What are the factors that lead to surgical thermal burns in the operation theatre how these can be prevented by adhering to clinical guidelines leading to lower accidents?

Introduction

Surgical thermal burns represent the avoidable injuries that take place during surgical interventions (Rocos and Donaldson, 2012). As per ECRI's latest analysis of case studies, the most common causes of fire in OR (operation room) include Electrosurgical equipments (68%) and Lasers (13%) **(**Van Wey, 2018**).** An O2 rich environment is a major causal factor in 74% of all surgical fire accidents**(**Van Wey, 2018). Some other risk factors for these accidental fire injuries incorporate alcohol-based surgical preparation solutions, electrosurgical devices, and inflammable drapes (Saaiq et al., 2012). Enhanced use of electronic and electrical equipment for electrocauterization poses a higher risk of burns in the operating rooms (Saaiq et al., 2012). Other reasons of surgical burns and fires in the operation rooms are linked to spirit based skin preparation solutions and inflammable anesthetic gases (Tooher Patel et al 2010; Rocos and Donaldson, 2012; Tooher et al 2004). In the present study, a systematic review has been done to find out the risk factors responsible for surgical thermal burns in the operation theatre and various interventions and guidelines which can lower the risk of such accidents.

Research Question:

"What are the factors that lead to surgical thermal burns in the operation theatre how these can be prevented by adhering to clinical guidelines leading to lower accidents?"

Population: Clinical Staff

Intervention: Clinical Guidelines

Comparison: NA

Outcome: Less surgical thermal burn accidents

Background and Relevance

Electrical burns during surgery may result from a high radiofrequency current produced from an electrosurgical unit (ESU) and/or from the direct current from the out of order device. Incompetent handling knowledge of such concerned devices or conditions warrants cautions as such ESUs have been responsible for severe burn injuries and patient mortality (Demir et al 2006) Moreover, inappropriate functioning of such ESU or improper location of the grounding pad are other reasons for electrical burns in the operation theatre. Chemical burns result from skin preparation solutions. The intensity of such burns depends on the concentration and solubility of the chemicals used, toxicity of the solutions, period of contact, preceding condition of the skin and type of contact (Demir et al., 2006). This study will provide an insight into the various risk factors responsible for the surgical burns in operation theatre and preventive measures which need to be followed to reduce the rate of such accidents.

Methodology

Search Plan (write your **search terms**, including synonyms, truncations).			
Population	Intervention/Issue	Comparison (if applicable)	Outcome
Clinical Staff	Clinical Guidelines	na	Less surgical thermal burn accidents
Search Strategy			

The present study followed a review of literature based systematic review guidelines. Moher et al., (2015) provides the guidelines for conducting systematic review. Two databases Medline and CINAHL were used to retrieve the research articles using predefined keywords and the filters.

The following search terms combinations were utilized to retrieve the articles of interest.

- Surgical burns AND operations theatre OR operation room
- Thermal surgical burns AND operation theatre OR operation room
- Prevention AND thermal surgical burns AND operation theatre
- Burns AND operation theatre
- Surgical burns AND during operation
- Burns AND surgical equipments
- Burns AND during operations AND prevention
- Clinical Guidelines AND Prevention AND Burns AND During Operations
- Burns AND Surgical equipments OR Surgical Devices
- Operation Room AND Fire AND Prevention

All of the above mentioned keyword and keyword combinations were used in both databases

Limits applied

Inclusion Criteria:

All the studies published between 2008 to 2018

All full-text articles

All the articles in English were included

All studies based on quantitative or qualitative data were included

Exclusion criteria:

