

ENDOTRACHEAL INTUBATION ASSEMBLY AND RELATED METHOD

BACKGROUND OF THE INVENTION

This invention relates to an endotracheal intubation method and an associated instrument assembly for use in performing the method.

During a major surgical operation, a patient is anaesthetized and accordingly requires endotracheal intubation for purposes of providing oxygen to one or both lungs. Generally, unless one of the lungs is being operated on, it is desirable to place the distal end of the endotracheal tube proximally of the junction between the bronchi.

Endotracheal intubation can be difficult even for an experienced anaesthesiologist. The endotracheal tube can be inadvertently placed down the esophagus instead of the windpipe. Moreover, even if the tube is correctly placed at the onset of an operation, it can become dislodged as a consequence of the movements of the patient caused by the operative procedures. Thus, it is important to periodically determine the location of the endotracheal tube during an operation.

The positioning of an endotracheal tube is determined currently by three methods. First, the anaesthesiologist listens to the lungs during a lung oxygenation or pressurization step. The sounds made upon proper endotracheal tube placement are generally different from the sounds made upon an improper placement. Second, the carbon dioxide content of gases expelled via the endotracheal tube is measured. If the tube is improperly placed in the esophagus, there will be no carbon dioxide in the outgoing gases. Third, tissue oxygenation, for example, in the finger, is measured to determine whether the blood is carrying oxygen to the patient's tissues.

None of these methods is universally effective in determining proper endotracheal tube placement.

OBJECTS OF THE INVENTION

An object of the present invention is to provide a method, utilizable during endotracheal intubation, for determining whether an endotracheal tube is properly placed.

Another, more particular, object of the present invention is to provide such a method which is implementable both during intubation and subsequently.

Yet another particular object of the present invention is to provide a method for automatically monitoring endotracheal tube placement during surgery to automatically determine that correcting positioning is maintained.

A further object of the present invention is to provide a device or assembly for carrying out the method of the present invention.

A more specific object of the present invention is to provide such a device or assembly which is at least partially disposable and inexpensive to make.

These and other objects of the present invention will be apparent from the drawings and detailed descriptions herein.

SUMMARY OF THE INVENTION

An endotracheal intubation assembly comprises, in accordance with the present invention, a tubular member provided with openings at a proximal end and a distal end, an illumination transmission guide attached

to the tubular member for transmitting optical radiation from the proximal end to the distal end of the tubular member, and an image transmission guide attached to the tubular member for transmitting an image from the distal end to the proximal end of the tubular member.

According to another feature of the present invention, the image transmission guide includes a fiberoptic cable removably attached to the tubular member. More specifically, the fiberoptic cable is removably inserted into an ancillary tube connected to the tubular member, the ancillary tube extending longitudinally therealong from the proximal end to the distal end. The ancillary tube is preferably provided at the distal end with a transparent end cap attached to the ancillary tube in a fluid tight seal.

According to a further feature of the present invention, the endotracheal intubation assembly further comprises an image analyzer operatively connected to the image transmission guide for automatically monitoring the image carried by the image transmission guide. The analyzer preferably includes a comparator for comparing, with a stored image, the image carried by the image transmission guide. A signaling component or alert indicator is operatively connected to the analyzer for indicating to an operator that the distal end of the endotracheal tube has moved from a predetermined position within a patient's trachea.

According to an additional feature of the present invention, the endotracheal intubation assembly also comprises a selector for programming the analyzer to recognize a selected image upon insertion of a distal end portion of the assembly into a patient's trachea. The selector may include a switch or other input device for instructing the analyzer that a currently transmitted image is to be stored as a reference image for comparison with subsequently arriving images.

An endotracheal intubation method comprises, in accordance with the present invention, the steps of (a) inserting an endotracheal tube into a trachea of a patient, (b) transmitting optical radiation along the endotracheal tube from a proximal end to a distal end thereof during the insertion of the endotracheal tube, and (c) transmitting an image along the endotracheal tube from a distal end to a proximal end thereof, thereby enabling an operator to determine proper placement of the endotracheal tube.

Pursuant to another feature of the present invention, the method further comprises the steps of (d) automatically monitoring the image transmitted from the distal end of the endotracheal tube and (e) automatically indicating to an operator that the distal end of the endotracheal tube has moved from a predetermined position within the patient's trachea. The monitoring of the image includes the step of automatically comparing the image with a stored reference image.

Pursuant to yet another feature of the present invention, the method also comprising the steps of (f) selecting a desired image upon insertion of a distal end portion of the endotracheal tube into a patient's trachea and (g) storing the desired image as the reference image.

The method may further comprise the step, performed prior to the insertion of the endotracheal tube into the patient, of inserting an optical fiber bundle into a channel provided on the endotracheal tube, the image being transmitted along the optical fiber bundle. The insertion of the optical fiber bundle into the channel may be stopped upon abutting by a distal end of the