STAB INCISION GLAUCOMA SURGERY (SIGS)

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SIGS or Stab Incision Glaucoma Surgery is a guarded filtration procedure that was introduced by me and is slowly but surely becoming popular amongst many Ophthalmologists who have tried it out around the world. Many Ophthalmologists all over India within and outside the Dr. Agarwal's group have started doing this technique and are satisfied with it. There are many international ophthalmologists who have adopted this technique and are now doing it - in the US, Europe, Africa and the Middle East, and again are pleased with the results (numerous personal communications). The advantages of this technique include simplicity, effectiveness, lack of need for special instruments & devices; and being much more cost effective as compared to many of the currently popular MIGS devices while performing well when compared to the gold standard - trabeculectomy.

As with any other procedure, there is a learning curve and it is important to know the technique properly. Pre-operative MMC, loose speculum, well pushed down conjunctiva, shallow short superficial tunnel, a good ostium, good peripheral iridectomy are crucial for success as is checking for the anterior chamber behavior at the end. A soft AC that however does not shallow and a good bleb are indicators of good post op filtration.

Steps for a successful SIGS are:

1. Pre-operative sub-conjunctival MMC 0.02% (0.2 ml) 20 min prior to surgery in the intended site of SIGS.

Pre-op MMC: 0.2 ml of 0.02% is injected in the sub-conjunctival space about 6 mm behind the limbus 20 minutes prior to surgery. The SIGS tunnel is then created at this site. This prevents the conjunctiva from scarring down. This is easy and safe and avoids the need for conjunctival incision to be opened excessively and is done for all cases unless specifically contra-indicated. Many prominent glaucoma surgeons use the pre-op subconjunctival injection of MMC in their trabeculectomy cases as well and this is an accepted technique. Pre operative MMC is given tangential to limbus 6mm above the superior limbus and is therefore above the site of the incision. Also the
needle is introduced from temporal conjunctiva parallel to limbus till the site of intended surgery (tunnel creation) is reached and then the MMC is injected. This avoids buttonholing at the site of the bleb.

2. It is advisable not to have the speculum opened up too wide in order to prevent conjunctiva from getting pulled into the fornices, and thus being unable to push conjunctiva down well. The conjunctiva is pushed downwards with two non-toothed forceps. While holding it pushed down, the 2.8 mm bevel up keratome is used to make a shallow, superficial and short tunnel through the sclera (in such a way that the blade is seen through the overlying conjunctiva). This then tunnels 0.5 to 1mm into the cornea (not too deep and with a sufficiently thick lower lip) and finally enters the AC horizontally upto the shoulder of the blade. The blade should be passed avoiding major blood vessels. Small bleed can occur and stops itself. Any blood gets washed out easily at the end of surgery on irrigation through a 26 gauge side port.

3. It is important to make the right depth tunnel. For this, the incision is made about 2 mm back from the limbus on conjunctiva. That comes to a scleral tunnel about 1.5mm from the limbus. The tunnel should be short in length. (I currently make tunnels shorter than seen in my online videos).

4. The tunnel should be superficial in the sclera to give the right depth. For this, the keratome should be kept pointing/ angulating slightly upwards. It is important not to make a deep scleral tunnel. The correct depth is so that you are just able to see your blade through the overlying lamellar sclera and conjunctiva. The tunnel enters the AC after traversing 0.5 to 1 mm in lamellar cornea. This is done with the bevel up metal 2.8 mm phaco keratome. Posterior pressure should be avoided with the keratome while entering the AC. The eye is held at the limbus with a strong one -toothed forceps (like a St Martin) with the left hand so that good control over the position of the globe is obtained while making the tunnel. Controlling the eye position with the left hand is important. Another important point to note is that the keratome is directed horizontally and not angled either upwards towards the endothelium or downwards towards the lens. While removing the keratome, it is just pulled out smoothly without any slicing movements. If a phaco is also planned, it may be done in the normal manner at this stage before creating the ostium. The ostium is then created after IOL implantation.

