

ALTERNATIVE OF CARBON DIOXIDE FOR LAPAROSCOPIC PNEUMOPERITONEUM IN A LOW RESOURCE REMOTE AREA

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ABSTRACT

Background: Laparoscopy is commonly used for number of abdominal surgical diseases. It requires regular supply of carbon dioxide cylinders. This is a big hindrance in remote area due to poor connectivity and logistic reasons. This study is carried out to establish the safety of gas used in our study.

Methods: Between June 2009 to Apr 2011, 30 laparoscopic surgeries were performed using gas ejected from muffler of oxygen concentrator. The technicality, conversions, operative time, complications and post op recovery were analysed.

Result: 30 patients (17 females and 13 males) underwent laparoscopic surgeries. 24 cases were done using gas ejected from muffler of oxygen concentrator. 24 underwent lap cholecystectomy, 02 lap varicocelectomy, 03 appendectomy and 01 tubectomy. Mean duration of surgery was 75.38 minutes. Post op fever was seen in 10% cases. Vomiting / nausea were seen in 23.3% cases. 16.6% patients experienced shoulder pain. 16.6% patients had moderate pain (verbal rating scale- 4 to 7) on 2nd POD. No serious complications and post op infections were seen.

Conclusion: Gas used for pneumoperitoneum in our study is cheap, safe and readily available. Moreover it is safer than air due to double filtration and low oxygen concentration. In a low resource setting it can be used if carbon dioxide is not available.

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INTRODUCTION

Laparoscopic surgery is gold standard for increasing number of intra-abdominal surgical diseases.⁽¹⁾ People located at remote areas are devoid of this surgical technique. The reason being non availability of Laparoscopy set and expertise. Also the surgery requires CO₂ for pneumoperitoneum the availability of which is also not guaranteed in remote areas.⁽²⁾ Also at high altitude due to low atmospheric pressure there is CO₂ leak from the cylinders. Moreover anaesthesia machine in these areas are generally old modeled and lacks Et CO₂ monitoring.

Doing Laparoscopic Surgery using room air pneumoperitoneum, after filtration and oxygen extraction, is a feasible modification in these areas. Kargil is one of the most remote areas of India situated at 10,000ft. It gets cut off in winter and essential supply is maintained by air. Military Hospital Kargil is located next to Kargil town where this study was performed.

MATERIALS AND METHODS

Circuit of oxygen concentrator

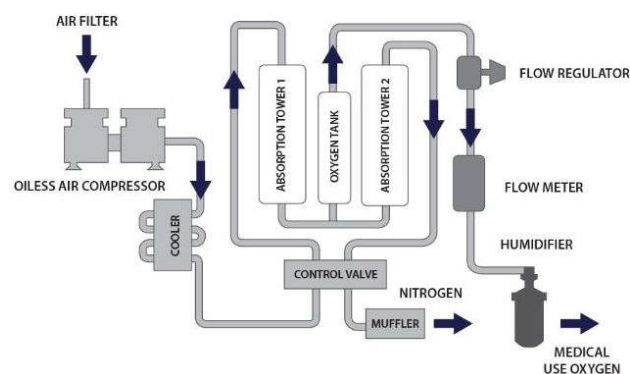


Figure 1

Oxygen concentrator filters room air and takes out oxygen for supply to the patient and discards the air (rich in nitrogen) through muffler. In this study we have used discarded air from muffler to create pneumoperitoneum.(Fig 1)

Total numbers of 30 laparoscopic surgeries were done at MH Kargil from June 2009 to Apr 2011 using air from Oxygen concentrator for pneumoperitoneum. Written informed consent was obtained from patients and their relatives. GA was given

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to all patients. Insufflator (fig-2) was connected to the outlet from muffler of oxygen concentrator (fig-3).



Figure 2



Figure3

Veress needle was used to create pneumoperitoneum. In patients with previous h/o abdominal surgery Hasson technique was used for camera port insertion. Pressure was built to 12 mm Hg. Operative time was calculated from time of incision to the closer of the port sites. Pneumoperitoneum was deflated completely after the surgery by suction. The GB and appendix were sent for HPE. Ryles tube used to deflate stomach if required which was removed after surgery. Significant subcutaneous emphysema was considered if it involved the chest and neck. Antibiotic (Cefotaxime) was given before giving the first incision. It was repeated 8 hourly on the day of surgery. In case of bile spillage gentamicin was added and antibiotics were continued for first POD (post op days). Pain assessment was done using verbal rating scale (20, 21). Injectable NSAIDs were given on day 01 followed by oral NSAIDs. Fluid diet was started on the POE (post op evening), if the patient had no nausea and vomiting. Complete diet was started on 1st POD. Patients were called on 10th day for suture removal. Patients were then reviewed after 03 months.

