Case Report

Combination of adult and pediatric fiberoptic bronchoscopy in bronchial cleaning in smoke inhalation-induced respiratory distress syndrome

Saenghirunvattana S, MD
email: sawang.sa@bgh.co.th

Sawang Saenghirunvattana, MD[1]
Cecille Lorraine Castillon, RN[1]
Chittisak Napairee, MD[2]
Soracha Mekin, RN[2]
Wannipa Kodkaew, RN[2]
Kodchakorn Netrawong, RN[2]
Piyapong Sabaisuk, RN[2]

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[1] Pulmonary Center, Bangkok Hospital Medical Center, Bangkok Hospital Group, Bangkok, Thailand.
[2] Operating Room, Bangkok Hospital Medical Center, Bangkok Hospital Group, Bangkok, Thailand.

**Address Correspondence to author:*
Pulmonary Center, Bangkok Hospital Medical Center, 2 Soi Soonvijai 7, New Petchburi Road, Bangkapi, Huaykwang, Bangkok 10310, Thailand.
E-mail: sawang.sa@bgh.co.th

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In the practice of medicine, new technologies are developed and old models are improved upon. As new technologies are integrated into standard practices, further innovation occurs to meet situational demands when patients have critical needs; what follows illustrates such an adaptation using modern bronchoscopic instruments.

Smoke inhalation-induced respiratory distress has been known to cause high mortality among victims of fire accidents, especially for those who have been trapped inside burning buildings. In the aftermath of a fire accident, several victims died as a result of smoke inhalation-induced respiratory distress. We have effectively saved fire victims by scrubbing their bronchial airways using a fiberoptic bronchoscope to improve ventilation and oxygenation.

However, with a standard-sized bronchoscope it is not possible to reach smaller bronchi, so we combined the use of a pediatric bronchoscopy to the procedure in order to better clean the debris and secretions.

A successful case is reported below:

A 28-year-old patient, male, was admitted due to smoke inhalation and consequently developed pneumonia and conjunctivitis. Upon initial assessment, the patient presented with difficulty in breathing, chemical corneal burn of both eyes, coryza with mucus discharge and black ash debris in the pharynx. No wheezing was noted.

The patient was admitted to the Intensive Care Unit. Initial x-rays revealed diffuse interstitial opacity in both lungs, likely indicating pneumonia. Mild cardiomegaly was noted and was probably related to suboptimal inspiration. Subsequent x-rays revealed increased infiltration of the lungs as in Acute Respiratory Distress Syndrome (ARDS). The patient was intubated. Fiberoptic bronchoscopy was suggested to enable further investigation. The initial bronchoscopic visualization via endotracheal tube revealed burned nasal cavity and epiglottis, burned bronchial mucosa and thick secretions in every single airway. Debris and pus were removed through bronchial washing. Due to the narrowed condition of the bronchi, an innovative technique combining the use of an adult and pediatric fiberoptic bronchoscopy was performed in order to reach through the deeper areas of the lungs thus thoroughly cleaning out pus and debris. This helped to improve the patient's oxygenation. Cefditoren was administered to control the infection.

Subsequent bronchoscopy procedures were done with the goal of removing debris and secretions inside the burned lungs, to decrease infiltration, to improve the patient's breathing and to prevent further complications.

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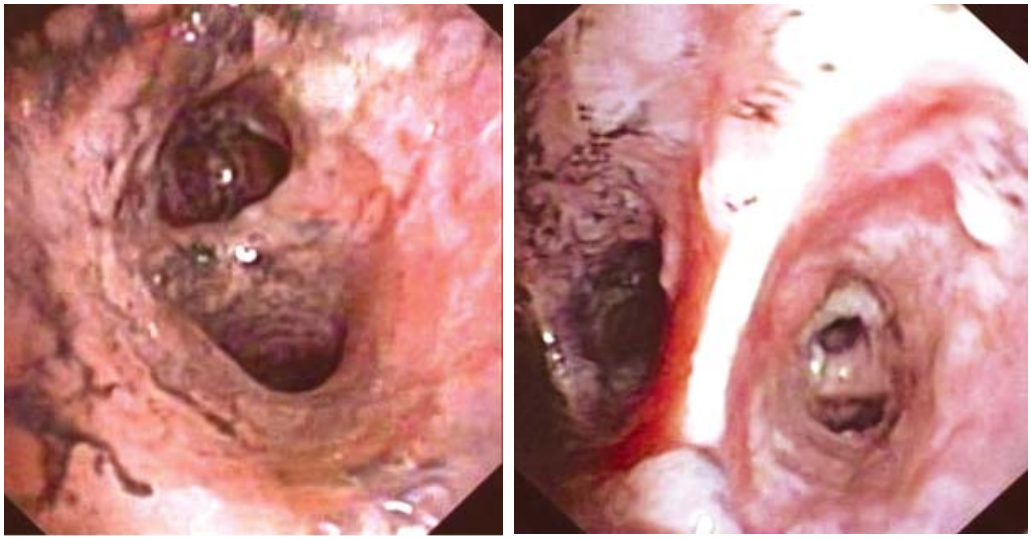

