

A Chamber for Exposure of Small Animals to Anesthetic Gases for Long Periods

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A chamber for exposure of small animals to subanesthetic concentrations of gases and vapors for prolonged periods must provide for the daily supply of food and water, cleaning of excreta, and change of soda lime. Initially, we used the chamber designed by Zauder and Orkin.¹ However, when long observation periods were required, it proved necessary to interrupt the exposure and remove the animals to maintain the interior of the chamber. This motivated the design of a chamber (fig. 1) that allows us to keep rats, mice and guinea pigs exposed continuously for more than four months, during which time it is necessary to remove the animals only for taking blood samples. Halothane, fluoroxene and methoxyflurane have been administered, as well as hydrocarbon and inert gases. Food pellets and water can be added to the chamber, beddings changed, and excreta removed.

The external dimensions of the chamber are $22.5 \times 23.75 \times 40$ cm. The bottom, the two sides where the ports of entry are placed, and the drawer are made of 32-gauge galvanized sheet steel. The top and other two sides are built of 1-cm-thick plexiglass. The top has a lid 21.2×12.5 cm, also made of plexiglass, that covers a rectangular opening. The lid rests on the rim of the opening, the edges of which are covered with soft sponge material for a seal ($1 \text{ cm} \times 1 \text{ cm}$), and is fastened by two screws with wing nuts. To introduce or remove the animals, one of the nuts is loosened and the other removed, allowing the lid to be lifted and rotated to permit access to the interior of the chamber. Two orifices 3.2 cm in diameter, located on the top above the containers, allow food and water to be replenished periodically. Three outlets of 1.9 cm thin-wall brass tubing in one wall and two in the opposite wall accept 1-mm male connections

from an elbow Y from the rebreathing circle or from a rubber hose from the outlet of a vaporizer. The outlets can also be used for sampling anesthetic agents or oxygen concentrations.

The capacity of the chamber is 15 liters. A flow of 10 l/min saturates the chamber in two minutes; thereafter, a 5-l/min flow can be used if two of the five ports of entry are closed. When lower flows are needed, three of the five ports of entry are closed. If maintenance of a specific internal pressure is required, a pressure gauge or a water manometer can be adapted to one of these ports to monitor chamber pressure.

The main upper compartment of the chamber measures $17.5 \times 22.5 \times 38.12$ cm. It is separated from the drawer layer compartment by two fixed sheets of 1-sq-cm mesh wire cloth. The drawer compartment is 3.75×22.5

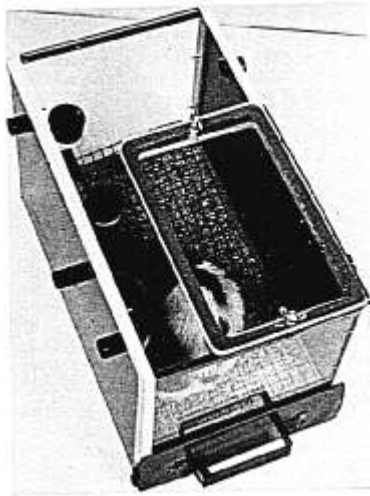


FIG. 1. Chamber.

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× 38.12 cm, with the face of the drawer being sealed by soft sponge material. When low flows are used and accumulation of carbon dioxide may occur, soda lime granules can be deposited in the bedding drawer.

In addition to studies of toxic or teratogenic effect of prolonged inhalation of anesthetic agents, other potential uses of this chamber

include exposure of small animals to environmental atmospheres containing pollutants (CO, NO₂, cigarette smoke, etc.) on a long-term basis.

REFERENCE

1. Zauder, H. L., and Orkin, L. R.: Chamber for anesthetization of small animals, *ANESTHESIOLOGY* 20: 707, 1959.

CASE REPORTS

Pneumopericardium: A Complication of Prolonged Ventilation

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Pneumopericardium usually has been considered to be secondary to trauma, gastropericardial fistula, tuberculosis, pericarditis, thoracentesis or paracentesis.¹ Loftis² reported six cases of pneumopericardium in infants caused by excessive inflation pressures during anesthesia or resuscitation attempts. To our knowledge no case of pneumopericardium as a complication of prolonged artificial ventilation has been reported.

CASE REPORT

A 2.2-kg white male infant was born to a gravida 4, para 3 woman after 34 weeks' gestation. The mother had mild vaginal bleeding prior to onset of labor. The first stage of labor was four hours long, the second half an hour, and delivery was uncomplicated. Apgar score at one minute was 7 and at five minutes, 3. The infant's condition became worse and positive-pressure breathing and closed-chest massage for three minutes were required to resuscitate him. Because of persistent cyanosis he was transferred to Children's Hospital New Born Center at 3 hours of age. On admission he was in moderately severe respiratory distress with nasal flaring and moderate retraction of the intercostal muscle. Roentgenograms of the chest showed changes compatible with hyaline membrane disease.

Blood gas values with an ambient atmosphere of 100 per cent oxygen were: pH 7.28; PaCO₂ 43 mm Hg; PaO₂ 37 mm Hg. Sodium bicarbonate was given to correct the metabolic acidosis. The following day the infant's condition seemed unchanged, and blood gas values breathing 92 per

cent oxygen were: pH 7.24; PaCO₂ 64 mm Hg; PaO₂ 31 mm Hg. On the third hospital day the infant's condition deteriorated, with severe chest retractions and grunting, a respiratory rate of 100/min and increasing peripheral cyanosis.

In an atmosphere of 95 per cent oxygen blood gas values were: pH 7.16; PaCO₂ 77 mm Hg; PaO₂ 34 mm Hg. Because of the increasing respiratory failure it was decided to assist ventilation. The trachea was intubated with a 3.5-mm nasotracheal tube, and a Bird Mark 14 respirator was used for controlled ventilation. Tracheal suction was performed hourly and manual hyperinflation with a breathing bag was done every three hours. The following day, with ambient oxygen at 90 per cent, blood gas values were: pH 7.36; PaCO₂ 45 mm Hg; PaO₂ 55 mm Hg. In the next ten days there was no appreciable change in the patient's condition, and attempts to wean him from the respirator were fruitless. On the fourteenth hospital day the nasotracheal tube was dislodged inadvertently, and the infant vomited and aspirated acid gastric contents. The trachea was reintubated and lavaged with physiologic saline solution and a three-day course of corticosteroid therapy was started. Artificial ventilation was resumed, but because of a rising PaCO₂ it was necessary to increase the peak inspiratory pressure from 25 to 40 cm H₂O. On the sixteenth hospital day the infant suddenly developed marked abdominal distention and physical signs of left pneumothorax. This was confirmed by roentgenogram, a chest tube was inserted and the lung subsequently re-expanded.

The following day there was rapid deterioration in the infant's condition. He became very cyanotic, with almost-inaudible heart sounds, and a previously-unpalpable liver was now felt 3.5 cm below the costal margin. Roentgenograms of the chest showed a large pneumopericardium (fig. 1),

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