step immediately stops ventilation and fresh gas supply to the burning tube, be it still in the patient or, having been removed by the surgeon, free in the operating room. To disconnect at the anesthesia Y increases the risk of burns to personnel, takes more time in that it is a second step, may be beyond the anaesthetist's reach, and may not solve the problem.

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Combined loss of resistance-free flow hanging drop technique for spinal anaesthesia

To the Editor:

We were encouraged by a recent article on hypobaric lidocaine[1] and decided to comment on our own experience with hypobaric tetracaine.

Forty ASA physical status I or II patients scheduled for elective perirectal surgery were placed, initially, in either the prone jack-knife position (Group 1, $n = 20$) or the lateral recumbent position (Group 2, $n = 20$) for spinal hypobaric anaesthesia. All lumbar punctures (LP) were performed using Taylor's approach[2,3] at the L_5–S_1 interspace using a Pharmaseal® spinal anaesthesia tray (Baxter Healthcare Corp., USA). A combined loss of resistance (LOR) to air and free flow hanging drop technique (FFHD) using the STYLEX® plastic syringe detected the epidural and subarachnoid spaces, respectively, in all but three (Group 1) patients. Prior to surgery, all patients placed themselves in the prone jack-knife position, with head down 20° from horizontal. After surgery they were transported, supine, to the recovery room. Hypobaric tetracaine 1.0–1.5 mL (Niphanoid® crystals, 0.4% in sterile water, specific gravity 1.0020, baricity 0.9951 via sterile water calibration with refractometer at 37° C) was injected slowly (≤5 sec) after evidence of cerebrospinal fluid (CSF) free flow through the needle hub. A 22- or 25-gauge 3.5 inch Becton-Dickinson Yale® spinal needle (Rutherford, NJ., USA) was used without four quadrant aspiration or barrotage.[3,4] In three out of the 20 in Group 1, CSF had to be aspirated from 25-gauge needles to establish subarachnoid entry,[5] even though, epidural LOR to air was apparent. This method was used because reduced CSF pressure[3] in this position impeded free flow of CSF through the 25-gauge needle. Free flow using the 22-gauge needles was unhampered, irrespective of initial positioning. No patients developed postoperative headaches, intra/postoperative hypotension or hypoxaemia ($SaO_2 < 90\%$, FiO_2 0.21). All patients had selective sacral blocks as evidenced by lack of anal sphincter tone and absence of motor weakness (L_1–S_1).

The LOR-FFHD approach simulates conventional epidural techniques[3] except that the spinal needle is attached to the plastic syringe. As the bevel is directed towards the midline, LOR to air is checked repeatedly as it nears the ligamentum flavum. Upon penetration of the ligamentum flavum, a subtle loss of resistance is perceived as the syringe plunger abruptly descends one or two graduations (0.1–0.2 mL). The synringe is immediately detached from the needle hub and checked for CSF free flow. The spinal needle is then cautiously advanced in tripod fashion, until a distinct pop is felt with free flow of CSF seen "hanging" to the needle hub. The syringe is then reattached with the requisite dose deposited into the subarachnoid space. The block is usually established within seconds as evidenced by loss of anal sphincter tone.

The LOR-FFHD technique allows for controlled proprioception in the approach to the ligamentum flavum and dura. However, in the prone jackknife position, where free flow is limited by CSF pressure,[3] the use of 25-gauge or smaller spinal needles may require careful aspiration for CSF detection despite epidural space identification. This technique may prove helpful in the difficult and/or failed spinal or subarachnoid puncture above the termination of the spinal cord. In contrast to Bodily's study,[1] selective hypobaric anaesthesia can be attained with lower volumes (1–1.5 mL) at lower baricities (0.9951 vs 0.9985) and at lower spinal levels (L_5–S_1 vs L_{3-4}) without physiological trespass.

