Literature review

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Laparoscopy explosion – hazards with nitrous oxide

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Anesthesiology 1993; **78**: 875–9

The use of laparoscopic surgical techniques for various gynaecologic procedures has increased over the last 20 years, as well as their use in general surgery. The report of an intraabdominal explosion causing the death of a patient undergoing laparoscopic surgery, in which nitrous oxide was used as the insufflating gas, as well as other reports of less severe episodes of intraperitoneal combustion, has led to the gradual abandonment of nitrous oxide as an insufflating agent in favour of carbon dioxide.

The composition of intestinal gas is nitrogen, oxygen, carbon dioxide, hydrogen and methane. The maximum measured concentration of hydrogen and methane in bowel gas has been reported as 69% and 56% respectively. During laparoscopic surgery utilizing carbon dioxide as the insufflating agent, nitrous oxide will diffuse into the peritoneal cavity if it is used as part of the anaesthetic. Bowel perforation and the subsequent release of volatile bowel gas could create an explosion hazard.

This paper was divided into two parts. It quantified the transfer of nitrous oxide, over time, in 19 female patients undergoing laparoscopy. The second part established the lower limits of flammability of a range of concentrations of methane and hydrogen diluted with nitrogen (simulated bowel gas) in a range of concentrations of nitrous oxide diluted with carbon dioxide (simulated peritoneal gas).

The mean concentrations of N_2O at 10, 20 and 30 min from the time of insufflation were 19.9 ± 4.8%, 30.3 ± 6.8% and 36.1 ± 6.9% respectively. The maximum reported concentrations of methane and hydrogen in bowel gas are 56% and 69%, respectively. The concentration of nitrous oxide necessary to support combustion of 56% methane is approximately 47%. By contrast, the concentration of nitrous oxide needed to support combustion of 69% hydrogen is approximately 29%. Therefore, it is possible for nitrous oxide to reach concentrations in the peritoneal cavity that can support combustion of bowel gas.

This paper points out the possibility for nitrous oxide to reach concentrations in the peritoneal cavity that can support combustion of clinically observed concentrations of methane and especially, hydrogen. As laparoscopic surgical techniques become more complex, the chance of intentional or unintentional perforation becomes more likely. The authors recommend that if a bowel perforation is recognized, the peritoneal cavity should be vented and purged with carbon dioxide, and the nitrous oxide removed from the anaesthetic mixture. The hazard of explosion can then be reduced.

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Improved postoperative analgesia with morphine added to axillary block solution

Denis L Bourke, William R Furman

J Clin Anesth 1993; **5**: 114–17

This study determined whether the addition of morphine to the axillary block local anaesthesia solution provided improved or prolonged postoperative analgesia. Patients in the treatment group were given intravenous saline and had morphine 0.1 mg kg^{-1} added to their axillary block solution. Control subjects received morphine 0.1 mg kg^{-1} iv and had saline added to their axillary block solution. All axillary blocks were performed using 0.55 ml kg^{-1} of 1.5% lidocaine with epinephrine 1 : 200 000.

Both groups had similar visual analogue scale pain scores in the postanaesthesia care unit, 6 h, 12 h and 24 h postoperatively. In the 24 h postoperative study period, the treatment group required approximately half as many doses of supplemental analgesic as control subjects. There were no major complications in either group. It was concluded that morphine 0.1 mg kg^{-1} added to the axillary block solution resulted in comparable pain scores, and patients required approximately half as much supplemental analgesic.

The mechanism responsible for enhanced postoperative analgesia when morphine was injected into the brachial plexus neurovascular sheath remains unknown. The addition of morphine to an axillary block solution is simple and safe and the technique offers patients the possibility of improved postoperative analgesia without an increased frequency of side effects or complications.

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