# The Idea of Compact Bronchoscope

## *Bütünleşik Bronkoskopi Fikri*

Melih Kaptanoğlu, Zeynep Büyükbaş, Muhammed Yavaş*, Özgür Katrancıoğlu
Department of Thoracic Surgery, Faculty of Medicine, *Department of Mechanical Engineering,
Faculty of Engineering, Cumhuriyet Üniversitiy, Sivas, Turkey

## Summary

**Objective:** The aim of the study is to discuss the idea of "Compact bronchoscope" models.
**Method:** Two models are presented in this article. The first instrument (Model A) was designed and created as a maquette by a medical student using daily materials. We were inspired by our student's project and designed another model (Model B) in the computer with the help of a mechanic engineering student.
**Results:** Both of the models are compact and they have their own energy and light source. The body is plastic in Model A whereas it is metallic in Model B. Controls are mechanic and manual in Model A but they are electronic in Model B. In contrast to Model A, Model B has a closed tube system. Additionally Model B has optic investigation capability and aspiration/ventilation feasibility.
**Conclusions:** These concept models eliminate the usage of detailed accessories. These kinds of bronchoscopes are necessary for emergent or resuscitative measures. *(Archives of Lung 2007; 8: 27-9)*

**Key words:** Bronchoscopy, endoscopy, foreign body tracheobronchial

## Özet

**Amaç**: Bütünleşik bronkoskop kavramı ve olası modelleri hakkında tartışmaktır.
**Metod:** Bu makalede iki model sunulmuştur. İlk model (Model A) bir tıp öğrencisi tarafından çevremizde bulunan günlük malzemeler kullanılarak tasarlanmıştır ve maket olarak yapılmıştır. Bu modelden esinlenilerek ikinci bir model (Model B) bir makine mühendisliği öğrencisinin yardımıyla biligisayar ortamında tasarlanmıştır.
**Bulgular**: Her iki model de bütünleşik olup enerji ve ışık kaynakları kendi üstündedir. Model A'da gövde plastik iken Model B'de metaliktir. Model A mekaniktir ve elle kumanda edilmektedir, Model B ise elektroniktir. Model B'nin, Model A'nın aksine, kapalı bir tüp sistemi vardır. Model B'de ayrıca optik inceleme, aspirasyon ve ventilasyon yapabilme imkanları vardır.
**Sonuç:** Bu modellerin konsepti detaylı aksesuarların kullanımını elimine etmektir. Bu tarz bronskoplar acil veya kurtarıcı ölçümler için gereklidir. (*Akciğer Arşivi 2007; 8: 27-9)*

**Anahtar Kelimeler:** Bronkoskopi, endoskopi, trakeobronşiyal yabancı cisim.

## Introduction

Either flexible or rigid bronchoscopes are used for patients in a wide spectrum of conditions (1). Many accessories and appropriate surroundings are needed for both, such as; operation or intervention room, power cable, light source, light cable, connectors, forceps and etc.

In this article we present two bronchoscope-/tracheoscopes for emergency situations under unsuitable conditions without the need of detailed accessories. Of these models, Model A was created as a maquette whereas Model B was hypothetic and designed by computer. The properties of these two models are represented here.

**Address for Correspondence:** Melih Kaptanoglu, M.D., PK: 702 58141, Sivas, Turkey
Tel.: +90 346 219 13 00/2146 - +90 505 428 17 56 Fax: +90 346 219 12 84 E-mail: mkaptan@cumhuriyet.edu.tr

