The Role of Nd:YAG Laser in Thoracoscopic Surgery
— Compared with Endoscopic Staplers —

Tadasu Kohno, Toshiya Ohtsuka, Jun Nakajima,
Kuniyoshi Yagyu, Akira Furuse

Department of Cardiothoracic Surgery, Faculty of Medicine, University of Tokyo, 7-3-1 Hongo
Bunkyoku, Tokyo, 113, JAPAN

Abstract: The development of current thoracoscopic surgical equipment and instrumentation allowed recent advancement of the procedures. Among that equipment, endoscopic staplers and Nd:YAG laser were the two most important components. Endoscopic staplers are used to separate the lung tissue, blood vessels, bronchus and so on. The cut end is safely sealed. Although they are easy to use, there are some limitations to employ the staplers. Thick tissue cannot be separated and the stapler cannot be applied on some part of the lung as diaphragmatic surface, mediastinal side near the vessels and around the pulmonary ligament. Enucleation of the nodules in the lung cannot be performed by the stapler. Nd:YAG laser with contact tip scalpel is also used to separate the tissue. The bleeding as well as the air leakage from lung parenchyma is controlled by this method and reinforced by the application of free beam Nd:YAG laser. Bleeding from the vessels and air leakage from the bronchioles must be closed by clips or suture. Though some advanced technique is required, there is almost no limitation of the separation with Nd:YAG laser method. Enucleation is possible, any part of the lung with any thickness can be separated. Another important application of the laser is to contract an emphysematous lung surface to reduce the residual volume and to normalize the static lung compliance. After the ablation of the emphysematous lung surface, the patient’s lung function and clinical symptoms are improved. In conclusion, endoscopic staplers are playing the role of spreading the procedure while Nd:YAG laser does expanding the application of thoracoscopic surgery.

Key Words: Thoracoscopic Surgery, Nd:YAG laser, lung resection, emphysema

The development of current thoracoscopic surgical equipment and instrumentation allowed recent advancement of the procedures. The procedures include apical bullectomy for spontaneous...
pneumothoraces, wedge resection for lung nodule, giant bullectomy, laser ablation for advanced bullous emphysema, lung biopsy and many mediastinal procedures. For the separation of the lung tissue, endoscopic staplers are used in most of the cases. However there are some occasion where endoscopic stapler cannot be applied and we need a help of Nd:YAG laser. In addition to the separation of the lung, Nd: YAG laser with contact tip is used to contract the lung surface to reduce the residual volume and static lung compliance in the patients with severe emphysematous lung disease. Thus, endoscopic staplers and Nd:YAG laser were the two most important components among the thoracoscopic surgical equipment.

**Usage of the instruments**

Endoscopic staplers are used to separate the lung tissue, blood vessels, bronchus and so on. The cut end is safely sealed by 3 rows of staple line on each side. Before squeezing the lever and firing the staple, the tissue must be correctly placed between the jaws that opens less than a centimeter. The technique is relatively easy for even a beginner. However this maneuver limits the application of the procedure. Thick tissue and stiff lung tissue cannot be put between the jaws. Then enucleation of a nodule sitting in a relatively deep area cannot be performed and wedge resection of a stiff lung cannot be achieved by this method. Because of the straight shape of the staple line, large amount of an adjacent normal tissue tends to be taken out with the lesion at the same time. Then it causes some difficulty to apply a stapler in a patients with very poor pulmonary reserve and in a area where important structure such as big vessels are located near by. Also rigid straight shaft of the instruments limits the application of the placement. It is difficult to work on the diaphragmatic surface, near the pulmonary ligament and the mediastinal side of the lung. There is a demand to use other device to solve these difficulty in using the staplers.

Nd:YAG laser with contact tip scalpel is also used to separate the tissue. The bleeding as well as the air leakage from lung parenchyma is controlled by this method and reinforced by the application of free beam Nd:YAG laser. Bleeding from the vessels and air leakage from the bronchioles must be closed by clips or suture. Though some advanced technique is required, there is almost no limitation of the separation with Nd:YAG laser method. Enucleation is possible, any part of the lung with any thickness can be separated. Another important application of the laser is to contract an emphysematous lung surface to reduce the residual volume and to normalize the static lung compliance. After the ablation of the emphysematous lung surface, the patient's lung function and clinical symptoms are improved.
Discussion

In laparoscopic surgery, laser devices were used only in the beginning of the expansion of the procedure and no longer used. This was mainly because the same procedures were performed by the use of electrocautery and electrocautery was much handy and easy to use. In thoracoscopic surgery, main procedure is the separation of the lung tissue. Using electrocautery in the separation of the lung, tissue splashes, comes to the tip of the scope and interfere the view. We need something else that doesn't scatter the tissue. Then Nd: YAG laser is mandatory in advanced thoracoscopic procedures.

The recent available endoscopic laser probe is made for laparoscopic surgery and is too long in the use of thoracoscopic surgery. New technology such as bipolar YAG laser needs more progress to be used in thoracoscopic surgery.

Conclusion

In conclusion, endoscopic staplers are playing the role of spreading the thoracoscopic surgical technique while Nd:YAG laser does expanding the application of thoracoscopic surgery. Endoscopic laser probe and bipolar technology need improvement in the wide application in thoracoscopic surgery.

Reference

2) Kohno T., Murakami T., Wakabayashi A.