

The Effect of Landiolol on Prevention for Supraventricular Arrhythmia after Thoracic Surgery

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Abstract

Tachyarrhythmia including atrial fibrillation is a major complication in respiratory surgery. In this study, we investigated the preventive effect of landiolol hydrochloride on atrial fibrillation and tachyarrhythmia in 50 patients who underwent pulmonary resection for lung cancer between June 2008 and October 2009. The patients included 33 males and 17 females and had a mean age of 70.3 ± 8.6 years. Continuous administration of landiolol at $5 \mu\text{g}/\text{kg}/\text{min}$ for 48 hours was initiated immediately after induction of anesthesia. Heart rate was monitored during and after surgery for detection of arrhythmia. No atrial fibrillation or tachyarrhythmia occurred in any patients. Our results suggest that intraoperative initiation of landiolol may prevent postoperative atrial fibrillation and tachyarrhythmia, which are common complications following pulmonary resection.

Key words; Landiolol, arrhythmia, chest surgery

Introduction

Tachyarrhythmia including atrial fibrillation is a postoperative complication that occurs at a relatively high incidence after pulmonary resection. Several

reports have demonstrated that postoperative arrhythmia occurred about 10–20%^{1~4)} in noncardiac thoracic surgery. An increased right heart load because of a decrease in the pulmonary vascular bed after pulmonary lobectomy may contribute to the occurrence of arrhythmia. Atrial fibrillation causes cardiac dysfunction and can also cause thromboembolism. Therefore, it is important to attenuate tachyarrhythmia including atrial fibrillation in respiratory surgery. β blockers are used for this purpose, but they also have a bronchial spastic action and long-acting effects. In contrast, landiolol hydrochloride, a selective short-acting β_1 blocker, was developed in Japan with the aim of regulation of heart rate in surgery and the treatment of postoperative tachyarrhythmia. In this study, we administered landiolol starting during surgery in patients undergoing pulmonary resection to investigate the preventive effect on atrial fibrillation and tachyarrhythmia.

Patients & Methods

The subjects were 50 patients who underwent pulmonary resection for lung cancer between June 2008 and October 2009. Patients with atrial fibrillation before surgery and those under treatment with oral β blockers were excluded. The subjects included 33 males and 17 females with a mean age of 70.3 ± 8.6 years. Continuous administration of landiolol at $5 \mu\text{g}/\text{kg}/\text{min}$ for 48 hours was initiated immediately after induction of anesthesia. Heart rate was monitored during and after surgery to detect the oc-

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currence of arrhythmia. Electrocardiogram (ECG) was monitored until the following morning and vital signs were checked every 8 hours. The purpose of this study was explained to the patients and informed consent was obtained.

Results

The patients' background is shown in **Table 1**. Landiolol was discontinued on the operation day in 2 patients due to a tendency for bradycardia, and terminated after 24 hours in 6 patients in whom surgery was completed with partial resection. In the other 42 patients the administration was continued for 48 hours. No atrial fibrillation or tachyarrhythmia occurred in any patients. The maximum heart rates were 91.7 ± 8.6 /min during surgery, 87.6 ± 12.0 /min after surgery on the day of the operation, 79.5 ± 9.7 /min on day 1 after surgery, 82.2 ± 9.9 /min on day 2, and 84.7 ± 11.5 /min on day 3.

Discussion

The incidence of atrial fibrillation after noncardiac thoracic surgery and pulmonary resection has been reported to be about 10–20% in many studies^{1~4}. Of 112 patients who underwent pulmonary resection at our department between May 2005 and April 2008, postoperative atrial fibrillation and tachyarrhythmia

occurred in 13 patients (11.6%). To promote active ambulation from the day following surgery, we ended continuous monitoring of ECG at the morning following surgery. This may be a major limitation of this study. However, the patients were followed very carefully for several days with special attention paid to symptoms such as an unpleasant feeling in the chest and palpitation. The patient was monitored by ECG when the symptoms appeared. It is possible that no observation of postoperative arrhythmia may be due to the early removal of the ECG.

Causes of arrhythmia after pulmonary resection are considered to be due to local injuries of the cardiac branch of the vagus nerve or nerve fibers forming the sympathetic nerve plexus by mediastinal lymph node resection^{5~7}, a load on the right heart due to a reduced pulmonary vascular bed⁸, and spread of inflammation to the pulmonary vein and atria in the hilar region². Cutting of the pulmonary vein has also been suggested to be a cause of the arrhythmia^{9,10}. In a study of an oral β blocker for atrial fibrillation following pulmonary resection, the incidence of atrial fibrillation was reported to be 23.3% in the placebo group, but pre- and postoperative oral administration of metoprolol reduced this rate to 6.7%¹¹. On the other hand, the occurrence of hypotension and bradycardia has also been reported in a similar study¹².

Table 1

Age : 70.3 ± 8.6 (48~86) years
Sex : Men=33, Female=17
Diagnosis : Lung carcinoma=50
Operative method : Pneumonectomy=7, Lobectomy=37, Partial resection=6
 (VATS^{#1}=33, Thoracotomy=17)
Operation Time : 282 ± 117 min. (62~594)
Hemorrhage volume : 157 ± 207 g (10~1080)
Heart Function : Ejection fraction $58.2 \pm 5.6\%$ (51.4~74.3)
Pulmonary Function : %VC $100.4 \pm 17.6\%$ (52.4~132.9)
 %FEV_{1.0} $75.0 \pm 11.3\%$ (45.8~ 96.3)
Underlying Disease :

Hypertension=20	COPD ^{#2} =12
Diabetes mellitus=8	Hyperlipidemia=6
Brain infarction=4	Peripheral vascular disease=4
Ischemic heart disease=2	Chronic renal failure=2
Chronic heart failure=1	Others=15

^{#1} VATS:Video Assited Thoracoscopic Surgery

^{#2} Chronic Obstructive Pulmonary Disease

The blood half-life of landiolol is about 4 minutes, which is much shorter than other β blockers. The β_1 selectivity of landiolol is high, which facilitates safe use. Thus, landiolol is frequently used in heart surgery to maintain cardiac output and prevent postoperative arrhythmia^{13,14}. The recommended dose of landiolol was higher than ours, but continuous administration of landiolol at 2.5 $\mu\text{g}/\text{kg}/\text{min}$ was reported to reduce the frequency of postoperative arrhythmia¹⁴, and thus we used to continuous administration of landiolol at 5 $\mu\text{g}/\text{kg}/\text{min}$ in this study. Landiolol could block the effect of an increase in the blood norepinephrine level caused by activation of sympathetic nerves by surgical stress. In addition, sufficient cardiac output might be maintained by reducing the heart rate, which may have retained myocardial contractile force and prevented an increase in myocardial oxygen consumption and a decrease in coronary blood flow.

Less invasive thoracoscopic surgery is also used in respiratory surgery, but the incidence of postoperative arrhythmia including atrial fibrillation does not differ significantly from that after thoracotomy¹⁵. This suggests that sympathetic nerve activation by surgery on the hilar region is a major risk factor, as described above. Advanced age, a long operation time, lymph node resection, and ischemic heart disease are also considered to be risk factors for postoperative arrhythmia. The results of this study suggest that continuous administration of landiolol after induction of anesthesia is desirable in cases with risk factors.

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