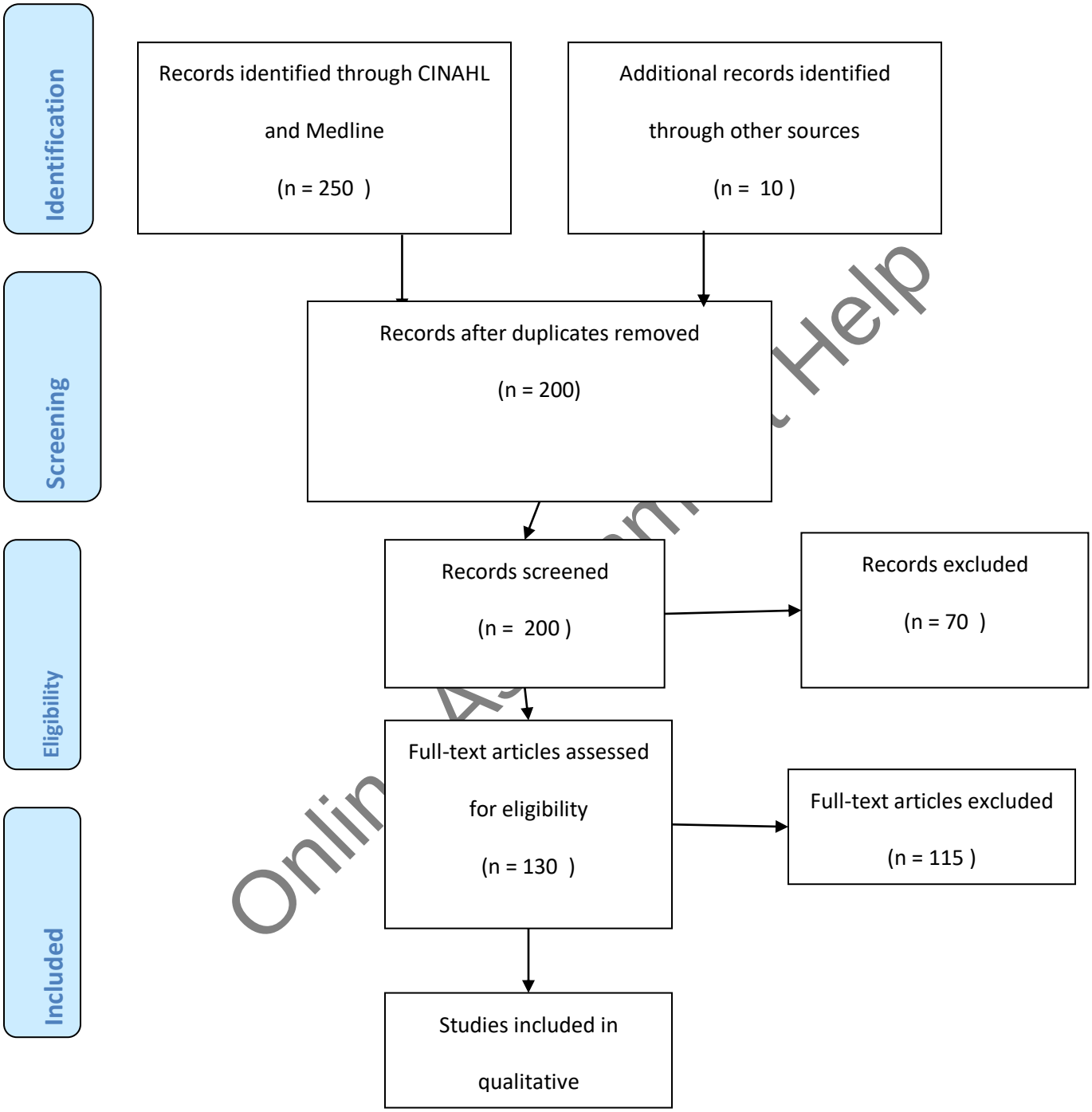
All the articles before published before 2008

Articles published in a language other than English would be excluded

The literature search was performed using predefined keywords in the following databases.

