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# Laparoscopic Sterilization with Room Air Insufflation: Preliminary Report

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## ABSTRACT

*Diaz MO, Atwood RJ, Laufe LE (Centro Medico, Instituto Salvadoreño de Seguro Social, San Salvador, El Salvador, International Fertility Research Program, Research Triangle Park, NC, USA, and Duke University Medical Center, Durham, NC, USA). Laparoscopic sterilization with room air insufflation: preliminary report.*

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*Laparoscopic sterilizations can be safely performed using room air insufflation. In a series of 400 procedures, the rates of surgical complications and complaints were comparable to other laparoscopy studies in which high-pressure gas was used. The purported problems associated with room air insufflation were not encountered in this study.*

## INTRODUCTION

Air is a gaseous medium that has been extensively used in medical practice. Gunning (9, 10) has chronicled the history of laparoscopy, including the development of modern endoscopic instruments and the use of air in open-cavity endoscopic procedures. The first cystoscope used air, and its development was the basis for the specialty of urology. Gynecologic laparoscopy was developed at the beginning of the 20th century because of the desire to visualize the pelvic organs without major surgery. In 1910, Jacobaeus (9) was the first to report the introduction of air to create a pneumoperitoneum in humans, although Kelling (9) had previously used air in living dogs in 1901. Ruddock (15) used air for pneumoperitoneum without complications and eventually published, in 1957, the results of over 5000 cases of diagnostic peritoneoscopy. Air insufflation has been used for a variety of diagnostic and therapeutic procedures, such as pneumothorax (17), gynecography (3) and in the diagnosis of subphrenic and liver abscesses (8, 16).

The first reference to the use of an insufflating gas other than air was in 1924 by Zollikofer (9), who used carbon dioxide because it was more rapidly absorbed. As modern laparoscopy evolved toward an outpatient procedure with local anesthesia, physicians wanted to minimize possible complications and patient discomfort. Carbon dioxide and nitrous oxide have been readily available in the developed world and became the insufflating gases of choice. Also, the fear of air embolism, the anecdotal reporting of possible deaths due to air and the potential hazard of combustion or explosion pushed the medical community into choosing the more absorbable and noncombustible gases (1, 14, 19). In the developing world, these gases are either in limited supply or too expensive, and air continues to be used to insufflate the peritoneal cavity for laparoscopic procedures, but documentation of its incidence is absent (18).

Air-induced pneumoperitoneum has also been used for laparoscopic sterilization. During a discussion at a 1971 conference on female sterilization, Wheeless (19) noted that hand pumping of room air was possible, but air is not readily absorbed into the blood stream and causes more postoperative patient discomfort than $CO_2$. In 1972, Chaturachinda (4) reported on 250 cases, and one year later (12) on a total of 800 cases of laparoscopic sterilization by electrocoagulation in which room air was used for pneumoperitoneum without complications. Another participant at the first meeting of the American Association of Gynecologic Laparoscopists in 1972, Frangenheim, reported on the safe use of air for peritoneoscopy (12). Bhatt (2) of Baroda, India, has recently reported on the safe use of air insufflation in over 5000 cases of laparoscopic sterilization.

With the replacement of electrocoagulation by occlusive methods of tubal sterilization, the reexamination of room air as the insufflating medium for voluntary sterilization seems appropriate. International assistance programs are focusing on those technologies that can achieve the greatest worldwide acceptance through simplicity, wide availability and few requisite equipment maintenance needs. Re-

cently developed laparoscopic equipment has been designed to use either a high-pressure gas source or a low-pressure insufflator with room air. This paper documents that room air can be used safely for laparoscopic sterilization.

## MATERIALS AND METHODS

From October 1978 to April 1979, 400 sterilization procedures were performed at the Centro Medico, Instituto Salvadoreño de Seguro Social, San Salvador, El Salvador. Two series of procedures were performed: the first 100 sterilizations involved a standard laparoscopy technique that familiarized the operating physician with the laprocator; the next 300 sterilizations were accomplished by Hasson's open laparoscopy technique using the Hasson trocar and blunt cannula (11). In both series, pneumoperitoneum by room air was used for insufflation.

The tubal ring was the technique used for tubal occlusion. Analgesia plus local anesthesia were used for all but one of the procedures (99.8%); general anesthesia was used in the single exception. There were no technical failures, and all procedures were completed as planned. Both series were devoid of any technical/equipment problems.

Air insufflation was accomplished by the KLI insufflator (KLI, Newton, PA, USA) (Fig. 1), which can deliver either gas under pressure or air with a pneumatic bulb. Air is pumped through the insufflator, which contains a filter, into the patient. The volume of air delivered into the patient was determined on the basis of abdominal distension and percussion. Prior to withdrawal of the trocar, the abdominal wall was compressed to express as much air as possible.

