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### CARBON DIOXIDE INSUFFLATIONS IN ROUTINE COLONOSCOPY IS SAFE AND MORE COMFORTABLE THAN ROOM AIR

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#### ABSTRACT

A colonoscopy is an outpatient procedure in which the inside of the large intestine (colon and rectum) is examined. A colonoscopy is commonly used to evaluate gastrointestinal symptoms, such as rectal and intestinal bleeding, abdominal pain, or changes in bowel habits. Colonoscopies are also performed in individuals without symptoms to check for colorectal polyps or cancer. More than 14 million colonoscopies are performed annually in the United States, with approximately half of these examinations for colorectal cancer screening. During the insertion phase of colonoscopy, at least partial distention of the lumen is needed to allow adequate visualization to safely direct the instrument to the cecum. During withdrawal, a greater degree of luminal distention is desired to allow optimal inspection of the colonic mucosa. The use of CO<sub>2</sub> as an insufflating agent for the large bowel was initially proposed in 1953 as a method to prevent gas explosions during the electrosurgical removal of polyps at rigid proctoscopy. In addition to being non-flammable, CO<sub>2</sub> is absorbed across the intestines 160 times more rapidly than nitrogen and 13 times more rapidly than oxygen, which are the principal gas components of air. In the 1980s, endoscopists began to evaluate CO<sub>2</sub> insufflation as a potential method to reduce post colonoscopy pain and bloating. More recently, CO<sub>2</sub> insufflation has been evaluated in upper endoscopic procedures including ERCP and balloon-assisted enteroscopy. Many patients experience pain and discomfort after colonoscopy. Carbon dioxide (CO<sub>2</sub>) can reduce periprocedural pain although air insufflations remained the standard procedure. The main purpose of this trial is to evaluate whether CO<sub>2</sub> insufflations does decrease pain and bloating during and after colonoscopy compared to room air.

**Key Words:** Colonoscopy, CO<sub>2</sub> insufflation, Air insufflation, Periprocedural pain.

#### INTRODUCTION

Many patients experience pain and discomfort after colonoscopy. An explanation for this observation is the retention of gas in the colon, as several litres of air are insufflated during colonoscopy [1]. For decades, CO<sub>2</sub> insufflation has been routinely used to create the pneumoperitoneum in laparoscopic surgery. Conversely, room air insufflation has remained the standard of care in most endoscopy centres. Preliminary studies indicate that insufflation of carbon dioxide (CO<sub>2</sub>) may reduce periprocedural pain [2]. CO<sub>2</sub> was first recommended 1953

to avoid gas combustion in the colon during electrocoagulation [3]. In 1986, the rapid absorption of CO<sub>2</sub> in the colon and minimal interference with colonic circulation were described, therefore minimizing the risk of bowel ischemia [4]. CO<sub>2</sub> is absorbed about 150 times faster compared to nitrogen and is rapidly eliminated through the lungs. Interestingly, 30 minutes after insufflation with CO<sub>2</sub>, the gas has disappeared, whereas patients with standard room air insufflation still have a significant distension of both small bowel and colon. In addition to better periprocedural pain control, another, potential benefit of CO<sub>2</sub> use is that no gas aspiration is necessary during withdrawal due to the fast gas absorption. Better colonic insufflations may be associated with a better diagnostic yield and especially a higher polyp detection rate. Comfort

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during and after colonoscopy represents a major issue for patient tolerance and acceptance [5]. It is imperative that the nowadays recommended longer withdrawal times, and consecutively longer insufflations, do not compromise patient comfort. It would be wrong to shorten the withdrawal time during colonoscopy to make concessions with respect to patient comfort [6]. The objective of the present trial was to assess patient satisfaction, pain, and bloating between patients undergoing colonoscopy with CO<sub>2</sub> insufflations versus standard room air. A colonoscopy is an outpatient procedure in which the inside of the large intestine (colon and rectum) is examined. A colonoscopy is commonly used to evaluate gastrointestinal symptoms, such as rectal and intestinal bleeding, abdominal pain, or changes in bowel habits. Colonoscopies are also performed in individuals without symptoms to check for colorectal polyps or cancer [7].