- **Medline**
- **CINAHL**

PRISMA


Identification
Screening
Eligibility
Included
Records identified through CINAHL and Medline (n = 250)
Additional records identified through other sources (n = 10)
Records after duplicates removed (n = 200)
Records screened (n = 200)
Records excluded (n = 70)
Full-text articles assessed for eligibility (n = 130)
Full-text articles excluded (n = 115)
Studies included in qualitative

Literature Analysis

Reference 1	
Reference citation in APA 6th Style	Bae, H. S., Lee, M. Y., & Park, J. U. (2018). Intraoperative burn from a grounding pad of electrosurgical device during breast surgery: A CARE-compliant case report. *Medicine, 97*(1).
20 words describing the main focus of the article	This study is based on the grounding pad linked risks of burns during electro-surgery. Ignorance and /or negligence while handling the grounding pads leads to burn injuries which can be prevented. This case study reports the appropriate management of electrical burns from optimal use of grounding pads during electrosurgery.
Type of study: a quantitative or qualitative study	It is a qualitative case study
A brief description of the study	This study is based on emphasizing the improper use of grounding pad during electrosurgery. Negligence in using the grounding pads was studied in relation to burn injuries.
A brief description of findings	This study emphasises the importance of proper use of grounding pads during electrosurgery as an intervention to prevent the burn injuries.
A brief description of study limitations	This study is based on a case study, based on a single case report explaining the cause of burn injury. Interventions based on the case study were suggested.

Reference 2	
Reference citation in APA 6th Style	VanCleave, A.M., Jones, J.E., McGlothlin, J.D., Saxen, M.A., Sanders, B.J. and Vinson, L.A., (2014). The effect of intraoral suction on oxygen-enriched surgical environments: a mechanism for reducing the risk of surgical fires. *Anesthesia progress*, *61*(4), 155-161.
20 words describing the main focus of the article	This study is based on a mechanical simulation model to study the effect of high-volume intraoral-suction in the context of inhibition of combustion during surgery. This study was based on the hypothesis that using suction one can reduce the oxygen-enriched setting to hinder if not reduce combustion completely
Type of study: a quantitative or qualitative study	This a quantitative study case on case and control groups.
Brief description of study	This is a trial based study where the effect of suction was studied on reducing the oxygen-enriched environment and its impact on decreasing fire rate.
Brief description of findings	This study proves that intervention was useful in reducing fire accidents.
Brief description of study limitations	The sample size was small.

Reference 3	
Reference citation in APA 6th Style	Roy, S., & Smith, L. P. (2015). Surgical fires in laser laryngeal surgery: are we safe enough?. *Otolaryngology--Head and Neck Surgery*, *152*(1), 67-72.
20 words describing the main focus of the article	Larynx laser surgery is a risky one for the causing operation room fire. *I*n this study, the efficacy of laser safe" tubes has been sought with the help of mechanical model trials.
Type of study: a quantitative or qualitative study	A quantitative study based on the mechanical model.
Brief description of study	These mechanical model based trials were done to test the efficacy of laser safe"tubes in preventing fires in the operation room.
Brief description of findings	"laser safe" tubes though offer protection against fires, it has been found from this study that it is not fireproof. Involuntary cuff perforation might cause risk of fire in low-level oxygen enriched setting.
Brief description of study limitations	The sample size could be increased.

Reference 4	
Reference citation in APA 6th Style	Maamari, R. N., & Custer, P. L. (2018). Operating room fires in oculoplastic surgery. *Ophthalmic Plastic & Reconstructive Surgery*, *34*(2), 114-122.
20 words describing the main focus of the article	This study was aimed at finding at a frequency, reasons, and probable risks in the operating theatre.
Type of study: a quantitative or qualitative study	Quantitative study
Brief description of study	For this study questionnaire were given to the members of the American Society of Ophthalmic Plastic and Reconstructive Surgery, to collect the information on surgical fires faced by subjects during their careers. Information regarding fire safety, the present practice of oxygen supply and surgical tool practice, and administration of patients from earlier surgical fire incidents was also sought.
Brief description of findings	There were 258 subjects in the study. 32.2% subjects faced at least 1 fire incident during surgery in their careers. Majority of fires happened while tackling the sedation cases with O2 delivery through nasal cannula underneath long curtains entirely covering the head area and while using the battery-operated machine. Skin and hair were fuel sources commonly found, and the majority of the damage was limited to facial hair.