The light source used a rechargeable battery pack (KLI, Newton, PA, USA) (Fig. 2). The physician rated the light source excellent for 19.0% of the standard laparoscopic procedures and for 26.7% of the open laparoscopic procedures and adequate for the remaining cases.

The women undergoing both types of sterilization were similar in age, parity and previous contraceptive use (Table I). Each patient had terminated her last pregnancy at least six weeks before sterilization. All except one of the women (99.8%) returned for a scheduled follow-up 7–21 days after sterilization.

## RESULTS

There were no surgical, recovery-period or follow-up complications in the standard laparoscopy series.

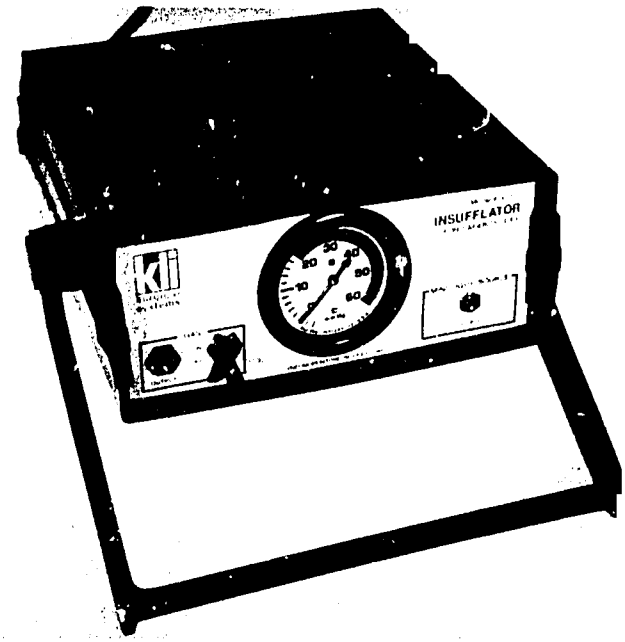


**Fig. 1.** KLI insufflator.

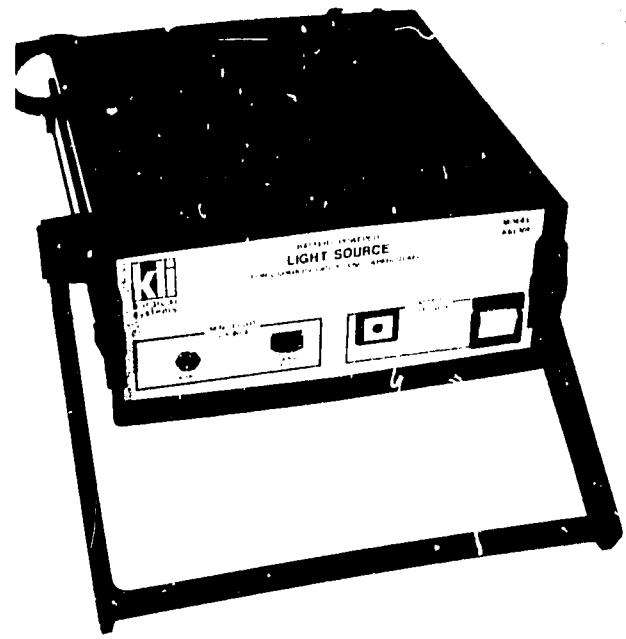


**Fig. 2.** KLI rechargeable battery pack used for light source.

Among the 300 open laparoscopy procedures, one case (0.3%) of mesosalpingeal injury without bleeding was recorded as a surgical complication. The follow-up complications were two cases (0.7%) of urinary tract infection and two cases (0.7%) of incision inflammation that required medical treatment with only aspirin or oral penicillin.

The reported sites of pain during the standard laparoscopic procedures were pelvic (5%) and shoulder (2%) (Table II). The intensity of pain at these sites was reported as mild. Sites of pain during the recovery period were reported as pelvic (88%) and shoulder (3%). The pelvic pain was rated as mild by 87%) of the patients and moderate by 2%; 11% reported no pain (Table III).

During the open laparoscopic procedures, only one woman (0.3%) reported pelvic pain that was not rated for intensity (Table II). Recovery-period pain sites were reported as pelvic (90.3%) and shoulder (5.7%). The pelvic pain was rated as mild by 62.0% of the patients and moderate by 31.0%; the other patients had no pain (6.3%) or unknown responses (0.7%) (Table III). Within 30 days of the procedure, only one woman (0.3%) still reported pelvic pain.

