I have measured the FIP N_2O in 50 laparoscopic gynecology, intraperitoneal hernia repair and cholecystectomy patients. The FET N_2O was 65%–70%, the duration of cases from 20 min to 3 h.

At case end, a sterile tubing was connected to the trocar stopcock before deflation of peritoneal gas. The tubing was then connected to a standard end-tidal gas monitor. Peritoneal gas was sampled for approximately 60 s, at which time a stable reading had been achieved.

The smallest FIP N_2O observed was 1%–2%, the largest was 9%–10%. Small numbers were associated with shorter cases, large numbers with longer cases. The FIP N_2O never exceed 10%, a concentration that does not facilitate combustion. Bowel lumen N_2O was not measured and would require a different methodology.

The difference between observations in the pig model and clinical patients may be by a "washout" effect on the increase of FIP N_2O caused by the loss of insufflating CO_2 around additional trocar incisions used in patients. The seal around the trocar in the pig experiment may have been airtight. It is a common observation that large quantities of insufflating CO_2 are required in patient cases to replace lost CO_2. Interested parties can easily duplicate my study in the clinical patient setting. All that is required is a sterile IV extension tubing and 60 s of time. If FIP N_2O concentrations stay at or below the 10% level during cases of 3 h, perhaps N_2O ought not be abandoned.

Those who advocate abandonment of N_2O usually advocate use of 100% O_2. This same methodology could easily be used to measure the intraperitoneal concentration of O_2, a gas that supports combustion at roughly one-half the concentration that does N_2O and might increase the risk of combustion rather than decrease it.

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References

1. Diemunsch PA, Torp KD, Van Dorsselaer T, et al. Nitrous oxide fraction in the carbon dioxide pneumoperitoneum during laparoscopy under general inhaled anesthesia in pigs. Anesth Analg 2000;90:951–3.

In Response:

As stated in our article (1), the aim of our study was to establish the time course of the N_2O pollution in a CO_2 pneumoperitoneum. This was done under precise experimental conditions, i.e., a 9-h pneumoperitoneum without external leaks and provision of fresh CO_2 from the insufflator limited to the amount needed to compensate for peritoneal gas resorption, i.e., 3.5 ± 0.8 L/h, to maintain an intraperitoneal pressure of 12 mm Hg.

It seems unlikely that these experimental conditions, in which FIP N_2O ultimately approaches FET N_2O, could be met in a usual clinical situation. Conversely, as shown by Neuman et al. (2), time periods with no external leaks from the pneumoperitoneum can occur and last long enough for the FIP N_2O to reach values above 30%, which may support combustion of bowel gases.

Even in the presence of such FIP N_2O, the risk of fire is fortunately small because a bowel perforation has to occur to allow H_2 and/or methane to reach the pneumoperitoneum. Indeed, the flammable colonic gases cross the intact bowel barrier poorly. Hunter et al. (3) could not detect methane and found hydrogen in very small amounts (0.016% to 0.075%) in the pneumoperitoneum during laparoscopic procedures lasting 30 min to 2 h. Similarly, in our experimental model, H_2 and O_2 were found as traces only (one search every 10 min during 9 h after the peritoneal insufflation).

The simultaneous occurrence of 1) a high FIP N_2O, 2) a bowel perforation, and 3) an electric spark, certainly represents an unlikely event (because of the relative scarcity of the two first points), but the risk is not nil. More important may be the risk for a N_2O-containing CO_2 pneumoperitoneum to worsen the consequences of a gas embolization. We are currently working on this subject.

Avoidance of N_2O pollution in the CO_2 pneumoperitoneum could be achieved by giving anesthesia without N_2O. However, the solution we suggest for a constant N_2O-free pneumoperitoneum is to set up a constant pneumoperitoneal leak whose continuous compensation by fresh CO_2 from insufflator to maintain the pre-set pressure; this would prevent any significant N_2O accumulation. The two FIP N_2O and the flow of the leak necessary to avoid such a FIP N_2O. Preliminary results indicate that a leak of 24 L/hour is enough to maintain FIP N_2O less than 10%.

Most laparoscopic procedures are performed by using a much higher total pneumoperitoneal turnover, and the usual total gas output from the insufflator in our clinical conditions can range from 100 to 300 L/hour. This washout is neither steady nor constant. It occurs mainly during limited periods of time, essentially when the surgeon moves instruments in and out through the trocars, or during the extraction of surgical samples. All maneuvers of this kind cause the gas-tight septa of the trocars to open. Leaks around the trocars are less important in our practice. Between these high-flow washout periods, other phases without leaks may occur and promote N_2O accumulation. In the Neuman et al. (2) series (19 female patients), when no external leak occurs, FIP N_2O reaches 19.9% ± 4.8%, 30.3% ± 6.8%, and 36.1% ± 6.9% after 10 min, 20 min, and 30 min, respectively. This means that during the course of a laparoscopic procedure, the FIP N_2O may increase relatively fast and evolves alternately with the washout phases. One sole measurement at the end of the procedure may conceal the possible "peaks and valleys" in FIP N_2O and does not reflect the associated risk periods that may have occurred during the surgery. However, short procedures (20 min in all) may not allow a gas-tight pneumoperitoneum time enough to enable the FIP N_2O to rise.

