COMPARISON OF OUTCOMES WITH OR WITHOUT OXYGEN SUPPLEMENTATION IN REGIONAL ANESTHESIA

Megha Pandurang Tajne[1], Shweta Shashikant Aswale[2], Anjali Rakesh Bhure[3], Manish Ram Vinod Singh Kumar[4], Heena Dinesh Pahuja[5], Gopalji Ramesh Gupta[6], Ajay Vasant Watve[7], Apoorva Mahendra Garhwal[8]

[1]Associate Professor, Department of Anaesthesia, NKPSIMS & RC & Lata Mangeshkar Hospital, Digdoh Hills, Hingna Road, Nagpur.
[2]Senior Resident/Tutor, Department of Anaesthesia, NKPSIMS & RC & Lata Mangeshkar Hospital, Digdoh Hills, Hingna Road, Nagpur.
[3]Professor & HOD, Department of Anaesthesia, NKPSIMS & RC & Lata Mangeshkar Hospital, Digdoh Hills, Hingna Road, Nagpur.
[4]Resident, Department of Anaesthesia, NKPSIMS & RC & Lata Mangeshkar Hospital, Digdoh Hills, Hingna Road, Nagpur.
[5]Assistant lecturer, Department of Anaesthesia, NKPSIMS & RC & Lata Mangeshkar Hospital, Digdoh Hills, Hingna Road, Nagpur.
[6]Resident, Department of Anaesthesia, NKPSIMS & RC & Lata Mangeshkar Hospital, Digdoh Hills, Hingna Road, Nagpur.
[7]Senior Resident, Department of Anaesthesia, NKPSIMS & RC & Lata Mangeshkar Hospital, Digdoh Hills, Hingna Road, Nagpur.
[8]Resident, Department of Anaesthesia, NKPSIMS & RC & Lata Mangeshkar Hospital, Digdoh Hills, Hingna Road, Nagpur.

ABSTRACT

BACKGROUND AND OBJECTIVES

Oxygen is routinely supplemented in patients of regional anaesthesia. There are many pros and cons in the use of oxygen supplementation and its real benefit. In our study we tried to find out the effect of oxygen supplementation on the haemodynamic parameters, oxygen saturation, post-operative nausea vomiting and wound healing.

MATERIAL AND METHODS

The study was a prospective randomized controlled trial. Two hundred and forty patients belonging to ASA 1 physical status of either gender, aged 30-65 years were randomly allocated into two equal groups; group O and group N. Group O: Control group in which oxygen was supplemented through Ventimask Group N: Study group in which oxygen was not supplemented. They underwent elective lower abdominal surgery including general surgery, orthopaedics and gynaecological surgeries. Both the groups were compared for haemodynamic parameters, oxygen saturation (SpO_2), post-operative nausea vomiting and surgical site infection.

RESULTS

The mean pulse rate (intra operative) in group O was 83.45±11.82/min. In group N it was 84.01±11.88. The mean systolic blood pressure (intraoperative) in group O was 107.83±13.37/mmHg. In group N it was 106.62±11.03 mmHg. The mean diastolic blood pressure in group O was 72.56±0.51 mmHg and in group N it was 70.75±7.53 mmHg. The mean oxygen saturation in group N was 97.4%±1.09 while in group O it was 99.3%±1.15. There was no statistical significant difference in both the groups for haemodynamic parameters and oxygen saturation (P >0.05). 16 patient had post-operative nausea vomiting in group N while 15 patients in group O. There was no statistical significant difference between the two groups for post-operative nausea vomiting (P>0.05). 12 patients had surgical site infection in group N while the number was 10 in group O. There was on statistical significant difference between the two groups for surgical site infection. (P value was >0.05)

CONCLUSION

There was no statistically significant difference for pulse rate, blood pressure, post-operative nausea vomiting and surgical site infection in between the two groups i.e. with and without oxygen supplementation groups.

KEYWORDS

Oxygen supplementation, Haemodynamic parameters, Oxygen saturation, Postoperative nausea vomiting, Surgical site infection.

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Corresponding Author:
Dr. Megha Tajne,
#10-R, Pioneer Residency Park,
Somalwada Square, Wardha Road, Nagpur-440025.
E-mail: uikeymegha@rediffmail.com, drshwetaaswale@yahoo.com
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INTRODUCTION: Ever since the discovery of oxygen, its value is recognized worldwide. Today not a single anaesthetic procedure is done without the consideration of oxygen supplementation. The usefulness and benefits of oxygen administration remained unchallenged until a few decades ago when our understanding of oxidative stress and oxygen toxicity became more comprehensive and a more balanced application of oxygen therapy was proposed.[1]

Oxygen supplementation during regional anaesthesia has been routinely practiced for many years. But a lot of debate is going on its usefulness.