Brief description of study limitations	The study was based on questionnaires. The data could be more reliable and elaborate if interview schedule as a technique was used.

Reference 5

Reference citation in APA 6th Style	Connor, M. A., Menke, A. M., Vrcek, I., & Shore, J. W. (2017). Operating room fires in periocular surgery. *International Ophthalmology*, 1-9.
20 words describing the main focus of the article	This study is based on the survey of ophthalmic plastic and reconstructive surgeons to analyze their experience and viewpoints regarding operation room fires during periocular operations.
Type of study: a quantitative or qualitative study	Quantitative study
Brief description of study	This a quantitative survey conducted on ophthalmic surgeons.
Brief description of findings	168 surgeons contributed in this online survey. about 44% subjects faced at least 1 operation room fire incident. Additional oxygen was given in 88% of such cases. Majority of the surgical fires happened in a hospital's operation room 59 %, and under supervised anesthesia.
Brief description of study limitations	The survey was conducted online.

Reference 6

Reference citation in APA 6th Style	Chee, W. K., & Benumof, J. L. (n.d.). Airway Fire during Tracheostomy Extubation May Be Contraindicated. *Anesthesiology: The Journal of the American Society of Anesthesiologists*, *89*(6), 1576-1578.
20 words describing the main focus of the article	This is a case study of airway fire during tracheotomy, and here author discusses the reasons, precautionary measures and suggest guidelines for the avoidance of such complications.
Type of study: a quantitative or qualitative study	This is a qualitative study based on a case
Brief description of study	This a case report on the fire during tracheostomy.
Brief description of findings	The better supervision of airway fire during tracheostomy surgery was suggested. Better communication and coordination amid the surgical and anesthetic teams, usage of bipolar diathermy as a technique for hemostasis; attaining homeostatic state before trachea surgery; employment of suction all through tracheostomy to get rid of any oxygen and flammable remains.
Brief description of study limitations	This is based on limited evidence.

Reference7.

Reference citation in APA 6th Style	Bisinotto, F.M.B., Dezena, R.A., Martins, L.B., Galvão, M.C., Martins Sobrinho, J. and Calçado, M.S., 2017. Burns related to electrosurgery-Report of two cases. *Revista Brasileira de anesthesiologi*st, *67*(5), pp.527-534.
20 words describing the main focus of the article	In this paper, two cases of burns during electrosurgery has been reported.
Type of study: Qualitative study	It is a report of two cases of burns during electrosurgery.
Brief description of study	This report is related to the burns due to electrocautery. This report suggests that adequate knowledge of electrosurgery, its proper use, safe device choice, constant supervision, and instant inquiry before any reservations can certainly address issues.
Brief description of findings	This study suggests useful interventions for reducing the rate of burns during electrocautery.
Brief description of study limitations	Interventions are based on limited evidence.

Reference 8

Reference citation in APA 6th Style	Goel, L., Murdeshwar, G. and Bharne, S., 2013. Surgical site fire during cesarean section. *Journal of Obstetric Anaesthesia and Critical Care*, *3*(1), p.40.
20 words describing the main focus of the article	TIt is a case report reporting burns during C- the section where where alcohol was used for skin preparation before surgery using electrocautery. Thus this study provides an insight into the risk of alcohol mishandling leading to burns.
Type of study: quantitative or qualitative study.	This is a case report based qualitative study.
Brief description of study	This study suggests the risk factors and interventions prevent burns during electrocautery based operations where alcohol is used for skin preparation before surgery.
Brief description of findings	This case report is relevant in suggesting the importance of caution whilst applying alcohol-based fluid while preparing for operations. Burn injuries can be easily avoided by not permitting the alcohol to gather near the surgery site. Before electrocautery operation, alcohol should be dried.
Brief description of study limitations	Interventions are based on limited evidence.

