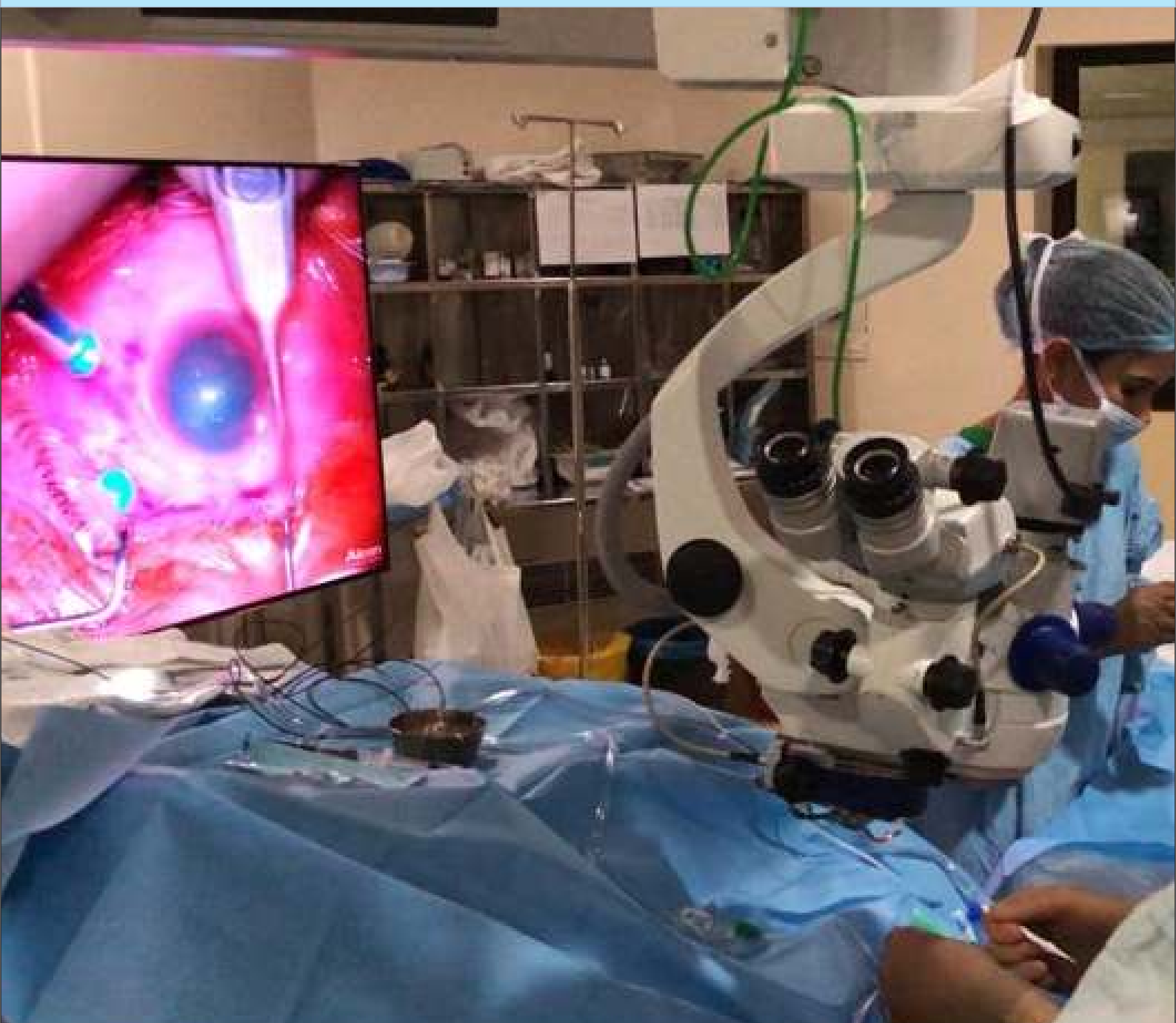


The Official Newsletter of the

# VITREO RETINAL SOCIETY - INDIA



March 2018



Official Website: [www.vrsi.in](http://www.vrsi.in)

World class Indian Ranibizumab



# RAZUMAB<sup>TM</sup>

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Approved medication for wAMD, DME, RVO & mCNV<sup>1</sup>

Revived vision Of  
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### Abridged Prescribing Information

**Active ingredient:** Razumab contains Ranibizumab solution for intravitreal injection 10 mg/mL vial (2.3 mg/0.23 mL). **Indication:** Wet Age-Related Macular Degeneration (wAMD), Diabetic Macular Edema (DME), Macular Edema Following Retinal Vein Occlusion (RVO), Visual impairment due to chorioidal neovascularization (CNV) secondary to pathological myopia (PM). **Dose and method of administration:** Ranibizumab 0.5 mg (0.05 mL of 10 mg/mL Ranibizumab solution) is recommended to be administered by intravitreal injection once a month (approximately 28 days). **Contraindications:** Ocular or periocular infections and hypersensitivity to Ranibizumab. **Warnings and precautions:** Endophthalmitis, retinal detachments, increases in intraocular pressure and thromboembolic events. **Adverse reactions:** The most frequently reported ocular adverse reactions following injection of Ranibizumab are: eye pain, ocular hyperaemia, increased intraocular pressure, vitritis, vitreous detachment, retinal haemorrhage etc. **Drug interactions:** Drug interaction studies have not been conducted with Ranibizumab. **Use in specific populations:** Pregnancy Category C, Nursing Mothers: It is not known whether ranibizumab is excreted in human milk. **Overdosage:** More concentrated doses as high as 2 mg ranibizumab in 0.05 mL have been administered to patients. No additional unexpected adverse reactions were seen. **Incompatibilities:** In the absence of compatibility studies, this medicinal product must not be mixed with other medicinal products. **Storage and handling instruction:** Store refrigerated between 2 °C to 8 °C in the carton to protect from light. Do not shake. The preparation should not be allowed to freeze. Keep out of reach and sight of children.

1. Myopic Chorioidal Neovascularization \*Internal Data

## Editorial Board

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Guidelines for the manuscript submission in  
VRSI Newsletter

### Original articles:

These include randomized controlled trials, intervention studies, studies of screening and diagnostic test, outcome studies, cost effectiveness analyses, case-control series, and surveys with high response rate. The text of original articles amounting to up to 3000 words (excluding Abstract, references and Tables) should be divided into sections with the headings Abstract, Key-words, Introduction, Material and Methods, Results, Discussion, References, Tables and Figure legends.

### Case reports / Challenging case /Innovations / Instruments / Techniques

New, interesting, challenging, rare cases, innovations, instruments and techniques can be reported. They should be unique and providing learning point for the readers. Manuscripts with clinical significance or implications will be given priority. These communications could be of up to 1000 words (excluding Abstract and references) and should have the following headings: Abstract (unstructured), Key-words, Introduction, Case, Discussion, Reference, Tables and Legends in that order.

The manuscript could be of up to 1000 words (excluding references and abstract) and could be supported with up to 10 references. Case Reports could be authored by up to four authors.

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## From the President's Desk

Dr. A. Giridhar

Medical Director  
Giridhar Eye Institute, Kochi  
giridhareye@gmail.com

Dear Members:

Greetings from the Vitreo Retinal Society-India!

It gives me immense pleasure to pen down few lines for the first issue of the VRS-I newsletter 2018. The theme for this particular issue is indeed an out of the box thinking by the editorial board and I am sure that this issue would be of very great interest to all our members.

With increasing number of Vitreo Retina surgeons practicing in tier-2 and tier-3 cities of our country, developing a good vitreo retina set up on an individual basis has become very necessary. It is only when we start building our own unit we realize all that we need to know and also we realize all the challenges that we come across in the frame of developing this set up.

This issue, I am sure, will give an answer to many of these questions that young retina specialists have when they start their own career in vitreo retina practice.

Wishing you all a very happy, prosperous and professionally successful 2018.

With kind regards



## From the Honorary Secretary Desk

### Dr. Raja Narayanan

Director-Head, Clinical Research Consultant,  
Smt. Kanuri Santhamma Centre for Vitreo Retinal Diseases  
Kallam Anji Reddy Campus, Hyderabad  
narayanan@lvpei.org

Dear Members:

Greetings from the Vitreo Retinal Society-India!

Greetings from VRSI! I am delighted to know that the first issue of VRSI newsletter in 2018 is being published by Dr. Vishali Gupta on 'Modular Vitreo-Retinal Operating Room'. I am sure that you will find the information extremely valuable for your daily practice, and to provide the best care to your patients. I take this opportunity to request you all to submit your interesting cases, articles and innovations to the VRSI newsletter, which will help improve the scientific knowledge base of our members.

VRSI is also holding the annual meeting at Jaipur from Nov 29 to Dec 2, 2018, under the stewardship of Dr. Pavan Shorey, and Dr. R.K. Sharma. Dr. Vishali Gupta is creating a wonderful scientific program for us, with numerous International and National faculty. I request you all to participate enthusiastically in the activities of VRSI.

I wish you a great year ahead.



## From the Convenor Scientific Committee Desk

### Dr. Vishali Gupta MD

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Dear Members:

Greetings from the Vitreo Retinal Society-India!

It gives me immense pleasure in bringing out the first newsletter for the year 2018. The last year was quite eventful for VRSI with lot of new activities added by the efforts of Dr. Raja Narayan and a very successful annual meeting at Bhubneshwar. I would like to thank all the members of VRSI who participated with great enthusiasm to make the scientific program a great success.

Keeping up with our promise of bringing out the newsletter quarterly, it gives me immense pleasure to theme this issue based on the developing of a modular operating room for the VR surgeon. I am really thankful to our members who have so enthusiastically contributed to it and do hope that you enjoy reading it.

## NABH guidelines and Modular OT in Ophthalmology

Dr. Cyrus Shroff  
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 Shroff eye centre, New Delhi  
 Dr. Manisha Agarwal  
 Associate Medical Director and Head of Vitreoretina Services  
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 Dr. Suneeta Dubey  
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 Dr. Daraius Shroff  
 Medical Director and Consultant Vitreoretina  
 Shroff Eye Center, New Delhi

### Introduction

Operation Theatre (OT) is a specialized facility of the hospital where lifesaving or life improving procedures are carried out on the human body by invasive methods under strict aseptic conditions in a controlled environment by specially trained personnel to promote healing and cure with maximum safety, comfort and economy.

The physical infrastructure and construction practices in healthcare industry have not undergone a major change in the last few decades. However, with the advent of prefabrication and modular manufacturing, healthcare has embarked on to the next stage of innovation i.e. world-class facilities and smart patient rooms that will help improve outcomes and patient experience. This is true with regard to the construction, and organization, of the modern operating theatre suite as well.

The operation theatres have been divided into two groups by NABH :-

1. Super-speciality OT- operation theatres for specialities like neurosciences, cardiothoracic, orthopedics (joint replacement) etc.
2. General OT- for basic surgical disciplines including Ophthalmology.

Day surgery is defined as the admission of the selected patients to the hospital for a planned surgical procedure, returning home on the same day and would fall under the category of general OT.

Basic requirements are:

- Occupancy: standard occupancy of 5-8 persons at any given point of time inside the OT
- Equipment load: Standard equipment load of 5-7 kW and lighting load of 1 kW per OT

- Ambient temperature and humidity at each location to be considered while designing the system

### Other Requirements

1. Air change per hour- Minimum total air changes should be 20, though they may vary with the biological load and the location. The fresh air component of the air change is required to be minimum 4 air changes out of total minimum 20 air changes
2. Air velocity: The vertical down flow of air coming out of the diffusers should be able to carry bacteria carrying particle load away from the operating table. The airflow needs to be unidirectional and downwards on the OT table. The air face velocity of 25-35 FPM (feet per minute) from non-aspirating unidirectional laminar flow diffuser/ceiling array is recommended.
3. Positive pressure: It is required to maintain positive pressure differential between OT and adjoining areas to prevent outside air entry into OT. The minimum positive pressure recommended is 2.5 pascals (0.01 inches of water)
4. Air handling/filtration: the AHU (air handling unit) must be an air purification unit and air filtration unit. There must be two sets of washable flange type filters of efficiency 90% down to 10 microns and 99% down to 5 microns with aluminium /SS 304 frame within the AHU. The necessary service panels to be provided for servicing the filters, motors and blowers. HEPA filters of efficiency 99.7% down to 0.3 microns or higher efficiency are to be provided. When not possible, the OTs should be well ventilated with 2 levels of filtrations as mentioned (pre and micro vee filters should be in position at the AHU).
5. Temperature and humidity: The temperature should be

maintained at 21C+/-3 degree C inside the OT all the time with corresponding relative humidity between 20 to 60 %. Appropriate devices to monitor and display these conditions inside the OT may be installed.