**Table I.** Study patient characteristics.

| Patient Details | Standard Laparoscopy (N = 100) | Open Laparoscopy (N = 300) |
|---|---|---|
| Age (years) | | |
| Mean ± SD | 28.8 ± 4.2 | 27.6 ± 4.3 |
| Range | 20–39 | 18–43 |
| Parity | | |
| Mean ± SD | 3.1 ± 1.5 | 3.0 ± 1.0 |
| Range | 1–11 | 1–10 |
| Contraceptive method used in past 3 months | | |
| None | 22 (22.0%) | 28 (9.3%) |
| IUD | 13 (13.0%) | 52 (17.3%) |
| Orals/injectables | 62 (62.0%) | 187 (62.4%) |
| Other | 3 (3.0%) | 33 (11.0%) |

**Table II.** Primary sites of pain.

| Primary Sites of Pain | Standard Laparoscopy (N = 100) | | Open Laparoscopy (N = 300) | |
|---|---|---|---|---|
| | No. | % | No. | % |
| During procedure | | | | |
| Pelvic | 5 | 5.0 | 1 | 0.3 |
| Shoulder | 2 | 2.0 | 0 | 0.0 |
| Unknown | 0 | 0.0 | 1 | 0.3 |
| None | 93 | 93.0 | 298 | 99.3 |
| Recovery period before discharge | | | | |
| Pelvic | 88 | 88.0 | 271 | 90.3 |
| Shoulder | 3 | 3.0 | 17 | 5.7 |
| Unknown | 0 | 0.0 | 2 | 0.7 |
| None | 9 | 9.0 | 12 | 4.0 |
| Within 30 days after discharge | | | | |
| Pelvic | 0 | 0.0 | 1 | 0.3 |
| Unknown | 0 | 0.0 | 1 | 0.3 |
| None | 100 | 100.0 | 298 | 99.3 |

**Table III.** Pain intensity.

| | Standard Laparoscopy (N = 100) | | Open Laparoscopy (N = 300) | |
|---|---|---|---|---|
| | No. | % | No. | % |
| Primary pain during procedure | | | | |
| None | 93 | 93.0 | 299 | 99.7 |
| Mild | 7 | 7.0 | 0 | 0.0 |
| Unknown | 0 | 0.0 | 1 | 0.3 |
| Pelvic pain during recovery period | | | | |
| None | 11 | 11.0 | 19 | 6.3 |
| Mild | 87 | 87.0 | 186 | 62.0 |
| Moderate | 2 | 2.0 | 93 | 31.0 |
| Unknown | 0 | 0.0 | 2 | 0.7 |

One of the most significant concerns about air insufflation is postoperative pain, possibly caused by delayed air absorption. No women undergoing open laparoscopy with room-air insufflation reported any primary pain during the procedure, whereas seven women (7%) in the standard laparoscopy series, also with room air, reported mild pain. However, during the recovery period, more women in the open laparoscopy series reported moderate pain. No women in either series reported severe pain, and when present, the pain disappeared by the 7–21 day follow-up visit.

The primary sites of pain were similar for the two series, and the high incidence of pelvic pain was probably related to the technique of tubal occlusion. Some women reported shoulder pain during the recovery period after air insufflation had been used, but this pain was never incapacitating and was of short duration. There was no statistically significant difference between the two series for shoulder pain. No patients complained of shoulder pain at the 7–21-day follow-up.

## DISCUSSION

Room-air insufflation during laparoscopy does not appear to increase the complication or complaint rate compared to gas usage. In this study, the complication rates were low in both the standard and the open laparoscopy series. There were no

complications in the standard laparoscopic series. In the open laparoscopy procedures, the only surgical complication was one case (0.3%) of mesosalpingeal injury without bleeding. These complication rates are similar to or lower than other laparoscopy studies (6, 7, 13). The sites of pain and its intensity varied only slightly between the two series for shoulder pain. However, this pain differential dissipated to no shoulder pain for both series by the follow-up visit 7–21 days after the procedure. The intensity of the abdominal pain was significantly greater for the open laparoscopy series. The pelvic pain intensity compares favorably with other studies of laparoscopy with tubal occlusion by tubal ring (5).

The advantages of the use of room-air insufflation are universal availability, low cost, simplification of the procedure, reduction of the cost of the back-up equipment and reduction of performance time (4). The purported disadvantages with room-air insufflation—pain, air embolism, infection or death—were not encountered in this study. The increased pain was related to the procedure performed and disappeared in a short time. Room-air insufflation during laparoscopy can be safely and effectively used, simplifying the procedure.

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