

The mat should be kept moistened with water. After cleaning the shoes of foreign material such as wax, dust or powder, a second test should be made.

In the event that the needle shows no deflection when the testing button is pressed, the apparatus may be checked roughly but quickly by contacting the two steel foot plates with the fingers of one hand and depressing the test button. If the tester is in working order the needle will deflect into the safe position of the scale; if there is no deflection the apparatus should be considered to be out of order.

SUMMARY

A simple and inexpensive apparatus has been described for testing the electrical conductivity of shoes used by personnel in hazardous locations within hospitals. The testing apparatus has proved satisfactory for daily usage during the past three years at Hartford Hospital. It is con-

sidered a valuable adjunct in meeting the Code established by the National Fire Protection Association.

REFERENCES

1. Bulletin, National Fire Protection Association; Combustible Anesthetics in Hospital Operating Rooms. Boston, 1941.
2. Ibid., revised 1944.
3. Bulletin No. 56, National Fire Protection Association, Recommended Safe Practices for Hospital Operating Rooms, Boston, May 18, 1950.
4. Hickcox, C. B., and Lovell, B. B.: A New "Build-It-Yourself" Conductive Shoe Tester, *Hospitals* 24: 57-59 (Nov.) 1950.

CURTISS B. HICKCOX, M.D., *Associate*,
RALPH M. TOVELL, M.D., *Chief*,
Department of Anesthesiology,
AND BURTON B. LAMMEL, B.S.,
Chief Engineer,
Hartford Hospital, Hartford, Conn.

VOCAL CORD PALSY AS A COMPLICATION OF ROUTINE ARTERIOGRAM OF INTERNAL CAROTID ARTERY: TWO CASE REPORTS

Two cases are reported to call attention to the possible complication of palsy of the vocal cords in conjunction with the technic of arteriography of the internal carotid artery. This complication may occur whether the procedure is performed by percutaneous technic or by surgical exposure of the artery. In the first case report palsy of the vocal cord was suspected twelve hours after arteriography and confirmed in twenty-four hours. In the second case the procedure was done ten days later. The complication was recognized at the time the procedure was completed.

REPORT OF CASES

Case 1.—On December 31, 1949, a 48-year-old white woman was admitted to the hospital, with a history of emotional and mental disturbances, gradually developing before admission. Further history was unobtainable since the patient was disoriented and moderately agitated.

Physical examination revealed that the patient was obese. The essential physical

findings were as follows: blood pressure 120 mm. systolic and 70 mm. diastolic, pulse 80, respirations 20 and temperature 98.4 F. There was a midline rectus scar in the lower part of the abdomen. Findings on neurologic examination were compatible with an expanding intracranial lesion in the left cerebrum.

Routine admission examinations of the blood and urine were within normal limits. The Kahn test gave negative results. An electro-encephalogram showed a focus of delta waves in the left prefrontal area (nothing posteriorly). Roentgenograms of the skull revealed marked erosion of the sella and posterior clinoids.

On January 5, 1950, bilateral arteriograms were done. The patient was given nembutal, 0.1 gm., at 12:00 noon and demerol, 50 mg., with scopolamine, 0.3 mg., at 12:30 p.m. In surgery the patient's larynx was cocaineized and anesthesia begun at 1:54 p.m. using intravenous pentothal-curare mixture (1.0 gm. with 100 units [15 mg.] in 40 cc.). The vocal cords moved well and seemed normal in every re-

spect. Oro-endotracheal intubation was accomplished at 2:12 p.m. Nitrous oxide, 75 per cent, and oxygen, 25 per cent, were then given to the patient by to-and-fro absorption technic, using the semiclosed method from time to time. The exposure of the carotid vessels was begun at 2:22 p.m., the right side being operated on first. The transverse colli nerve had to be sacrificed on this side. The vagus nerve "was in full view, being lateral to the common carotid artery. . . . It was necessary to manipulate the vagus slightly in order to expose the carotid artery. . . . The bifurcation of the artery was . . . very high . . . under the angle of the jaw" (from the surgeon's description of the operation). The operation on the left side was begun at 3:32 p.m. It was not necessary to manipulate the vagus on this side.

At 4:15 p.m. the patient was taken to the x-ray room for arteriograms. Diodrast, 64 cc. of a 35 per cent solution, was used, with five injections on the left and three on the right.

At 5:45 p.m. the arteriograms were completed and the patient was returned to surgery for closure of the operative incisions. This was completed at 6:15 p.m., and the anesthesia was terminated at 6:20 p.m. The patient strained on the tube during extubation and had a moderate degree of laryngospasm which cleared up when oxygen was given under positive pressure. Her airway then seemed clear, and she was returned to bed in good condition.

The total dose of anesthetic drugs was 3 gm. of 2.5 per cent pentothal, and 100 units (15 mg.) of d-tubocurarine (high potency).

At 9:00 p.m., when examined, the patient's breathing was sonorous, and frequent pharyngeal aspirations were required, which caused her to swallow and gag. Four hours later she was moving spontaneously.

At 9:30 a.m. of the morning following operation, the patient was placed in an oxygen tent as a general supportive measure since the breathing seemed somewhat labored. She was breathing easily at 6:00 p.m. that evening.

