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A Defective Washington T-piece: An Example of Inevitable Failure and Lessons to Be Learned

To the Editor:—The Washington T-piece (suffix code "W" on product numbers 5101W-5105W; see fig. 1) is an injection-molded alternative to the standard metal 90-degree elbow adaptor containing a side accessory nipple. This T-piece is used to administer fresh gas flow in both the Jackson-Rees and Mapleson D circuits presently marketed by Vital Signs, Inc., East Rutherford, New Jersey. Recently, however, we experienced a significant problem with this T-piece while we were preparing for a pediatric case.

Routine preparation for our pediatric cases involves a modified leak test of the low-pressure components of the anesthetic breathing circuit as recommended in National Institute for Occupational Safety and Health (NIOSH) criteria.* (This involves occlusion of all fresh gas exit sites from a completely assembled anesthesia breathing circuit. The system is pressurized to 30 cm water. The oxygen flow required to maintain the pressure is a measure of the leak rate.) On our first attempt to perform this test, we were surprised to find that we could not pressurize our Mapleson D circuit. Upon closer inspection, we discovered the reason for the failure of pressurization. Figure 2 documents that a piece of molded polyethylene fully blocked the fresh gas inlet orifice. (For comparison, a small wooden stick is seen passing through a patent T-piece on the left.) This obstruction could not be perforated by any immediately available sharp object.

Complications secondary to foreign or defective material obstructing fresh gas flow have been documented sporadically in the past.^{1,2} Unfortunately, as more and more disposable, plasticlike material is mass produced for use in anesthesia, the incidence of defective products being overlooked by quality control could increase.

Vital Signs, Inc., was informed immediately of this serious equipment problem. Acting conscientiously and rapidly, they indicated that possible causes for this defect included improper mold setup, mold wear, or a foreign object between the mold faces. They assured us that, to date, this case represented the *only* event brought to their attention. Yet, they stated that even with 100% testing by the manufacturer, a defective part was a possibility resulting from human error. It was

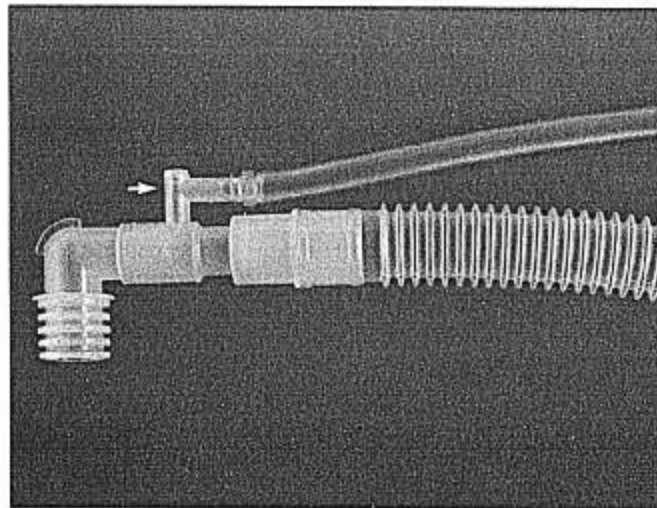


FIG. 1. Lateral view of completely assembled Mapleson D circuit demonstrating the relationship of the Washington T-piece to the other parts of the breathing circuit. (An arrow indicates the position of the Washington T-piece).