Design considerations for planning new operation theatres

OT Consideration: OT complex is divided into four following zones:

ZONE-1: Protective

Reception, waiting, trolley bay, change rooms, rooms for administrative staff, stores and record and conference room

ZONE-2: Clean area

Pre-operative, post-operative, staff lounges, stores

ZONE-3: Sterile area

Operating theatre, scrub room, anesthesia room, setup room

ZONE-4: Disposal area

Dirty utility, disposal areas from each OT and corridor leading to disposal zone

1. OT complex should have unidirectional flow movement with no crisscross of movement
2. OT complex should have one entry and one exit
3. Preoperative and postoperative rooms should be placed such that there will not be any crisscross of the pre and post-operative patients
4. Scrub room should preferably be in between OT or at the nearby place of OT. It should be equipped with plumbing line for supply of water and drain line for outflow of the water from scrubber
5. Each OT must have one patient entry and another for the surgeon from the scrub room
6. There should be no toilet in the upper floor of the OT complex
7. There should be no seepage or dampness inside the OT complex
8. No fire pipe and sprinkler should be inside the OT
9. No shaft or projected portion/sharp corner inside the OT.
10. Exhaust cabinet should be equipped for ease of fumigation in OT
11. The AHU for each OT should be dedicated one and should not be linked to air conditioning of any

other area.

12. Window and split A/c should not be used in OT because they are pure recirculating units and have convenient pockets for microbial growth which cannot be sealed.
13. Paint-antimicrobial, anti-fungal/epoxy painting of 300 micron thickness
14. OT door-automatic/hermitically sealed/touch free (preferable)
15. General lights-clean room lights preferably to be fitted in the center of the OT Room
16. Provision of safety against static charge
17. Separate power circuit for equipment like laser
18. The anti-static flooring, walls and ceiling should be non-porous, smooth, seamless without corners (coving) and should be easily cleanable repeatedly. The material (PVC roll/tile/epoxy) should be chosen accordingly. Anti-static flooring-seamless, including skirting, should not be of porous stone as it absorbs moisture and could be a source of bio burden. The floor finish should continue up the wall upto 100 mm.

Maintenance of the system

During the non-functional hours AHU blower will be operational round the clock (may be without temperature control). Variable frequency devices (VFD) may be used to conserve energy. Air changes can be reduced to 25 % during non-operating hour through VFD provided positive pressure relationship is not disturbed during such period.

Validation of system to be done as per the ISO 14664 standards and should include:

- Temperature and humidity check
- Air particulate count
- Air change rate calculation
- Air velocity at outlet of terminal filtration unit/filters
- Pressure differential levels of the OT with respect to ambient/adjoining areas
- Validation of HEPA filters by appropriate testes like DOP (dispersed oil particulate)/POA (poly alpha olefin) to be repeated after 6 months.

Preventive maintenance of the system: It is recommended that periodic preventive maintenance be carried out in terms of cleaning of pre filters, microvee at the interval of 15 days. Preventive maintenance of all the



parts of AHU is carried out as per manufacturer recommendations.

#### Modular OT

A modular operation theatre is a framework made up of steel or timber with joint less sterile coating manufactured in a factory setup. The customized framed module can be delivered and installed at the required site(5).

Benefits of modular operating theatres:

One major advantage of the modular solution is that it is brought to the site in ideal condition and defect-free state. If it does not meet required standards, it can be rectified by the manufacturer according to the need. Being pre-formed in the factory gives an opportunity for innovation in the design, with sealed finishes that are easy to clean and aid rapid decontamination.

The modular operating theatres have certain benefits over conventional operating theatre

- Improved Health & Safety
- Minimal Site Disruption and noise
- No Compromise On Quality associated with bouncy floors, Cavities, Sharp Edges
- Highly Customizable- no restrictions regarding layout, internal appearance and external treatments
- Sustainability- These are more energy efficient, environmentally friendly and deliver a rust and maintenance free system with longer service life

The quality control is easier as construction takes place in a factory environment. It is less weather-dependent; therefore chances of delay are less.

The following are the differences between modular and conventional built operation theatres:-

In performance, quality and functionality there are no differences between modular surgical facilities and those built conventionally. Both are subject to the same standards and regulations. However there are differences in the processes for a modular build that planners and designers have to take that into account. Project specifications and acceptance tests should be defined early to ensure that quality standards are met.

#### Planning and Design Considerations in Modular OT

While choosing the material for modular OT, one should choose carefully as for long life steel frame may be more suitable than a timber frame. Designers should take into account the best practices followed worldwide while

planning the modular OT. For use of any specific equipment required, structural design should be planned accordingly.

General considerations for planning a modular OT:

It is very important to choose materials carefully when designing for long life and flexibility of the theatre. It is pertinent to specify the life expectancy of the OT in the early stage of planning. The choice of frame: steel or timber will affect durability. The roofing options should be well considered and floor design should be chemical resistant. There must be provision of laminar flow/HEPA filters.

#### Equipment in OT:

Control panel: There should be a provision of control panel for modular OT. It can be a touch panel or can be provided on a membrane type, microcontroller based electronic control mounted in the theatre wall panel. The Control panel can be customized. (Picture 1)



**Picture :1**

Scrub Stations: Surgical Scrub sink is designed for use in modular OT providing surgeons with a convenient sink for pre OT Scrub up. It can be made of high grade stainless steel and seamless welded construction, polished to a satin finish. It can have infrared sensor, thermostatic mixing valve, foot operated manual operation and soap dispenser.

Other physical facilities:

Doors: Hermetically sealed sliding doors can be provided to maintain sterility and correct air pressure in the room. It requires less space than hinged doors.

Ceiling Pendant System: The pendant consists of a ceiling support, upon which a wide section of arms can be mounted.

Types:

- Dual Arm Pendant
- Swivel Type rotating pendant
- Single arm Pendant

It has the greatest advantage to accommodate all medical gas, electrical services, data communication services.

Lights: A modular OT can have high quality shadow less lights to inbuilt wide range OT camera system which can be useful for communicative TV solutions for documentation, teaching and consultation.

Modular OT provides some definite benefits in terms of:

- Reduced Construction Duration
- Cost-Saving Construction
- Safer Method Of Construction
- Highly Customizable Construction & Longer Sustainability Option
- It also has lesser impact on the environment and surroundings

Assessors checklist during NABH audit

1. To check the temperature, humidity inside the OT
2. The differential pressure inside and outside the OT
3. Maintenance record of AHU and filter cleaning frequency
4. Last HEPA filtration report and HEPA validation report
5. Is air conditioning done through split AC or AHU.

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## Ophthalmic Anaesthesia - Equipment & Care

Dr Veena Borse  
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### Introduction :-

The majority of ophthalmic procedures are now performed in day care centres and the use of local anaesthesia is widespread. *Most of the cataract surgeries are done under topical anaesthesia.*

Many patients however may need sedation and a small percentage may need general anaesthesia. All techniques have specific risks and benefits. Hence, a well-equipped operation theatre is always beneficial. Decisions regarding the type of anaesthesia should be made individually for each patient and each procedure.

The discipline of ophthalmic surgery encompasses the following areas: intraocular surgery, extraocular surgery, oculoplastic surgery, naso-lacrimal surgery and orbital surgery. Ophthalmic surgery is undertaken in a wide variety of different settings, including multispecialty general hospitals, isolated units and large, single-specialty centres.

The ophthalmic anaesthetist has a key role in the organisation and management of the pre-operative assessment of patients; the administration of local anaesthesia, sedation or general anaesthesia; the monitoring, prevention and management of adverse events; and efficient service delivery. Today, ophthalmic anaesthesia is a sub-specialty of anaesthesia and the anaesthesiologist deals with a wide range of patients, from neonates to the very elderly. Close team work with the ophthalmologist is therefore essential. Multi-professional teamwork is the key to safe surgery and is essential to every stage of the process. Ophthalmic surgery is thus a joint venture between the anaesthesiologist, surgeon, nurse and technical staff. Ophthalmic surgery is often required for ocular manifestations of systemic disease, and patients exhibit a high incidence of co-morbidity and uncommon medical conditions.

### Pre-operative assessment :-

Ophthalmic pre-operative assessment clinics are essential in optimising and preparing patients for surgery.

Patients having ophthalmic surgery should undergo pre-operative preparation, where there is the opportunity to assess medical fitness and impart information about the procedure. The pre-operative assessment should preferably be done by the anaesthesiologist. This should not be a problem in multispecialty general hospitals and in large ophthalmic centres. But even in small centres, this can be done by careful planning and coordination between the surgeon and the anaesthesiologist.

Preoperative assessment is very important because it gives us information about pre-existing diseases and medications which the patient is taking. This is very important in case of anticoagulants which may need to be discontinued a few days prior to surgery especially when a regional block has been planned.

*Recently one of the ophthalmic centres where I work had posted a young male for Vitrectomy surgery. He had travelled all the way from another city for the surgery. On preop evaluation however I learnt that he was on Warfarin following a Mitral Valve replacement surgery. The surgery had to be rescheduled until his INR came down by shifting him to subcutaneous Clexane. If there was no anaesthesia evaluation, this would have been a catastrophic surgery*

Also in case of diabetics, it gives us an idea about blood sugar control and if any intervention by a diabetologist is required.

Pre-operative assessment also gives us an opportunity to explain the anaesthetic technique and surgery to the patient and also to allay any anxiety that the patient may

have. In case of patients with claustrophobia, spine problems or if a patient cannot lie down flat for a prolonged period, a preoperative assessment helps us to plan the surgery in advance and there are no surprises on the day of the surgery.

A pre-operative checklist is very useful before the patient enters the operation theatre. This must include the patient's name, accompanying relative, NBM period, whether investigations have been done, confirmation of eye to be operated, consent of patient and whether local anaesthetic drops and dilating drops have been instilled. Each setup can make their own individual checklist according to their working patterns.

#### Equipment, services and facilities :-

Whatever may be the case, it is very important that all ophthalmic surgery performed under LA should be carried out in a facility which is appropriately equipped and staffed for advanced resuscitation.

*This is especially needed since most of the patients in ophthalmology are in the geriatric age group or in case of vitreo retinal surgery they may have associated co morbidities.*

*Any undesirable event or death is not ever expected or accepted by the establishment / the patients relatives. Hence it is mandatory that the centre is well equipped to deal with any emergencies. In the present scenario the medical community is constantly under public lens, hence this has now become a necessity.*

The mandatory equipments for an ophthalmic operation theatre I feel are:

- Anaesthesia Machine with adequate O2 cylinders
- Cardiac Monitor for safe conduct of surgery / anaesthesia
- Suction Machine
- A defibrillator
- Crash Cart with emergency medicines
- Standardised resuscitation equipment

The most frequently asked question is whether to buy a basic Anaesthesia machine or a higher end one like the Dragger.

The basic anaesthesia machine is not good for general anaesthesia. It uses halothane which gives a very deep sedation. Such cases need a close monitoring by trained personnel.

The modern day ophthalmic set up is basically a day care facility. For faster recovery from general anaesthesia we need to have machines with vaporisers for sevoflurane or higher gases.

Hence, if a facility has regular paediatric or general anaesthesia cases then anaesthesia machines with these vaporisers have to be procured.

The equipments however should be maintained and serviced regularly.

All emergency drugs and equipment should be readily available to deal with emergencies such as cardiac arrest, respiratory arrest, anaphylaxis, local anaesthesia toxicity etc.

*This is often found lacking in many centres akin to a disuse atrophy.*

Many ophthalmic centres have suffered major avoidable catastrophes due to the inadequate life saving equipments or equipments which lie unserved.

The other areas found wanting are:

#### 1) Inadequate training given to staff to deal with emergencies:

In many ophthalmic centres which are usually managed by optometrist and partly trained nurses, a smooth response to emergencies is lacking. In many centres a simple fall also creates panic.

Therefore all medical and non-medical personnel should be trained in basic life support as majority of the patients are elderly and with co morbidities. A protocol should be in place in case of a crisis. All ophthalmic units should have formal policy for dealing with medical emergencies should they occur.

Ophthalmologists themselves are isolated from systemic emergencies for many years of their practice. A sustained effort in the form of standard resuscitation courses should be conducted for ophthalmologists.

Keeping such courses in the annual ophthalmic conferences maybe a good idea to start with.

#### 2) Inadequate / Improper storage of emergency medicines:

Storage arrangements should be such that there is prompt access to them if clinically required. The storage should maintain integrity of the medicines and compliance with safe and secure storage of medicines regulations should be ensured.

These medicines should also be regularly checked for expiry dates.

### 3) Ophthalmic OT tables with lack of head low facility:

Many fancy new ophthalmic OT tables lack the basics needed for emergency management. They are extremely good for ophthalmologist but do not have basic facilities for emergencies.

For example it is very important that the operating table should be able to tilt down at the head end. This is especially if a case is going to be performed under general anaesthesia.

