

Benefit from omentopexy on bronchial wound healing in performing concurrent esophagectomy

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ABSTRACT : The healing process of bronchial wound was compared among wrapping tissues such as pedicled omentum, pericardium, and parietal pleura in terms of the degrees of revascularization of the bronchial artery interrupted by bronchoplasty itself by microangiography, including the circumstances of performing a procedure of esophagectomy.

The development of neovascularity was marked and facilitated by omentopexy. The procedure of wrapping by pedicled pericardium and pleura was not so useful for promoting neovascularity as would be expected, and it was almost the same as non-wrapping one. Meanwhile, recanalization by wrapping with free pleura was delayed. When esophagectomy was combined with bronchoplasty, revascularization was apparently retarded. In conclusion, wound healing at bronchial anastomosis was markedly impaired so that omentopexy was recommended for facilitating wound healing at anastomosis.

INTRODUCTION

It has been emphasized that satisfactory wound healing at bronchial anastomosis is ensured by the adequate anastomosis that provides sufficient blood supply at both edges of the bronchus without any tension. However, it is inevitable that bronchoplasty itself ensues the interruption of the bronchial artery and deteriorates wound healing by reduction of nutritional blood supply.

Furthermore, the posterior wall of the bronchial tree was protected and supported by a presence of the esophagus which may also help to inflow the nutritional blood vessels into bilateral walls of the tracheobronchial tree.

When thoracic esophageal cancer involves the trachea or the main bronchus, combined resection of the trachea or main bronchus with esophagectomy is needed for oncological radicality. If combined resection with esophagectomy is made, tracheobronchial tree loses the posterior support. The wound healing at anastomosis will be also jeopardized by mediastinal dissection which has often been used for enhancing oncologic radicality.

In fact, the wound healing at bronchial anastomosis performed with esophagectomy may have some danger, and our clinical experience is not yet satisfactory.

In this present study, usefulness of omentopexy is experimentally evaluated by using microangiography, in particular, under the condition that

esophagectomy was combined.

METHOD AND MATERIAL

Mongrel dogs (weighing from 10 to 15 kg) were anesthetized with intravenously administered pentobarbital sodium (25 mg per kg of body weight), tracheally intubated, and maintained on position-pressure ventilation. Left thoracotomy was made in these dogs. The experimental groups of dogs were divided into 6 groups. Group I (G_1) underwent left sleeve upper lobectomy in 14 dogs, G_2 received the same as G_1 with omentopexy in 12 dogs. G_3 was with pedicled pericardial wrapping in 13 dogs. G_4 was with pedicled parietal pleural wrapping in 11 dogs, G_5 was with free pleural wrapping in 11 dogs, G_5 was the same as G_1 combined with esophagectomy in 12 dogs, and G_6 was the same as G_5 with omentopexy in 12 dogs respectively.

On day 3~5, 7, 10, 12 and 14 of postoperative period these dogs were rethoracotomized. A No 7 cut-down tube was introduced into the descending aorta. The lung was infused with saline and contrast material was injected. The trachea-lung preparation was removed and microangiogram was made by Softex (type EMB) using the specimen of the bronchial anastomosis which was longitudinally extended.

In the groups of omentopexy, laparotomy was made at the same time and recanalization with the omental artery was evaluated on microangiogram.

The grades of recanalization on microangiogram was analyzed and it was graded as follows (Fig. 1). Grade 0 ($G-0$): there was no communication by arterial regeneration. Grade I ($G-I$): A little arterial regeneration was seen on the part of a bronchial artery. Grade II ($G-II$): arterial regeneration was well seen in while the arterial wall. Grade III ($G-III$): There were marked development of the neovassels more than in $G-II$.

RESULT

Omentopexy was effective to facilitate arterial recanalization at anastomosis. As shown in Fig. 2, microangiogram in which contrast mate-

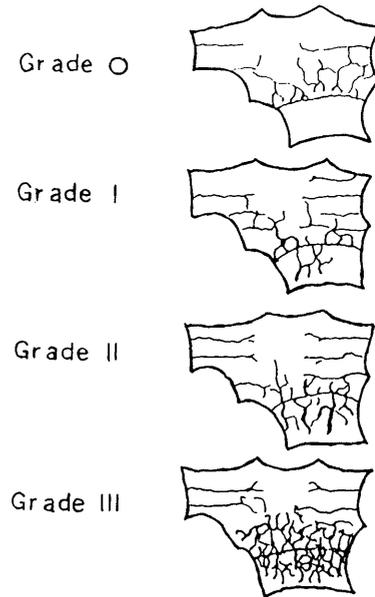


Fig. 1. Schema of the grades of arterial recanalization at anastomosis on microangiography.

rial was infused from the celiac artery clearly displayed well developed vascular network originated from the omental artery. It was observed from day three to day five, thereafter showing excellent blood supply.

With time after bronchial anastomosis, the grades of bronchial artery regeneration were carefully observed on micronangiogram.

As indicated in Fig. 3, in the control group, arterial communication was initiated on day seven to day 14, showing a maximum of the Grade, II and then vascular network had become well developed more than $G-II$. On the contrary, in the Group II (omentopexy group) the arterial regeneration occurred on day three and become dense on day five to seven. Meanwhile, in the Group III (wrapping with pedicled pericardium) the arterial regeneration began on day five to seven and gradually became developed. It was useful for facilitating arterial recanalization, although still more retard than that of omentopexy.