Figure 1 and 2: *View of patient's lungs during first session of fiberoptic bronchoscopy.*

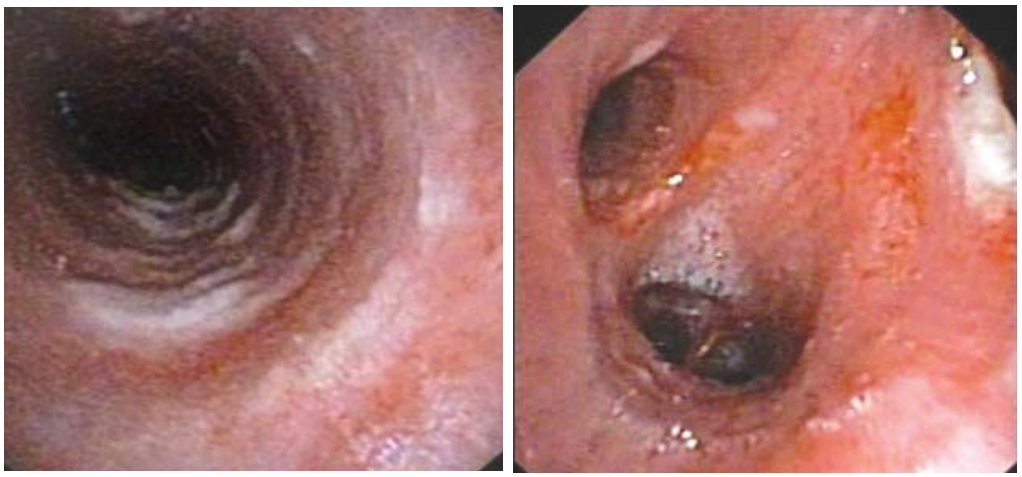

Figure 3: *View of patient's lungs after first session of fiberoptic bronchoscopy.*

Figure 4: *Bronchoscopic view of patient's lungs after fifth consecutive FOB session.*

Upon the fifth consecutive day of performing this bronchoscopic procedure, the patient went through visualization and washing without desaturating. Extubation was done without complications.

Discussion

In the USA, more than 1 million burn injuries occur every year. Although the survival rates from burn injuries has increased in recent years with the development of effective fluid resuscitation management and early surgical excision of burned tissue, the mortality rates of burn injury cases is still high. In these fire victims, progressive pulmonary failure and cardiovascular dysfunction are important determinants of morbidity and mortality. The morbidity and mortality increases when the burn injury is associated with smoke inhalation.[1]

In 2000, Alpard et al.[2] developed a predictable, dose-dependent, clinically relevant model of severe respiratory failure associated with a 40% total body surface area, full-thickness (third-degree) cutaneous flame burn and smoke inhalation injury in adult sheep. Development of respiratory distress syndrome (RDS) by smoke and cutaneous flame burn injury depends on the smoke inhalation dose. A combination of 36 breaths of smoke and a 40% total body surface area (third-degree) cutaneous flame burn injury can induce severe RDS (PaO2/FIO2 < 200) within 40 - 48 hours. All animals developed RDS in 24 - 30 hours, and none survived the experimental period. When all other techniques fail to remove secretions, the use of a fiberoptic bronchoscope has proven to be of benefit. In addition to its diagnostic functions, bronchoscopy retains important therapeutic applications. Copious secretions encountered

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in patients with inhalation injuries may require repeated bronchoscopic procedures when more conservative methods are unsuccessful. The modern fiberoptic bronchoscope is small in diameter, flexible, and has a steerable tip which can be maneuvered into the fourth or fifth generation.

Conclusion

This case is likely to be the first reported use of the combined adult and pediatric fiberoptic brochoscopy technique to effectively remove debris inside a burned lung airway. A combination of further controlled experimental studies, as well as anecdotal evidence from the frontline of emergency rooms and pulmonary centers will serve to continue the development of innovative techniques. This in turn will drive the need for technological advances in medical instruments and the integration of the resulting methodologies into standard treatment procedures.

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