4) Lack of Access to Secure Intravenous lines: With the equipment needed for surgeries like VR surgeries increasing, the space available for anaesthetist to work is decreasing. Remember: the anaesthetist also works in the same regional area as the ophthalmologist ....the head end. Also once all machinery is set and the patient is draped, it is very difficult to access the patient. Hence, intravenous access should be established prior to performing sharp needle blocks and for any patient deemed to be high risk due to severe co-morbidity. No local anaesthetic technique is entirely safe.

### 5) Lack of Paediatric equipment:

Where paediatric ophthalmic surgery is performed, appropriate paediatric anaesthetic equipment and monitoring should be available. This should be checked regularly.

Remember ..adult anaesthesia and monitoring devices do not work for paediatrics. Also postoperative monitoring and care is very important in paediatric cases.

Paediatric surgeries hence need to be performed with extreme caution, only when the centre is fully equipped for it.

### Conclusion:

All modes of ophthalmic local anaesthesia may result in complications. Practitioners should be fully aware of these risks and ensure that they know how to avoid and recognise complications, and also be able to safely and effectively manage problems when they do occur.

Most ophthalmic procedures can be safely performed using local anaesthesia only, but some patients may benefit from strategies to reduce anxiety such as hand holding, verbal reassurance, adjustment to drapes, and administration of anxiolytic or sedative agents.

No LA technique is totally free of the risk of serious systemic adverse events which may occur irrespective of the choice of surgery or anaesthetic technique. Contributing factors include pre-existing medical conditions, anxiety, and pain or stress reactions to the operation.

The anaesthesiologist has an important role to play. The anaesthetist should be aware of all the non-surgical factors that promote the smooth running of the ophthalmic operating list. Their role ranges from leading pre-operative assessment to administering the local anaesthetic, sedation, general anaesthesia, intravenous antibiotics, steroids, intraocular pressure reducing medication, as well as monitoring, prevention and management of adverse events should they occur.

All emergency drugs should be readily available on the anaesthesia trolley. This is especially important in case of an oculo-cardiac reflex when sudden bradycardia or in some instances, asystole may even occur.

In centres where surgeries are done under general anaesthesia, an important necessity is a well-functioning suction machine, which is usually ignored.

It is also important to have a tie up with a hospital nearby, to shift a patient there in case of emergencies.

In the present era, ophthalmic practice needs high investment. Many a times the anaesthetic equipment mentioned above are sacrificed in a cost cutting exercise.

However one must keep in mind the consequences of an untoward incident.

Lack of proper anaesthesia & resuscitation equipment can be counted as negligence.

Hence the dictum should be..Be equipped, be prepared and be safe.

*Welcome to*

# VRSI - 2018

Pre-conference RISHI-3 (limited slots; on first come basis) on 29<sup>th</sup> Nov 2018 at Le Meridian Spa & Resort, Jaipur

Main Conference: 30<sup>th</sup> Nov -2<sup>nd</sup> Dec 2018 at Marriott Jaipur

## Highlights of Scientific Sessions

- Symposium by 'The Macula Society'
- Symposium by 'ASRS'
- Symposium by 'The Egyptian Vitreoretina Society'
- Symposium by 'Asia Pacific Society of Ocular Oncology and Pathology'
- Session by " Retnet India'
- Fluorescein Conference
- Challenging cases & Videos
- Roundtables and Panel Discussion
- Workshops on Retinal procedures
- Fellows Forum
- Mentorship for budding Retina Surgeons



**29<sup>th</sup> November - 2<sup>nd</sup> December 2018, Jaipur**



# Invited Faculty



**Pulido S. Jose**  
The Mayo Clinic, USA



**Marc de Smet**  
Laussane, Switzerland



**William F Mieler**  
University of Illinois at Chicago  
USA



**Glen J Jaffe**  
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**Rishi P Singh**  
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**SriniVas Sadda**  
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**Adrian Koh**  
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Singapore



**Kenneth Fong Choong Sian**  
Malasiya



**Gaurav K Shah**  
St. Louis, Missouri  
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**Hany Hamza**  
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**Gemmy Chung**  
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**Kamal Kishore**  
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**Taiji Sakamoto**  
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**Amol Kulkarni**  
Wisconsin Madison  
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**Dilraj Grewal**  
Duke University School of Medicine  
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**Colin S Tan**  
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**Sherif Embabi**  
Egypt

## Choosing the right microscope for VR Surgeons

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Dr. Manisha Agarwal  
Associate Medical Director and Head of Vitreoretina Services  
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Dr. Shalini Singh  
Vitreoretina Consultant  
Dr. Shroff's Charity Eye Hospital, New Delhi

Operating microscope along with fundus viewing system is one of the important factors having an impact on the surgical outcome of vitreoretinal surgeries. Microscopes have evolved over the last few decades from mere zooming scopes into a highly sophisticated electronic device with enhanced optics, intra-operative surgical assistance, high definition video recording with wireless foot switch control and touchscreen customization. [1] Buying a microscope means making a considerable investment and the goal should be to choose the best with all the available latest features as it will be in use for at least a decade and often much longer. The best way to compare different microscopes is by understanding their optics and available features and then taking them for a "test drive" on multiple operating days before making the final decision. While comparing the microscopes, the primary focus should be on the quality of the optics. The image quality perceived by the surgeon depends on the optical resolution, depth of field, light transmission and apochromatism. [2] Additional features may include integrated video and intra-operative optical coherence tomography (i-OCT).

A microscope for performing a vitreoretinal surgery should have the following basic features

- Invertertube
- Continuous/Motorised
- Zoom X-Y Coupling

These basic features are available in vast majority of the microscopes such as- Zeiss – Lumera series and OPMI Visu series (Zeiss), OMS 800 (Topcon), Lieca- 651 and Lieca- M800 series, Allegra 900 and Allegra 90 microscope (Haag Striet), Truglow FS-1 (Appasamy Associates) etc.

We hereby describe in detail a few of the microscopes specially designed for performing vitreoretinal surgeries :- OPMI Lumera 700

This ophthalmic surgical microscope from Zeiss features Stereo Coaxial Illumination technology which makes even fine anatomical details clearly visible. It

features completely apochromatic optics with high light transmission, resulting in maximum image quality for surgery and documentation. The red reflex is high in contrast and stable. For retinal surgeons, the OPMI Lumera 700 (Fig-1) and Resight 700 fundus viewing system allows recognition of every detail of the retina. The microscope can be configured with inverter tube E, which facilitates an upright, ergonomic posture as well as rapid changeover from cataract to vitreoretinal surgery. The Superlux Eye xenon illumination provides a natural colour view while the HaMode filter enables the surgeon to quickly change to a halogen light source. A fully integrated HD video recording system includes a 1080p HD video recorder, which can be operated by the foot control panel or handgrip of the microscope head and customizable touch screen controls. It also includes an integrated assistant microscope that works with no light loss for the main surgeon. It features a zoom function that can work with the main surgical microscope or independently. It also features intraoperative OCT scanning of both posterior and anterior segment which is of great assistance during surgery.



Fig-1. Zeiss Lumera 700

### PROVEO 8

The latest microscope from Lieca promises to deliver excellent optical performance. Featuring a high degree of light transmission, the Optichrome technology allows for low light while still delivering high contrast, high resolution and natural colors. Its Innovative Fusion-Optics technology and CoAx 4 illumination, provide consistent



red reflex and an expanded area in focus, ideal for anterior and posterior segment surgery. Fusion-Optics captures different information from each of the two beam paths, delivering high resolution to the left eye and depth of field to the right eye, the brain merges the two images into a single optimal spatial image. The CoAx 4 illumination uses four individual beam paths from two LED lamps, providing consistent red reflex. The microscope also has pre-program settings for light, focus, and magnification which can be set according to procedure and surgery phase and then can be controlled with just a tap of the footswitch. The Proveo 8 microscope (Fig-2) also allows flexible integration of digital imaging technologies such as IOL guidance, intraoperative OCT and High Definition 2D & 3D recording.



Fig- 2. PROVEO 8 microscope from Leica

#### LuxOR LX3

The state-of-the-art ophthalmic microscope LuxOR LX3 by Alcon (Fig-3) offers an expanded visual field larger and stable red reflex, excellent visual detail, touch screen video control, and customized settings. It contains ILLUMIN-I technology to provide a consistent 6 times larger, high-quality, stable red reflex zone regardless of pupil size, centration, eye tilt or patient movement. There is an increased focal length between the lens and the patient's eye, which gives a greater depth of focus for better visualization, detail and contrast with less focus adjustment. The Q-VUE optical head is a 3D stereo assistant scope with an independent light path that does not reduce light from the surgeon's optical pathway, features an independent magnification changer, and swivels 180 degrees for convenient positioning. AMP technology delivers more light to the surgeon during retinal procedures.



Fig-3. Alcon LuxOR LX3

#### MS-800 OFFISS Operation Microscope from Topcon Medical Systems

TOPCON has developed a state-of-art observation system for vitrectomy procedures that does not require the use of fiber optic illumination. This new concept for vitreous surgery is called "OFFISS" which stands for "Optical Fiber Free Intra Vitreal Surgery System". This helps to eliminate the need for fiber optic illumination and allows the surgeon to use both hands for manipulating surgical instruments during surgery. The surgeon is free to simultaneously use two instruments for a bimanual surgery. The TOPCON OFFISS system (Fig-4) does not require the complicated focusing since the microscope head and the front lens move independently of each other facilitating clear focus in virtually any situation. The image inverter will activate automatically whenever the OFFISS is in use. The front lens can be easily replaced and the new 80D and 120DS front lenses expand the field of view during vitreoretinal surgery. (Fig-5) All front lenses are autoclavable so shorter sterilization time (about 5 min) is required for a more efficient inter-operative time. It has a programmable multi-function footswitch and electromagnetic locks. This is a space-saving design which provides large working area. Easy illumination bulb exchange allows the spare lamp to be immediately rotated into position if the main lamp fails.



Fig-4. TOPCON OFFISS 800

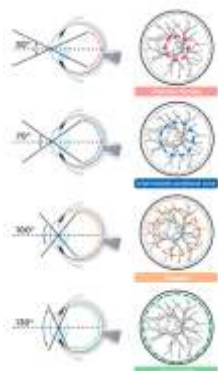


Fig-5. Field of view with different lenses with TOPCON OFFISS

Three different types of illumination angles are available to meet any lighting needs during surgery.(Fig-6) Each mode can be easily selected from the foot switch.

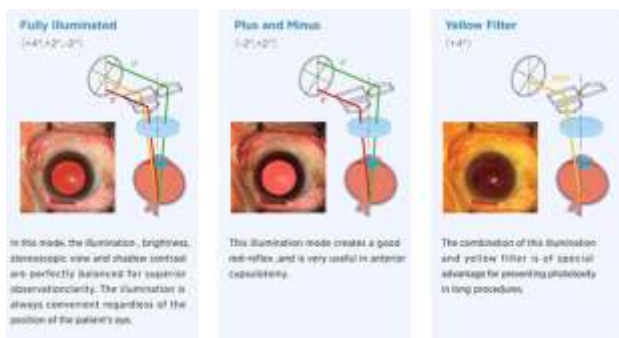


Fig-6. Three different illumination modes of TOPCON OFFISS

**HAAG-STREIT Hi-R NEO 900**

The Hi-R NEO 900 surgical microscope from Haag-Streit (Fig-7) allows superior judgment and treatment with very good depth perception and 3-dimensional vision due to a 25 mm stereo base and red reflex enhancer. The microscope's integrated display gives instant feedback on all important settings. By a single glance one can find information on the positions of focus, zoom, and X-Y coupling, as well as the level of illumination. To maximize the freedom of positioning the microscope, an inclination mechanism has been integrated ranging from -70° to +90°. Fine adjustments can be made in sterile manner during surgery. In the variation HS Hi-R NEO 900A, the microscope is equipped with intraoperative OCT (iOCT). Standard accessories are available like observers, cameras, a recording system, a keratoscope, a motorized slit lamp, a depth-of-field diaphragm and foot switches. It offers the assistant full stereoscopic vision. The assistant scope with its 12.5x oculars has its own magnification changer (5 steps) and focusing device allowing both surgeons independently to select the focal plane and magnification. Due to the large depth of field achieved by the microscope,

focusing procedures are limited to a minimum. It also features Microscope imaging and Operation System. Its prime functions are recording of operation scenes, capturing and recording of snapshots, together with proper identification of patients and hospital data.



Fig-7. Haag-Streit Hi R Neo 900

**BRILLIANT ADVENT FS-9**

The BRILLIANT ADVENT FS-9 surgical microscope from Appasamy Associates is a compact, safe and ergonomically designed surgical microscope for ophthalmic microsurgery. It features specially coated Achromatic high resolution optical system with wide field Eye-piece. The microscope provides smooth five-step magnification changer with Motorized Foot Control & manual over-ride. Its Co-axial LED Illumination gives superior red-reflex which comes with intensity controller. It has noise less Motorized fine focusing mechanism with Foot switch control. The foot switch is multi functional and allows for various controls. The stand is completely balanced ergonomically. It is rust free and has four castor wheels with lock. Green filter, UV filter, heat absorption filter and blue filter are provided for eye protection. Provisions to upgrade the assistant microscope, C-mount Beam-splitter and HD Monitor with Integrated Camera Module are also available.

