Hypoxaemia During Gynaecological Laparoscopy Under Local Anaesthesia and Sedation.

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Abstract

Context: *Laparoscopy is a procedure with significant potential for hypoxaemia due to the respiratory changes accompanying pneumoperitoneum and the Trendelenberg position used. Hypoxaemia may be critical when the procedure is conducted under local anaesthesia and conscious sedation.*
Objective: *The aim of this study was to determine the extent to which hypoxaemic episodes occurred during gynaecological laparoscopy performed under conscious sedation.*
Study Design, Setting and Subjects: *This was a cross-sectional study of consecutive patients undergoing investigative laparoscopy at the University College Hospital, Ibadan. Informed consent was obtained from patients and they were prepared for the procedure on a day-care basis. The demographic data and vital signs were recorded. Pentazocine (60 mg) and diazepam (10 mg) were administered intravenously.*
Main Outcome Measures: *The respiratory rate, pulse rate, blood pressure and oxygen saturation were measured pre-, intra-, and post-operatively.*
Results: *Thirty-two patients were recruited into the study. They had no intercurrent medical diseases. Mean age was 33 years (SD 4.2) and mean Body Mass Index (BMI) was 24.49 (SD 2.87). Oxygen saturation was normal in every patient pre-sedation. Post sedation, 19 (54%) of the patients desaturated in the period before surgical stimulation. Oxygen saturation remained between 90% and 95% in 6 (19 %) patients intraoperatively. There were no postoperative episodes of desaturation. There was no correlation between the BMI and the degree of desaturation.*
Conclusion: *A significant degree of desaturation occurs during gynaecologic laparoscopy under pentazocine and diazepam sedation. It is recommended that oxygen should be administered to all patients during the procedure.*

Key Words: Gynaecological Laparoscopy, Sedation, Hypoxaemia. [Trop J Obstet Gynaecol, 2002, 19: 4-7].

Introduction

One of the major reasons why endoscopic surgery is widely popular today is because of the overall reduced costs of care [1]. Gynaecological laparoscopy may be performed for diagnostic and curative indications. Diagnostic gynaecological laparoscopy is usually carried out on a day-care basis under general anaesthesia where there are ample facilities and personnel [2]. In a developing nation like ours, many constraints such as dearth of anaesthetists, pressure on theatre space and the cost of general anaesthetic agents dictate the resort to local anaesthetic (LA) and sedation techniques in our institution [3], while some perform the procedure under ketamine anaesthesia without endotracheal intubation [4]. The technique of anaesthesia notwithstanding, there are cardio-respiratory adverse effects consequent on the creation of pneumoperitoneum and placing of the patient in the Trendelenberg position. These must be taken into consideration in the care of the patients. The respiratory effects include decrease in lung volumes, lung compliance and increased ventilation perfusion mismatch with resultant hypoxaemia [5]. In the head down position, when the intraabdominal pressure (IAP) is less than 10 mmHg, cardiac output is enhanced whereas when the IAP is greater than 20 mmHg, reduced cardiac output is observed [6]. These effects are marked during general anaesthesia but are thought to be minimal when laparoscopy is performed under LA because of the retention of the reflexes. This may not be so if sedative agents are also employed.

Routinely at the University College Hospital, Ibadan, gynaecological laparoscopy is performed under LA with sedation. The sedative agents used to be promethazine and pethidine but are now diazepam and pentazocine when strong opioids became unavailable. These two agents are expected to provide analgesia and anxiolysis for a calm and cooperative patient. Sedation is not without risk, especially if it is administered by the intravenous route. Although the depressant effect of pentazocine on the respiratory system is thought not to be as strong as that of morphine or pethidine, the addition of diazepam might synergise with it resulting in hypoxaemia.

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Although Babarinsa *et al* [7] (1997) and Arowojolu *et al* [8] (1998) had reported on the technique of LA and sedation in laparoscopy in our institution, the effect on oxygenation was not evaluated. This study was designed to find out the frequency of hypoxaemia occurring during gynaecological laparoscopy performed under local anaesthesia and pentazocine diazepam sedation.

Patients and Methods

Consecutive patients presenting for diagnostic gynaecological laparoscopy were recruited over a three-month period. Informed consent was obtained from each patient after the procedure had been explained. After the routine preoperative counselling of the patients by the nursing staff, demographic data, weight, height, and baseline vital signs were taken and recorded. The routine of the unit was followed, the Nellcor Pulse Oximeter being the only additional equipment introduced for monitoring.

The patients were positioned on the operating table and an intravenous line was inserted. The baseline pulse rate, blood pressure, respiratory rate and oxygen saturation (SaO_2) using the pulse oximeter were noted. The patients were sedated with 10 mg diazepam and 60 mg pentazocine intravenously. Oximetric readings were taken continuously, while the other readings were taken every five minutes intraoperatively. Local anaesthetic, 10 ml of 1% lignocaine with adrenaline, was infiltrated into the laparoscope's entry site. The operative time was noted and other intraoperative complications such as dizziness, nausea, vomiting and pain were also recorded. Monitoring of the vital signs and observation for complications were continued postoperatively until discharge.

Results

Thirty-two women aged 24-40 years (mean 33 ± 4.2) were recruited into the study. The body mass index (BMI) ranged between 17 and 41 (mean 24.49 kg/m^2, SD: 2.87). They had no intercurrent medical disorders. The mean operative time was 25 minutes (SD: 6.7). There were statistically significant differences between the preoperative and intraoperative values of the pulse rate [86.6 ± 14.1 vs 91.4 ± 12.2, $p = 0.004$] and the systolic blood pressure [114.8 ±13.8 vs 125± 10.6, $p < 0.01$]. Apnoeic episodes greater than 15 seconds were recorded in 6 (19%) patients and this correlated with the degree of desaturation ($r = 0.88$). The cardiorespiratory changes did not extend into the postoperative period.

