DISCUSSION
Hypoxemia has been a matter of concern not only in the operating room but also in the immediate post-operative period. However, clinical assessment of hypoxemia is rather difficult. Cyanosis is only detectable when the arterial oxygen saturation (\(SaO_2\)) is below 80% (M. Nakatsuoka et al., 1989). The human eye is a poor judge of changes in skin colour, particularly in dark-skinned patients and under fluorescent lights. The recent introduction of pulse oximetry has provided a continuous, non-invasive, real time method to detect \(SaO_2\) intra-operatively and post-operatively (M. Nakatsuoka et al., 1989). Anaemia is very frequently seen in Indian women and anaesthetic practice more so with major surgery like hysterectomy operations.

The present study was conducted in the series of 50 patients undergoing hysterectomy with three different anaesthetic techniques. Continuous \(SaO_2\) monitoring was done with the pulse oximeter (Minolta PULM-3A-7) and following clues were made:

In our observations the \(SaO_2\) was not affected by the age and weight of the patient as also confirmed by M. Nakatsuoka and D. Belling (1989) who had shown that the
age and weight had no significant effect on the post-operative hypoxemia.

The \( S_\text{ao}_2 \) was significantly affected by the type of operation (Table 14). Under general anaesthesia with ether, there was significant decrease in the \( S_\text{ao}_2 \) during the post-operative period (91.60%) as compared with the pre-operative period (97.80%) in abdominal hysterectomy operation. Under general anaesthesia with muscle relaxant, there was no significant effect over the \( S_\text{ao}_2 \) during the intra and post-operative periods. There was significant fall in \( S_\text{ao}_2 \) in patients undergoing spinal analgesia which responded very well to the oxygen therapy. The finding is not in accordance with the study of M. Nakatsu and D. Bolling (1989) who didn't find any significant changes in different anaesthesia techniques. Patients undergoing vaginal hysterectomy had more desaturation (pre-operative 97.27%, intra-operative 85.55% and post-operative 67.73%) as compared to patients undergoing abdominal hysterectomy (pre-operative 97.42%, intra-operative 85.55% and post-operative 90.36%). This might be due to the lithotomy and head-down position in vaginal surgery as confirmed by the study of M. Nakatsu and D. Bolling (1989).

Morris et al. studied 241 adult patients in the recovery room, measuring \( S_\text{po}_2 \) values upon arrival, 5 min. after arrival, 30 min. after arrival and just prior to discharge. The recovery room personnel were blinded
to the $S_{p}O_{2}$ data. Of the 149 inpatients studied, 14% had episodes of desaturation to below 90%. As might be expected, the factors associated with desaturation were obesity, extensive surgery, age and ASA physical status. Most surprising is the fact that more patients were found to be hypoxemic at the time of discharge than at any of the other measurement times. These results demonstrate our present lack of knowledge as to what saturation levels imply immediate danger or a poor prognosis in post-operative patients under various clinical circumstances.

The $S_{a}O_{2}$ was significantly affected by the fall in blood pressure (20 - 30%) during the intra and post-operative periods. The episodes of desaturation was seen in the patients undergoing the hysterectomy operation under the spinal analgesia. After 10 to 15 mins. of giving the spinal analgesia there was the fall in blood pressure due to the sympathetic block of the lower half of the body. Due to the reduction in the blood pressure there was the tissue hypoxia or lowered arterial oxygen concentration towards the peripheral tissue. This episode was detected by the finger probe and oximeter shown the fall in the $S_{a}O_{2}$. The $S_{a}O_{2}$ was not affected significantly in those patients who were going to be operated under general anesthestia during the intra-operatively as well as the post-operatively. This was only because of the adequate administration of the gas mixture and ventilation during the intra-operative period. In post-operative period these patients were not
significantly affected as the oximeter showed little difference in the pre-operative and post-operative readings of the $\text{SaO}_2$ (Table 9 and 12).