All the microscopes are comparable in most of the basic functions however may differ slightly in some additional features which may add to surgeons comfort however we need to strike a balance between the cost and these additional features which may not be always required for the majority of the surgeries performed.

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## Choosing the right vitrectomy machine:

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Vitreous surgery has come a long way since 1863, when Von Graefe invaded the sacrosanct vitreous for the first time. Open sky vitrectomy was first described by David Kansner in 1968.

The credit of first modern day vitrectomy goes to Robert Machemer, who in 1972 developed the first single port multifunctional 17 G cutter called VISC (Vitreous Infusion Suction Cutter). VISC



O'Malley & Heintz in 1975 introduced the concept of three port vitrectomy with 20 G cutter.

Almost after 3 decades, the concept of Minimally Invasive Vitreous Surgery (MIVS) was introduced in 2002 by Fuji & Co. But MIVS was popularised by De Juan E in 2003.

With the advent of MIVS, vitreous surgery has become more safe and predictable. This credit goes to the technological innovations besides better understanding of patho anatomy of various retinal disorders.

Today we are spoiled by the number of machines offering this technological platform, with very subtle differences amongst them. So choosing one amongst them is a big challenge.

So let us first understand, what are the basics expectations which a retina surgeon has from the machines:

- 1) Speed – we need a machine with the highest cutting rate, but at the same time safe even when close to the mobile retina.
- 2) Stable chamber (IOP control) - even at the highest vacuum to facilitate faster vitrectomy.
- 3) Illumination - adequate enough even in hazy media to see the minutest details without causing

toxicity to the retinal tissue even at the closest distance.

- 4) Port size – smallest port to facilitate suturless and leak proof closure.
- 5) Multifunctional / Versatile – Phacoemulsification, Fragmentation, Viscous Fluid Injection (VFC) & Endo laser should all be possible on this single platform.
- 6) Up-gradable – any new advancement should be easily possible to be incorporated in the same platform.
- 7) Maintenance free / service support - 24 x 7
- 8) Economic

### Technical features that make difference

Essential :

- 1) Cutter technology
- 2) Chamber stability - Infusion (Fluidics)  
- Vacuum
- 3) Illumination

Others :

- 1) Phaco / fragmotome
- 2) Endo Laser
- 3) Fluid Gas Exchange
- 4) Viscous fluid injection
- 5) Cautery / Diathermy
- 6) Accessories

### VITRECTOMY CUTTER

Vitreous cutters work on the principle of Guillotine.

Spring Based Cutters

- 1) The pump pushes the cutter, while the recoil is

- based on the elasticity / recoil of the spring.
- 2) The efficiency of cutter improves with the cut rate.
- 3) The cutter for most machines are spring based.
- 4) Most of the machines like Stellaris, Geuder, Turbo Vit, Reticare have this technology.



**Limitations:**

As the spring recoil is not in under our control (passive), one can have predominantly closed port at higher vaccum.

**TDC Cutters:**

- Opening of port in cutting shaft also
- Cutting speed 20 – 16,000 cpm
- Excellent in detached retina (Minimal traction).
- DORC Eva has TDC (Twin Duty Cycle) Cutter.



**Limitation:**

- 1) Spring Mechanism
- 2) 92% port open time

**Pneumatic dual drive cutter**

- 1) Pneumatic dual drive – Two air lines controlling movement of cutter
  - Better control
- 2) No Spring - limitations of spring cutter avoided
- 3) Precise control flow - flow rate independent of cut rates and vaccum
- 4) Duty Cycle – Ratio of port open / port closed
 

Three types of duty cycles are:

  - Core : Port biased open
  - 50/50
  - Shave : port biased closed
- 5) Alcon Constellation (Ultravit cutter) has this technology.



**Port Optimization (Constellation)**

- 1) The port is moved close to the tip – allows tissue dissection (Peeling)

- 2) Port area is less least (0.313 mm<sup>2</sup>) – maximize flow efficiency.

**CHAMBER STABILITY:**

Chamber stability is dependent on infusion (flow rate) and aspiration.

**Gravity Dependent Flow Rate.**

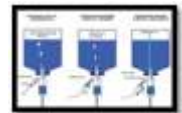
- a) IOP maintained by height of the bottle
- b) Most basic machines have gravity based infusion.

**Vented Air Forced Infusion (AFI)**

- a) Independent air pump - More sensitive and responsive control of intraocular pressure than gravity based.
- b) Rapid pressure changes - 60 to 40 Hg in 0.5 sec
- c) Power failure mode - Preserves existing IOP
- d) Available in Stellaris

**Vacu Flow VTI**

- Precision flow control – precision of 0.1 cc / min
- Pulsation free flow – no rollers induce pulsation of peristaltic system
- Fast vaccum response time:
  - fast vacuum build up (0.3s)
- Available in EVA (DORC)(18)

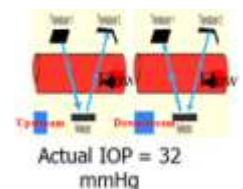


**Limitation of AFI & VTI**

- 1) Flow variations
- 2) No IOP control
- 3) No Low/empty bottle alerts

**Non Invasive Flow Sensor (NIFS)**

- 1) Ultrasonic technology to measure flow non invasively
- 2) Integrated pressurized infusion & IOP control
- 3) Low & bottle empty alert.
- 4) IOP control –
  - a) Stable IOP +/- 2mm Hg



b) Physiological IOP – can operate at low IOP – thereby reducing chances of corneal edema & ischaemic damage to compromised disc.

5) Available with Constellation (Alcon)

**ILLUMINATION**

Light sources available are

- 1) Halogen
- 2) Mercury vapour
- 3) Xenon
- 4) Metal Halide

Halogen: Iodine or Bromine is used as a halogen

Oldest source of illumination

Yellow light

Cheap

Output : 650 nm

Hazard Efficiency : Up to 1920 Lumen's Per hazard watt

Limitations: a) Emits Heat

b) Low illumination

Mercury: Illumination better than halogen

Cold source of light

Available with Stellaris

Output : 400 nm

Hazard Efficiency : Up to 2200 Lumen's/hazard watt

Advantages: Reduced dazzling reflection from retina

Output : 550-580 nm

Xenon: Highest source of illumination

White light

Cold source of light

Available with Constellation, Stellaris

Output : 420 – 700 peak at 450

Hazard Efficiency : Up to 1,913 lumen's / hazard watt

Limitation: A) Cost – 1.2 lakhs

B) Life of bulb – 500 working hours

Metal Halide: Powerful illumination (up to 40 lumen's)

Safe – (No toxic UV / IR wavelengths)

Life of bulb 10000 working hours

Available in EVA (DORC)

Output : 550 – 580 nm

Hazard Efficiency: 1, 343 lumen's / hazard watt.

Dyeless Chromatic Vitrectomy:

Available with Stellaris: Light filters for enhanced visualization

Amber : For core vitrectomy and PVD induction (FAG / BBG 118 times safer than xenon)

Yellow:- Peripheral retina (16 % safer than xenon)

Green:- For visualizing retinal membranes better (as safe as xenon)

Number of light source:

It is preferable to have at least two light source to permit chandelier assisted surgery in necessary cases

*Associated Features – look for the availability of the below mentioned features which need to be compatible to the system.*

a) Fragmatome - Essential for managing dropped nucleus and its fragments. Only DORC has 23 G there by permitting complication of surgery through the 23 G port. The others have only 20 G fragmatome, thereby necessitating creation of one more port which needs to be sutured at the end of the procedure.

b) Phaco: Constellation has torsional (Ozil) type of Phaco.

Rest all the machines have linear type of Phaco.

c) Viscous Fluid Injector - Essential for silicon oil injection / extraction. Higher PSI is needed for injection of more viscous silicon oil eg. 5000 cst. Constellation permits 0-120 psi, Stellaris 0-70 psi & EVA 0.5- 6.0 barsteps.

d) Cautey / Diathermy : Should be bipolar.

Can be linear / proportional

influence your decision.

#### Accessory supports

Vitreous forceps, scissors, cautery, endolasers should be available and compatible with machines one buys. The premium machines have tied up / acquired the supporting companies.

Stellaris : Synergistic / Midlab

DORC : DORC

Constellation : Grieshaber

#### Vitrectomy Packs

The costing of the packs need to be considered as this is significant recurring cost. The Stellaris & EVA have options of standalone / total pack while Constellation only has option of total pack. Also one needs to take in to consideration the increase cost of packs in Stellaris & EVA, which increase significantly in comparison to Constellation as one goes for lower gauges.

#### Service Backup

Being a single platform machine, small problems can lead to shut in all the functions of machines. Therefore a prompt and close service backup is mandatory and needs to be considered while making decision to buy the machines.

#### Cost

Most premium machines are costly and worth more than 40 lakhs.

One can have option of bundling / deferred payment / finance.

The indigenous machines are cheaper and have excellent service support.

#### Machines Options

##### Preimere

- 1) Alcon : Constellation
- 2) DORC : EVA
- 3) B & L : Stellaris
- 4) Geuder : Megatron

##### Indigenous

- 1) Appasamy : Turbo Vit
- 2) Reticare

So whenever we plan to buy a machine, the technical factors of utmost importance to be considered are Cutter technology, Illumination & IOP control. One should also look for maximum associated features.

The cost & service backup are also an important factors to

# Give your patients the

# Accentrix® Advantage



## Unmatched Wealth of Data<sup>1-39</sup>



## Pharmacovigilance



## Disease Education



## Patient Counseling



## Compliance Program



## Insurance Helpdesk

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2. On submission of 3 invoice copies, prescription copy with the patient's name, identity proof, stamped and signed patient diary page  
3. Please note that the 31 Compliance Support Initiative is a limited period offer and may be amended, modified or discontinued at any time.

**ACCENTRIX®**  
**Presentation:** Vial: Ranibizumab, Each vial contains 2.3 mg of ranibizumab in 0.23 mL solution.  
**Indications:** Improvement and maintenance of visual acuity and function and for reduction of vascular leakage and retinal oedema, in patients with neovascular age-related macular degeneration (AMD); the treatment of visual impairment due to diabetic macular edema (DME); the treatment of macular edema following retinal vein occlusion (RVO).  
**Optic treatment of visual impairment due to choroidal neovascularization (CNV) secondary to pathologic myopia (PM):** Dosage and administration: The recommended dose is 0.5 mg (0.05 mL) given as a single intravitreal injection. The interval between two doses injected into the same eye should not be shorter than 1 month. Wet AMD, DME, RVO, PM. Treatment is initiated with one injection per month until maximum visual acuity is achieved and/or there are no signs of disease activity. Thereafter, monitoring and treatment intervals should be determined by the physician and should be based on disease activity as assessed by visual acuity and/or anatomical parameters. Monitoring for disease activity may include clinical examination, functional testing or imaging techniques (e.g. optical coherence tomography or fluorescein angiography). While awaiting the treatment interval, the treatment interval should be extended by two weeks at a time for wet AMD and central RVO, or by one month at a time for DME and branch RVO. Accentrix and laser photocoagulation in DME or in branch RVO (BRVO) Accentrix has been used concomitantly with laser photocoagulation in clinical studies. When given on the same day, Accentrix should be administered at least 30 minutes after laser photocoagulation. Accentrix can be administered in patients who have received previous laser photocoagulation. Accentrix must be administered by a qualified ophthalmologist using aseptic techniques. Broad-spectrum topical microbials and anaesthetics should be administered prior to the injection. Not recommended in children and adolescents. Contraindications: Hypersensitivity to ranibizumab or to any of the excipients; patients with active or suspected ocular or periorbital infections, patients with active intraocular inflammation, Warnings and precautions: Intra-vitreal injections have been associated with endophthalmitis, intraocular inflammation, rhegmatogenous retinal detachment, retinal tear and iatrogenic traumatic cataract. Therefore proper aseptic injection techniques must be used. Patients should be monitored during the week following the injection to permit early treatment if an infection occurs. Transient increases in intraocular pressure (IOP) have been seen within 60 minutes of injection of Accentrix. Sustained IOP increases have also been reported. Intraocular pressure and the perfusion of the optic nerve head must be monitored and managed appropriately. There is a potential risk of arterial thromboembolic events following intravitreal use of VEGF inhibitors. A numerically higher stroke rate was observed in patients treated with ranibizumab 0.5 mg compared to ranibizumab 0.3 mg or control; however, the differences were not statistically significant. Patients with known risk factors for stroke, including history of prior stroke or transient ischaemic attack should be carefully evaluated by their physicians as to whether Accentrix treatment is appropriate and the benefit outweighs the potential risk. Available data do not suggest an increased risk of systemic adverse events with bilateral treatment. As with all therapeutic proteins, there is a potential for immunogenicity with Accentrix. Accentrix has not been studied in patients with active systemic infections or in patients with concurrent eye conditions such as retinal detachment or macular hole. There is limited experience with treatment of patients with prior episodes of RVO and of patients with ischemic branch RVO (BRVO) and central RVO (CRVO). In patients with RVO presenting with clinical signs of irreversible ischemic visual function loss, treatment is not recommended. Should not be used during pregnancy unless the expected benefit outweighs the potential risk to the fetus. For women who wish to become pregnant and have been treated with ranibizumab, it is recommended to wait at least 3 months after the last dose of ranibizumab before conceiving a child. Use of ranibizumab is recommended for women of child-bearing potential. Breast-feeding is not recommended. Following treatment patients may develop transient visual disturbances that may interfere with their ability to drive or use machines. Patients should not drive or use machines as long as these symptoms persist. Interactions: No formal interaction studies have been performed. Adverse drug reactions: Very common (>10%): Intraocular inflammation, vitritis, vitreous detachment, retinal hemorrhage, visual disturbances, eye pain, vitreous floaters, conjunctival hemorrhage, eye irritation, foreign body sensation in eye, lacrimation increased, diplopia, dry eye, ocular hyperaemia, eye pruritus, intraocular pressure increased, nasopharyngitis, headache, asthenia. Common (1 to 10%): retinal degeneration, retinal disorder, retinal detachment, retinal tear, detachment of the retinal pigment epithelium, retinal pigment epithelium tear, visual acuity reduced, vitreous hemorrhage, vitreous disorder, eyelitis, iritis, iridocyclitis, cataract, cataract subcapsular, posterior capsule opacification, punctate keratitis, corneal abrasion, anterior chamber flare, vision blurred, injection site hemorrhage, eye hemorrhage, conjunctivitis, conjunctivitis allergic, eye discharge, photophobia, photophobia, ocular discomfort, eyelid edema, eyelid pain, conjunctival hyperaemia, stroke, influenza, urinary tract infection, anemia, asthenia, cough. Uncommon (1 to 10%): blindness, endophthalmitis, hypopyon, hyphema, keratopathy, iris adhesions, corneal deposits, corneal edema, corneal stain, injection site pain, injection site irritation, abnormal sensation in eye, eye red irritation. Serious adverse events related to intravitreal injection: Puck of Vial

