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ORIGINAL ARTICLE

Effect of Supplemental Oxygen on Risk of Surgical Wound Infection

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ABSTRACT

Background: There is a risk of different complication after the surgery but delaying in wound healing or infection is one of most common risk. Oxidative killing is a process of tissues partial pressure of oxygen throughout the observed values ranges. The main defense against foreign particles in result of surgery is oxidative killing through neutrophils. In a study by Greif et al4 indicated oxygen 80% during the surgery and after 2 hours later of surgery 50% risk get lesser as compared to the patient who had administrated with 30% oxygen.4 Another study proved that chances of risk for infection get increase in patients who were administrated oxygen 11 % as compared to the patients with 25% oxygen administration.5

The current study was conducted to test the hypothesis that supplemental oxygen decreases the risk of post-operative wound infection.

Objective: The objective of the study was to determine the effects of supplemental oxygen on risk of surgical wound infection.

Materials and Methodology: A randomized Clinical Trial- double- blinded was conducted at DHQ hospital, Karachi from March 1, 2011 to October, 31, 2016. A total of 300 subjects with age around 18 to 80 years who underwent elective colorectal surgery and satisfying the inclusion and exclusion criteria were recruited in the study. Non-probability Purposive sampling technique was used to collect the data. Double-blinded technique was used. Blinded investigators diagnosed the wounds infection by following the criteria of centers of disease control and prevention. Patients were randomly allocated in two groups by sealed-envelope method. Baseline assessment was performed on each patient which included patient's medical history, physical examination and Lab tests i.e. complete blood picture and biochemical analysis. Characteristics for patient's baseline and aesthetic treatment were confound factors. 3rd generation antibiotics cephalosporin were administrated 1 to 2 hours before of surgery. Patients of Group 1 received oxygen fraction of inspired oxygen FIO_2 of 30 and group 2 of 80 percent. Randomly chosen concentration flow of oxygen 16l/min was given. Patient was breathing ambient air. Supplemental oxygen was given to maintain the patient's oxygen saturation to 92% that is measured by pulse oximetry. Patient's treatment was slandered with antibiotics and anesthesia administration. For wound evaluation, tools used were National nosocomial infection surveillance scale 6 and Efficacy of infection control,7 Wounds were checked for infection on daily basis by surgeons who were blinded. And wound thought to be infected when they full fill the criteria of Centers for Disease control and prevention standard.

Main outcome measure was surgical site for infection and secondary outcomes were recovery of bowl function, duration of hospital stay, ambulation and ability to absorb the solid food.

Statistical Analysis: Analysis was done on SPSS by applying parametric and non-parametric test according to normality.

Results: Results showed no significant difference in %age Surgical infection site, Daily ASEPSIS value ≥20 at any time (p-value<0.06), Admission in ICU (p-value= 0.74), Bowel function recovery (p-value=0.74), Solid food intake (p-value=0.54), Walking (p-value=0.57), Removal of Staples(0.72), Duration of post-surgery hospitalization(p-value=0.09) of both the groups as p-value >0.05 of all variables.

Practical implication: If we provide pre-operative supplemental oxygen it will be helpful to decrease SSI.

Conclusion: Patients who received supplemental oxygen showed significantly decrease in the risk of wound infection. Hence, Pre-operative supplemental oxygen proved to be an effective intervention to decrease SSI in the patients having rectal or colon surgery.

Keywords: ASEPSIS, Surgical Wound, Infection, Supplemental Oxygen

INTRODUCTION

There is risk different complication after the surgery but delaying in wound healing or infection is one of most common.[1] An extremely common and dangerous perioperative complication is surgical site infection (SSI). Surgical wounds can become infected even with the finest sterile techniques. The major defense against pathogens, oxidative death by neutrophils, needs the availability of molecular oxygen, which is highly dependent on the local tissue oxygen partial pressure. Consequently, tissue oxygenation is adversely correlated with SSI both during and after a few hours following surgery. Increase duration of stay in hospital probably more than 1 week increase the risk of infection.[2]