In our study we tried to find out the effect of oxygen supplementation on haemodynamic parameters, oxygen saturation, post-operative nausea vomiting and surgical site infection.

MATERIAL AND METHODS: Our study was a prospective randomized control trial. The study was conducted after Institutional Ethical Committee approval and informed consent. 240 adult patients belonging to ASA 1 physical status, of age group 30-65 years of either gender were included. Patients undergoing lower abdominal surgeries including general surgery, orthopaedics and gynaecological patients wherein regional anaesthesia was given were selected. Patients whose SpO2 was >95% on room air was one of the inclusion criteria. Patients not accepting facemask or having suffocation sensation with mask were excluded from the study.

Patients were randomly allocated in two equal groups, 120 in each group by computer generated table. Group O in which oxygen on ventimask at the rate of 5 liters/min was supplemented and was continued postoperatively for 2 hours. In group N patients breathed air. Surgeries of orthopaedics, gynaecology and general surgery lasting for one to two hours were included in our study.

In the operation theatre ECG, pulseoximeter, non-invasive blood pressure (B.P.) were attached and baseline pulse rate, blood pressure and SpO2 were obtained. I.V. ringer lactate at the rate of 20 ml/kg/hour was started with a 18 gauge cannula. Out of which 500 ml of ringer lactate was preloaded. Subarachnoid block was achieved at L3-L4 space with 25 g needle and 0.5% bupivacaine (hyperbaric) 4 ml (20 mg) was injected. After the level of T6 was achieved, ventimask with 5 liters/min of oxygen was supplemented to only group O patients. Oxygen was supplemented in group N if saturation went below 92% and they were excluded from the study. Sedation 0.02 mg/kg midazolam iv was given in both the groups.

Haemodynamic parameters like pulse rate, systolic and diastolic blood pressures and SpO_2 were recorded.

The data for haemodynamic parameters and oxygen saturation was statistically analysed by student t test and Chi square test were applied for post-operative nausea vomiting and surgical site infection.

RESULTS: The patients' characteristics are given in Table 1. The two groups are comparable with respect to age, gender, body mass index. (P value >0.05 not statistically significant). The baseline haemodynamic parameters were comparable in both the groups. (P >0.05) i.e. not statistically significant. The mean pulse rate (intra operative) in group O was 83.45±11.82/min. In group N it was 84.01±11.88. Mean pulse rate was found to be less in cases of oxygen supplementation than without oxygen but there was no statistical significance between the two groups (P >0.05). The mean systolic blood pressure (intraoperative) in group O was 107.83±13.37/mmHg. In group N it was 106.62± 11.03 mmHg. There was not much variation of systolic blood pressure intra operatively with or without oxygen supplementation. The mean diastolic blood pressure in group O was 72.56±0.51 mmHg and in group N it was 70.75 ±7.53 mmHg. There was no statistical significant difference between the two groups for blood pressure (P>0.05). The mean oxygen saturation in group N was 97.4%±1.09 while in group O it was 99.3%±1.15. The P value was >0.05 which was statistically not significant. Student t test were applied for statistical analysis of all the haemodynamic parameters and oxygen saturation. 16 patients had post-operative nausea vomiting in group N while 15 patient had postoperative nausea vomiting in group O. The P value was >0.05 which was statistically not significant. 12 patients had surgical site infection in group N while the number was 10 in group O. There was no statistical significant difference between the two groups for surgical site infection (SSI). (P> 0.05). Chi square test were applied for statistical analysis of postoperative nausea vomiting and surgical site infection.

Demographic data	Group N n=120	Group O n=120
Age (Years)	41±10	45.05±11.5
Sex (M: F) ratio	56:64	57:63
Body mass index	23.44±1.34	22.9±1.27

Table 1: Demographic data (data are expressed as mean ± standard deviation for age, sex and body mass index)

Parameters	Group N	Group O	P value
Pulse rate	84.01±11.88	83.45±11.82	> 0.05 NS
Systolic BP	106.62±11.03	107.3±13.37	> 0.05 NS
Diastolic BP	70.75±7.53	72.56±9.51	> 0.05 NS
SpO2	97.4±1.09	99.3±1.15	> 0.05 NS

Table 2: Mean pulse rate, systolic blood pressure, diastolic blood pressure, and oxygen saturation data. (mean± standard deviation)

NS (not significant). Student t test applied.