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## Viewing Systems for Vitreoretinal Surgery

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Good visualization of the fundus is crucial for successful vitreoretinal surgery. In order to view the Fundus intraoperatively, it is necessary to compensate the refractive power of Cornea and the Lens to achieve clear image of the Fundus in the Operating Microscope. Therefore, the Fundus Viewing System is necessary. optical principles have been used to design viewing system, which allows uninterrupted view during vitreoretinal surgery. Historically, viewing system originated with hand held irrigating contact lenses and have evolved over a period of three decades to sophisticated wide angle observation system. The first indirect lens to be used for vitreous surgery was the Rodenstock panfundoscope lens and its modification. Continuing research into this area has led to the development of better, more ergonomic and convenient system for intraoperative fundus viewing. There are various viewing system available for use during vitreoretinal surgery.

### Intraoperative Fundus Viewing Systems

Intraoperative Fundus Viewing systems can be divided in Two Categories.

1. Contact Viewing System:- Here the Viewing system touches the Cornea. it includes,

- a. VPFS (Vitreous Panfundoscope)
- b. ROLS (Reinverting Operating Lens System)
- c. CWF (Contact Wide Field System)
- d. AVIS (Advanced Visual Instrument System)

2. Non Contact Viewing System:- Viewing system does not touch the Cornea. it includes,

- a. RESIGHT (ZEISS)
- b. BIOM (OCULUS)
- c. EIBOS
- d. OFFISS (TOPCON)
- e. MERLIN (VOLK)

f. PEYMAN (VESSELS LANDERS)

### 1. Contact Viewing System

a. VPFS (Vitreous Panfundoscope) [Fig 1a]

Here, Meniscus Lens is coupled with a Spherical lens and It Gives Real, Inverted Image. The Field of View is wide and the image is small.

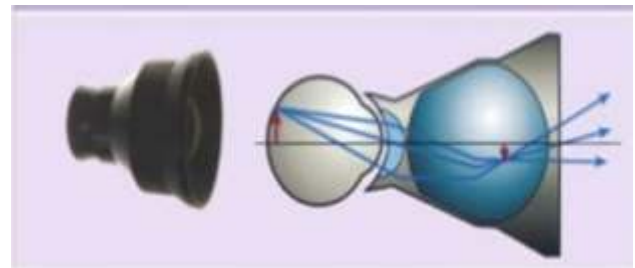


Fig 1 a-VPFS (Vitreous Panfundoscope)

b. ROLS (Reinverting Operating Lens System) [Fig 2a]



Fig 2 a - Reinverter Prism

A unique single-element reinverter prism design presents the fundus image and surgical instrumentation in the eye in an upright and correctly oriented position, and guarantees left/right eye image fusion, high efficiency light transmission and perfect optical "transparency" for an all-in-all better view of the interior of the eye. It has a diode laser safety filter permanently installed.

c. CWF (Contact Wide Field System) [Fig 3a]





Fig 3 a - CWF (Contact Wide Field System) VOLK

it gives high resolution.  
contact wide field lens [Figs 3b]



Fig 3 b -Contact Wide Field Lens (CWF)

It is lighter than VPFS. The Weight is 4 grams. It gives the field of view about 120-130 degrees.it requires an inverting system. There is also an autoclavable panoramic lens.[Fig 3 c]

Autoclavable Panoramic lens (APL)



Fig 3 c - Autoclavable Panoramic lens (APL)

It is an autoclavable wide field lens .It can be held by an handle or standard lens ring ,it requires an inverting system.

d. Advanced Visual Instrument System (AVIS)

It consists of 2 parts, an AVI stereo inverter to invert the image and 2 miniature contact lenses one for 68 degree field of view other for 130 degree field of view.

The major drawback of currently available wide angle contact lens system is that they are bulky and not very stable on the cornea. It is hard to maintain a steady view of the fundus because an assistant must hold the lens precisely on the cornea well centered and coaxial with the

microscope. This makes the surgery cumbersome both for the surgeon and for the assistant ,besides warranting the need for a skilled assistant to hold the lens.

2.Non-Contact Viewing System

a. ZEISS RESIGHT 500/700 [Figs 4a,b]



Figs 4 a-,b Zeiss Resight 500/700

This device is manufactured by Carl Zeiss and is suitable for Zeiss Operating Microscopes. It Gives sharp, clear image of Fundus. Here, quick lens change is possible due to lens turret. Sterilization is easy. It has hands free focusing with wireless foots witch. An automatic image inversion of Image in microscope and Video for RESIGHT 700 used with OPMI Lumera 700.

b.OCULUS BIOM

It is wide angle system, it has many lens options. It requires an Inverter and there is no lens turret.

Binocular Indirect Ophthalmomicroscope (BIOM) [figs 5a,b,c,d]



Figs 5 a- BIOM With Surgical Microscope



Fig 5 b-Disposable unit



Figs 5 c - lenses



Fig 5 d - Binocular Indirect Ophthalmomicroscope (BIOM)

It is an invention of Dr. Spitznagel where he incorporates the principle of indirect ophthalmoscopy in an operating microscope. An SDI is used to invert the image. BIOM can be mounted very fast and shifted into the beam path when required. A wide angle of view 90-110 degrees is possible. It is the most widely used noncontact viewing system.

**Stereoscopic Diagonal Inverter (SDI)**

It is an inverter system incorporated in the operating microscope to reinvert the inverted image. It was invented by Spitznagel and Reiner. It provides a stereoscopic image with good depth of field.

**c. Moller EIBOS (Leica RUV 800)**

It gives the direct image (No Inverter necessary). It's a compact design. Here, the 90 degree and 124 degree lenses are available. [Figs 6 a,b]



Figs 6 a- Moller EIBOS (Leica RUV 800)

**Erect Indirect Ophthalmomicroscope system (EIBOS)**

It is a new non contact wide angle viewing system which

works on the same principle of BIOM however, it has integrated reversing optics so an SDI is not required.

**d. OFFISS (TOPCON)**

It is optical Fiber Free Intravitreal Surgical System. It has easy focusing. Here, the 40 degree and 128 degree lenses are available. It requires Inverter. It is adaptable with Topcon Microscope only. [Figs 7a]



Figs 7 a - OFFISS (TOPCON)

**e. MERLIN (VOLK) [Figs 8a]**



Figs 8 a - MERLIN (VOLK)

Here, the 90 degree and 120 degree lenses are available. It has easy Focussing. It requires Inverter. It has manual focusing only.

**f. PEYMAN (VESSELS LANDERS)**

It has 132 degree Upright Vitrectomy lens. It gives Wide field Upright images (No inverter required). It is mounted on Operation Table. It Can be used with any Operating Microscope. [Fig 9a]



Fig 9 a - PEYMAN (VESSELS LANDERS)

Comparison of Various Non contact Viewing Systems



Zeiss Resight 500/700

- Excellent optics
- Quick Lens change
- Varioscope constant focus
- Easy sterilization
- No inverter required
- When used with Invertube
- Large safety distance



Zeiss Resight 500/700

- Wide angle system
- Many lens options
- Inverter required
- Short safety distance
- Lens requires replacement



Zeiss Resight 500/700

- No inverter requirement
- Compact size
- Short safety distance
- No wide view



TOPCON OFFISS

- Optical fibre free
- Easy focusing
- Requires inverter
- Adaptable only to Topcon microscope



VOLK MERLIN

- Good optics
- easy focusing
- needs inverter



PEYMANN (V & L)

- Wide field images
- No inverter required
- Table mounted

Non-contact fundus viewing with the BIOM

In the early 90s the company OCULUS introduced the BIOM, the Binocular Indirect Ophthalmic Microscope, an attachment to the standard surgical microscope. It quickly gained popularity among retinal surgeons and still today is by far the market leader in non-contact surgical fundus viewing systems.

The BIOM has the following advantages over a contact lens system:

- It can be moved in an out of the field of surgery very quickly.
- It is not necessary to fasten the contact lens to the eye with sutures or for an assistant to hold the contact lens.
- Due to the wide angle, the surgeon has a good overview of anatomic structures.
- It works very well in the extreme periphery, not only due to the wide angle, but also because the surgeon can sit eye to extreme positions.

The BIOM is available for ZEISS, Leica and other leading ophthalmic microscopes.

RESIGHT DESIGN FEATURES [Fig 10 a]

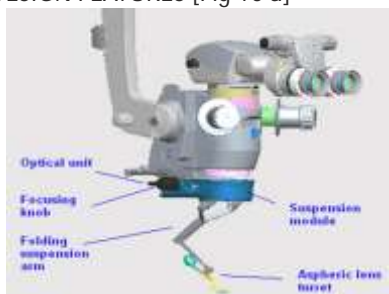


Fig 10 a -RESIGHT DESIGN FEATURES

The ZEISS RESIGHT 500 and 700 represent a new generation of non-contact fundus viewing systems. With a totally new design, RESIGHT features a number of unique advantages over previous systems.

There are currently two aspheric lenses available, a 128 D lens with a viewing angle of XX degrees and a 60 D lens with a viewing angle of XX degrees. The two lenses can be mounted simultaneously on the aspheric lens turret.[Figs 11a ]



Figs 11 a - Aspheric Lenses

INVERTERTUBE[Fig 12a]



Fig 12 a



Fig 12 b

The ZEISS Invertertube was introduced in 2005 as more ergonomic solution in comparison to the SDI [Fig 12b]from Oculus. A new prism system integrated into the binocular tube was developed for inverting the image and exchanging the right and left stereo beam paths.This design has the following advantages:

The height of the microscope is considerably reduced so that the surgeon no longer has to look upwards into the binocular tube. The eyepieces are further away from the vertical axis of the microscope so that the surgeon now can sit in a more comfortable upright position and does not have to lean in to the microscope.

The Invertertube is available in both a manual version and an electrical version (Invertertube) controlled via the foot control panel.

Comparing features between RESIGHT and BIOM

FOCAL LENGTH REDUCTION IN RESIGHT and BIOM

In Resight, Reduction is done in vario-type optics unit,

which is also used to focus the image. The same optics units can be used for all combinations of objective lens and aspheric lens. The optical unit can also be used in conjunction with indirect contact lenses so that the microscope does not have to be repositioned to focus on intermediate image. Whereas, in BIOM Focal length reduction is done with the lens mounted underneath the microscope. Several lenses are available depending on the combination of objective lens and aspheric lens. The reduction lens needs to be sterilised. The reduction system can not be used in conjunction with indirect contact lenses because you can not fold back the aspheric lens separately.