## MATERIALS AND METHODS

### Study objectives and Purpose

The objective of the present trial is to assess patient satisfaction, pain, and bloating between patients undergoing colonoscopy with CO<sub>2</sub> insufflations versus standard room air. Many patients experience pain and discomfort after colonoscopy. Carbon dioxide (CO<sub>2</sub>) can reduce periprocedural pain although air insufflations remained the standard procedure. The main purpose of this trial is to evaluate whether CO<sub>2</sub> insufflations does decrease pain and bloating during and after colonoscopy compared to room air.

### Study Design

This is a type of observational study in East Indian population where questionnaire method was used for collection of data. Data was collected from Colonoscopy patients in Medica Super speciality Hospital during 3 months of study period. Data was collected to understand that CO<sub>2</sub> insufflation does decrease pain and bloating during and after colonoscopy compared to room air. 20 patients for air insufflations and 20 patients for CO<sub>2</sub> insufflations, recruited for this trial. This information will be useful in framing the treatment modalities for better patient care.

### Study Duration

The study took place over three months. For each patient a questionnaire based study was done first and a data was taken within three months.

### Description of Study Population

20 patients for air insufflations and 20 patients for CO<sub>2</sub> insufflations process, required for this study after reading and signing the Informed Consent Form.

### Duration of Subject Participation

Patients were recruited for study after reading and signing the Informed Consent Form. The study took place over three months. For each patient a questionnaire based study was done and data was taken within three months.

### Description of Discontinuation Criteria for subjects

The participation of the patient will be voluntary and he/she will be free to withdraw anytime, without giving any reason, without his/her medical care and rights being unaffected.

### Inclusion Exclusion criteria for subjects

#### Inclusion criteria:

1. Male or female above  $\geq 18$  years of age.
2. Subjects who receive Screening colonoscopy or secondary colonoscopy.
3. Subject is able to comprehend, sign and date the written informed consent document to participate in the study.

#### Exclusion criteria:

1. Child.
2. Pregnant woman.
3. Subjects who have COPD or cardiovascular diseases.
4. Artificial heart valve.

### Subject withdrawal criteria:

The participation will be voluntary and any time they can withdraw from the study if it is not feasible for the patient.

If there is any Serious Adverse Event (SAE) with the study patient, though not related to the study.

## RESULTS & DISCUSSION

A total number of 40 patients undergoing colonoscopy were enrolled in this study. 20 patients were randomized to the CO<sub>2</sub> group and 20 to the room air group.

A 100-mm visual analogue scale (VAS) consisting of a horizontal line 100 mm in length was used for measuring patient abdominal pain and discomfort (0 mm = painless, 100 mm = extremely painful).

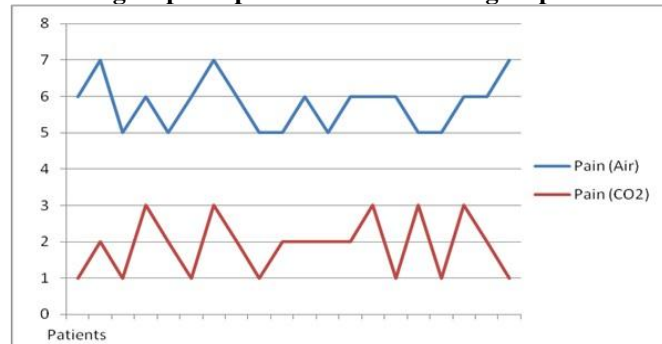
This randomized controlled trial comparing the use of CO<sub>2</sub> versus room air in patients undergoing colonoscopy with propofol sedation using continuous monitoring by capnography for all patients. Our investigation provides compelling evidencethat CO<sub>2</sub> insufflations compared with standard room air significantly reduces bloating and pain in patients undergoing routine colonoscopy. The use of CO<sub>2</sub> for routine colonoscopy was associated not only with significantly less pain and bloating but also with superior patient tolerance. This benefit is particularly remarkable considering that the CO<sub>2</sub> group had significantly more women and more IBS patients compared to the room air group. Use of CO<sub>2</sub> was not associated with a prolonged preparation time to set up

or perform the procedure, and there were no side effects and no complications. Abdominal pain after colonoscopy is common. CO<sub>2</sub> use for balloon enteroscopy was not only less painful for patients, but also associated with a significantly deeper intubation length of the small intestine. Another advantage is that CO<sub>2</sub> is less combustible in presence of stool or sub-optimal bowel preparation and, therefore, potentially safer when diathermy is being used.