5. Ostium creation: A 1 mm Kelly's Descemet's punch (Appasamy Associates, Chennai, India) is used for creating the ostium. It is preferable to have a punch with a small head and not a bulbous space occupying one as they sometimes are. The 1 mm punch is inserted (do not try and insert the punch with the tip retracted) under the conjunctival- Tenon's cut and into the AC through the SIGS tunnel. It is inserted with the cutting tip facing horizontally and once inside the AC, is turned posteriorly to engage the posterior lip of the tunnel. Punches are taken through the cornea and sclera posteriorly enough to break the scleral shelf. This is done before removing OVD from the anterior chamber to avoid AC shallowing and the iris getting caught in the punch. The SIGS
ostium thus created should never extend beyond the scleral incision of course. Horizontal extension is not required and only punches that are directed in a linear manner posteriorly are required. Once the ostium is created, filtration is assessed by partially irrigating out the OVD through the main port and then performing side port irrigation. A free flow of BSS is looked for through the SIGS tunnel. A trick is to just hold the cut conjunctival edges with a forceps and look for ballooning on irrigation from the side port. If ballooning well without having to use force or without the AC deepening excessively, the SIGS ostium is adequate. If however ballooning is not seen/ a free flow of BSS is not seen or the AC becomes tense before flow is established, it means one of two things: either the iris is plugging the ostium or the two scleral lips are apposing and closing off filtration (to avoid which is the reason the scleral tunnel is kept short). In case of inadequate flow, the ostium is enlarged more towards the limbus. Irrigation is checked for again. A free flow without shallowing of the AC is the end point.

6. A peripheral iridectomy is always done. A PI is very easy to do and should be done in ALL cases as posteriorly placed ostia work better but stand the chance of getting plugged by the iris. A non toothed forceps is inserted, the iris base grasped and the iris withdrawn slightly through the mouth of the scleral tunnel. The assistant now retracts conjunctiva and the iris is cut with a curved Vannas. The iris should be grasped at the base and not in the midperiphery or to either side of the ostium. It should be made sure that the iris is pushed back into the AC completely either with OVD injection or by gently pulling the iris in with a rod inserted from the side port.

7. The tunnel can always be viewed by just retracting the conjunctival flap with one forceps and the ostium may be seen by lifting up the scleral lip with a toothed forceps (saline irrigation by assistant and mopping with a bud helps to see more clearly). Thus, the scleral tunnel can be visualized at every step whenever one likes to.

8. Viscoelastic is then removed from the AC either with the I/A probe through the phaco incision or with the Symcoe cannula inserted through the tunnel. The conjunctival incision can then be sutured. The Tenon's should not be included in the conjunctival sutures. Only the cut edges of conjunctiva are sutured to each other in a neat and regular way avoiding bunching it up which can induce scarring. A 10-0 nylon suture is preferred as 8-0 vicryl has a broader needle and can cause needle track leak. A running suture from one end of the incision to the extreme other end is passed and tied down using a loop. On tying down, the edges get slightly twisted which provides a very good leak proof closure. 26G side port irrigation at the end causes the bleb to rise well. While suturing, the AC should be watched for any shallowing. The ideal AC is soft but doesn't shallow at the end of surgery. In the eventuality that a shallowing is noticed, a releasable suture can be applied either directly trans-conjunctival or as in conventional trabeculectomies. This releasable suture is managed post-operatively just as a releasable suture in trabeculectomy.
9. Post-op management is much easier than in a trabeculectomy but if required one can do massage, teach the patient massage, inject 5FU in the inferior sub-conjunctiva, do a bleb needling on the slit lamp and so on. A dry needling may be done without injecting BSS. However, it may be combined with simultaneous sub-conj 5-FU.

10. One does need to have adequate virgin conjunctiva available to allow post op filtration in SIGS. Extensive scarred conj cases are not likely to do well. Ideal initial cases to do are POAG with or without phaco. PACG and eyes with shallow AC's are also more challenging.

12. SIGS makes the procedure faster and is good for high volume practice. One can finish a phaco SIGS in the normal phaco time + an additional 5 min.

ADVANTAGES OF SIGS:
The entire surgery may be done through a single small 2.8 mm conjunctival incision that is placed well away from the scleral cut. There is therefore lesser risk of scarring and failure. Virgin conjunctiva is maximized for other possible future surgeries. A biplanar scleral tunnel is preferred to a triplanar flap. A controlled posteriorly directed flow with a diffuse bleb is obtained. A bleb is created by the more physiological hydrostatic expansion. All sub-conjunctival drainage channels are intact. There are less suture and flap related complications. It is easier to tackle expulsive hemorrhage. Surgery is easier, faster, less traumatic and more economical with good results.

* SIGS videos are available on my Youtube Channel: Dr. Soosan Jacob. However, I currently give pre-operative sub-conjunctival MMC in all cases, make shorter (on the scleral side), shallower and more superficial tunnels than seen in the videos and make a PI in all cases.