**FOCUSSING IN RESIGHT AND BIOM**

Focusing is done with the vario-type optics of the optics unit. The microscope and the aspheric lens remain stationary while focusing. This does not affect the pupil alignment and so focusing is quicker and more direct. Focusing in BIOM is done by moving the aspheric lens up and down, which changes the pupil alignment, often causing a tunnel view effect. That has to be corrected by moving the microscope up and down.

**STERILIZATION IN RESIGHT AND BIOM**

In more subject to wear. RESIGHT, Only the caps, the suspension module and aspheric lenses needs to be sterilized. And these are the only parts required in multiple for several concurrent sterilization cycles. In Biom, the entire system except for the mounting plate requires sterilization. This includes the reduction optics and the electronics on the motorized version. It becomes very expensive to keep enough equipment for backup and multiple concurrent sterilization cycles. In addition, all sterilizable parts are much

**ASHERIC LENSES IN RESIGHT AND BIOM**

RESIGHT features the unique aspheric turret so that the surgeon can switch between high resolution (narrow angle) and a wide angles lens during the procedure. This is very helpful at different stages of the procedure. In BOM, Only one aspheric lens can mounted at a time. If the surgeon needs to change the field of view, he/she needs to change either the lens completely (which is difficult during the procedure) or use a contact lens.

**SAFETY FUNCTIONS IN RESIGHT AND BIOM**

In RESIGHT, If something causes the patients head to move upwards, for example a malfunction of the electrical headrest, the suspension arm of the microscope can hold all the way back up to the optical unit before damage occurs. There is plenty of time for the surgeon to react. Whereas in Biom, if the patients head moves upwards, the column holding the aspheric lens telescopes into the system only a few centimeters (24 mm[?]). After that the system is rigid, there have been accidents.

**ELECTRICAL FUNCTIONS IN RESIGHT AND BIOM**

RESIGHT 700 together with the invertertube integrate perfectly into the microscope system. Pulling the optical system forward into the position automatically triggers inversion in the invertertube and in trio eye video camera. It also reprograms the foot control panel so that the fundus image can be focused using the focus button on the foot control panel. In Biom, as a third party system, the Biom and the SDI can not be expected to integrate fully into the ZEISS microscope system. Separate power supplies and footpedals are required, and lot of external wiring. According to their website, the new BIOM 4 can automatically trigger the new SDI 4 when it is brought into the position

**FUNDUS IMAGING SYSTEM COMPARISION OF CONTACT AND NON CONTACT SYSTEM**

	SPECIFICATION	CONTACT	NON CONTACT
OPTICS	RESOLUTION	HIGH	MLD
	MAGNIFICATION	HIGH	LOW
	LIGHT TRANSMISSION	HIGH	MLD
HANDLING	HANDLING	NOT SO EASY	EASY
	LENS RING (HOLDER)	NECESSARY	NOT NECESSARY
	XY INVERT	YES	NO
OTHERS	PRICE	LOW	HIGH
	TO BE USED WITH SLIT	YES	NO
	INFECTION	YES	NO

Intraoperative OCT

The use of intraoperative OCT during vitreoretinal surgery provides rapid visualization of the area of interest and our understanding of the tissue alterations that occurs during surgical manipulations, which may impact surgical decision making.

Intraoperative OCT (Not integrated)[Figs 13a]



Figs 13 a -Intraoperative OCT (Not integrated)

Intraoperative OCTs were developed in two stages. In the first stage, the OCT with handheld probe was kept in the OT as a separate instrument and the scan of the eye was taken before, during and after surgery. This requires interruption of the Surgery and scanning of the Eye. Envisu from Bioptigen company was one such OCT. In second stage, the OCTs were integrated in the Operating Microscope, thus giving dynamic scans of the eye without eye surgeons having to look away from Microscope. Carl Zeiss, Haag Streight and Bioptigen companies have launched such Intraoperative OCTs commercially.

Intrasurgical OCTs (Integrated (Figs 14a)

Figs 14a - Intrasurgical OCTs (Integrated)



ZEISS RESCAN 700

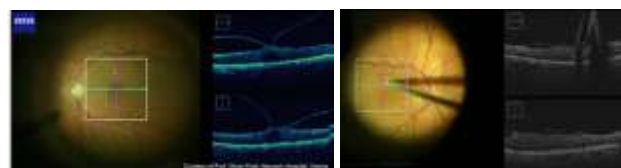


Enfocus (Bioptigen) on Leica



Haag Streight iOCT  
iOCT made by OPMedT

ZEISS RESCAN 700 - Visualization of structures becomes possible. It gives Real-time OCT imaging and real time z-tracking of OCT z-position. OCT scanner is integrated into microscope head.



Traction

Membrane Peeling

There is conventional viewing system also, which includes following lenses and are classified as follows:

DIRECT VIEWING, CONVENTIONAL LENSES (Direct) :-  
Self retaining lenses

- O'Malleys lens
- Machemer lens
- Chalam lenses

Sutured lenses

- Kloti lens
- Tolentino lens
- Wilson lens
- Zinn lens
- Ho lens

Lenses attached to a handle (Assistant held)

- Peyman-Green lens

Prismatic lenses

- Tolentino's HO lens
- Mainster lens
- Chalam 15/30/45 Degrees Prismatic

lenses

High magnification lenses

- Chalam High Mag lens

Irrigating contact lenses

- 45D Irrigating contact lens
- 90D Irrigating contact lens

Air Fluid exchange lenses

- Lander's lens
- Chalam AFX lens
- Chalam Mid Field lens

Miscellaneous

- Air Bubble in anterior chamber in Aphakic eye to visualize retina
- Microscope slide cover slip over Healon as a self retaining contact

lens (Frederman)

Conventional lenses.

They are planoconcave or bi concave lenses. A direct image of the retina is seen so no inverter (for e.g.ROLS,SDI) is required.Only central 20-30 degrees of fundus are seen.

Self retaining lenses

They are so designed that they fit snugly over corneal surface. The need of an assistant is eliminated. However, blood and fluid may deposit over the surface or undersurface of lens making visualization difficult.[Fig 15a]



Fig 15 a -SELF RETAINING LENSES

Sutured lenses

The lenses are placed in a ring which is sutured to the cornea. The centering of these lenses is excellent. However they are rarely used nowadays as they are superseded by self stabilizing or self retaining lenses

Lenses attached to a handle

(Assistant held)

The lens is held over the cornea by an assistant usually over a viscoelastic. A trained assistant is required as too much pressure over cornea will cause hypotony and lens not touching cornea will form an air bubble or fluid meniscus at lens cornea interface hampering visualization.[Fig 15b]



Figs 15 b-Lenses attached to a handle (Assistant held)

Prismatic lenses

They are angulated to enhance visualization of the peripheral retina. They are designed for mid peripheral fundus pathologies and are recommended for tractional retinal detachments (PDR, BRVO etc.) and Rhegmatogenous retinal detachment. Periodic cleaning of lens may be required intra operatively.[Fig 15c]



Figs 15 c - Prismatic lenses

High Magnification lenses

They are specifically designed for internal limiting membrane peeling in macular hole surgery, optic nerve neurotomy, sheathotomy and macular epiretinal membrane removal, traditional macular edema and other situations warranting higher magnification.[Fig 15d]



Figs 15 d –High magnification lenses

**Irrigating contact lenses**

They are held by an assistant with saline constantly washing away the bleeding maintaining a clear view. The fluid meniscus eliminates astigmatism. The fluid meniscus also allows prismatic effects at the edge helping in visualization of the peripheral retina.[Fig 15e]



Figs 15 e -Irrigating contact lenses

**Air Fluid exchange lenses**

In a phakic air filled eye a biconcave lens of about -100 diopters is required to visualize the retina. The image seen is minified but a wider field of view is visible.[Fig 15f]



Figs 15 f - Air Fluid exchange lenses

**Vitreous Panfunduscope System (VPFS)**

It is a modified Rodenstock Pan Fundoscope. It has to be held by an assistant. An inverting system in the microscope is required. The major disadvantage is that its weight is 28 grams which is very heavy as compared to the other lenses.[Fig 15g]



Figs 15 g-(VPFS) Vitreous Panfunduscope System (VPFS)

I when started my practice and residency and fellowship I used Machermer irrigating contact which i modified with viscoelastic as a coupling agent on the cornea. Then i progressed to using Landers contact lens with a limbal ring sutured to stabilise the lens. The first wide angle system i used was the Peymen Landers non contact system attached to the operating table. This gave good view but the assembly was cumbersome. I started using the BIOM at a private hospital and took to it like a fish to water and was with a minimal learning curve. The problem was corneal touch and macular surgery.

I was one of the first person to use the Resight and is extremely easy to assemble and use . The retinal view is excellent as the optics is integrated in the Lumera microscope with the variofocus and inbuilt inverter it is user friendly. The high mag green lens in the turret is great for macular surgery.

So the final choice depends on your budget as these wide angle viewing systems are great but costly ;using even a Machermer irrigating contact lens you can do a perfect retinal surgery with base excision by scleral depression and give great results to your patients.

## OT etiquettes for Staff

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### OT etiquette

One of the typical referrals to a vitreoretinal surgeon is of an isolated case of post cataract surgery endophthalmitis the referring doctor operated on a particular day. The cataract surgeon is flummoxed that it was the 4<sup>th</sup> case in his list of 10 cataract surgeries and this particular case alone had endophthalmitis post-surgery whereas the other cases were absolutely pristine. There are numerous risk factors for endophthalmitis like contaminated instruments, contaminated irrigation fluids, defective sterilization techniques and so on. These factors however, lead to cluster endophthalmitis. This article focusses on the possible reasons for endophthalmitis post-surgery due to breach in operation theatre (OT) etiquette by the OT staff, surgeon or the patient himself. The article discusses examples of patient factors, errors on part of the OT personnel and the common mistakes committed by the surgeon.

**Patient factors-** It is imperative to make sure that the patient has good hygiene. An adnexal examination should be done to look for blepharitis, warts in the area surrounding the eye, blocked nasolacrimal duct etc. (Figure 1). Hair should be washed and facial hair preferably be shaved. Apparently innocuous things like a nose-ring/ pin worn by many women in India can harbor a lot of pathogens and must be removed before surgery. (Figure 2-top left) Women from tribal populations owing to superstitious practices leave their hair untamed and even uncombed for several years. (Figure 2 right) This matted, unkempt hair should be covered entirely when the patient is being taken up for surgery. (Figure 2 bottom left) Older patients tend to have a walking stick that they use to move around. (Figure 3) This walking stick would have travelled with them to toilets as well. OT personnel should be educated about debarring crutches/ walking sticks from the sterile areas of the OT. These patients need to be wheeled in to the OT with a wheelchair/ trolley reserved

only for OT use.



Figure 1 (left) - Boil on the nose of a child. Figure 1 (right) - Wart on the upper lid of an elderly patient



Figure 2 (top left) - A large nose pin that must ideally be removed before surgery. Figure 2 (right)- A tribal woman with long, unkempt hair. Figure 2(bottom left) - The method to cover the mass of hair



Figure 3- An elderly male patient with a walking stick that should not be brought inside the OT



Operating surgeon and assistants-

OT attire- OT attire for the surgeon should preferably be a top/ shirt and pants. The shirts should be half sleeved and above the elbows. The outfit should be well fitted and the shirt tucked at the waist. Loose sleeves, long ill- fitting shirts can touch sterile trollies and cause contamination. OT shoes should be well fitted, cleaned every day and not be worn in the unsterile areas of the OT, let alone outside the OT.

Scrubbing - When one scrubs their hands up to the forearms following the 7 steps of scrubbing with a disinfectant, one usually approaches the scrub nurse for a gown. It is important to keep dripping wet hands away from the trolley. Even if reverse osmosis- treated water is used for scrubbing it is unsterile and these water droplets should not drip on to the sterile trolley and cause contamination. (Figure 4)

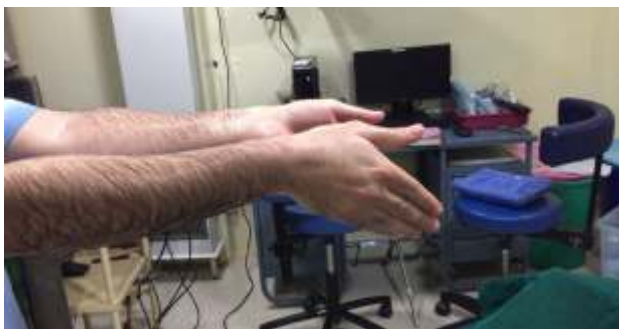


Figure 4- Dripping wet hands held over a sterile trolley causing water droplets to fall on the set.

Gowning- Surgeons must be cognizant of their surroundings while wearing their gown. It is not uncommon for the gown sleeves /string to secure the wrist area, to touch an adjacent wall or unsterile equipment or even an unscrubbed personnel, because of flailing the arms in abandon while wearing a gown. (Figure 5) It is very important to have a clearing of at least 7 feet by 7 feet while wearing one's gown.