For all the above mentioned reasons, we advocate the setting of a constant and measured pneumoperitoneal leak rather than the abandonment of the N_2O as part of the anesthesia and lung ventilation with oxygen-enriched air. Some surgeons open one of the trocar stopcocks from time to time or even leave it open all the time for the smoke from electrocautery to be vented. This unmeasured venting may also prevent N_2O accumulation, but it is unpredictable and, according to our recent experiments, seems much too important for the aimed objectives. A much oversized gas turnover unduly increases the heat loss associated with laparoscopic procedures.

Finally, our end-tidal gas monitors based on infrared technology are not efficient enough to perform the above-mentioned measurement, i.e., to provide simultaneous readings of CO_2, N_2O, O_2, CH_4 and H_2 in a range of concentrations from 0% to 100% (the initial value of FIP CO_2). The devices used in the literature for similar protocols are mass spectrometers, alone or coupled with a gas chromatograph as in our study. For our research protocols in progress, we are currently using a micro gas chromatograph, allowing reliable constant monitoring of the pneumoperitoneum composition in the operating theater, just as the end-tidal gas monitor does for the respiratory gas mixture.

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References

1. Diemunsch PA, Torp K, Van Dorsselaer, T et al. Nitrous oxyde fraction in the carbon dioxide pneumoperitoneum during laparoscopy under general inhaled anesthesia in pigs. Anesth Analg 2000;90:951–3.
2. Neuman GG, Sidebotham G, Negoianu E, et al. Laparoscopy explosion hazards with nitrous oxide. Anesthesiology 1993;78:857–9.
3. Hunter JG, Staheli J, Oddsdottir M, et al. Nitrous oxide pneumoperitoneum revisited: is there a risk of combustion? Surg Endosc 1995;9:501–4.

Any Propofol Compatibility Study Must Include an Emulsion Stability Analysis

To the Editor:

We would like to comment on the recent technical communication by Stewart et al. (1) concerning the stability of a propofol and remifentanil admixture. Any stability study involving emulsions must address not only the chemical stability of the constituent drugs as determined by high-performance liquid chromatography

the mixture can be considered safe for clinical use. Any change in the emulsion particle size resulting from admixing propofol may have adverse consequences for patient safety. Fat emulsion particles large enough to cause fat emboli may not be visible to the unaided eye. Laser diffraction and optical microscopy particle size analysis, such as that published by Prankerd and Jones (2) concerning the propofol/thiopental mixture must be performed before using any propofol admixture.

We would also question the authors' statement that the propofol/remifentanil mixture is safe to store for 36 hours. It is well documented that propofol's fat emulsion vehicle is an excellent medium for microbial growth (3,4). Studies similar to those conducted with the thiopental/propofol mixture, which have documented that combinations antimicrobial activity because of its high pH (5), need to be performed. However, there is nothing in the physiochemical nature of the remifentanil/propofol mixture that would appear to confer similar antimicrobial properties. Until microbiological and emulsion stability studies are performed, a propofol/remifentanil mixture cannot be assumed to be safe for storage or for administration to patients.

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Drs. Stewart et al. did not wish to respond to this letter.

References
1. Stewart JT, Warren FW, Maddox FC, et al. The stability of remifentanil hydrochloride and propofol in polypropylene syringes and polyvinyl chloride bags at 22°–24°C. Anesth Analg 2000;90:1450–1.
2. Prankerd RJ, Jones RD. Physiochemical compatibility of propofol with thiopental sodium. Am J Hosp Pharm 1996;53:2606–10.
3. Carr S, Waterman S, Rutherford G, et al. Postoperative infections associated with an extrinsically contaminated intravenous anesthetic agent.
4. Bennett SN, McNeil MM, Bland LA, et al. Postoperative infections traced to contamination of an intravenous anesthetic, propofol. NEJM 1995;333:147–54.
5. Crowther J, Hrazdil J, Jolly DT, et al. Growth of microorganisms in propofol, thiopental, and in a 1:1 mixture of propofol and thiopental. Anesth Analg 1996;82:475–8.