At 8:00 p.m. the same evening the patient began having a dusky flush to the face, marked distention of neck veins, marked inspiratory stridor, diminished

breath sounds and marked sternal retraction. She was conscious and apprehensive. The respiratory rate was 34 to 40. The impression was acute laryngeal edema, possibly palsy of the vocal cords, marked respiratory obstruction and evidence of massive atelectasis. She was seen in consultation by an otolaryngologist at 9:00 p.m., and tracheotomy was seriously considered. It was possible, however, to relieve her by placing her in the Trendelenburg position, and administering propylene glycol inhalations, intravenous benadryl, hypertonic plasma intravenously and positive pressure oxygen. The respiratory rate at that time was 44.

The acute laryngeal edema soon began to subside and within several hours the patient was much improved, with a respiratory rate of 28.

The following day (February 7, 1950), indirect laryngoscopy revealed fixation of the right vocal cord, two plus edema of the arytenoids and both cords. Four days later the edema had entirely disappeared, and oxygen was discontinued although the right vocal cord was still fixed.

The arteriograms revealed a parasagittal filling defect in the left occipitoparietal region, interpreted as probably a meningioma. No spill of diodrast into the neck tissues was seen on the roentgenogram.

On February 16, 1950, this patient again came to surgery. Preoperative medication consisted of nembutal, 0.1 gm. at 8:00 a.m. and demerol, 50 mg., with scopolamine 0.4 mg., at 8:30 a.m. Anesthesia was induced and oro-endotracheal intubation accomplished as before. The right vocal cord was still fixed at this time. The patient was turned prone and a craniotomy performed, with removal of a meningioma, approximately 8 cm. in diameter, from the left parieto-occipital region. During most of the operation anesthesia was maintained with an ether-oxygen mixture. The larynx and cords were carefully examined following extubation, and their appearance was as before intubation, without ulceration or injury. Total dose of anesthetic drugs was: pentocurare, 1.0 gm. and 100 units; ether-oxygen as required. The operating time was four and a half hours and anesthesia time five and a half hours. The patient was returned to bed in good condition.

From that point on the patient made an

uneventful recovery except for a prolonged period of slight elevation of temperature, which could not be explained. She was discharged on February 18, 1950, in good condition, with residual euphoria, shallow effect and hemianopsia.

Case 2.—A well-developed white man, 51 years of age, was admitted to hospital on January 6, 1950, with a chief complaint of gradual onset of severe bitemporal and retro-orbital headaches during the previous three to four months. Also, during this time, projectile vomiting, memory lapses and fainting episodes developed, usually preceded by olfactory hallucinations. A peculiar shuffling gait also had developed. Further significant history was the presence of hay fever and asthma of moderate severity. Just previous to admission an electro-encephalogram revealed findings suggestive of a lesion deep in the right frontal area.

Physical examination revealed that the patient was heavy set, well developed, and muscular, 6 feet tall, and weighed about 200 pounds. The blood pressure was 120 mm. systolic and 80 mm. diastolic, temperature 99 F., pulse 80, and respirations were 22. The lungs were resonant to percussion, with a faint expiratory wheeze. The chest was barrel-shaped. The trachea was in the midline. Neurologic findings of significance were slight left lower facial weakness, minimal lagging on elevation of the right arm, with increased deep reflexes, and past-pointing to the left with both arms. Left abdominal reflexes were diminished. There were no abnormalities in the ocular fundi, no speech disturbances and no sensory changes.

Laboratory examinations were as follows: routine admission studies of the blood and urine were within normal limits. The Kahn test of the blood gave negative results. Roentgenograms of the skull revealed destructive changes in and about the stella turcica compatible with increasing intracranial pressure.

On January 10, 1950, the usual tests for diodrast sensitivity were negative.

At 1:30 p.m. on January 10, 1950, the patient was given demerol, 100 mg., and scopolamine, 0.4 mg. At 3:02 p.m. anesthesia was started with intravenous sodium nembutal and 0.5 per cent procaine by intravenous drip. The throat was co-

cainized and a pharyngeal airway was inserted. A right-sided percutaneous arteriogram was attempted, but the surgeon had considerable difficulty keeping the needle in the carotid artery. Seventy-two cubic centimeters of diodrast were used, most of which spilled into the neck tissues. The artery was punctured on three separate occasions. The operative procedure lasted until 4:03 p.m. (operating time was fifty-five minutes). With each injection of diodrast the patient had a mild convulsive type of movement after a lag of several seconds following the injection. The total dose of anesthetic drugs was procaine 0.5 per cent, 3¼ gm. and nembutal 11¼ grains.

Following the procedure the trachea was markedly deviated to the left, there was partial obstruction and a moderate amount of mucous secretions was present. The patient was watched closely by the anesthesiologist for about one hour in surgery before reflexes began to return; oxygen under positive pressure was administered intermittently and pharyngeal suction performed. Laryngoscopic examination revealed extreme deviation of the glottis to the left and palsy of the right vocal cord. He was then returned to bed. He was watched closely for another hour, during which time his airway was adequate only when he lay on this right side with his head turned to the right. At the end of this hour, about 6:00 p.m., he had regained consciousness and his condition was considered safe.

By January 13, 1950, the cervical edema had largely subsided and the trachea, while still deviated to the left, was not markedly so. Indirect laryngoscopy demonstrated that the right vocal cord palsy had disappeared.

On January 14, 1950, a ventriculogram and craniotomy were done under local anesthesia and nembutal sedation, with partial removal of an extensive glioma and right frontal lobectomy.

The anesthesia course and recovery following this operation were uneventful, and the patient was discharged in good condition on January 29, 1950.

MARY LOU BYRD, M.D.,
Director of Anesthesia, and
WILLIAM B. JENSEN, M.D.,
Butterworth Hospital,
Grand Rapids, Mich.