## Material and Methods

First bronchoscope/tracheoscope (Model A) created by a medicine student is 30 cm. long with a 2.5 cm. diameter (Fig.1a). The materials are mounted on a plastic electric pipe. A schematic cross-out section is seen in Figure 1b. Two small batteries (1.5 volt and 300 mille ampere each) are used for energy supply (Fig. 1b/j) and a 3- volt electric bulb (Fig. 1b/b) is used for light source. Batteries and an on/of switch (Fig. 1b/k) are mounted on the bronchoscope using adhesive band (Fig. 1a). An isolated copper wire (Fig.1b/l) is used as an electric cable. An inner tube is prepared by using two empty board marker pens (Fig.1b/d). A steel umbrella stick (Fig.1b/f) and a 35- cm- long fishing line (Fig.1b/h) are passed through this inner tube. An alligator forceps (Fig.1b/a) is mounted on the steel stick, which is controlled by a hinged steel latch (Fig.1b/g). All of these are fixated onto the bronchoscope with copper wires at 4 levels (Fig.1b/e).
Second bronchoscope (Model B) is designed with the help of a mechanic engineering student by using a kind of graphic programme (AutoCad; 2005). Model B (Fig. 2) is in adult size (40 cm. long, 8.5 mm. wide). The functions of the device are illuminating the area by it's lamp at the tip, investigating the environment by a lens or a telescope, removing the foreign bodies by it's forceps and aspirating blood or secretions by an aspiration channel irrigation is also possible from the same channel. Another channel for ventilation also is mounted near the aspiration channel. Forward and backward movements of the forceps provided by a piston cylinder and jaw openings obtained by micro stop motors. The mechanism of piston cylinder is hydraulic (or pneumatic). The pump of this system is placed in a room under command center and action will be transmitted to cylinder by a canal. All functions are electronic and controlled by a "control panel" at the head of the device (Fig.2 b). The head of the device has some specifications. There is an optic viewer at the top. Aspiration and ventilation ports are placed dorsally at the top. There are some control switches on the panel, these are; open (1) and close (0) buttons for the device, increasing (‰) and decreasing (Ğ) illumination buttons for the light source, jaws open (Ã), jaws closed (À), forward (p) and backward (q) movement buttons for the forceps. Control panel has also room for energy and necessary circuits.

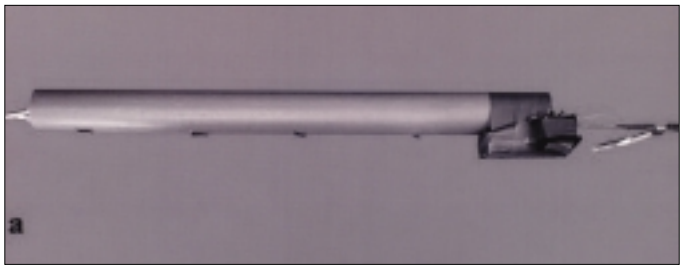

Figure 1a. Panoramic view of Model A

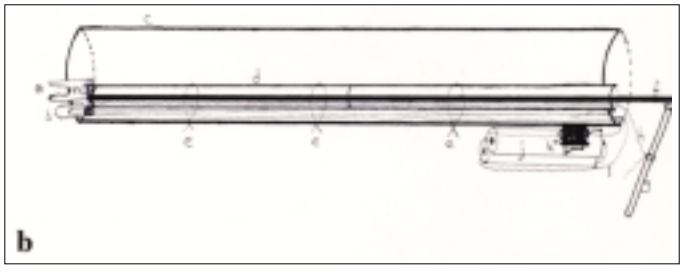

Figure 1b. Schematic design of the Model A

## Results

Both of the models were compact and they have their own energy and light source. Model A was tested on a maquette and it was possible to investigate the trachea and extract foreign bodies from the main brochci. Whereas Model B was just an imaginary design and completed the defective parts of the Model A. Controls were mechanic and manual in Model A whereas they were electronic in Model B.

