

## LACK OF LARYNGEAL TRAUMA AFTER USE OF THE CARLENS CATHETER

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VARIOUS complications arising from the use of endotracheal tubes have been reported (1-15). Contact ulcer of the larynx was described in 1928 by Chevalier Jackson (16) on the basis of 248 cases observed in forty years. In 1935 Jackson (17) reported 45 additional cases, making a total of 293 cases. "In none of these cases was the laryngeal condition a sequela of endotracheal anesthesia or of endolaryngeal instrumentation" (18).

Chevalier Jackson stated in 1953 that "In the available literature there is one report of systematic laryngeal examination after anesthesia in which an indwelling tube was used. In 1913 Jackson reported . . . postanesthetic laryngoscopy in 80 cases . . ." (18).

Flagg (8) in 1951 reported the results of a survey questionnaire sent to 514 laryngologists, receiving answers from 154 of them. One hundred one granulomatous lesions following endotracheal anesthesia were reported at this time.

Baron and Kohlmoos (10) also in 1951 reported a series of laryngoscopic examinations on 80 patients following endotracheal anesthesia. They found no granulomatous lesions in their series but reported seven cases from other hospitals in their area.

In February, 1954, Melick and associates (15) reported a case of bilateral granuloma of the larynx following endotracheal anesthesia and stated, "Undoubtedly the too light anesthesia during the last hour, with the motion of the larynx over the tube due to swallowing and coughing, is . . . responsible for the production of the granulomatous tissue."

The Carlens endotracheal tube (19) is a large (15 mm. external diameter), irregularly shaped endotracheal tube, as illustrated in figure 1. It is more difficult to insert than an ordinary endotracheal tube. The distal end is designed to lie in the left main stem bronchus, as illustrated in figure 2. It was thought that the use of such a large, irregular tube would be traumatic, and this disadvantage would outweigh the advantages to the surgeon of having such a tube in place during open thoracic procedures.

The present study was undertaken to determine what trauma would result from the routine use of such a tube, particularly since all of the patients used in this study had tuberculosis and were therefore

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notably subject to laryngeal complications. The use of this tube seemed to fulfill all the qualifications of trauma necessary to produce laryngeal contact ulcers and subsequent granulomas as described by Flagg (8), by Baron and Kohlmoos (10), by Melick (15), and by Jackson (18).

This 486-bed tuberculosis hospital is well suited for a systematic study, since the patients require prolonged hospitalization, allowing adequate time for postendotracheal study. They also have multiple endotracheal instrumentations, including preoperative bronchoscopic examination, bronchspirometric measurements, endotracheal anes-

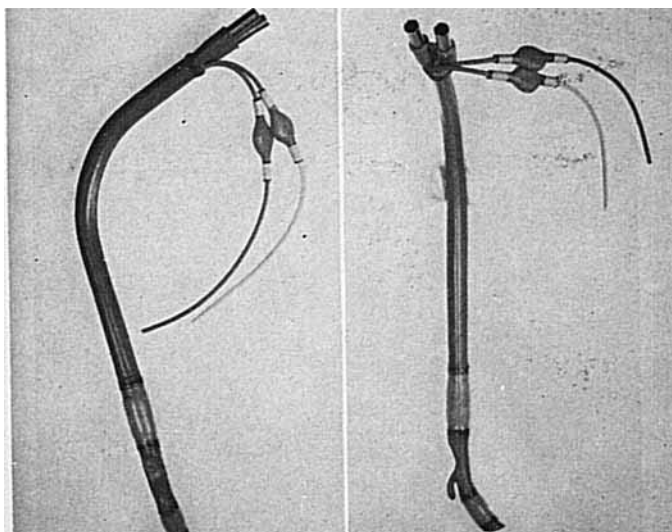


FIG. 1. The Carlens double-lumen catheter.

thesia, usually with a Carlens double-lumen catheter, and some require postoperative tracheobronchial aspiration either through an endotracheal tube or a bronchoscope.

#### METHOD

All of the 206 patients in this series had endotracheal anesthesia with a Carlens catheter at least once. The anesthetic was usually started with sufficient thiobarbiturate to render the patient just un-

conscious. Succinylcholine chloride, 1 mg. per kilogram of body weight, was administered intravenously. The patient's lungs were then inflated with 100 per cent oxygen for 30 to 60 seconds. By means of a MacIntosh, curved blade laryngoscope, the tip of which was placed anterior to the epiglottis, the epiglottis and tongue were elevated to

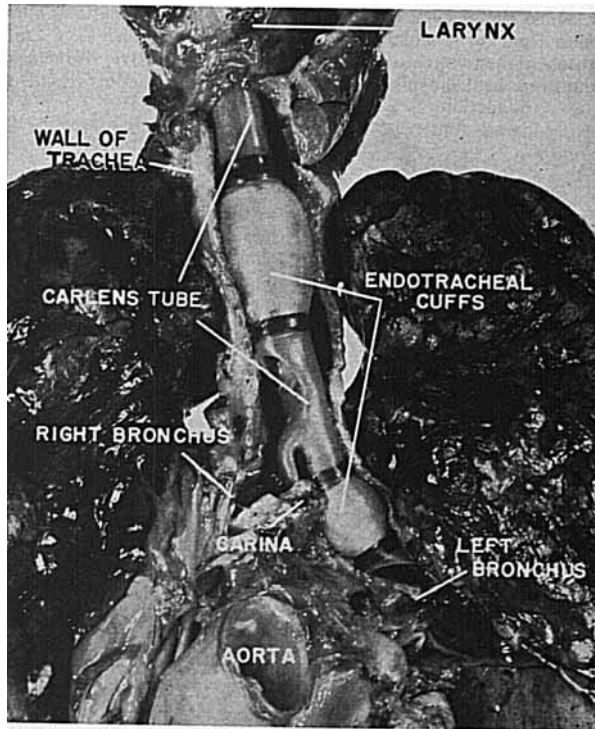


FIG. 2. The Carlens catheter in place. (Reprinted from: Siebecker, K. L., and Mendenhall, J. T., *ANESTHESIOLOGY* 17: 468 (May) 1956.)