9.

Reference citation in APA 6th Style	Jalali, S. M., Moradi, M., Khalaj, A., Pazouki, A., Tamannaie, Z., & Ghanbari, S. (2015). Assessment of Electrosurgery Burns in Cardiac Surgery. *Trauma monthly*, *20*(4).
20 words describing the main focus of the article	This study is aimed at evaluating the various factors linked to electrosurgery burns during cardiac surgery.
Type of study: quantitative or qualitative study	This is quantitative case-control study.
Brief description of study	In this study, 150 patients were selected before alterations in the system of the hospitals. These groups were selected in the season f summer after the alterations were used. Both the groups were compared for burn injuries after operations
Brief description of findings	75 subjects from controls and 35 patients from the case group experienced burns. These results were significant.
Brief description of study limitations	This study is based on small sample size.

10.

Reference citation in APA 6th Style	Townsend, N.T., Jones, E.L., Overbey, D., Dunne, B., McHenry, J. and Robinson, T.N., 2017. Single-incision laparoscopic surgery increases the risk of unintentional thermal injury from the monopolar "Bovie" instrument in comparison with traditional laparoscopy. *Surgical Endoscopy*, *31*(8), pp.3146-3151.
20 words describing the main focus of the article	The main aim of this study was to compare and contrast the transfer of energy with traditional TED during SILS.
Type of study: a quantitative or qualitative study	This is a case-control study
Brief description of study	This study aims at comparing the energy transfer during SILS and (TRD).
Brief description of findings	The main findings of the study suggest that SILS improves the energy transfer twice as much as TRD with the use of monopolar equipment.
Brief description of study limitations	This is based on small sample size.

Reference 11

Reference citation in APA 6th Style	Selli, C., Turri, F.M., Gabellieri, C., Manassero, F., De Maria,

	M. and Mogorovich, A., 2014. Delayed-onset ureteral lesions due to thermal energy: An emerging condition. *Archivio Italiano di Urologia e Andrologia*, *86*(2), pp.152-153.
20 words describing the main focus of the article	This is an observational study where cases of ureteral injury as a result of "energy-based surgical devices" are reported during 20 months.
Type of study: quantitative or qualitative study	Qualitative study
Brief description of study	In this study, five cases of ureteral burn injury as a result of ESD have been reported.
Brief description of findings	Based on the findings from the case reports risks of such a procedure and interventions has been suggested.
Brief description of study limitations	The findings are based on limited evidence.

Reference 12.

Reference citation in APA 6th Style	Mehta, S.P., Bhananker, S.M., Posner, K.L. and Domino, K.B., 2013. Operating Room FiresA Closed Claims Analysis. *Anesthesiology: The Journal of the American Society of Anesthesiologists*, *118*(5), pp.1133-1139.
20 words describing the main focus of the article	This study was aimed at assessing the blueprint of injuries and burdens connected with operating room fire accidents, closed negligence cases from the database of American Society of Anesthesiologists Closed Claims.
Type of study: quantitative or qualitative study	It is a quantitative study.
Brief description of study	It's an analytical study of several cases to find out the frequency, causes, and recommendations to fire accidents.
Brief description of findings	Electrocautery-induced fires during supervised anesthesia care were the most widespread cause OR fires claims. Appropriate handling of fire triad that is an oxidizer, fuel, and an ignition source, have a crucial role to prevent fire accidents while using the electrocautery. Continuing education and communication among the staff of the operation room and following the fire prevention guidelines in high-fire-risk dealings can diminish the fire incidents in the operation rooms.
Brief description of study limitations	The data from the secondary source was taken for analysis. There was little scope to verify the facts.