The $\text{SaO}_2$ was significantly affected by the pulse rate during the intra and post-operative periods (Table 5 and 12). The $\text{SaO}_2$ was decreased when pulse rate was decreased. It was seen that when blood pressure was decreased, there was an increase in the pulse rate for few seconds and later on pulse rate was decreased. Due to the fall in the blood pressure and pulse rate, there was the reduced cardiac output. Peripheral tissue perfusion was affected significantly according to the post-operative readings of the oximeter. On the contrary, the study carried out by M. Nakatsuha and S. Holling (1969) shown that "the anaesthesia technique had no significant effect on post-operative hypoxemia. There was a trend towards a higher incidence of post-operative hypoxemia in supine head down position of the patients in the recovery room".

The $\text{SaO}_2$ was significantly affected by the respiratory rate during the intra-operative and post-operative periods (Table 6 and 12). In the study, the $\text{SaO}_2$ was significantly decreased when the respiratory rate was decreased. In those patients who were going to be operated under spinal analgesia were not affected significantly during the post-operative period. After giving sedation (Diazepam 5 – 10 mg) to the patient,
there was a fall in the respiratory rate, there was a fall in the $\Delta O_2$ during the intra-operative as well as the post-operative periods. The patients undergoing hysterectomy with general anaesthesia with ether were affected more rather than the patients undergoing hysterectomy under general anaesthesia with muscle relaxant. This was only because of the residual effect of the ether. Peripheral vasoconstriction could be a contributing factor over the patients during the post-operative period. Patients were not able to breath satisfactorily in the recovery room due to the post-operative pain. But the patients undergoing the hysterectomy under general anaesthesia with the muscle relaxant were reversed adequately and patients were fully conscious. The conscious patients were able to breath satisfactorily during the post-operative periods without any pain because of the effect of analgesics. As it was confirmed by the study of M. Nakatsuka and D. Helling (1959) that the use of muscle relaxant had no significant effect on hypoxemia.

There was the remarkable effect of the hemoglobin level over the $\Delta O_2$ (Table 10 and 13). It was seen that the $\Delta O_2$ was decreased significantly in the low hemoglobin level patients during the intra as well as the post-operative periods. In this study, the patients who were having hemoglobin level less than 10 gms were having the
$S_aO_2$ below 90% during the post-operative period. This was only because of the poor compensatory mechanisms for the blood lost during operation. Lower level of the hemoglobin directly affect the oxygen demand of the tissues and patients developed tissue hypoxia. Due to the tissue hypoxia, the $S_aO_2$ was also reduced and patients developed hypoxemia post-operatively. The study of H. Nakatsuka and P. Holling (1989) suggest that there was a trend towards a higher incidence of post-operative hypoxemia in patients with ASA III, chest surgery and ventilator support.

This study demonstrated that the $S_aO_2$ was significantly affected by the fall in the blood pressure, pulse rate, respiratory rate and low hemoglobin level of the patients during the intra-operative as well as the post-operative periods. It was seen that the $S_aO_2$ was significantly affected in those patients who were operated under the spinal analgesia with bupivacaine. The patients who were operated under the general anaesthesia with Ether were also having the low $S_aO_2$ but not significantly. The patients undergoing hysterectomy operation under general anaesthesia with the muscle relaxant were having the adequate arterial oxygen saturation during the intra-operative as well as the post-operative periods. The study of Nakatsuka and Holling (1989) confirmed that supplemental $O_2$ inhalation
decreased the incidence of hypoxemia significantly.

"There was a trend towards a higher incidence of postoperative hypoxemia in patients with ASA III, chest surgery and ventilator support. Supine head-down position and lateral position in the recovery room seemed to have higher incidence of hypoxemia. Age, anaesthesia technique, use of muscle relaxant, body temperature, post-anaesthesia medication, obesity, history of asthmas, COPD, AIDS and heart disease had no significant effect on hypoxemia."