## Discussion

In recent years manufacturers are making very well designed fiberoptic endoscopes with excellent video systems (2). On the other hand rigid bronchoscopes are still same for many years except small differences (3). We think rigid instruments should evolve in our days' perspective.
Actually, an alternative current, a power cable, a halogen or

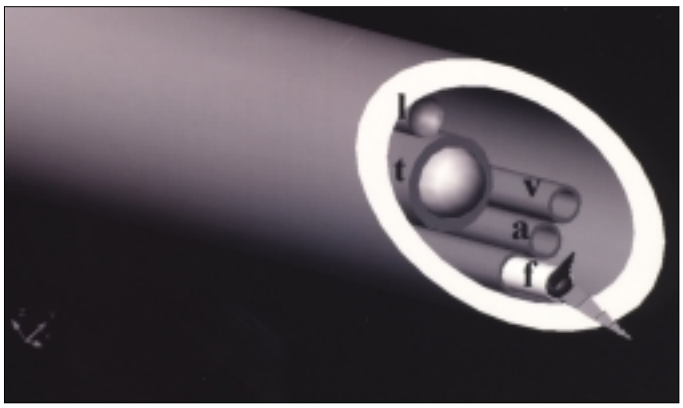

Figure 2a. Close-up view of the tip of Model B showing the light source (l), telescope (t), forceps (f), aspiration (a) and ventilation (v) channels

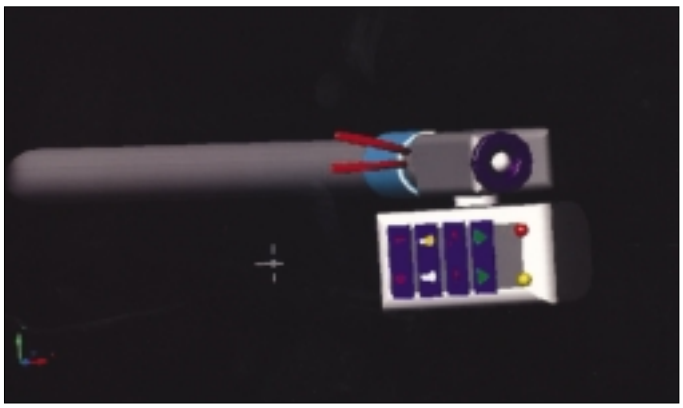
Figure 2b. The posterior oblique view of the Model B, which shows the control panel, viewer, aspiration and ventilation ports

xenon light source, a fiberoptic light cable and a prismatic light deflector are needed for a standard rigid bronchoscope. However our models have their own power supply, light source and cable, catching forceps and controller.

Some aspects of our models should be developed. For example, a cold light source should be used in Model A instead of a simple bulb such as in modern laryngoscopes. The shape, size and material of this model should be more ergonomic and reliable for performing resuscitative or emergenct adult bronchoscopies. There is no anesthesia connector in Model A. This deficit is resolved in Model B. However, bronchoscopy can be performed under light or deep sedation with spontaneous ventilation, as well as with jet ventilation (4-6). Besides, a resuscitative measure can be performed under apnostic condition after a face-mask or ambu ventilation. The tip of the grasping forceps could be changeable according to the nature of the foreign body. The control mechanism of the forceps is one digit type in Model A and it is superior to three digits type, because it provides wider channel view. However electrical button type control mechanism is more appropriate, as it controls not only jaw openings but also forward or backward movements like in Model B. The cleaning of the secretions is another problem of Model A; this problem is resolved in Model B.

Control panel of Model B could be more sophisticated. For example; aspiration and ventilation switches can be added. These buttons can control the strength of functions. Optic system can zoom, records when necessary, and all functions can be controlled from an on-screen display like nowadays' video cameras. Model B uses either alternative or direct current with the help of rechargeable batteries and proper in-puts.

Although these models are prototypes, they are presented for mostly bringing new ideas into the readers' mind. After power analysis, system optimization and simulation periods, the device will come into existence. This topic was not discussed in this paper as it will be better discussed by electric-electronic and machinery engineers.

Chest specialists, bronchologists, thoracic surgeons should think, discuss and work together with bio-mechanical engineers for developing better bronchoscopes. Regarding today's micro technological opportunities, future bronchoscopes will be completely controlled digitally, by using micro electric motors. We believe that, these kind of compact models will be used either for urgent or elective conditions in a near future.

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