expose the larynx to direct vision. The vocal cords were then sprayed with 1 per cent tetracaine or 5 per cent hexylcaine. The tip of the MacIntosh spray was then inserted between the vocal cords, and the trachea and bronchi sprayed. A total of not more than 4 cc. of local anesthetic agent was used at any time. The patient's lungs were again

inflated with 100 per cent oxygen for 30 to 60 seconds, after which time the larynx was exposed, and the Carlens catheter was inserted by direct vision. The tube had previously been lubricated with 0.75 per cent cyclomethycaine in water soluble jelly. We have thought it not necessary to tie down the carinal hook as recommended by Carlens (19), because gentle rotation of the tube as it is inserted prevents damage to the vocal cords. The anesthetic was maintained with nitrous oxide-oxygen, thiobarbiturate, meperidine, and either tubocurarine chloride in divided doses or succinylcholine chloride by continuous intravenous drip. The patients were kept in as light a plane of anesthesia as possible and nearly all responded immediately upon removal of the endotracheal tube.

The endotracheal tubes were washed with water and liquid soap containing hexachlorophene and then soaked in 70 per cent ethyl alcohol for several hours. They were then allowed to dry overnight before the next day's use.

Most of the anesthetics were administered and the intubations performed by anesthesiology residents in their second year of training, under the supervision of a staff anesthesiologist, or occasionally by the staff anesthesiologist. The intubations were performed as carefully as possible, but some trauma accompanies endotracheal intubation under the best of circumstances, as pointed out by Gillespie (20). Three of these intubations were noted to be particularly difficult and accordingly traumatic.

Two hundred and six patients were studied closely and laryngoscopic examination was performed at varying intervals after endotracheal anesthesia. Most patients were examined eight weeks after their last operative procedure. A few were examined within one or two weeks, and some were seen as long as six months postoperatively.

## RESULTS

Two hundred forty-five preoperative endotracheal procedures were done on 206 patients, an average of 1.19 per patient. There were 313 operative procedures requiring endotracheal anesthesia, an average of 1.52 per patient. The average length of time the endotracheal tubes were in place was three hours and forty-four minutes, the longest being eight hours and thirty minutes. The tracheobronchial tree was sprayed with either tetracaine or hexylcaine preceding 240 of the 313 intubations. There were 36 postoperative bronchoscopic aspirations performed. Thus, there were 594 endotracheal procedures, or an average of 2.88 per patient. No laryngeal lesions were found in 204 of the 206 patients. One patient, following a left pneumonectomy, had paresis of the left vocal cord. The surgeon was certain that the left recurrent laryngeal nerve was damaged during dissection of dense adhesions around the arch of the aorta. One patient presented a purple, raised

lesion on each vocal cord, probably hematoma, when he was examined on the sixth postoperative day. He had 5 bronchoscopic aspirations during those six days because of a severe, persistent atelectasis. This patient had another endotracheal anesthetic three weeks after this examination and was examined again seven weeks after this last procedure, which was eleven weeks after the lesions had been seen. There was no laryngeal lesion observed at this last examination.

One patient reported hoarseness for two weeks after operation, but examination revealed no visible lesion of the larynx. The hoarseness disappeared and had not recurred when he was discharged from the hospital nine months later.

#### DISCUSSION

One of the advantages of this large, irregularly shaped endotracheal tube is that it is possible to maintain the patient in good condition through respiration with only one lung for moderate periods of time. This allows collapse of the lung on which the operative procedure is being done, and gives the surgeon more room to work. This is a distinct advantage in some cases and also shortens the operative time in a fair number. The isolation of this lung from the respiratory circuit allows the surgeon to cut and close the bronchus without application of a bronchial clamp. Our surgeons believe this technique causes less trauma to the bronchial stump and decreases the incidence of bronchopleural fistulas. A further advantage is that when the patients are placed in the lateral position for thoracic operations, the use of the Carlens tube prevents dumping of pus, blood, and secretions into the lower lung. The bronchus of either lung can be aspirated easily without missing a single respiratory inflation. This is particularly valuable in cases of bronchiectasis, tuberculous cavitation, and lung abscess. It was considered to have been life saving in several instances in this series.

This systematic postoperative study of 206 patients in whom endotracheal intubation was performed with a Carlens double-lumen catheter has revealed no laryngeal pathological condition attributable to the use of the tube. The use of the Carlens tube in an additional 394 cases during the past three years has produced no untoward results as far as clinical observation can determine. Accordingly, it is thought that the advantages offered by the use of this tube, both as to the convenience to the surgeon and to the safety of the patient, warrant its further use.

#### SUMMARY

Laryngoscopic examinations have been performed on 206 patients following intubation with a Carlens endotracheal catheter for anesthesia in open thoracic operative procedures. Only 2 patients presented any abnormality of the larynx, neither of which was attributable

to the intubation. Clinical observations of an additional 394 patients have revealed no untoward results.

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