References: 13

Reference citation in APA 6th Style	Sabzi, F., Niazi, M., & Ahmadi, A. (2014). Rare case-series of electrocautery burn following off-pump coronary artery bypass grafting. *Journal of Injury and Violence Research*, *6*(1), 44.
20 words describing the main focus of the article	This study reports the rare cases of burn accidents as a result of electrocautery during "off-pump coronary artery surgery". Here unique mechanisms are explained for the burn.
Type of study: quantitative or qualitative study	It's a qualitative study.
Brief description of study	It's a qualitative case study
Brief description of findings	In this study based on the case, report recommendations are given to prevent such injuries in the future.
Brief description of study limitations	Recommendations are based on limited evidence.

Reference 14

Reference citation in APA 6th Style	Seguridad, S.E.D.N.E., (2018). Surgical burn secondary to the use of alcoholic chlorhexidine. *Revista espanola de anesthesiologist y reanimation*, *65*(3), pp.e1-e3.
20 words describing the main focus of the article	In this case, report patient suffers burn injury as a result of electrocautery surgery after skin preparation using chlorhexidine alcohol.
Type of study: quantitative or qualitative study	A case report which is a qualitative study
Brief description of study	This study reports severe burn injury to a 51-year-old male who encountered severe burn as a result of electrocautery after skin preparation with clorhexidine alcohol. Hence, this study explains the cause of burns in a patient during surgery and suggests interventions which could prevent such incidents.
Brief description of findings	This case report offers the importance of taking caution while using alcohol for skin preparation for surgery using electrocution.
Brief description of study limitations	Limited interventions suggested.

Reference 15.	
Reference citation in APA 6th Style	Chae, S. B., Kim, W. K., Yoo, C. J., & Park, C. W. (2014). Fires and burns occurring in electrocautery after skin preparation with alcohol during neurosurgery. *Journal of Korean Neurosurgical Society*, *55*(4), 230.
20 words describing the main focus of the article	The study is all about analyzing the probable risk factors for the fire accidents in the operation room and seeking interventions which can prevent these accidents.
Type of study: quantitative or qualitative study	This is a qualitative study based on the case study report
Brief description of study	This is a case study focused on analyzing the probable causes of fire accidents in the operation room and suggesting interventions which can be used to prevent such accidents
Brief description of findings	Base on this study fires in the operating room can be due to 1) Alcohol solution not sufficiently dried 2) Alcohol on the cover was not desiccated properly as it was folded before the surgery. 3) Staff and other others in the operation theatre were unaware of risks of fire as a result of improper handling of alcohol as antiseptics 4) Fire extinguisher not installed in the operating room.
Brief description of study	

limitations	This was a case study, so the interventions are proposed on limited data.

Identification of key themes identified in the literature.

Key theme	References that report on theme	Summary of the comments related to the theme identified in the reference
Improper use of alcohol and spirits for skin preparation procedures before operations result in burns and fire accidents.	Chae,Kim, Yoo, & Park., 2014; Seguridad. (2018) Mehta, Bhananker, Posner & Domino (2013) Goel, L., Murdeshwar, G. and Bharne, S. (2013) .	The alcohol mishandling for skin preparation during operations is a major cause of burns and fires in operation rooms. It may lead to fire accidents and severe burns. It may be coupled to electrocautery operations as alcohol pools at some skin sites.
Negligence of staff, incompetency in handling devices, fatigue and shortage of staff (e.g. ESD and electrocautery) in operation theatre. leads to a fire.	Sabzi, F., Niazi, M., & Ahmadi, A. (2014) Jalali, S. M., Moradi, M., Khalaj, A., Pazouki, A., Tamannaie, Z., & Ghanbari, S. (2015) Bisinotto, F.M.B., Dezena, R.A., Martins, L.B., Galvão, M.C.,	This is the major cause of fire accidents and burns injuries among the patients. These issues can easily be tackled with proper training and caution

