NEW PARADIGM IN POSTERIOR VITRECTOMY
MIVS

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Micro incision vitrectomy surgery

Introduction

• Minimally invasive surgery
• Everything from smart phones to surgical incisions are getting smaller and more refined
• Ophthalmology,
  – Cataract surgery trending towards smaller incisions
  – Similar trend followed in vitreoretinal field.
• Better understanding of vitreoretinal diseases, superior instrumentation, desire to reduce surgery times and hasten postoperative recovery
History

- Robert Machemer- VISC 1971, 17 Gauge
- O’Malley and Heintz, 1974, 20G 3port pars plana vitrectomy
- Trend toward MIVS started in 1990
  - Steve Charles, one of the pioneers of MIVS
  - 25 gauge instruments by de Juan and associates
  - 23 gauge system first used by Singh n associates 1995
  - Full set of 23 G instruments introduced by Eckardt 2005 with better rigidity and stability
  - 2010 Oshima introduce 27 Gauge instrumentation
• 23 G vitrectomy system has become popular among VR surgeon and almost all replaced 20-gauge as the gold standard.
Indications

• Ideal for macular surgery
  – Macular hole
  – Epiretinal membrane
  – Vitreomacular traction
• Retinal detachment
• Surgery for diabetic complications
• Endophthalmitis surgery
• Trauma
• Intraocular foreign body
• Nucleus drop/ dislocated lens fragments management
Wound construction and microcannula placement

- Proper wound construction is vital to the success of MIVS
- The principle of wound construction for MIVS is misalignment
- Two techniques
  - Two-step technique by Eckardt
  - One-step technique utilizes a trocar-cannula set
• The conjuntiva is held by forceps or by cotton tip and displaced laterally about 2-3mm
• The trocar is introduced obliquely through the sclera to create the incision
• Microcannula is left behind in place as trocar is withdrawn
• Microincision wounds are essentially scleral tunnels
  – Surface entry
  – Intrasceral path

• Scleral entry
  – Parallel (circumferential)
    • Intrasceral path anteroposterior (radial)
  – Perpendicular (radial)
    • Intrasceral path parallel (circumferential)
23Gauge Microcannula Placement
25Gauge Microcannula Placement
Surgery

- Infusion cannula is secured first in inferotemporal quadrant
- Tip of infusion cannula should visualised
- Once correct placement is confirmed, the infusion can be turned on
- Active sclerotomies, preferably placed 1 clock hour above the horizontal
- Distance from limbus; phakic eyes 4mm, aphakic or pseudophakic eyes 3-3.5mm
Surgery

- Vacuum setting 350-400mm Hg
- Cut rates 2,500-5000 cpm
- Avoid unnecessary movements and drifting in vit cavity
- PVD can be induced with vit cutter with suction of 300-400 mm Hg
• Peripheral vitrectomy can be carried out with improved safety as compared to 20G
• Scleral depression can be used for peripheral vitreous removal
• For tough tissue we need to reduce cut rate with proportional reduction in suction.
• Lumen area of 23 G instruments is half of the 20 G
• Smaller gauge reduces flow, thus affects efficiency of vitreous removal. To counter the same, higher vacuum settings need to be used
• The Port of the 23G vitrectomy probe is closer to the tip(0.229mm Vs 0.457mm)
• Having the port closer to the tip enhances 23G versatility manifold
• Cutter easily performs the role of
  • Curved scissors
  • Vertical scissors
  • Blunt spatula tip
  • Blunt hemostat n extrusion
• We can perform membrane dissection without multiple instrument exchange and its associated problems
Microcannula removal and wound closer

- Adequate attention at the end of surgery ensures that the case concludes with the achievement of the aims of MIVS
- Secure wound closer prevents hypotony and endophthalmitis
- Infusion pressure should be lowered during microcannula removal
- Light probe is inserted through microcannula and then microcannula should be pulled out slowly
Microcannula Removal

• The light probe then slowly withdrawn and gentle massage is done over the sclera
• After removing both superior microcannula always check the wound leak by raising infusion pressure
• Leaky wound should be secured with a single 7-0 or 8-0 vicryl suture
• The infusion cannula is removed the last
Factors associated with wound leaks include:
- Eyes under going resurgery
- Multiple instrument exchanges
- Extensive vitrectomy with base dissection
- Low scleral rigidity e.g. Children

A large study found sclerotomy leakage need suturing in silicone oil (20%) > fluid BSS filled eyes (4.9%) > Gas filled eyes (1.9%)

Desire for sutureless sx should not supersede the need for safer sx
25 Gauge vitrectomy