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REPLY

We wholeheartedly agree that hypobaric spinal anaesthesia is a useful technique for perirectal surgery when performed in the prone jackknife position. Furthermore, we appreciate the technical suggestions and comments. Your method for documenting loss of resistance is interesting, may well facilitate correct needle placement, and is worth a trial in any anaesthetist's clinical practice. We certainly plan to evaluate it in ours! However, we do have some questions regarding your technique. First, we would be interested to know the reasons for selecting tetracaine as the local anaesthetic. Were any of your patients discharged on the same day as the operation? If so, how long did it take to recover from the hypobaric tetracaine spinal anesthetic? Second, my experience with hypobaric tetracaine suggests that even smaller doses would still be effective. Have you utilized less than 4 mg? Third, did you collect additional data regarding the extent of anaesthesia produced by this dose of tetracaine? For example, can you describe the rapidity of onset, extent of spread, and rate of regression of sensory anaesthesia in greater detail? Did you observe any change in the spread of anaesthesia after surgery when the position was changed? Fourth, the lack of motor blockade is surprising (particularly in the foot). Please comment on the methods and timing of these assessments. Finally, the closing sentence contrasts your technique with ours, noting that you utilize a lower volume and baricity of local anaesthetic, and a lower interspace for spinal puncture. If your intention was to imply that these differences constitute advantages, we are forced to disagree for the following reasons: (1) we routinely utilize volumes of 4–8 ml of hypobaric tetracaine solutions (in concentrations of 1–2 $mg \cdot ml^{-1}$) for spinal anaesthesia in our practice without apparent complications; (2) to our knowledge, the impact of varying degrees of hypobaricity on the quality or spread of spinal anaesthesia has not been established. Thus, the effect of these minor differences in baricity remain speculative; and (3) although the Taylor approach has obvious theoretical advantages in patient populations where flexion of the spine is limited (such as this population where the prone jackknife position limits flexion of the spine) we rarely find it necessary to utilize this approach in our patients. We have found that needle placement is usually accomplished quite easily with a midline or paramedian approach when patients are in the prone jackknife position.

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Vaporizer overfilling

To the Editor:

As one of the experts involved in the litigation arising from the case referred to in the Letter by Sinclair and Van Bergen,[1] with the accompanying Editorial by Hardy,[2] I am particularly interested in the issue of vaporizer overfilling and its consequences. The various parties in the Defense in this legal matter have admitted liability, although the issue of damages remains to be determined.

My initial impression, when confronted with the suggestion of vaporizer overfilling, was that this was not possible. The information subsequently made available to me, both in the form of the results of the investigation summarized by Sinclair and Van Bergen[1] and separate tests clearly demonstrated that overfilling with the vaporizer model in question was indeed very easily achieved. Two faults (vaporizer concentration dial "on" and air entry allowed at the threaded connection between bottle neck and filling adaptor) are required to achieve the overfilled state. Critical overfilling (that required to produce markedly increased vaporizer output) was not possible with either single fault condition. The reason I was so sure at the outset that vaporizer overfilling was not possible was because of my knowledge of the Canadian Standards Association (CSA) Anaesthetic Gas Machine Standard Z168.3–M84.[3] Clause 12.2.2 states: "Each vaporizer shall be equipped with a liquid-level indicator, and shall be designed so that it cannot be overfilled when in the normal operating position ... ."

It appears that despite this very clear wording, manufacturers and others have added an implied qualifier to the clause, namely ... "when the manufacturer's operating instructions are followed." This implied (but not approved by CSA) qualifer has become the essential issue with respect to the prevention of another patient injury. Is this qualifier an acceptable solution? The qualifier is indeed the basis for the concluding message of Dr. Hardy's Editorial as Chairman of the Canadian Anaesthetists' Society Standards of Practice Committee: "This editorial comment entreats clinicians, for the sake of patient safety, to follow instructions ... please."

I accept fully that if correct filling instruction had been used in the Windsor hospital, or even if a single fault error had been made, the overfilling would not have occurred. But it did occur. The filling technique errors occurred despite operating instructions to the contrary. The result of the overfilling was a catastrophic injury to a young patient who was left permanently and severely neurologically impaired. A second victim of the incident was the anaesthetist, who was provided equipment to use with a hidden defect – a vaporizer critically overfilled by a