Nausea vomiting	Group N	Group O	P value
Yes	16(13.34) %	15(12.5) %	>0.05 NS
No	104(86.66) %	105(87.5) %	>0.05 NS

Table 3: Post-operative nausea vomiting data

NS (not significant). Chi square test applied

Surgical site infection	Group N	Group O	P value
Yes	12(10) %	10(7.5) %	>0.05 NS
No	108(90) %	110(92.5) %	>0.05 NS

Table 4: Surgical site infection data

NS (not significant). Chi square test applied.

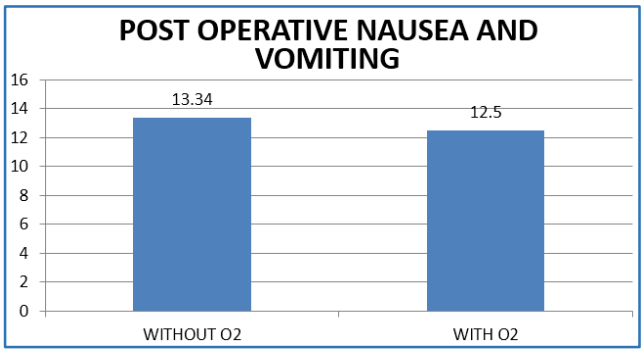

Fig. 1: Comparison of postoperative nausea vomiting in with and without oxygen group

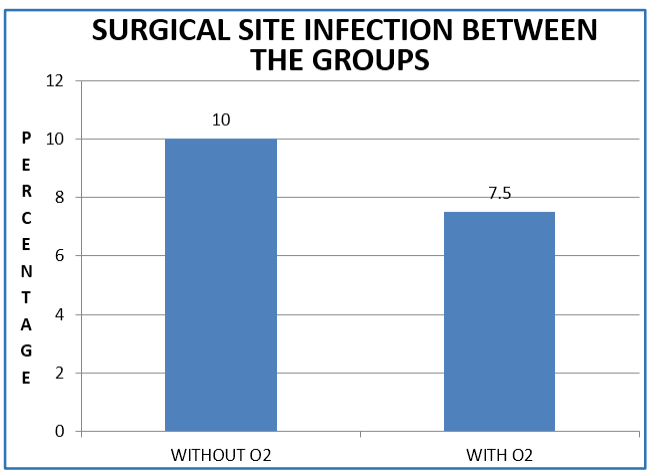

Fig. 2: Comparison of surgical site infection in with and without oxygen group

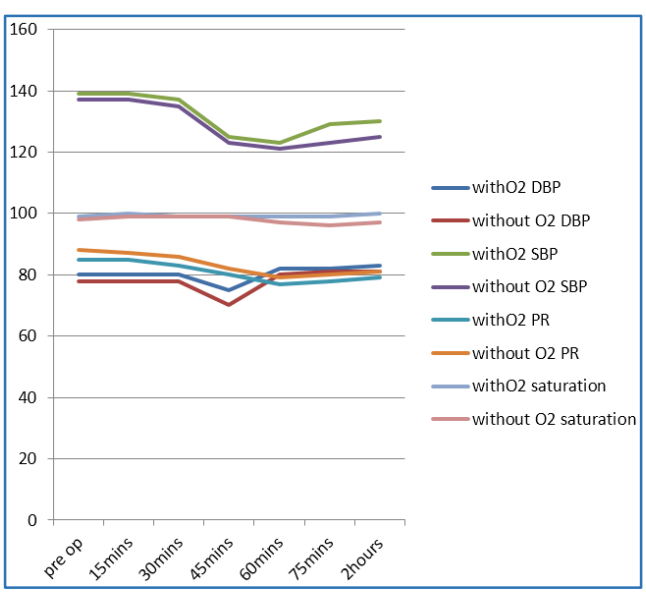

Fig. 3: Comparison of changes in pulse rate, systolic blood pressure, diastolic blood pressure and oxygen saturation

PR-pulse rate SBP-systolic blood pressure DBP-diastolic blood pressure O2-oxygen.

DISCUSSION: We designed this hypothesis that oxygen supplementation would be beneficial in haemodynamic stability, oxygen saturation, post-operative nausea vomiting and surgical site wound healing.

Walter J. et al studied the effects of oxygen breathing on the heart rate, blood pressure, and cardiac index of normal men. They found that there is slight but consistent decrease in the resting heart of a normal man.[2] Barrat-Boyes and Wood found a 4% increase in mean radial pressure and 10% increase in overall systemic resistance in hyperoxic subjects, but no change in cardiac output.[3] Walter et al study demonstrated that breathing concentration of oxygen above 21% produces a vagus dependent decrease in heart rate and a rate dependent decrease in cardiac index. The possibility of a lesser direct myocardial effect of hyperoxia is not excluded. The increase in blood pressure and systemic resistance which is at least in part related to the decrease in cardiac output, although direct or reflex vascular effect of hyperoxia is not excluded as BP rose substantially in atropinised subjects breathing oxygen. The observed changes in circulation times probably reflect the composite effect of decreased cardiac output and increased systemic resistance.

