no regional anesthesia developed. However, quantitative chemical determination of local anesthetic agents in blood is complex and necessary facilities are usually not available. Consequently when direct intravascular injection of a local anesthetic agent is suspected during attempted epidural block RISA may be used in the manner described to establish a diagnosis.

When systemic toxic reactions occur during or immediately following the injection of a local anesthetic agent through a catheter or needle inserted into the epidural space and regional anesthesia does not develop, intravascular injection of the anesthetic agent is the most likely cause. In three consecutive cases it was possible to demonstrate this by the quantitative recovery of RISA, injected through epidural catheters, from samples of peripheral blood.

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REFERENCES


Preservation of Volatile Anesthetics in Blood and Tissue

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Recent advances in the determination of anesthetic vapors in gas, blood, and tissues by means of flame ionization detection permit an analysis of samples weighing one to 20 mg. to be completed within one-half to two minutes.a, * Tissue blanks do not produce any volatile organic components when heated between 100 to 120°C. At this temperature, cyclopropane, ether, chloroform, halothane, methoxyflurane, and trifluoromethane are distilled, rapidly and quantitatively, into a carrier gas for analysis. Chromatography is not required when any one of these agents is employed as the sole volatile anesthetic agent; and tedious tissue extractions are avoided.

The techniques developed for the collection and preservation of the anesthetic levels in tissues should be of particular interest to clinical anesthesiologists, pathologists, pharmacologists, and toxicologists. The methods provide a convenient means for mailing specimens to laboratories specializing in these determinations.

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METHOD

Ordinary core solder (1.5 mm. inside diameter, 3.12 mm. outside diameter) was purchased from a hardware store in the form of one-pound spools. Without removing the solder from the spool, the two ends were opened by scratching deeply with a file and flexing until a clean break was obtained. The loose or free end was attached to a vacuum source and the entire spool was submerged in hot water to remove the zinc chloride flux. The tubing was rinsed several times with distilled water and sucked dry with air. The internal volume was approximately 0.05 ml. (50 μL or 50 mg.) per inch of length and could be broken off to any desired length.

Tissue specimens obtained during operation, autopsy or animal experimentation were inserted into 1 ml. disposable polyethylene tuberculin syringes with a minimum of exposure. The rubber tipped plunger was covered with a small square of Saran Wrap † and inserted into the barrel behind the tissue. The plunger was advanced until the tissue reached † Dow Chemical Company, Midland, Michigan.
the tip of the syringe. A metal cap was tightly attached to the tip of the syringe; and vigorous pressure was applied to the plunger to force any remaining air around the Saran-wrapped tip of the plunger. Tissues collected in this manner retained their anesthetic level for 24 hours when stored in the cold. Liquid samples, however, lost 30–40 per cent of their original concentration.

For longer periods of storage or for mailing purposes, the tissue was extruded from the syringe into the core of the solder tubing. The solder tube was attached to the air-free syringe containing tissue by means of a Touhy-Borst adapter.† (It was necessary to substitute a thin-walled gum rubber gasket for the rubber gasket normally provided with this adapter in order to accommodate the diameter of the solder tube). Pressure was applied to the syringe plunger until the extruded tissue appeared at the distal end of the solder tube. It was essential to fill the section of solder tube to avoid air trapping. Air trapping was avoided by noting the volume of tissue specimen available in the tuberculin syringe and using a length of solder tubing of smaller volume (0.05 ml/inch). When the solder tube was completely filled, the distal end was crushed with pliers. Before removing the solder tube from the syringe, the proximal end was crushed just distal to the adapter to avoid further exposure of an open end.

Tests in this laboratory indicate that the tissue concentrations of the anesthetics listed above are stable for at least three weeks when stored in this manner. This period was considered sufficient to permit mailing of specimens to any locality.

