Brief Communication

Fire Safety in the Ophthalmic Operating Theatre: A Guide to Safe Oxygen Practices

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Introduction

Fire is ophthalmic operation room (OR) is a rare and serious concern. Fire risk in the OR is often evaluated using a three-point scale, based on the presence of the factors such as surgery above the xiphoid process, delivery of supplemental oxygen and use of an ignition source. Since ophthalmic surgeries fulfill all three criteria, so they are classified as high risk for OR fires. Even though the incidence is often underestimated, OR fires can have serious consequences, including airway injuries, facial burns and equipment damage. There are various risk factors which are responsible for fire in OR and includes oxidizer, ignition source and fuel source.

Oxidizers include oxygen and nitrous oxide which are supplied through nasal canula or mask and are often required by the anaesthesia team. Oxygen under the drapes usually create oxygen enriched zones. Sometimes this oxygen gets trapped beneath drapes around the surgical field.

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High flow oxygen via nasal canula which is above the atmospheric pressure further increases the risk. In all such scenarios even a small spark may trigger the combustion. Various ignition sources such as fiber optic cable, electrosurgery and lasers are required by the ophthalmic surgical team. Electrocautery have found to be responsible for 80-90% of the OR fires. Fiber optic light sources operate at high temperature and sparks from battery operated devices or malfunctioning cords can be responsible for fire in OR.

32% of oculoplastic surgeons reported OR fires in their career.[1] Factors such as use of monopolar electrosurgery and battery powered electrocautery have noted to be the high risk factors for causing fire in OR. Stuchi et al has reported spark with monopolar cautery and supplemented oxygen with mask at 7L/ minute during ptosis surgery resulting in singeing of the left eyebrow hair.[2]

Fernandez N et al reported fire due to an electrocautery spark in a case of bilateral blepharoplasty under local anaesthesia with intravenous sedation supplemented with oxygen via nasal canula at 4L/ minutes under surgical drapes resulting in cosmetic sequelae.[3]

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Lastly, various flammable preparatory solution such as alcohol based skin preparation or petroleum or paraffin based eye lubricants are required by the nursing team. Also drapes, patients clothing and hair can act as a fuel source.

OR team should be aware of fire risk associated with each surgical procedure and should discuss preventive and management strategies before every case. Various preventive guidelines have been suggested by emergency care research institute (ECRI) and anaesthesia patient safety foundation and include oxygen management, ignition source control and fuel control. (Table1)[4,5]

Table1: Steps to prevent operating room fire [4,5]

Oxygen Management	• Discontinuation of traditional open 100% oxygen delivery for procedures around the periorbital area. • Sedated, spontaneously breathing patients with normal oxygen saturation on room air should not receive supplemental oxygen and incase if supplemental oxygen is needed then concentration should be <30% FiO2. • Secure airway with supraglottic device or ET tube, if more FiO2 is required. Head up postures results in oxygen being delivered at a plane below operative field. • Nasal canula with flow rate 2L/ minute over Hudson mask can be considered. Electrocautery should be kept at least 10 cm away from nasal canula when flow rate equal or exceeds 4L/ min. • To manage ignition source, bipolar cautery can be considered over monopolar cautery
Ignition Source Control	• It is important to ensure regular maintenance of electrocautery. • Consider storing of electrocautery device in a safety holder when not in use. • Surgeon must inform anaesthesia team before activating any ignition source which allows them to reduce oxygen flow to safer level. • Fiber optic lights should be turned off when not in use. • Laser should be activated only when the beam is visualized and kept on standby idle.
Fuel Control	• Use of flame-resistant drapes and avoiding petroleum-based ointments can help prevent fire. • Trimming and managing facial hair and lashes before the procedure can help prevent the fire. • Moistening Gauze and towels before use can help control the fire. • Training in the form of regular mock drills and team briefings should be considered. Carryout incident debriefs after every event for collective learning.

One should carryout incident debriefs after every event for collective learning. In case of fire, one should immediately activate the fire response algorithm which comprises 6 steps: 1. Stop ignition 2. Kill oxidizer 3. Remove fuel 4. Extinguish 5. Re-oxygenate 6. Assessment and documentation of incident. Figure 1 illustrates the detailed fire response algorithm.

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Thus, to conclude OR team should never underestimate the risk of low flow oxygen under the drapes to ignite fire. Fire in ophthalmic OR is preventable with vigilance, teamwork, communication and adherence to protocol.

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Conflicts of interest

There are no conflicts of interest.

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