The main defense against foreign particles in result of surgery is oxidative killing through neutrophils. Oxidative killing is a process of tissues partial pressure of oxygen throughout the observed values ranges. [3]. Tissue oxygenation, demonstrating regional and arterial partial pressure of oxygen (PaO2), the improvement of cardiac output, control of pain, more hydration intake, and carbon dioxide management CO2, as well as epidural anesthesia. Supplemental oxygen boosts wound tissue oxygen in the presence of sufficient tissue perfusion. One trial in patients undergoing colorectal surgery revealed that SSI risk was roughly cut in half when patients were given 80 percent inspired oxygen rather than 30 percent; however, other trials carried out in abdominal surgery patients (colorectal, caesarean section) failed to show any benefit. However, only one study has measured wound tissue oxygen tension and demonstrated that when this is increased by higher supplemental oxygen levels, SSI risk was reduced.[4]

In a study by Greif et al[4] indicated oxygen 80% during the surgery and after 2 hours later of surgery 50% risk get lesser as compared to the patient who had administrated with 30% oxygen.[4]

Anyhow, a current research conducted by Pryor et al [5] proved that chances of risk for infection get increase in patients who were administrated oxygen 11 % as compared to the patients with 25% oxygen administration. Hence, in current studies we determined the hypothesis that supplemental oxygen decrease the risk of post-operative wound infection. Patients who received 4–8 mg of dexamethasone intraoperative showed no statistically significant increase in SSI, according to a retrospective review. According to a sub analysis of the PROXI Trial, perioperative

dexamethasone did not increase 30-day mortality or surgical wound complications (comprised of SSI, anastomotic leak, wound dehiscence, and burst abdomen). While another case-control study did not reveal an elevated risk of SSI with a single dose of dexamethasone (4–8 mg) in gynecological patients, a case-control analysis reported that low-dose dexamethasone increases infection risk. Finally, a retrospective research found no evidence that using 4–12 mg of dexamethasone for PONV treatment in patients undergoing surgery for endometrial cancer increased the incidence of wound complications (cellulitis, superficial SSI, wound separation, and facial dehiscence).[6,7.]

METHODOLGY

STUDY DESIGN: A randomized control study –double blinded.
SETTING: DHQ hospital, Karachi from
DURATION OF STUDY: March 1, 2011 to OCT 31, 2021.
SAMPLE SIZE: 300 SUBJECTS
SAMPLING TECHNIQUE: Purposive sampling- sealed envelope method
DATA COLLECTION PROCEDURE: This randomized control study – double blinded of 300 subjects with age around 18 to 80 years. Patients who underwent elective colorectal surgery in DHQ hospital, Karachi from March 1, 2101 to OCT 31, 2106. Blinded investigators diagnose the wounds infection by following the criteria of centers of disease control and prevention. Patients were not informed about group selection and selection use by seal enveloped method. Characteristics for patients baseline were potential confound factors and aesthetic treatment. 3RD generation antibiotics cephalosporin were administrated 1 to 2 hours before of surgery. Lab tests which include complete blood picture and biochemical analysis were taken. To evaluate the wound infection.[6] following tools were used. Named as National nosocomial infection surveillance scale[7] and Efficacy of infection control, [8] these two scales showed their validation.
INTERVENTION: Patients were selected to oxygen fraction of inspired oxygen FIO2 of 30 to 80 percent. Randomly chosen concentration flow of oxygen 16l/min was given. Patient was breathing ambient air. In spite of supplemental oxygen was given to maintain the patient's oxygen saturation to 92% that is measured by pulse oximetry. Patient's treatment was slandered with antibiotics and anesthesia administration. Prior the surgery, patient's medical history was recorded and physical examination was performed. Wounds were checked for infection on daily basis by surgeons who don't know about the patient s group. And wound thought to be infected when they full fill the criteria of Centers for Disease control and prevention standard. 10 Timeline of administration of antibiotics, debridement of wound and drainage of pus under anesthesia. [3, 8]
STAISTICAL ANALYSIS: Analysis was done on SPSS by applying parametric and non-parametric test according to normality. Main outcome was surgical site for infection and secondary outcomes were recovery of bowl function, duration of hospital stays, ambulation and ability to absorb the solid food.