	Martins Sobrinho, J. and Calçado, M.S. (2017) Chee, W. K., & Benumof, J. L (n.d.) Connor, M. A., Menke, A. M., Vrcek, I., & Shore, J. W. (2017) Maamari, R. N., & Custer, P. L. (2018)	
Technical issues	Townsend, N.T., Jones, E.L., Overbey, D., Dunne, B., McHenry, J. and Robinson, T.N., (2017) Bae, H. S., Lee, M. Y., & Park, J. U. (2018) VanCleave, A.M., Jones, J.E., McGlothlin, J.D., Saxen, M.A., Sanders, B.J. and Vinson, L.A., (2014) Roy, S., & Smith, L. P. (2015)	Some techniques when properly used have a better chance of reducing the risk of fire and burns than others. Several studies are available which such comparable information.

	Maamari, R. N., & Custer, P. L. (2018)	

Findings:

From this systematic review of literature on surgical thermal burns and fire accidents in OR, it can be deduced that most of such accidents occur as a result of negligence, ignorance, unawareness coupled with fatigue as a result of workload (Bisinotto et al., Connor et al., 2017; 2017; Jalali et al., 2015; Martins Sobrinho & Calçado 2017; Maamari & Custer., 2018 Peterson, & Graham 2015; Sabzi & Ahmadi 2014). These type of accidents can easily be prevented as they are the result of human error. Another major cause of such accidents is faulty ESD and electrocautery machinery, which may lead to burns during surgery Bisinotto et al., Connor et al., 2017; 2017; Jalali et al., 2015; Martins Sobrinho & Calçado 2017; Maamari & Custer., 2018 Peterson, & Graham 2015; Sabzi & Ahmadi 2014). Bae et al in (2018).,reported the grounding pad associated risks of burns during electro-surgery. He found that ignorance and negligence while using the grounding pads leads to burn injuries which can be prevented if caution is taken while using them. This case study reported the appropriate management of electrical burns by optimal use of grounding pads electrosurgery. In such cases, it is important to check the functionality of such devices before procedures are conducted using them. In many cases, improper handling of devices due to lack of expertise in using them during was the cause of burns during surgeries (Bisinotto et al. 2017; Jalali et al. 2015; Sabzi & Ahmadi 2014). Inappropriate use of alcohol and spirit based skin prep solutions for skin preparation before surgeries resulted in surgical burns and fire accidents(Chae, Kim & Park 2014; Seguridad 2018; Goel, Murdeshwar, Bharne., 2013; Mehta, Bhananker, Posner & Domino 2013). The alcohol may pool at skin site and in such cases, if electrocautery operations are performed without letting the alcohol dry, it may cause severe burns to the patients (Chae, Kim & Park 2014; Seguridad 2018; Goel, Murdeshwar, Bharne., 2013; Mehta, Bhananker, Posner & Domino 2013). Some techniques when properly used have a better chance of reducing the risk of fire and burns than others. Proper use of technology and comparing them before introducing them for the procedures in OR can reduce many accidents related to burns and fire (Bae, Lee, & Park 2018; Maamari &