Upon receipt of samples, the solder tubes were refrigerated or chilled in an ice bath to minimize losses during subsequent handling. One end of the solder tube was opened (as described above) and attached to a weighed glass capillary tube § by means of an adapter constructed by welding the gasket half of a Touhy-Borst adapter to a 1/8 inch Swage-Lok fitting. The adapter permitted glass to solder contact eliminating all dead space. The distal sealed end of the solder tube was crushed between the jaws of a vise to extrude the tissue into the glass capillary. The glass capillary was weighed immediately on a torsion balance, placed in the solid sample injector, and crushed within the heated injection port of the flame ionization detector. As many as 8 to 10 samples were injected before cleaning the injection port.

**RESULTS**

Table 1 shows the results of tissue analysis obtained by exposing a 17 g. mouse to 1 per cent halothane for 3 hours. The versatility of the method was illustrated by the ability to perform triplicate analysis on a single mouse ovary within eight minutes. Liver, kidney, spleen, thyroid, thymus, blood, clotted blood, brain, ovary, and fat were handled without difficulty in extruding tissue into or out of the solder tubes. Muscle and connective tissue, however, require special all metal syringes to permit extrusion. These syringes are not generally available and have not been fully evaluated at this time.

**CONCLUSION**

With this simple, convenient technique for the transfer of tissue specimens to hollow core solder tubing for preservation of anesthetic levels, samples may be mailed to laboratories specializing in the analysis of volatile organic anesthetic agents.

### Table 1. Tissue Distribution of Halothane in a Mouse Exposed to One Per Cent Halothane for Three Hours

| Tissue | Number of Determinations | Anesthetic Concentration
|--------|--------------------------|---------------------------
|        | mg./100g.                | Range (mg./100g.)*        |
| Blood  | 5                        | 49.5                      | 48.2–50.8                 |
| Fat    | 6                        | 1,006                     | 950–1,100                 |
| Brain  | 0                        | 40.0                      | 30.1–42.0                 |
| Kidney | 6                        | 46.2                      | 42.0–48.1                 |
| Liver  | 6                        | 93.0                      | 90.0–99.0                 |
| Ovary  | 3                        | 760                       | 700–810                   |
| Urine  | 1                        | 6.0                       | —                         |
| Spleen | 2                        | 27.7                      | 25.6–29.8                 |
| Heart  | 2                        | 51.0                      | 48.0–54.0                 |
| Thyroid| 3                        | 960                       | 900–1,040                 |

* Many of these tissues are nonhomogeneous with respect to blood, fat, and connective tissue.
It is hoped that the availability of these techniques will provide a quantitative basis upon which to resolve many of the problems relating to anesthetic complications and mortality.

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REFERENCES


Terminology:

Endotracheal Tubes, Endotracheal-Tube Connectors and Adapters

Accepted by ASA Committee on Standards and Equipment

Endotracheal Tube. An endotracheal tube is a tube which is used to convey gases or vapors to and from the trachea. This term shall be used rather than synonyms such as "intracheal," or "catheter."

Tracheal End (Distal). This shall refer to that end of the endotracheal tube, usually beveled, which is intended to be inserted into the patient’s trachea.

Machine End (Proximal). This shall refer to that end of the endotracheal tube which is intended to project from the patient.

Bevel. The angle at which the tracheal end of the tube is cut.

Endotracheal Cuff. That inflatable sleeve which may be applied to the tracheal end of an endotracheal tube to provide an air-tight fit between the tube and the trachea.

Inflating Tube. That tube provided for inflating the endotracheal cuff.

Pilot Balloon. A small balloon which may be fitted to the inflating tube to indicate inflation of the cuff.

Nominal 15-mm (0.609-in.) od Connection. The nominal 15-mm (0.609-in.) connection refers to the "small size" connection in an anesthetic circuit, most commonly used to join an endotracheal tube to the next component in the circuit.

Endotracheal-Tube Connector. The straight or curved fitting that connects directly to an endotracheal tube shall be called an endotracheal-tube connector.

Adapters. Any fitting that joins an endotracheal-tube connector or a mask to a Y-piece, cannister, nonrebreathing valve, etc., shall be called an adapter. All other fittings shall also be called adapters, modified by appropriate descriptive terms.

Patient End (Distal). The end of the component part nearest the patient shall be called the patient end.

Machine End (Proximal). The end of the component part nearest the machine shall be called the machine end.

Authors are asked to use this standard terminology in manuscripts wherever possible.