Nigerian Journal of Clinical Practice
June 2008 Vol 11(2):127-129

IMPROVING THE SAFETY OF ROOM AIR PNEUMOPERITONEUM FOR DIAGNOSTIC LAPAROSCOPY.

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ABSTRACT

Background: Laparoscopic examination is a useful investigation in the evaluation of infertile women. To perform this test, pneumoperitoneum is required to distend the abdomen, improve visibility and displace the intestines out of the pelvis. Several gases have been used to achieve this purpose including Nitrous Oxide (N_2O), Carbondioxide (CO_2), Helium, Xenon and Air.

Study Design and Method: This was a prospective study in a private fertility centre in Nnewi, Nigeria aimed at reducing the morbidities inherent in the use Room Air pneumoperitoneum for diagnostic laparoscopy. This was sequel to an earlier study, which revealed that women who had Room Air pneumoperitoneum had a higher port wound infection rate, abdominal discomfort (feeling of retained gas in the abdomen) and shoulder pain with resultant delayed return to normal activity than women who had Co_2 pneumoperitoneum.

Results: This study demonstrated that the use of soda lime to purify the Room Air and a low pressure suction pump to evacuate the air after the procedure significantly reduced the wound infection rate and virtually eliminated the abdominal discomfort and shoulder pain associated with Room Air pneumoperitoneum. This was followed by early return to normal activity.

Conclusion: Therefore, use of Room Air for pneumoperitoneum is safe and affordable. It is recommended for low resource settings.

Key Words: Room Air, Pneumoperitoneum, Soda lime, Diagnostic Laparoscopy. (*Accepted 9 May 2007*)

INTRODUCTION

Laparoscopic examination is gradually becoming an indispensable investigation in the evaluation of the female internal genitalia especially for infertility management in our environment. Laparoscopy as is currently practiced in our environment is mainly for diagnostic purposes and pneumoperitoneum is required during this procedure to distend the abdomen, improve visibility and displace the intestines although gasless abdominal lift procedures have been done[1].

To achieve pneumoperitoneum, several gases have been used including Nitrous oxide (N_20), Carbondioxide ($C0_2$), Helium, Xenon and Air[2-4]. Each gas has its limitations and advantages. N_20 and Air supports combustion unlike $C0_2$ and cannot be used for procedures that require cauterization. All the other gases except air require expensive equipments and are not readily available. The main draw back for the use of Air which is freely available is wound infection since it is not sterile and is not pressurized[4] unlike $C0_2$ which has been shown to modulate the peritoneal host defences and inflammatory response to sepsis[5,6]. Any method of purifying the room air before its use will definitely reduce the rate of infection associated with its use and therefore improve its safety. In an earlier study on diagnostic laparoscopy clients in our centre[4], use of room air for pneumoperitoneum when compared with CO_2 was associated with increased port wound infection and higher residual gas in the peritoneal cavity leading to post operative abdominal discomfort, shoulder pain and late return to normal activity. It is our thinking that elimination of the residual air possibly by use of a low-pressure suction pump after the procedure will improve the patients outcome. Similarly, room air is known to be contaminated and its decontamination before use will reduce the risk of port wound infection. This can be achieved with bacterial filters which are rather expensive and not readily available in low resource settings. We decided to adapt the readily available soda lime for this purpose and analyse the outcome for any improvement in the use of room air

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for pneumoperitoneum.

SUBJECTS AND METHOD

This was a prospective comparative study conducted at the fertility unit of Life Specialist Hospital Nnewi, Anambra State, Nigeria. This study was conducted from 1st April 2001 to 31st December 2003 during our weekly day-case laparoscopy sessions.

Women who presented at the out patient clinic of the hospital with a diagnosis of infertility were recruited for this study. Where there was no contraindication for diagnostic laparoscopy, she was counselled and scheduled for the procedure. A written informed consent was obtained from each woman and she reported at 8am on the day of the procedure after an overnight fast. All the procedures were performed under aseptic conditions. General anaesthesia using ketamine[7] was administered to all the patients and a single puncture technique involving a 1cm transverse sub-umbilical stab incision was used. A second puncture at the supra pubic region was applied where necessary to remove any structure obstructing adequate visualization of the reproductive organs. In the first phase of the study, Room Air was used directly via an endo-pump to achieve pneumoperitoneum and at the end of the procedure; the gas was allowed to escape passively through the 10mm canular. The resultant morbidities were analysed and noted. Then the modifications to address the observed morbidities were conceptualised and used in the second phase of the study: i.e. room Air was passed through soda lime for humidification and purification, before peritoneal insufflation and at the end of the procedure; the 10mm canular was connected to a low pressure vacuum pump to evacuate the air before its removal. To avoid sucking omentum or intestines into the 10mm canular, the laparoscope was retained in position in the 10mm canular and only removed with the canular after evacuating the air.