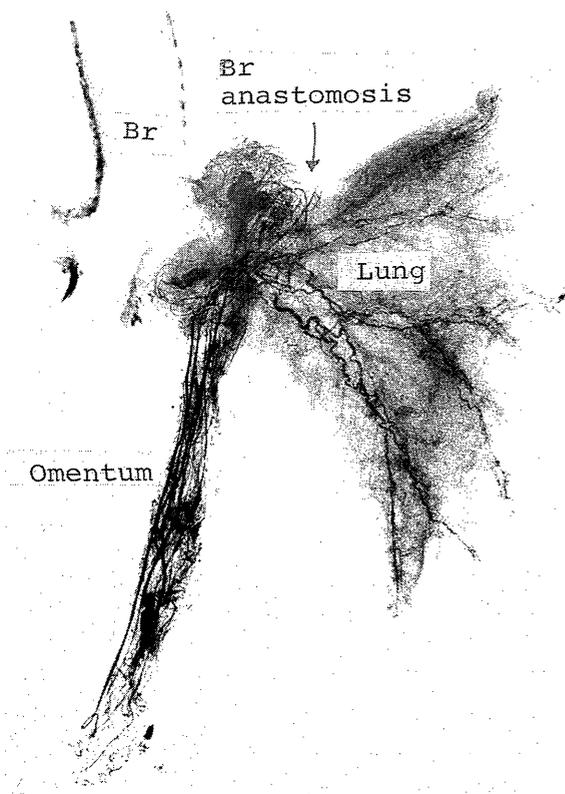


Fig. 2. Microangiographic pattern with omentopexy, showing arterial blood supply from the omental vessels.

As already shown in Fig. 3, in the group of wrapping with pedicled pleura, recanalization of the bronchial artery was seen on day five to seven and it was not different from that of wrapping with pedicled pericardium. However, wrapping with free pericardium was not of benefit in enhancing arterial regeneration. It was inferior to that of the control at times.

Furthermore, when esophagectomy was combined, arterial recanalization was retarded and it started on day seven to 10, and on day 14, thereafter it developed well, although poor blood perfusion was demonstrated following combined esophagectomy.

However, even under the conditions of esophagectomy concurrently performed, omentopexy prompted arterial revascularization. It was seen on day five to seven and well developed on day seven to 10.

DISCUSSION

Advances in surgery of tracheobronchoplasty has been remarkable and the number of the operative cases is now increasing. ISHIIHARA²⁾ in 1978 reported a nationwide survey concerning tracheobronchial plastic surgery in Japan. According to him, the number of tracheoplastic operations was 195 and that of bronchoplastic one reached 288 cases. However, in MAEDA's review of the nationwide collection in 1986, in which 578 of the tracheoplastic operations and 944 of the bronchoplastic one were included, the results were not yet satisfactory although the incidence of postoperative complications has been reduced with time.

The total incidence was 16.9%, 23.4% in the trachea and 12.0% in the bronchus, indicating that it is not necessarily low.

The contributing factors are that there is a limit to resect, blood flow of the bronchial artery is impaired⁴⁾⁵⁾, and an operative procedure of mediastinal dissection itself gives an insult to the bronchial arterial flow. Continuous movement of the trachea in accordance with respiratory cycle may well delay wound healing at bronchial anastomosis.

It is evident that omentopexy plays an important role in promoting arterial blood flow^{6)~8)} and it has been used for drainage

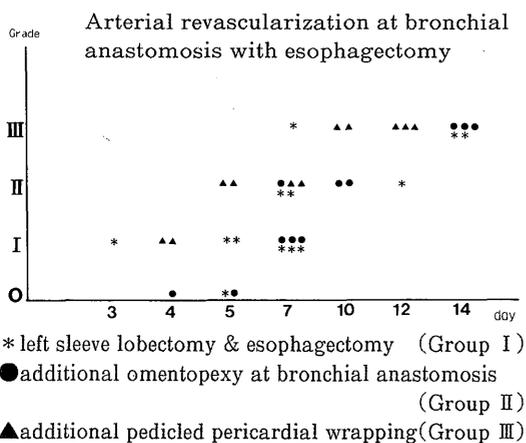


Fig. 3. Changes in the grades of arterial recanalization at bronchial anastomosis in each group in the course of postoperative period.

operation in the treatment of ascitic fluid and lymph edema as well as for aiding elimination of bacterial infection by activated macrophage. MORGAN *et al*⁹⁾. cited that wrapping with the omentum around bronchial anastomosis is of benefit in preventing granulation production which results in bronchial stenosis as well as in eliminating irradiation injury when radiation would be applied. LIMA *et al*¹⁰⁾. also reported that bronchial blood flow is accelerated by omentopexy after lung autotransplantation.

In this present study, wrapping effects of the omentum on bronchial recanalization at anastomosis were compared with those of the pericardium and the pleura.

The omentum has a large amount of tissue volume as well as vessels. It is helpful to make arterial recanalization hasten on day three despite day five to seven in the pericardial and/or pleural wrapping groups which was the same as that of non-wrapping group. However, wrapping with avascular free grafts such as pericardium and/or pleura aggravated arterial recanalization at bronchial anastomosis. Furthermore, combined esophagectomy made it retarded and deteriorated, and an initiation of arterial recanalization delayed behind seven to 10 days, providing the detrimental conditions to bronchial recanalization.

Therefore, if surgeons try to combine esophagectomy with bronchoplastic operation, omentopexy at bronchial anastomosis is necessary for overcoming the handicap of wound healing at bronchial anastomosis.

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