Figure 5- Flailing the arms while wearing a gown without checking the immediate environs. Both the sleeve strings are about to make contact with equipment in the OT.

Wearing gloves- Wearing gloves is an art that must be mastered to perfection by all surgeons. Even after scrubbing, bare fingers must not touch the sterile outside

of the glove. (Figure 6)



Figure 6 (left) - Incorrect method of gloving. Bare fingers should not touch the sterile glove. Figure 6 (right) The correct way of donning the first glove, where the sleeve end of the sterile glove is used to pick up the sterile glove.

Sterile Field- A sterile field/ trolley is created by providing a barrier between sterile and non-sterile areas, thereby reducing the risk of cross infection. This is done by ensuring the patient, operating table, and instrument trollies are covered in sterile drapes and that all equipment and instruments are sterile.

All staff operating within the sterile surgical field should have performed a surgical scrub and be wearing sterile gowns and gloves. All movements should be kept to a minimum, opening and closing doors should be kept to a minimum and scrubbed personnel should remain close to the sterile field.

Waiting time for surgeon- In many instances, there is a delay in starting the surgery, because the surgeon is held up in another case or is late in arriving to the OT. A ready trolley lies unexposed for several minutes before the surgery starts. The time between setting a trolley ready and the surgeon arriving has to be minimized, to avoid exposing the trolley and the sterile instruments for a long time. The patient's head may have been draped for a long time and they may fidget around touching the sterile drapes covering them or the sterile trolley with its instruments. (Figure 7) If nobody is manning the station, the surgeon may begin surgery, in blissful ignorance of the events occurring in his absence.



Figure 7- A dramatized version of a patient getting impatient from being covered by the drapes for too long. There was a delay in the surgeon arriving to the OT table and the sterile trolley, nursing staff and the assistant are waiting for the surgeon to arrive.

During surgery- As vitreoretinal surgeons, while doing conventional buckling surgery for example, we often get up from the surgeon's chair to do an indirect ophthalmoscopy examination. It is important for a swiveling chair to be pushed backwards before getting up. If this step is not followed, the rotation of a swivel chair can make the back rest touch the sterile trolley, surgical drapes or even the surgeon's or assistant's gown. While moving around the OT table, it is of utmost importance not to let the back of the gown touch any sterile area.(Figure 8) Another example of an inadvertent touch is when assistants are engrossed in looking at a particular step, there is a possibility of surgical caps touching the sterile knobs of the microscope handles. (Figure 9)



Figure 8- The surgeon trying to make his way in between the trolley and OT table and the back of his gown touching the sterile trolley.



Figure 9- An engrossed assistant unaware that his cap is touching the sterile knob of the microscope

Visitors and Anaesthesia personnel- Anaesthesiologists have the privilege of sitting in on surgeries in varied surgical specialties. The etiquette of different subspecialties may vary. Also, anaesthesiologists may change on any given day. It is important to brief them about etiquette of our own OT. They need to be briefed about keeping their mask on at all times (Figure 10), to not bring their mobile phones inside the OT and keep away from the sterile area.



Figure 10- The anesthesiologist talking to the operating surgeon without his mouth covered by a mask



Figure 13- Nursing orderlies must walk in wide circles around the sterile area.

Relocating OT equipment to accommodate special machines/ instrumentation e.g. those brought for demo may result in crowding of the theatre. This can result in compromise with standard protocols. e.g. the assistant may have to sit too close to the microscope stand and may inadvertently touch an unsterile object.

OT staff – Staff dedicated for the OT should be disciplined, have thorough knowledge about sterilization, disinfection and know their roles in the OT to perfection. They must know which areas in the OT are out-of- bounds and which areas are accessible to them. Carrying mobile phones inside the OT should be forbidden. Unscrubbed OT personnel should know the correct methods of opening sterile packs (Figure 11), helping the scrub nurse in getting syringes loaded with the appropriate drugs and so on. They should walk around the sterile areas in wide circles (Figure 12) and not let their scrubs/loose dresses touch any part of the trolley or sterile equipment. (Figure 13) When vials and ampoules are handed to the scrub nurses, they must ensure that the needle does not touch the rim of the vials. Breaking an ampoule has to be done carefully not allowing any glass particles to enter the ampoule lest the contents get contaminated. While doing so, they must also not be simultaneously carrying a pen or patient papers or any

such extra article in their hands. Both hands should be used to help load syringes. Irrigation bottles and packs must be shaken well to look for any obvious floating contaminants.

OT employees are a distinctive team and are chosen with care based on their discipline and work ethic. They are expected to remain professional, understand their roles in the OT, work as a team at the same time, and maintain a positive environment. They should demonstrate thorough knowledge and familiarity with dealing with fire hazards, sharps management, waste disposal and troubleshooting equipment. They should also be cognizant about infection control measures. A number of soft skills are also part of OT etiquette. Being kind in a setting of OT is very important for all team members because surgery is always a situation of high levels of anxiety for any patient. Talking softly, maintaining one's composure and not being abrasive towards team members is important. Patient anxiety rises if any team member be it a scrub nurse/ floor nurse is being shouted at by the operating surgeon. The patient may then feel someone incompetent is part of the staff or something is not going right during surgery. In fact, OT members are not allowed to even take sharp intakes of breath (indicating surprise or shock) during surgical steps or make "tsk tsk" or tutting noises that may perk up a patient's ears and cause him undue anxiety during surgery. Good etiquette also involves avoiding loud discussions about one's personal issues or making frivolous remarks about anything other than the surgery at hand. Although soft instrumental music/ melodies helps some surgeons, loud blaring music blasting out of an OT door is undesirable. One must always remember that the operating room is akin to a sanctum sanctorum and must be treated like a place of worship. Any breach in etiquette either in following OT protocol or in one's professional behavior can cost heavily to both the surgeon's team and an innocent patient.

It is important not to consider patients as just a 'procedure' for the day but part of a vulnerable population who need the best care possible to decrease any complications related to their surgical procedures.

## " Re-using the disposables in vitreoretinal practice'

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### 1. Introduction

Recently, several cardiology set-ups were indicted by regulatory authorities for reusing catheters and guide wires meant for single use in angioplasty procedures. In vitreoretinal surgery, the cost of consumables is a significant percentage of and consequently drives the patient's surgical package. With some variations, the 'reuse' approach is followed almost universally, from large high volume institutes to smaller private practices, to make vitreoretinal surgery affordable to our population. With the media sensationalizing the issue and government's lens on this practice of hospitals in India to recycle single-use instruments and disposables, it has become important to address this issue scientifically.

### 2. Rationale

The annual per capita income (nominal) of our country in 2017 was \$1850. The package for a vitreoretinal surgery in the US is approximately \$3500-7000, and for this surgery, a single use vitrectomy consumable pack costs between \$250-450. A similar surgery in India costs between \$500-1200, with the pack cost remaining almost the same. A consumable pack constitutes 10% of the package cost in the US, whereas it may make up 25-50% of the surgery package cost in our country, making the procedure unviable for the healthcare provider.

When a surgical set is re-used, the consumables cost comes down significantly. This enables us to provide treatment at affordable costs and gives us leeway in extending the benefit of treatment to socio-economically weaker patients. Re-use also reduces wastage in many cases, e.g. when you need to open a complete pack for a silicone oil removal when a cutter is not necessary. Re-use also reduces the amount of non-biodegradable plastic waste that is generated for each surgery, thereby easing

the burden of pollution and of processing prior to disposal. These lofty ideals would be in vain, however, if re-use practices are unsafe or unscientific and endanger patient safety.

### 3. Components

A typical vitreous surgery includes the use of solid instruments like MIVS trocar-cannula sets, endoilluminators, laser probes and consumables with hollow tubing and cavities, e.g. cassettes, vitrectomy probe and its connecting tubing (Fig 1). Since most of these are recycled for repeat use, it is essential to examine the processing of each separately. Cutting edge degradation and surface sterility are of importance for trocar sets. For laser probes and endoilluminators, surface sterility is paramount. Over few uses (3-5), very little, if any, degradation in fiber optic properties is seen with these, unless the optical fiber is physically damaged. Cassettes and tubings that handle potentially contaminated fluid need to be cleaned thoroughly so that organic matter is not left inside the cavities. These then need to be sterilized with a process that ensures efficient microbial kill on the surface as well as throughout the inner cavity along the complete length of the tubing.



Fig1. From Top, clockwise: 23 gauge single step trocar set form DORC, The Netherlands; 23 gauge single step trocar set from Alcon, USA; 23 gauge high speed TDS cutter from DORC, The Netherlands; Infusion tubing form 23 gauge vitrectomy pack, DORC, The Netherlands

#### 4. Methods

Trocar cannula sets are subjected to enzymatic and ultrasound cleaning to remove all organic material from the surface. They are then dried and packed before being sterilized by ethylene oxide (EO) sterilization as per standard protocol. Endoilluminators, laser probes and diathermy cables are wiped repeatedly with 98% alcohol before drying and packaging for EO sterilization. Cassettes and tubing of vitrectomy probe and other tubings are lavaged with 98% alcohol to inactivate contaminants and dissolve organic matter. They are subsequently lavaged with sterile distilled water. Thorough drying of the cassette and tubings is essential to ensure effectiveness of sterilization and elimination of endotoxin/sterilizing agent residuals. We achieve this by forcing pressurized nitrogen through the tubings to force out fluid, followed by a period of drying prior to packing and EO sterilization. EO is preferred over steam sterilization as most of the instruments are heat sensitive and impervious to steam, limiting its utility for tubings. Besides attention to cleaning, drying and packing, additional attention must be paid to the sterilization procedure. The EO sterilization process at our center is regularly validated with class V EO indicator strips and EO biological indicators (Fig 2).



Fig 2. Chemical indicator strip (left) and Biological indicator vial (right) for EO sterilization process validation.

#### 5. Assessment

To ascertain the microbial safety of instruments processed in the described fashion, we obtained cultures from the surfaces of trocars, endoilluminators, laser probes, cassettes and vitrectomy probes. Furthermore, lavage fluid was obtained from the cassettes, vitrectomy probe and the tubings and subjected to microbiology. Multiple such cultures did not reveal any growth. Since the tubings and cavities could be a source of endotoxin despite being sterile, fluid throughputs from them were subjected to bacterial endotoxin testing (BET) by the Limulus

Amoebocyte Lysate (LAL) test. This test has a detection limit of 0.125U/ml and is used to certify endotoxin safety of solutions meant for parenteral use.

We also designed an experiment to assess degradation of trocar tips on re-use. New 23 gauge trocar tips from DORC (The Netherlands) and Alcon (USA) were photographed on a scanning electron microscope (SEM) (Fig 3). These trocars were then used to make sclerotomies on enucleated goat eyes. The used trocars were then visualized under the SEM. This was repeated to simulate second, third, fourth and fifth use. The electron micrographs were evaluated for edge morphology. A retrospective review of our cases in the last two years was also performed to identify clinical indicators of safety while using reprocessed single use instruments.

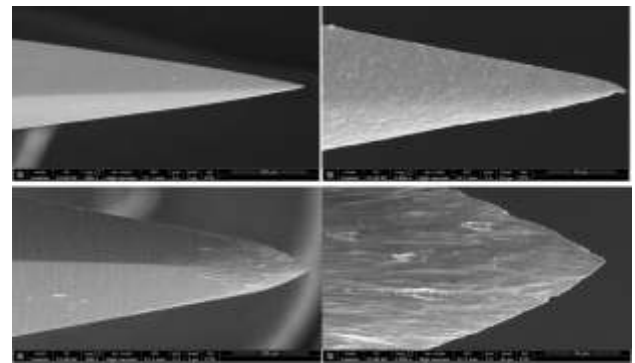


Fig 3. Electron Micrographs of new unused 23 gauge trocar tips at 500x and 3000x. Top panel- Alcon, USA; Bottom panel- DORC, The Netherlands

#### 6. Results

A total of 25 cultures (aerobic and anerobic, each) from instrument surfaces and fluid lavages did not reveal any growth. Endotoxin was not detected in any of the 18 specimens of fluid lavages subjected to BET- LAL testing. Electron microscope imaging of the trocar tips revealed minimum change in morphology for 2-3 uses. There was some degradation and deformation of the trocar tip beyond third use. There was significant distortion in the tip morphology of the trocars used five times to create sclerotomies (Fig 4).