The abdominal incision was closed with a No. 2/0 chromic catgut suture using the sub-curticular technique and dressing applied. All the patients received 5 days antibiotic coverage (ampicillin 500mg q.d.s and metronidazole 400mg t.d.s) after the procedure. The patients were allowed to go home same day on full recovery from anaesthesia and followed up in the clinic on the 2nd and 7th post-procedure days. Postoperative morbidities (wound infection, abdominal discomfort and shoulder pain) and time of return to normal activity were recorded. The data obtained was manually analysed with an electronic calculator and presented in a table. The morbidities for the two groups were compared with simple percentages. Chi square was used as a test of significance and P value < 0.05 was considered significant.

RESULTS

A total of 190 procedures were performed with Room Air pneumoperitoneum. The first group (room air direct) had 72 cases while the second group (room air modified) had 118 cases. There was good visibility during the procedures.

Morbidities encountered include wound infection in 16 (8.4%) women, abdominal discomfort in 72 (37.9%) women, shoulder pain in 64 (33.7%) women and peritonitis in 1 (0.5%) woman. The women who had modifications in the use of room air pneumoperitoneum had significantly lower morbidities as shown in table 1.

The average time of return to normal activity for these patients was also significantly less at 1.8 days $\pm$ 1.1 SD compared with 4.8 days $\pm$ 2.1 SD for those who used room air directly.

DISCUSSION

The use of room air for peritoneal insufflation during diagnostic laparoscopy has been shown to be safe[4]. This study demonstrates further improvement in the use of air to reduce the minor morbidities observed with its use.

Wound infection is commoner with room air which is not sterile when compared with carbondioxide[4].

Table: **Morbidities in women who had diagnostic laparoscopy and dye test**

Morbidities	Room Air (Direct) N=72	Room Air (Modified) n=118	Total n=190	Test of significance
Wound infection	11 (15.3%)	5 (4.2%)	16 (8.4%)	P < 0.05
Abdominal discomfort*	61 (84.7%)	11 (9.3%)	72 (37.9%)	P < 0.01
Shoulder pain	56 (77.8%)	8 (6.8%)	64 (33.7%)	P < 0.01
Peritonitis	1 (1.4%)	0 (0.0%)	1 (0.5%)	

*This was interpreted as a feeling of retained gas in the abdomen.

However, the passage of room air through soda lime in this study significantly reduced the infection rate. A possible explanation is that well packed soda lime as in the one used for this study could serve as a filter resulting in purification of the room air. It is also known that soda lime produces an exothermic reaction with the little CO^2 in the air. This possibly could be harmful to the bacteria in the air and the heat also contributes to the improved visibility in the peritoneal cavity.

The feeling of retained gas in the abdomen experienced by 84.7% of the first group of women reflects the slow re-absorption rate of the residual air from the peritoneal cavity. Although the excessive traction of the triangular ligament and overstretching of the diaphragmatic fibres due to insufflation are the main causes of shoulder pain[8], the high incidence of this pain with room air pneumoperitoneum indicates that direct irritation of the diaphragm due to the residual air contributes significantly to post-procedure pain[9]. The use of a low-pressure vacuum pump to suck out the residual air at the end of the procedure as practiced in the second group of women significantly reduced the complaint of abdominal discomfort and shoulder pain.

The higher morbidity rate with the direct use of room air could be the cause of the longer duration it took the patients to return fully to normal activity. There was greater than 50% improvement in the time of return to normal activity in the second group of women who had lower morbidities.

In conclusion, morbidity from use of room air pneumoperitoneum during diagnostic laparoscopy could be significantly reduced by passage of the room air through soda lime as well as the use of a low-pressure vacuum pump to suck out the residual air at the end of the procedure. These modifications are recommended for low resources settings and in areas where packaging of other gasses is not available.

Authors' contributions.

Dr. J.I. Ikechebelu. Conceived the idea of the study, performed the procedure and participated in outcome assessment, literature review and drafting of manuscript. JII is guarantor of manuscript.

Dr. C.A.F. Okeke. Assisted in the procedure with dye injection, assigned the subjects to a treatment category and participated in literature review and analysis of data.

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