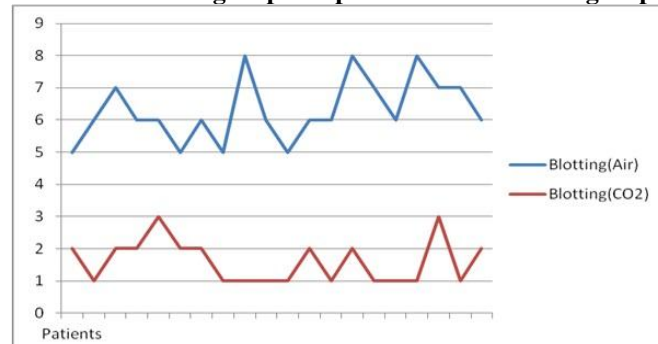
Moreover, it has advantages in longer procedures to avoid over distention of the colon.

For missing, unused, spurious data an application to the Clinical Research Ethics Committee will be submitted for continuation of the study. If it will get approval from the CREC then again the study will start with necessary documentation.

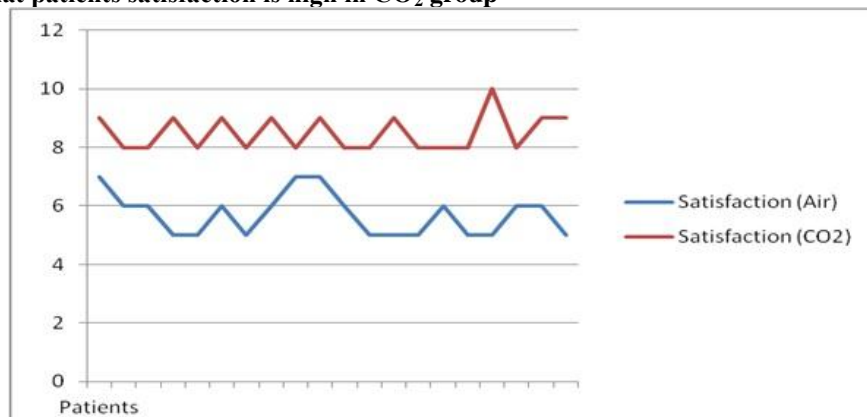
**Fig 1. At all points, the VAS scores for pain were lower in the CO<sub>2</sub> group compared to the room air group**



**Fig 2. At all points, the VAS scores for bloating were lower in the CO<sub>2</sub> group compared to the room air group**



**Fig 3. At all points, the VAS scores for bloating were lower in the CO<sub>2</sub> group compared to the room air group .So that's why we see that patients satisfaction is high in CO<sub>2</sub> group**



## DISCUSSION

Several gaseous and liquid agents have been used for colonic luminal expansion. The ideal agent for colonic luminal expansion would facilitate cecal intubation, provide excellent mucosal visualization, and limit intra- and postprocedure pain, and would be safe and inexpensive [8]. Several options are available for luminal expansion at colonoscopy. Air insufflations remain the most common method used [9]. The use of CO<sub>2</sub> insufflations has been associated with a reduction in abdominal pain intra- and post procedurally up to 24 hours compared with air insufflations, and CO<sub>2</sub> also appears to benefit patients undergoing some lengthier upper endoscopic procedures with respect to less post procedure pain. CO<sub>2</sub> insufflation is safe in unseated and sedated patients [10]. Outcomes data from these upper endoscopic applications are only

briefly summarized here; a more complete discussion is beyond the scope of this colonoscopy focused document. There are 3 CO<sub>2</sub> regulators designed for use with GI endoscopes that are approved by the U.S. Food and Drug Administration in the United States [11]. These regulators all require a CO<sub>2</sub> source, most commonly a medical gas cylinder, although some operative or endoscopy suites may be equipped with a medical gas pipeline for CO<sub>2</sub> [12-13]. A specialty water bottle is required, as well as gas tubing that transmits CO<sub>2</sub> into the water bottle. The air button on the endoscopic light source must be turned off for CO<sub>2</sub> to be used. The mean volumes of CO<sub>2</sub> used at colonoscopy are similar to those used for air, reported at 8.3 L to 14.0 L [14].

## CONCLUSION

This study provides compelling evidence that CO<sub>2</sub> insufflations are associated with significantly less bloating and pain during and after routine colonoscopy. Colonoscopy with CO<sub>2</sub> insufflations is safe as no significant differences in CO<sub>2</sub> measurements were observed. Based on these data, the routine use of CO<sub>2</sub>

insufflations for colonoscopy is encouraged.

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