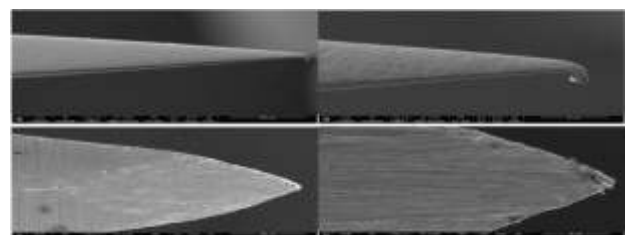


Fig 4. Electron Micrographs of 23 gauge trocar tips after fifth use, at 500x and 3000x. Top panel- Alcon, USA; Bottom panel- DORC, The Netherlands

On' retina cases like macular holes, epiretinal membranes and vitreous hemorrhage were included in the clinical chart review. Out of a total of 126 eyes that underwent 23-gauge surgery for the above indications at our centers during this period, 35 eyes underwent surgery with new instruments whereas the rest underwent surgery with re-processed instruments. There was no difference in the incidence of endophthalmitis, TASS or unusual post-operative inflammation, sclerotomy related breaks or iatrogenic retinal detachments between the two groups. There was a higher need for sutures (OR-2.55) to seal sclerotomies in the re-use group.

## 7. Recommendations and Best practices

Standard and meticulously adhered to protocols of reprocessing can ensure the availability of instruments that are safe for re-use. The performance of most components of a vitrectomy instrument pack does not degrade over 3-4 re-use cycles. Sharp edges of trocars can wear out with repeated use and they may need replacement after 2-3 uses or at the first sign of increased tissue resistance. Continuous monitoring of the reprocessing practices and the sterilization technique is essential to ensure sterility.

In today's era of medico-legal liability, it is a must to include your re-use policy in the surgical consent (Fig 5). Patients must be given the option to go in for surgery with new instrument packs, if they so desire, at the appropriate charges. After counseling, should they choose to allow us to use reprocessed instruments for their procedure, their desire to do so to reduce their costs should be available in writing.

surgery may involve infection, especially a complication known as endophthalmitis. This is called sympathetic ophthalmia. Although this can almost always be treated, in some cases, eyesight may be lost.

12. I have been offered the choice of surgery being done using all new instruments, and I have been told about the higher/additional cost of such a package.

I have been informed that some of the instruments to be used in my surgery are marketed for single use only. However, after first use, they can be used for future surgeries after proper sterilization and if their performance is found adequate. I have been told that such instruments are replaced for new if at any point during surgery, they are found to perform inferiorly. This reuse is being done to lower the cost of surgery without compromising on the result or safety, and is a widely accepted practice. I have been informed, have understood and chosen to have my surgery performed using re-sterilized single use instruments. This is being done at my request to reduce the cost of my treatment.

Fig 5. Paragraph regarding re-use policy from our informed consent. Relevant part is marked depending upon patient's choice.

Though it may be ideal to utilize new sets of consumables for every case, most of us lack such utopian settings. A significant cost reduction can well be achieved without compromising on surgical safety and quality. This can bring down overall surgical costs and increase the affordability of vitreoretinal surgery for the vast majority of our patients.

## How to optimize the Operation theatre utilization

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In any hospital, the operation theatre (OT)(also called operation room) is an integral and vital part. Setting up an OT is a costly process. Running it is also an expensive affair. And the revenue generated from the OT is far higher than the OPD and other procedures. Hence it makes sense to optimize the usage of the OT, in order to get maximum benefit from your investment.

### Wastage of OT time

When does the OT time get wasted ?

- Operations do not start on time
- Operation gets postponed/cancelled
- There is too much time between surgeries
- OT works beyond normal hours
- OT works less than optimal during normal hours

The actual operation is only a part of a larger process as outlined below.

### Pre operative

- Evaluation
- Counseling
- Medical evaluation for fitness
- Admission

### Intra operative

- Preparation of the patient-e.g. Dilatation etc
- Administration of anesthesia- either Local or General

### Post operative

- Accommodation/beds
- Ongoing care and Management

Hence the larger process has to be efficient to make the patient arrive in the OT on time for the surgery !

### Starting the OT on time

Starting the OT on time is one of the most important

practices to run the OT efficiently. While most desirable, this does not happen all the time. The factors that can cause this are listed below.

1. OT not ready !
2. Set not ready !
3. Staff not in
4. IOL not in !!!
5. Some important instrument not available/not working (eg Vitrectomy machine/laser/cryo machine etc )
6. Surgeon not in
7. Anesthetist not in
8. Patient not in !!!!

The following is the check-list for the OT staff

- Get the OT list for the next day- in time !
- Keep all the sets ready
- Check and keep IOLs/Vitrectomy packs, Gas, PFCL oil etc ready
- Make sure that all the instruments are working
- Allocate staff duties

This check list will ensure that the delay in starting the list does not occur due points 1-5 listed above !!

### OT List

The OT List is the single most important document that can ensure smooth functioning of the OT. It is the document that imparts information to all the departments of the hospital. Hence the information in the OT list has to be as comprehensive as possible. The various bits of information that need to be in the OT list are given below.

**Mandatory**

- Patients name, age/Sex
- Eye to be operated
- Diagnosis
- Surgery planned
- Type of anesthesia
- OT specification eg OT 1, OT 2 etc

**Optional**

- MRD no, phone no
- Surgeon +/- assistant, Anesthetist
- Time of admission
- Duration of surgery
- Insurance details
- IOL power
- Special instructions

For optimal use, the list has to be prepared well in advance ! It should be ready at least by the mid day prior to surgery. It should reach the OT in time for procurement of the IOLs, Vitrectomy packs, silicone oil, gas, PFCL, sutures, Buckles, Bands etc. needed for the list.

The list is also important communication tool for the Admission desk, Ward I/C, Insurance desk and the OT counselor. The surgeon and the Anesthetist need to be briefed about the list. Any systemic illness that has a bearing on the surgery and any special concerns need to be discussed with the appropriate team. In our institution, the fellow is entrusted the task of preparing the list and coordinating with various departments.

**Starting the OT on time**

The OT staff needs to be in the OT at least ½ hour before the starting time. This will ensure that the OT is ready for the surgeries.

The patients also need to report in time!! As we promote 'day-care' surgery, patients expect that they can come in 'just before' surgery and get out of the hospital 'soon after' the surgery. Almost all ophthalmic procedures need dilatation of the pupil. The time needed for this needs to be kept in mind.

A useful practice could be Prescribing dilating drops to the patients, to be instilled at home, before they start for the hospital. The downside of this is that indiscriminate use of the drops can increase the blood pressure !

Keeping the co morbidities in mind, it is better to get the patients at least 2-3 hours earlier to optimize the systemic parameters. This will ensure that all the patients are in the hospital well in time!

**Changeover time in the OT**

One of the most important factors in OT time utilization is the 'Turn over time'. This is the time taken to shift the patient whose surgery is over and put the next patient on the table for the next surgery. This could be the most uncontrollable factor contributing to delays in the OT. The ward should be notified as to who is the next patient, so that he can be kept ready. Next, the patient is kept ready to shift while the ongoing surgery is about to finish. The common causes of delay in shifting the next patient are a. Pupil not dilated b. Patient using the rest room c. Patient not in yet!! d. Wrong patient was kept ready.

If the surgery involves giving a local block (and not a 'topical' surgery), then time taken for this needs to be kept in mind. If it is under General Anesthesia, then the time taken to induce etc needs to be kept in mind.

**Block area**

Having a place where local block is administered to the next patient, while the surgeon is finishing one surgery, can reduce the turnover time. But it is desirable to have monitors in this place also to record the vitals of the patient while the block is given. Also, it may not be possible to give some sedation before the block, as the patient may need to walk to the OT table after the block.

**Utilizing the manpower**

When there is lot of surgical load with fewer skilled surgeons with availability of junior surgeons/fellows, then it is a good practice to use the skills of the senior surgeon for the critical steps only. The less critical steps like opening/closing, core vitrectomy, endolaser, silicone oil injection/removal can be delegated to the juniors/fellows. In this set up, having multiple OTs will be a pre requisite. The chief surgeon steps in at an appropriate time, finishes the critical steps and then proceeds to the next OT where another junior surgeon has already completed the initial steps. This way, the number of surgeries that can be accommodated can be increased.

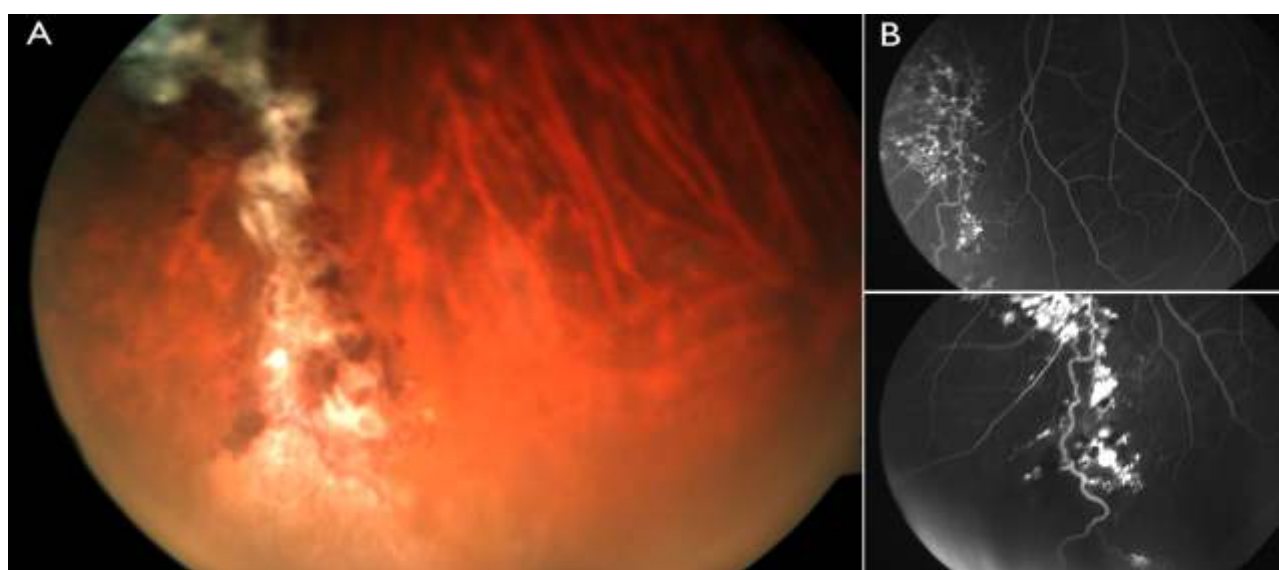
**Conclusion**

OT time is primetime. Proper utilization of the OT time is an important part of good management of any hospital. Proper planning and establishing standard protocols are the key to optimize the use of operation theatre. I hope that the tips given above are helpful in achieving the goal.

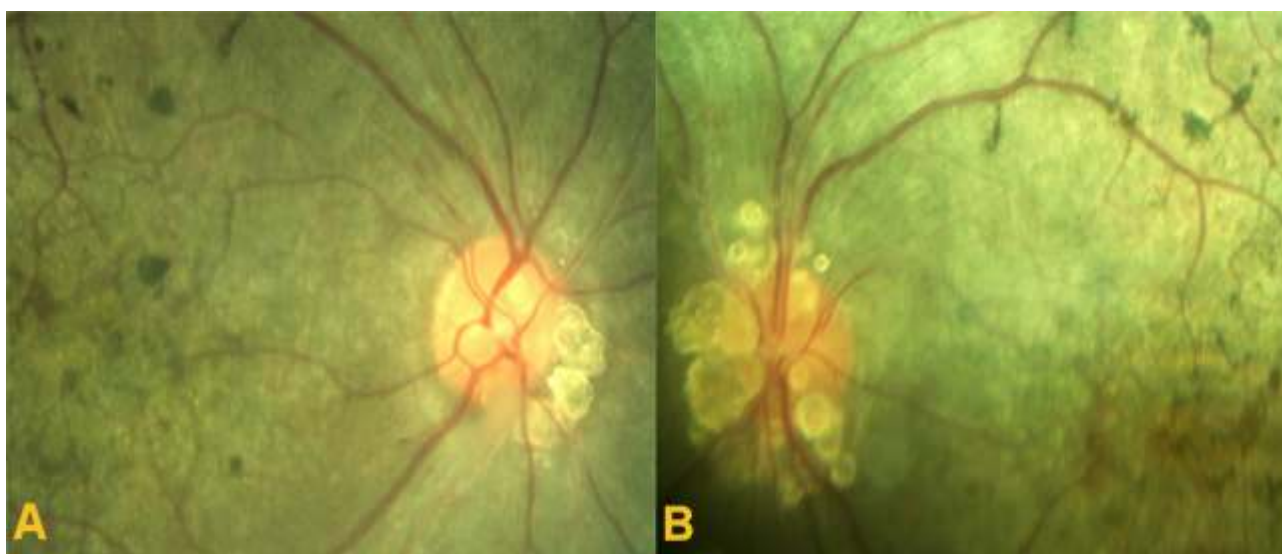


## Images in Retina

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Cavernous hemangioma of the retina in a young female



Astrocytic Hamartoma in a patient with LCA