Waring, W. Stephen et al studied the cardiovascular effects of acute oxygen administration in healthy adults. Oxygen administration of 15 l/min for 1 hour caused a reduction in heart rate ($P<0.01$) and cardiac index (0.05), and an increase in mean arterial pressure ($P<0.01$), systemic vascular resistance ($P< 0.05$), large artery stiffness ($P< 0.05$), and baroreceptor sensitivity ($P<0.05$).[4]

Our findings are consistent with those of Walter J et al and Waring W Stephen et al. In both groups there was slight decrease of pulse rate which was not significant. Also there was no significant difference in pulse rate between the two groups.

Our findings regarding BP are not consistent with those of Walter J et al and Waring et al. In both the groups there was fall in BP which was not significant. The fall of BP in our study was because of spinal anaesthesia and sympathetic blockade. But there was no significant difference in fall of BP in between the two groups.

H. S. Murthy el in 2003 studied the various factors influencing oxygen desaturation during spinal anaesthesia. They concluded that oxygen desaturation during spinal anaesthesia are significantly influenced by, the patients BMI, level of block, intraoperative sedation and site of surgery.[5] In our patients BMI was <24, level was not >T6, sedation was only 1 mg midazolam. In our patients breathing air there was no significant fall in oxygen saturation. Also there was no significant difference of oxygen saturation (SpO2) in between the two groups.

Nausea and vomiting remains one of the frequent complication post operatively. There are conflicting results regarding the effect of hyperoxia on postoperative nausea and vomiting (PONV). S. Purhonen et al in 2003 in their study found that the incidence of vomiting decreased during the short postoperative administration with supplemental oxygen 50%. However, perioperative oxygen 50%

administration did not prevent PONV over the 24 hour follow up period in patients undergoing breast surgery performed under general anaesthesia.[6] The most likely mechanism in reduction of nausea by oxygen depends on dopamine release from the carotid bodies. The carotid tonically releases dopamine in amounts that are inversely related to arterial oxygen tension.[7] The importance of this observation is that the chemotactic trigger zone is sensitive to dopamine as well as serotonin.[8] Hyperoxia per se may thus reduce nausea and vomiting via a dopamine-dependent mechanism. Jean L. Joris et al in 2003 found out that 80% perioperative oxygen was ineffective in preventing PONV after thyroidectomy.

They observed that droperidol 0.25 mg (5-HT3 receptor antagonists), which had serious side effects, significantly reduced the incidence of PONV.[9]

In our study there was no significant difference for PONV in both the groups. In spinal anaesthesia the factors responsible for PONV are opioids used intraoperatively i.v. or intrathecally. It can also be due to hypotensive episodes post operatively.

Surgical site infection (SSI) is the one of the most frequently and potentially serious complication. The clinical role of hyperoxia for surgical site infection remains uncertain because randomized controlled trials on this topic have shown disparate results. Pascal Thibon et al found out that the routine delivery of 80% FiO2 in abdominal, gynaecological, and breast surgery did not decrease the incidence of 30- day surgical site infections.[10] Al-Niami et al suggested an association between a decrease in surgical site infection and the use of high inspired oxygen therapy.[11]

There are not much studies of effect of oxygen supplementation on surgical site infection in regional anaesthesia patients. In our study we found that there was no significant difference in the surgical site infection in between the two groups.

W. Habre et al in 2014 has elaborately described the effect of hyperoxia on various systems. It enhances oxidative injury by increasing reactive oxygen metabolites. Hyperoxia has effect on actin and cause endothelial cell damage, thus impairing antibacterial function of macrophages. In lungs the kinetics of oxygen atelectasis development is primarily determined by alveolar concentration of oxygen. The cerebral vasoconstrictive potential of hyperoxia is also a matter of concern. Hyperoxic vasoconstriction also decreases blood flow on microcirculation even in the presence of anaemia.[12] Accordingly, high concentrations of oxygen can compromise tissue oxygenation rather than providing the anticipated beneficial effects.

CONCLUSION: Administering a high FiO2 to all the patients under regional anaesthesia is questionable provided continuous monitoring with pulse oximetry is available. It has been established beyond doubt that oxygen supplementation should be given only when indicated. It is more important to avoid haemodynamic alterations associated with regional anaesthesia. Oxygen is a drug. When appropriately used, it is extremely beneficial. When misused or abused, it is potentially harmful.

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