- 25 G cutters and infusion cannulas gives high resistance due to small diameter of lumen
- To compensate it have to increase infusion pressure
- The Alcon constellation pressurized infusion system and Accurus vented gas forced infusion (VGFI)
- High vacuum 650mm Hg and cut rate 5000 cpm
• Tool flexion is the most significant complaint about 25G system
• Careful positioning of the sclerotomies reduces tool flexion
  – Superonasal- lowest point on the bridge of the nose
  – Superotemporal port- low point on the brow
• Contact based wide angle viewing (Volk, AVI) decreases the need for extreme eye rotation compared to non contact visualization (BIOM, EIBOS)
Combined 25G/23G and 20 G vitrectomy

- Certain limitations of 25G/23G vitrectomy can be overcome by combined vitrectomy
- One sclerotomy can be enlarged for fragment (20G) to manage dropped nucleus and dislocated lens material
- IOFB can also be removed same way
- It’s a mismatch of inflow and outflow of fluid
  - Infusion pressure need to increase
  - Avoid aspiration when there is no lens fragments
27-Gauge vitrectomy

- Oshima et al 2010
- Indications
  - Macular surgeries
  - Floaters only vitrectomy (FOV)
  - Vitreous biopsy
  - Thin sclera, low scleral rigidity
- Instruments
  - 27 G cutter have shaft length 25mm (32 mm standard)
High flow infusion
– Cutter port larger and closer to the tip
– Duty cycle is better than 25 G
– Xenon and mercury vapor endoilluminator, chandelier light source available

• 27 G sclerotomies are made perpendicular to sclera in a single step
• Only 5% surgeon in USA and 10% surgeons worldwide using 27 G
Case 1-JBP61958

- 68Y/F, NO HTN, NO DM
- Vn OD-5/60, OS-6/36-6/18
- Cataract NSII (BE)
- OD- vitreomacular Traction(VMT)
- Phaco+ IOL+ (MIVS)23G PPV+ ILM peeling+ C3F8
- Post op Vn, 2 months 6/18
Case 2 - JBP4232

- 67/M Vn OD-6/60, OS-6/9
- HTN-5 yrs, DM-15 yrs
- c/o DOV RE
- h/o PRP 3 sittings, inj bevacizumab 3 inj in RE
- Cat –NSII
- OCT- RE-thick taut posterior hyaloid
- Phaco+ IOL+ 23G PPV+ posterior hyaloid removal
- Post op BCVA OD- 6/12
Case 3-JBP043276

- 63y/F, NO- HTN, NO- DM
- Vn OD-6/9, OS-6/60
- Ant seg- Early peripheral cortical cat
- LE- stage III macular hole
- LE- (MIVS)23G PPV+ ILM peeling+ C3F8
- Post op Vn 6/24
- 6 moths LE cat+ IOL
- Post op BCVA LE 6/12
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<tr>
<th>20 gauge</th>
<th>23 gauge</th>
<th>25 gauge</th>
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<tr>
<td>O’Malley and Heintz</td>
<td>Eckardt</td>
<td>de Juan</td>
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<td>Bulky and stiff instruments</td>
<td>Less rigid instruments</td>
<td>Stiffness of 23G is double of 25G</td>
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<td>Bulkier cutter and larger flow rate reduce safety while working close to retina, Multiple instrument exchange leads incision related complications</td>
<td>Enough stability to perform peripheral vitrectomy 23G cutter port is closer to the tip, facilitates segmentation, delamination</td>
<td>Counter-intuitive movements</td>
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<td>Low vacuum, low cut rates</td>
<td>High vacuum, high cut rates</td>
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<td>Sometimes 20G is the only feasible option Phacofragmatome, FB magnet forceps</td>
<td>Limited availability of fragmentom, multifunction instruments like aspiration cautery, lighted picks or lighted infusion cannula</td>
<td>Can be combined with 20 G to overcome this problem</td>
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<td>20G</td>
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<td>Postoperative discomfort, suture related complications, Surgically induced astigmatism, Postoperative conjuntival scarring, scleral thinning. Postoperative hypotony and related complications are less</td>
<td>Better comfort, faster healing and recovery of visual acuity MIVS related complications Hypotony, Choroidal detachment, Endophthalmitis</td>
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Conclusion

- The development of MIVS has provided surgeons with new options in the surgical treatment of vitreoretinal diseases.
- Each system has its advantages and disadvantages.
- The optimum gauge and settings have to be selected after careful deliberation to provide the best possible surgical outcome.