Coffee Is Not a Clear Liquid

To the Editor:

I read with interest the recent survey of the practice policies of anesthesiologists regarding the intake of clear liquids and a light breakfast by adult patients presenting for elective outpatient surgery (1). However, I was puzzled by the authors' statement: ". . .coffee and tea are included as clear liquids. . ." (1).

Shevde and Trivedi considered *black* coffee a clear liquid in their study of the effects of clear liquids on gastric volume and pH (2). They stated: "We have used the word 'clear' to exclude liquids with suspensions (such as juice with pulp) or those that may form solids in the stomach such as milk" (2). Shevde and Trivedi evidently did not consider coffee with milk to be a clear liquid.

An obvious fact is that coffee is not a clear liquid. Indeed, a test of several types of coffee contained in clear cups demonstrated the opacity of the liquids both before and after the administration of sugar and milk or cream.

I propose that authors should state explicitly if they mean that, in their judgment, coffee whether with milk or cream or black may be safely included with plain tea and other obviously clear liquids as a beverage that patients may safely consume before elective outpatient surgery. However, that would still not make coffee a clear liquid.

My reason for raising this apparently trivial point is that, as an anesthesiologist who works at several facilities dealing with outpatients, this issue has come up more than once, and it has been a source of confusion to health care professionals and patients.

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References
1. Pandit SK, Loberg KW, Pandit UA. Toast and tea before elective surgery? A national survey of current practice. Anesth Analg 2000;90:1348–51.
2. Shevde K, Trivedi N. Effects of clear liquids on gastric volume and pH in healthy volunteers. Anesth Analg 1991;72:528–31.

In Response:

We greatly appreciate Dr. Sosis's interest in our paper (1). This also gives us an opportunity to clarify the prevalent ambiguity about types of "clear" liquid that are allowed 2–3 h before elective surgery. Dr. Sosis has asked a very relevant question: is coffee (or tea) a clear liquid? According to the Webster's dictionary, the word "clear" (adjective) has many meanings. Some of these are, bright, luminous, obvious, plain, cloudless, free from blemishes, free from impurity, transparent, and free from doubt.

Dr. Sosis has interpreted "clear" as "transparent" or colorless, something that we can see through, e.g., water, transparent glass, a noncola drink (such as 7-Up). According to this interpretation, black coffee, plain tea, pulp-free orange juice, some types of apple juice, and cola drinks may not be accepted as "clear" liquid. However, if one takes the other meaning of "clear," that is, free from blemishes or particulates, then all of the above liquids are actually "clear." Milk, however, is not a clear liquid, because it forms curd (solid particulate material) as soon as it reaches the stomach. So, adding milk or cream to coffee makes it "unclear."

We have taken an informal poll among the members of our department, and almost everyone agreed that black coffee and black tea are examples of clear liquid.

Reviewing the published literature, we find that several authors have studied the implications of ingestion of black coffee before elective surgery. Hutchinson et al. (2) and Maltby et al. (3) found that neither the residual gastric volume nor the gastric acidity is increased after ingestion of black coffee (150 mL) or pulp-free orange juice (150 mL) 2–3 h before surgery, with or without ranitidine. Both concluded black coffee and pulp-free orange juice may be safely allowed 2–3 h before the induction of general anesthesia. Shevde and Trivedi (4) gave 240 mL of water, pulp-free orange juice, or black coffee to volunteers and found all volunteers had a gastric volume less than 25 mL with a slight decrease in pH within 2 h of orally taking one of the three 240-mL liquids. They concluded that ingestion of (any of the three) clear liquids (water, pulp-free orange juice, or black coffee) 2 h before general anesthesia is safe.

In summary, it is clear to us, as it is to a majority of practicing anesthesiologists in North America, that black coffee, black tea, apple juice, pulp-free orange juice, cola drinks, and of course, water are examples of clear liquid that could be allowed 2–3 h before elective surgery.

Finally, we would strongly suggest that the title of this correspondence that Dr. Sosis has supplied, "Coffee is Not a Clear Liquid," is inappropriate, because it sounds like a conclusion. It is not; at best, it is controversial. By looking at the title, a casual reader will get a wrong impression about the controversy. So, we would suggest a title: "Is Coffee a Clear Liquid?"

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References
1. Pandit SK, Loberg KW, Pandit UA. Toast and tea before elective surgery? A National survey on current practice. Anesth Analg 2000;90:1348–51.
2. Hutchinson A, Maltby JR, Reid CR. Gastric volume and pH in elective inpatients. Part I. Coffee or orange juice versus overnight fast. Can J Anaesth 1988;35:12–5.
3. Maltby JR, Reid CR. Gastric volume and pH in elective inpatients. Part II. Coffee or orange juice with ranitidine. Can J Anaesth 1988;35:16–9.
4. Shevde K, Trivedi N. Effects of clear liquids on gastric volume and pH in healthy