4)	0	1	S2

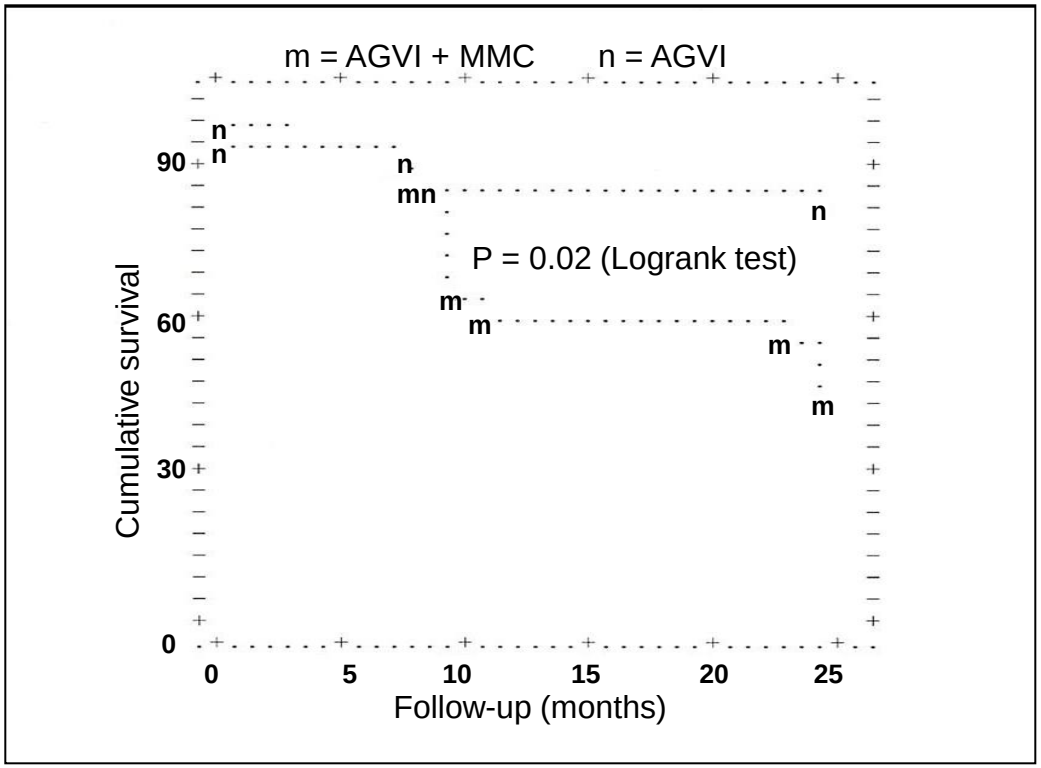


- The IOP exceeded 22 MMHg in 37 eyes of 42 (88.1%) at mean of 7 months (SD ± 7.2 , range =1 - 24) posoperatively.
- 36 eyes of 42 (85.7%) required resumption of antiglaucoma medications at mean of 7.2 months (SD± 6.8) postoperatively.
- 2.08 (SD± 0.81) medications were needed to control the IOP.
- Tube revision was done in 11 eyes of 42 (26.2%) postoperatively & it was explanted in 6 eyes of 42 (14.3%).
- 7 eyes of 42 (16.7%) needed a second implant to control the IOP,while 7 eyes of 42 (16.7%) needed CPC to control the IOP.

Diagnosis	Sex	Used MMC	Age at surgery (month)	Time to failure (months)	Reason for failure	Patch graft	Model
Peter anomaly	F	Yes	10	7	Endophthalmitis + preceptal cellulites	Dura	S2
Peter anomaly	F	Yes	3	7	IOP>22 + needed 2nd implant	Dura	S2
Aphakic glaucoma	M	Yes	19	24	IOP > 22 MMHg	Dura	S2
Congenital rubella	M	Yes	15	3	IOP > 22 MMHg	Sclera	S1
Congenital glaucoma	M	Yes	5	9	RD	Pericardium	S2
Aphakic glaucoma	M	No	11	0.25	Suprachoroidal Hge	Dura	S2
Congenital glaucoma	F	Yes	21	24	IOP > 22 MMHg	Dura	S2
Peter anomaly	F	No	20	24	IOP > 22 MMHg + needed CPC	Dura	S2
Congenital glaucoma	M	No	11	8	Endophthalmitis + RD + Preceptal cellulitis	Pericardium	S2
Congenital glaucoma	F	No	15	7	Endophthalmitis + RD	Pericardium	FP7
Aniridia	M	Yes	12	9	IOP > 22 MMHg + needed CPC	Pericardium	S2
Congenital glaucoma	M	Yes	14	11	IOP > 22 MMHg + needed CPC	Dura	S2
Aphakic glaucoma	M	Yes	8	9	IOP > 22 MMHg + needed CPC	Dura	S1
Aphakic glaucoma	M	Yes	8	9	IOP > 22 MMHg + needed CPC	Dura	S1
Peter anomaly	F	Yes	52	23	IOP > 22 MMHg + needed 2nd implant	Sclera	S2



The cumulative probabilities of success according to the Kaplan-Meier method were 73.8 % & 64.3 % 12 months & 24 months respectively.