Custer 2018; Townsend et al., 2017; Roy & Smith 2015; VanCleave et al., 2014). VanCleave et al in (2014) based on a mechanical simulation model studied the effect of high-volume intraoral-suction in the context of inhibiting combustion in OR. In another study conducted by Roy & Smith in 2015, the risk of OR room fire during larynx laser surgery was assessed. The effectiveness of laser-safe tubes was sought with the help of a mechanical model for this purpose. Such studies are important as they provide insight into the mechanism of devices and their efficacy and risks during surgical procedures. This study was based on the hypothesis that using suction, it is possible to reduce the oxygen-enriched setting to prevent combustion. From this study, it can be seen that surgical thermal burns and fire accidents in the OR are prevalent widely and need an appropriate, timely, harmonized, coordinated and efficient interventions (Seifert, Peterson, & Graham 2015). Adherence to fire guidelines and protocols by preoperative medical staff can help in curbing such accidents to a great extent. The medical staff's caution, expertise in handling devices, and following guidelines habitually can prevent such accidents. Properly handling of fire triad in OR is crucial to prevent many such cases. Thus, caution and proper handling of explosion resource in OR (e.g. ESU equipment and fibre -optic lights), the oxidizers (e.g. supplementary O_2 given at the time of anesthesia), and the fuels (e.g. alcohol-based skin prep solutions) can help in avoiding such accidents (Seifert, Peterson, & Graham 2015).

Limitations

One of the major limitations of the study is that the study is completely based on secondary data as the researcher has collected only peer-reviewed qualitative and quantitative journal articles. This methodological choice has a positive and a negative impact of the findings of the study. The selection of secondary data as a source has provided the researcher with the advantage of authentic and credible data which has made the findings of this study reliable and accurate. However, one of the major limitations of this data source is that new data is not is not introduced in the study as a result of which one may argue that the findings are outdated.

Discussion

Fire accidents in the OR are a serious crisis that needs a timely, synchronized and efficient intervention (Hart, Yajnik, Ashford, Springe & Harvey 2011; Seifert, Peterson, & Graham 2015). Precisely using fire guidelines by preoperative medical staff and their colleagues can reduce such accidents considerably. The medical staff's prompt action can often avoid or remodel the harmful thermal effect of a fire to the patient and to the staff itself. For instance it is possible to control all three aspects of the fire triad by the staff: the explosion resource during operations (e.g. ESU devices and fiberoptic lights), the oxidizers (e.g. OR air, supplementary O2 given throughout anesthesia), and the fuels (e.g. alcohol and spirit based prep solutions) (Hart, Yajnik, Ashford, Springe & Harvey 2011; Seifert, Peterson, & Graham 2015). Moreover many fire accidents in the OR are associated with the use of energy sources (Borie et al., 2018). Majority of these cases are due to the misunderstanding and incompetency regarding the proper handling of these devices by the paramedical and medical staff (Borie et al., 2018). Other causes of such accidents are an administrative choice regarding the technology and safeguarding of such devices (Borie et al., 2018). Proper training to use electrical devices, rehearsing suitable actions through mock drills or simulation models, and responding efficiently is crucial to prepare medical personnel's for such probable situations and provide optimum care (Hart, Yajnik, Ashford, Springe & Harvey, 2011; Seifert, Peterson, & Graham, 2015). To train the staff to tackle such accidents many simulation-based training tools are available. One of these includes the "Virtual Electrosurgical Skill Trainer" which is used to train surgeons for the safe operation of electrosurgery tools in case of open and modestly invasive surgery (Dorozhkin et al., 2017). Some common safety measure can save many fire accidents in the OR (Van Wey., 2018**).** Some such precautions include: Surgical drapes should be used in such a way that O_2 does not build up beneath them or around the region where the cauterizing device will be used. While taking the patient for operation, their body and hair should be covered in water-based jelly to render it non-flammable. Before operations, the medical team should make sure that alcohol and spirit -based inflammable skin prep solutions are dried before the patient is operated. Sponges used around the explosion source should be dampened and O_2 should be put off, if feasible to let it disperse before an ignition source is used. An extra bottle of saline should be kept in the OR to extinguish the fire. This bottle needs to be refilled before the operation.

Conclusion:

In the present systematic review based on standard guidelines, an extensive literature was explored to find out common causes of surgical thermal burns in OR. Many themes emerged from this study which explains the common and most prevalent causes of fire accidents in OR. Based on reported cases many studies provided interventions which can prevent such incidents in the future. This review provides insight into the causes, preventive measures and future interventions which can help in reducing such incidents provide quality care.

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