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Bronchoscopic Aid in Thoracotomy

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BRONCHOSCOPIC AID IN THORACOTOMY.

BY OTTO C. GAUB, M. D., AND CHEVALIER JACKSON, M. D., PITTSBURG

At the meeting of the American Laryngological Association at Boston, May, 1909,* one of us mentioned the aid the bronchoscopist should render the surgeon in thoracotomy by passing oxygen down to the lungs. So many inquiries for details have been received that we herewith give the method.

The lung which ordinarily collapses when the pleural cavity is opened may be inflated with oxygen, deflated, held partially inflated, etc., at will by the bronchoscopist at the command of the surgeon. Oxygen can be admitted to the unoperated lung and a constant return flow maintained so that the vital pulmonary hemic changes go on normally and pleural shock is also lessened. Furthermore, the lung on the operated side can be allowed to collapse without danger to the patient, thus allowing the surgeon ample room for work with the hands and instruments within the thorax. Again, independent of inflation and deflation a constant supply of oxygen is kept streaming through the lungs supplying every need, as shown by the pink color of the blood.

Thoracotomy is not within the province of one of the writers, and the experimentation was undertaken at the suggestion and with the guidance and wise council of Dr. Otto C. Gaub, who did the thoracotomy and who will give the methods and results in full when the full series of experiments shall have been completed.

The apparatus is simple and readily understood. As with anesthesia, the simpler the better; the main reliance for safety being upon the personal skill of the administrator, who is closely in sympathy with his patient's condition, pulse, respiration, and, above all, color. This matter of color is the safest and chief index of the perfection of the hemic pulmonary processes of oxygenation and excretion. Pressure gauges are easily attached but are dangerous and misleading for this work in practice, as they lessen the administrator's watch upon the just mentioned indices of the vital processes. The fundamental law which must be constantly before the mind is that of Crile. In brief, the intrapulmonary pressure must not exceed the capillary blood pressure or the compression of the capillaries and consequent ischemia will prove fatal. We at first

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thought of surrounding the bronchoscope with an inflatable rubber dam to make a pressure-tight fit around the bronschoscope, but upon talking over the subject with Dr. George W. Crile, he warned us of the danger of excessive pressure. It was then found upon experimentation that the aspirating bronchoscope (Fig. 1), would serve the purpose in the simplest and safest manner. This instrument lighted by a lamp at the distal extremity, was devised by one of us a number of years ago for the general purposes of bronchoscopy in cases where excessive secretion obscured the view. The auxilliary drainage canal in the wall of the tube was, for that purpose, connected with an aspirator. For the purposes now under consideration, however, this canal is used to convey oxygen to the distal extremity of the tube, this extremity being inserted into the main bronchus of the operated side to the point where the upper lobe bronchus is given off. This position is found instantly by sight, the bronchoscope being passed in through the mouth in a few

Fig. 1. Aspirating bronschoscope used to control pneumothorax in thoracotomy. The auxilliary canal in the wall of the tube ends in the lumen of the tube at the distal end.

seconds, and without the slightest difficulty. (At times it may be necessary to insert it in one of the branch bronchi, or to withdraw it to the tracheal bifurcation and insert it in the unoperated side. All of these manipulations can be performed promptly and with precision as the interior of the bronchi is at all times visible through the tube). The oxygen being turned on at the valve (V, Fig. 2), the oxygen rushes into the bronchi, and, the escape being free, the pressure is more or less under control of the valve V. Of course, if it were admitted to a closed cavity the pressure would soon equal that of the tank. The return flow of oxygen and other gases is chiefly through the main lumen of the bronschoscope. The careful and skillful regulation of the escape of gases by the thumb (T), of the administrator is a simple and perfect control for the inflation and deflation of the lung on the operated side. The lung on the unopened side of the thorax participates in the rise and fall of endo-pulmonary pressure by means of the lateral openings in the

main lumen of the bronchoscope and also by means of the accessory return flow of gases around the outside of the bronchoscope, being more or less, according to closeness of fit of the bronchscope in the bronchus. This accessory return flow is hindered by the glottis, to a greater or less extent, according to the closeness of fit of the bronchoscope in the glottis. If thought desirable, this could be closed off by an inflating collar like a Trendelenberg tracheal canula, but in our opinion this escape is a necessary safeguard to avoid the danger of over-pressure as warned against by Dr. Crile. The lung on the operated side is watched through the wound by the bronchoscopist, so that the lung may be held exactly where the

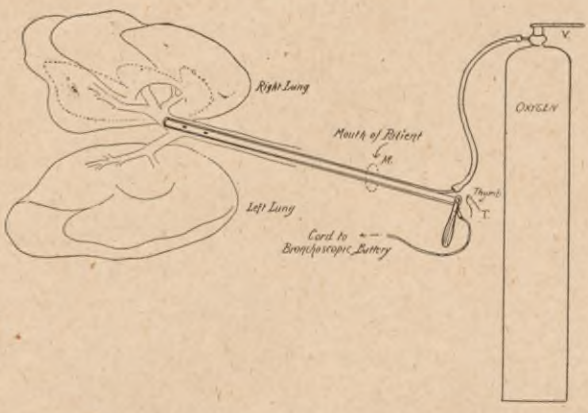

Fig. 2. Schema of bronchoscopic aid in thoractomy. The right lung is the operated side, and the dotted line represents schematically the collapse of the lung; this deflation is absolutely under the control of the bronchoscopist who at the command of the surgeon can inflate, deflate, or maintain at any stage of partial inflation, by the admission of oxygen by valve V and the control of the escape at the proximal end by more or less complete closure with the thumb. A wash bottle for the moistening the gas is omitted for clearness.

surgeon wishes. The bronchoscopist, however, is entirely out of the surgeon's sterile field and has a separate sterile organization of his own.

So far all the work has been done upon the dog, but our results have been such that we feel certain that much of the respiratory and circulatory disturbances incidental to large pleural openings can be prevented or controlled and that with further development the thorax may be opened with only very slightly higher mortality than the abdomen, and that such mortality as does occur will not be due to pneumo-thorax or its sequelae, but to pleural shock and other causes with which the surgeon is familiar.

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