The Kaplan-Meier survival analysis showed that the cumulative probability of success for the AGVI+MMC group is 60% & 45% at 12 & 24 months respectively & the mean survival time was 18 months compared with the AGVI group where the cumulative probability of success was 86.36% & 81.82% at 12 & 24 months respectively & in which the mean survival time was 21.3 months.

	AGVI+MMC	AGVI	P value
Preop Baseline			
IOP	34.35	32.77	0.419
Medications	2.65	2.68	0.642
Previous Glaucoma Surgery			
1	12	13	
2	5	5	
Postoperative			
One month			
IOP	11.25	13.86	0.801
% Of reduction	64.6 %	55.4 %	
Medications	0	Zero	Zero
3 months			
IOP	20.65	18.14	0.256
% Of reduction	35.6 %	43.14 %	
Medications	0.4	4.55E-02	0.00
6 months			
IOP	19.4	16.32	0.877
% Of reduction	39.6 %	48.6 %	
Medications	1.7	0.41	0.001
9 months			
IOP	17.85	17.95	0.67
% Of reduction	44.16 %	42.6 %	
Medications	1.9	0.45	0.078
12 months			
IOP	20.3	18.82	0.70
% Of reduction	37.64 %	39 %	
Medications	1.85	0.77	0.2
24 months			
IOP	21.6	18.64	0.307
% Of reduction	30.97 %	41.3 %	
Medications	1.85	1.09	0.403
Survival time	17.6	21	0.012

Study	Year	No. of eyes	Population	Mean Age	Mean follow-up	Cumulative probabilty of sucess	
						12 months	24 months
Coleman et al	1997	24	Children (< 18 y)	6.6 ± 5.7 y	16.3 ± 11.2 months	77.9% ± 5.8	60.6% ± 13.7
Englert et al	1999	27	Children (< 18 y)	6.4 ± 5.9 y	12.6 ± 8 months	90.6%	58.3%
Djodeyre et al	2001	35	Children (< 15 y)	4.4 ± 4.7 y	12.6 ± 10.8 months	70.1% ± 8.5	63.7% ± 9.9
Morad et al	2003	60	Children	6 ± 4.9 y	24.3 ± 16 months	93%	86%
Chen et al	2005	52	Children (< 18 y)	4.9 ± 6.5 y	2.2 ± 1.8 years	85.1%	63.2%
Current study	**2008**	**42**	**Children (< 2 y)**	**11.8 ± 5.6 m**	**24 months**	**73.8%**	**64.3%**

Factors predictors to outcome

Implant Type	Survival	Difference in survival
MOLTENO	Lee et al. Ophthalmology 1997	No difference
MOLTENO	Cantor et al. J Glaucoma 1998	No difference
AGV	Kurnaz et al. Eur J Ophthalmol 2005	No difference
AGV	Costa et al. Ophthalmology 2004	No difference
AGVI MODEL Silicon (FP7) Polydropylene	22.45 ± 5.1	

Complication / Study	Corneal-Tube contact	Choroinal effusion	Tenon cyst	Tube exposure	Wound leak	Lense opacity	RD	Endophthalmitis	Hyphema	Tube retraction	Tube block	Fibrous ingrowth	Preceptal cellulitis	Suprachoroidal Hge	AC shallowing
Coleman et al 1997				3 12%									1 4.2%	1 4.2%	
Englert et al 1999	9 33%	2 7.4%			1 3.7%		1 3.7%				1 3.7%				3 11%
Djodeyre et al 2001		6 17%				6 17%		1 2.9%	4 11%		1 2.9%				9 25%
Morad et al 2003	2 3%	11 18%	4 7%	7 12%	2 3%	1 2%		3 5%		3 5%	2 4%				9 15%
Wilson et al 2003				3 5%	2 3.4%				10 17%						9 15%
Beck et al 2003	16 35%			2 4.3%	1 2.2%	5 11%						1 2.2%			3 6.5%
Chen et al 2005	4 7.7%	1 1.9%	2 3.8%	3 5.8%		2 3.8%	1 1.9%	1 1.9%	1 1.9%		7 14%				9 17%
Pakravan et al 2007		2 13%												2 13%	2 13%
Current study 2008	2 4.8%	2 4.8%	1 2.4%	2 4.8%	1 2.4%	2 4.8%	3 7%	3 7%	2 4.8%	3 7%	1 2.4%	2 4.8%	2 4.8%	1 2.4%	2 4.8%

- Exploratory cox-regression analysis was conducted & showed the following:
  - Previous non glaucoma surgery had a shortening effect on survival & is a risk factor for failure.
  - Previous glaucoma surgery increase the survival. However, the frequency of previous surgery does not make a difference in survival.
  - Congenital glaucoma is not a risk factor for failure.
  - Conjunctival flap configuration & the type of patch graft did not influence the survival.
  - Polypropylen implants had a significantly shorter survival.

Conclusion

- In conclusion , Ahmed glaucoma valve implant in children less than 2 years of age have a probability of success similar to that of older children & adults & comparable to other treatment modalities.
- Using AGVI alone without MMC have more probability of success, requires less number of postoperative medications & increase the overall success rate.
- Complications that had occurred were comparable to those in older children. Most of these complication occurred in the first year postoperatively especially after 6 months. This make close ongoing follow-up essential.


Thank you