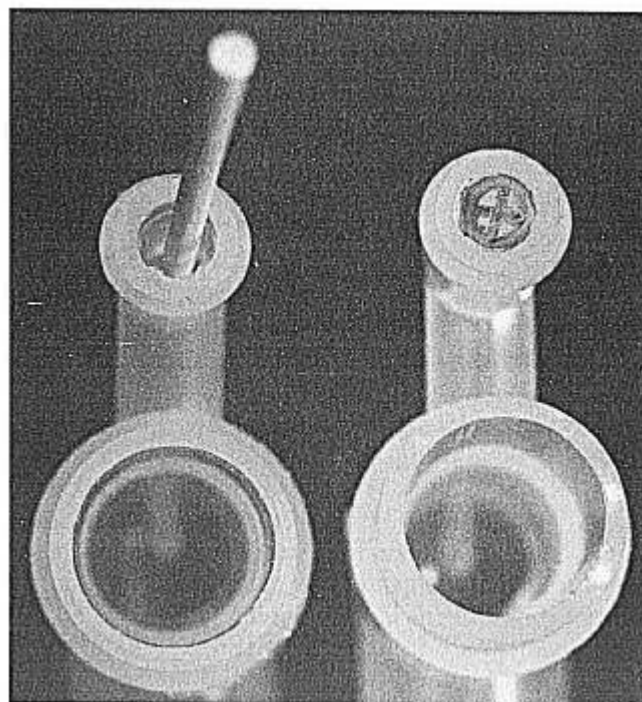


FIG. 2. Proximal view of two Washington T-pieces displaying a patent T-piece on the left (a wooden stick has been passed through the fresh gas inlet port) in contrast to the defective, nonpatent T-piece on the right. (The cross covers the nonpatent fresh gas flow inlet.)

* NIOSH, U. S. Department of Health, Education and Welfare: Criteria for a Recommended Standard . . . Occupations Exposure to Waste Anesthetic Gases and Vapors. Chapter IX, appendix J, 1982, pp 142-143

Vital Signs' final opinion that this occurrence resulted most probably from a foreign body between the mold faces, which caused significant flashing and occlusion.

In summary, it is virtually impossible to prevent this type of problem completely. However, to prevent such an occurrence from producing patient harm in the future, we recommend that 1) all anesthesiologists and department members continue to follow the NIOSH criteria for leak-test procedures of low-pressure components before the start of each case and 2) at least one complete extra set of breathing circuit equipment be maintained as insurance against discovered defects or the failure of equipment during cases in progress.

Finally, I would like to thank Vital Signs, Inc., Ms.

Mert Kincaid, CRNA, and Linda Cocuzzi for their help in isolating this problem.

AUGUST M. MANTIA, M.D.
Staff Anesthesiologist
The Western Pennsylvania Hospital
Pittsburgh, Pennsylvania 15224

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Use of a Garbage Bag for Patient Transfer

To the Editor:—We read the letter by Drummond and Sager¹ with great interest. Our way of using a garbage bag almost is identical except for one critical point. We cut the bottom part of the bag off so that it now can move like the caterpillar tread of a tank while the patient is being transferred. This is much smoother than sliding the patient on the bag.

MASAO YAMASHITA, M.D.
AKITOMO MATSUKI, M.D.

Department of Anesthesiology
Hirosaki University School of Medicine
Hirosaki, Japan

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Hypotension May Have Profound Effect on the Liver

To the Editor:—In their article, "Profound Arterial Hypotension in Dogs: Brain Electrical Activity and Organ Integrity," Dong *et al.*, underscore the need for a means of monitoring liver function during deliberate hypotension.¹ The authors ask why liver damage occurs before brain damage under their experimental conditions. If organ damage is a function of reduced blood flow and hence oxygen delivery, the brain seems to be remarkably resilient in maintaining flow, even at perfusion pressures below the lower threshold of autoregulation. During aneurysm clipping in humans, surgery usually is carried out in a head-up position; if the aneurysm ruptures during clipping, the pressure often is reduced deliberately to low values to facilitate hemostasis. Neuroanesthetists are aware that, in spite of position,

low arterial pressure, and ipsilateral common carotid artery compression, a surprising amount of arterial blood still enters the surgical field. One wonders what the concomitant changes in liver blood flow are under such circumstances.

The portal venous system does not display any significant autoregulation; autoregulation in the hepatic circulation is minimal and controversial.² At inspired halothane concentrations of 1% we found little baroreceptor homeostasis with respect to celiac blood flow in the dog.³ In the study of Dong *et al.*, inspired halothane concentrations were about 30% higher than this and probably ablated any residual hepatic artery blood flow homeostasis. Of the end-organs giving reason for concern during deliberate hypotension, namely the