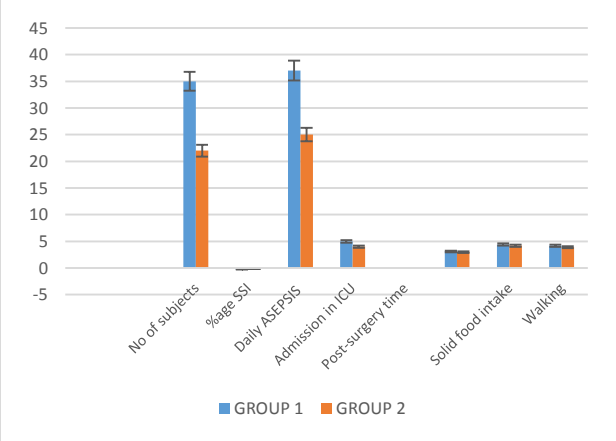
For enter method manipulation of variables in the models was taken, which amplifies the availability of variables of our interest according to specific criteria.

RESULTS

Out of 300 patients, 0 patients were excluded out of the trial because of their lab test values. Now out of 291 patients, 143 subjects were given 30 percent oxygen prior to surgery and 148 were given 80 percent pre-surgery oxygen. Route of administration and time for the first 48 hours was same for both groups. Mean SD of the duration of surgery was 1 hour in subject those were given 30% oxygen and 62 minutes in those patients who were given 80% pre-operative oxygen. There was no significantly variation between the intervention groups in terms of scenery outcomes. 57 (39%) patients had SSI in which 50 subjects had positive culture test for bacteria. 25(24%) patients had SSI in group of 30% FIO2 oxygen and 22 patients (14%) in the group of 80% FIO2 group.

Table 2: Comparison between the variables of group 1 and group 2

Variables	Group 1: 30% FIO2 n= 143	Group 2: 80% FIO2 n= 148	P-value
No of subjects %age Surgical infection site	35 (24%)	22 (14%)	.04
Daily ASEPSIS value ≥20 at any time	37 (25.9)	25 (16.9)	.06
Admission in ICU	5 (3.5)	4 (2.7)	.74
Post-surgery time mean (SD), Bowel function recovery	3.1 (1.7)	3.0 (1.5)	.54
Solid food intake	4.4 (2.0)	4.2 (2.2)	.57
Walking	4.2 (2.6)	3.9 (2.2)	.28
Removal of staples'	10.3 (3.0)	10.4 (3.6)	.72



DISCUSSION

In this RCT of 30% and 80% pre-operative supplemental oxygen, it is indicated that there is significantly reduction in risk of wound infection in 80% group by 39%. Same effect was observed in the study of Grief et al [4]. And he reported that risk of infection is inversely proportional to the supplemental oxygenation. This study result overlap the result of our study. On the other hand research conducted by Pryor et al [5] with 160 subjects reveled that supplemental oxygen increase the risk of wound infection. 7 It can be the cause that in his study the treatment group was not hemogenose.8 or maybe he failed to control the factor which control the risk of infection. [9]

All post-operative wounds contaminated to some extent that can control through use of antibiotics. [10] Another study support the result of our study that pre-supplemental oxygen is effective to decreases the risk of post-operative wound.[11] and it has been observe that smokers have higher risk of wound infection and delaying in wound healing. [12, 13]

Some previous researches 2,5,6 showed that infection usually diagnosed in early stage , but in Grief et al [4] research infectious get detected in the first 10 days pot surgery.[14] In grief et al [4] there is observed relationship between oxygen administrations in smokers as well. In his study he gave supplemental oxygen for 1 hour after smoking the cigarette. [15] however in our case we did not find any increase of risk infection in smokers.There are few limitations in current study. The rate of baseline infection in outpatient were probably more in study of grief et al[4] however infection can depend on multiple factors ,[16] it depends on the procedure 8, anesthesia duration,3 factors for control anesthesia, and temperature of body. Baseline values of current study reported in series. [17, 18]

In the study of Grief et al 6 infection was diagnosed only when the culture was positive, however in our study we used diagnostic criteria according to Centers of disease control and

prevention, because infection can be considered without lab investigation. In our study we considered all following symptoms, inflammation, pus, tenderness, pain, redness and heat. Another limitation of our study can be that we only considered the infection after 15 days of surgery and may we miss the preceding of stages of infection.

CONCLUSION

Patients who received supplemental oxygen showed significantly decrease in the risk of wound infection. Hence, Pre-operative supplemental oxygen proved to be an effective intervention to decrease SSI in the patients having rectal or colon surgery.

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