Preoperative oxygen saturation was normal in all patients. The SaO_2 ranges in the operative periods are on Table 1. Nineteen (59%) patients had more than 4% oxygen desaturation in the immediate post-sedation period.

Table 1

Oxygen Saturation

Oxygen Saturation	Range	Mean	SD	*p**
Pre-Operative	98-100	99.7	0.58	--
Least Post-Sedation	66-98	90.0	10.0	0.0003
Intra-Operative	93-98	96.0	2.8	0.1
Post-Operative	95-100	98.1	1.6	0.32

* p-value when compared with the pre-operative oxygen saturation levels

Of these 19 patients, SaO_2 was between 85% and 94% in 7 (36.8%) and less than 85% in 7 (36.8%). There was no correlation between the decreases in SaO_2 and BMI ($r = 0.17$, $p = 0.4$). At the introduction of pneumoperitoneum, the SaO_2 improved, except in 5 patients with SaO_2 less than 95%.

Twenty-three (72%) patients complained of moderate to severe pain intraoperatively. Three patients would have opted for general anaesthesia if they thought pain would be so severe. Five patients vomited postoperatively.

Discussion

This study has demonstrated that a significant number of patients desaturated during laparoscopy under LA supplemented with pentazocine and diazepam sedation. This finding appears to be mainly due to the sedation since it was most marked in the immediate post sedation period. In a similar study [9], it was reported that 47% of patients desaturated below 85% after sedation with diamorphine and diazepam. Pentazocine is an opioid analgesic with weak agonist-antagonist action at the mu receptors and agonist activity at the kappa and sigma receptor sites [10]. Because of the partial effect at the mu-receptors, it was thought not to be as depressant on the respiration as pure agonist opioids like morphine and pethidine. Indeed, it was once employed as a reversal agent for the respiratory depressant action of fentanyl, a potent opioid, until this was disproved [11]. To improve the hypnotic action of pentazocine, diazepam was added. Given alone diazepam has a good safety profile on the cardio-respiratory system. However a synergistic effect has been observed when opioid and benzodiazepine are co-administered with resultant deeper sedation, and unwanted respiratory depression, hypoxaemia and hypotension [12,13]

Under LA, apnoea will be noted easily if the patient is being monitored continuously by a health care professional. Hypoxaemia on the other hand may occur unrecognised if cyanosis, a subjective measure, is taken as its evidence unless the patient is being monitored with an oximeter [14]. A hypoxaemic patient may be observed to be restless or confused and presumed to be in pain or inadequately sedated resulting in the administration of more sedation and, consequently, more hypoxaemia.

The effects of unrecognised hypoxaemia are dire on all the organ systems but quite severe on the central nervous system. This can be more pronounced in patients with pre-existing medical conditions like sickle cell anaemia, cardiac disorders and respiratory disease, all of which were not present in any of the patients studied. In Nigeria, where sickle cell disorders (SCD) is common, hypoxaemia, a facilitating environment for sickling would result in a major complication for the SCD patient. Hypoxaemia should therefore be prevented by routine administration of oxygen before sedation and during the procedure.

It is notable that hypoxaemia spontaneously resolved on introduction of the pneumoperitoneum. This is probably due to the respiratory stimulant action of carbon dioxide (CO_2) absorbed from the peritoneal cavity, thereby overriding the depressant actions of the sedative agents. The amount of CO_2 absorbed is related to the volume insufflated and the length of the procedure. Carbon dioxide is retained because of the reduced pulmonary gas exchange occasioned by decreased pulmonary compliance. Insufflation of CO_2 and thence hypercarbia during laparoscopy has been associated with rises in mean arterial pressure and cardiac index [15, 16]. Since oxygen saturation is also dependent on the cardiac function, the increase in heart rate and blood pressure observed at CO_2 insufflation may be presumed to have improved oxygen saturation as well. The contribution of pain and arousal resulting from poor analgesia of pentazocine to the improvement of saturation cannot be denied.

Pain during laparoscopy under sedation and local anaesthesia appears to be difficult to control. Early reports from our centre suggest poor analgesia with the more potent agent pethidine [17]. We believe that analgesia was probably poor in the report of Arowojolu *et al* [8]. All the women in their study who had pentazocine and diazepam moved disturbingly during the procedure, 10 (55%) moaned intraoperatively and 11 (61%) commented on the procedure as being unpleasant. Takeuchi et al [18] in their study comparing ketamine and fentanyl for sedation during laparoscopy, had to rescue 47.6% of the patients in the fentanyl group with ketamine for the procedure to be completed. While excellent operative conditions have been reported with the routine use of ketamine for laparoscopy [4], it is not known if hypoxaemia occurs.

In conclusion, our study has shown that laparoscopy under pentazocine and diazepam sedation is associated with hypoxaemia and poor analgesia. The logical option to propose is general anaesthesia, which most patients cannot afford and requires anaesthetic staff who are, as yet, unavailable. The alternative is to subject the technique of ketamine anaesthesia to a well-designed study with full monitoring to optimise the potential already recorded for the agent. We recommend that whenever sedation is employed for a surgical procedure, oxygen must be administered and the patient must be monitored continuously clinically by a dedicated nurse or physician and electronically with an oximeter.

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