RESULT

30 patients (17 females and 13 males), in the age group of 20-65 yrs (Mean Age - 36.23 yrs) were operated at MH Kargil over the period of June 2009 to April 2011. 24 underwent lap cholecystectomy, 02 lap varicocelectomy and 03 underwent

appendectomy. 01 tubectomy. Mean duration of surgery was 75.38 minutes and for lap cholecystectomy was 74.78 minutes. Excluding 02 serving soldiers who were kept in the ward due to administrative reasons, the average hospital stay was 2.86 days. 3 out of 30 patients (10.0%) developed fever on 1st POD. 7 (23.3%) developed nausea vomiting on POE. 5 patients (16.6%) experienced shoulder pain which gradually reduced after 1st POD. Moderate abdominal pain on 1st POD was seen in 13 out of 30 patients (43.3%) and 05 out of 30 patients (16.6%) after first POD. After the 2nd POD all the patients had mild pain, which was limited to port site. 05 patients (16.6%) required injectable NSAIDs on 2nd POD. Subcutaneous emphysema was seen in 03 patients (10.0%) which took 01 week for complete resolution. 20 patients were given oral fluids on POE. There was no surgical site infection encountered. No other complication was observed.

| Variables | Value |
|--|-----------|
| Mean Operative time | 75.38 min |
| Average hospital stay | 2.86 days |
| Fever | 3(10%) |
| Nausea/Vomiting | 7 (23.3%) |
| Shoulder pain | 5(16.6%) |
| Moderate Abdominal pain on 2 nd POD | 5(16.6%) |
| Subcutaneous emphysema | 3(10.0%) |
| Infection (surgical site/Abdominal) | Nil |

DISCUSSION

In recent years there has been a paradigm shift towards minimally invasive approaches for the treatment of increasing number of diseases.⁽³⁾ In first Laparoscopic surgery room air was used.⁽⁴⁾ Kelling used air in 1901 in living dogs. Rudock used air in diagnostic peritoneoscopy in a series of 5000 cases in 1957. Air pneumoperitoneum has been popular for gynaecological and diagnostic procedures.⁽⁴⁾ But theoretically room air can cause infection and combustion as it contains oxygen. Zollikofer first used CO₂ in laparoscopy. CO₂ is absorbable, non combustible and reduces the risk of embolism and post operative pain abdomen.^(5,6,7) But significant hypercapnia and acidosis may occur during laparoscopy due to CO₂ absorption. Hypercapnia may cause a decrease in myocardial contractility and lower arrhythmia threshold. CO₂ forms carbonic acid which irritates the diaphragm and cause shoulder pain. However the incidences of these complications are low. Also CO₂ and argon are either limited in supply or too expensive.

In our study we have used the waste air from the muffler of oxygen concentrator for creating pneumoperitoneum in laparoscopic surgery.

Mean operative time was 74.78 minutes. The pressure was well maintained at 12 mm Hg. We encountered air leak in 03 (10.0%) cases due to defect in reducer valve and large port size. 23.3% of patients developed nausea or vomiting in comparison to 10% to 45% in CO₂ insufflations.⁽⁸⁾ Shoulder pain was noticed in 16.6% in our study while in case of CO₂ pneumoperitoneum 13-35% of the patients suffer with this.⁽⁹⁾ None of the patients developed surgical site infection or intra-abdominal infections. Pain rating scale was in equilibrium to CO₂ pneumoperitoneum.^(9,10) And severe complications like air embolism were not seen in our study. The insufflating gas used in our study was discarded air of oxygen concentrator which is not only filtered but also devoid of oxygen.

The Advantage of Air as Insufflating Gas is

- a. It is readily available.
- b. It is cheap, as the only cost is that of oxygen concentrator which any good OT will have.
- c. Dual purpose solved by oxygen concentrator.
- d. Hypercarbia and acidosis due to CO₂ pneumoperitoneum are not seen with this gas.
- e. Unlike room air insufflations, this air is filtered hence reduced infection risk.
- f. It does not support combustion as it is devoid of oxygen.
- g. Air used in our study is safe especially when Et CO₂ monitoring facility is not available.^(11,12)

However this study also has some limitations in the form of small sample size and the composition of insufflated air and its quality is further required to be tested.

CONCLUSION

CO₂ pneumoperitoneum is being widely used for laparoscopy. However its availability is a big problem in remote areas where patients are forced to undergo open surgery or they have to travel long to go to higher medical centers. Using discarded air from oxygen concentrator is a feasible option in low resource remote areas specially when EtCO₂ monitoring facility is not available

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