

A new marking technique for peripheral lung nodules avoiding pleural puncture: the intrathoracic stamping method

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Abstract

While performing thoracoscopic wedge resection of the lung, the location of the lesion is generally identified by visual inspection or palpation. When difficulty in identification of the lesion by thoracoscopy is anticipated, preoperative marking is performed. However, complications and technical difficulties plague current marking techniques. To overcome this problem, we designed a new, safe and easy marking technique that avoids pleural puncture, called the intrathoracic stamping method.

Keywords: Thoracoscopy • Thoracic surgery • Video-assisted • Computed tomography • Complications • Preoperative care

INTRODUCTION

The number of cases requiring thoracoscopic wedge resection of the lungs for diagnostic or therapeutic purposes has increased. Advancements in computed tomography (CT) and its popularity offer increased opportunities to detect small peripheral pulmonary nodules. In some cases, intraoperative localization is difficult because of the lesion size or its distance from the pleura. Preoperative marking is necessary in such cases.

Reports indicate that the adaptive criteria for marking are unclear, and various marking procedures for localization such as intrathoracoscopic ultrasound [1, 2], radio-guided [3], vital dye [4, 5], fluoroscopic [6, 7] and needle wire methods [8] have several advantages and disadvantages [9]. Although percutaneous CT-guided hook-wire placement is a relatively easy technique [8] and is performed in many facilities, complications resulting from the visceral pleural puncture, such as pneumothorax, haemothorax, intrapulmonary haemorrhage and air embolism, have been reported [10]. While marking techniques in which a contrast medium such as barium sulphate is injected via bronchoscopy have relatively fewer complications [6], a thin bronchoscope and skilled practitioners are required. Therefore, these techniques are not available in all facilities. For successful thoracoscopic resection of small peripheral pulmonary nodules, a safe and easy marking technique that avoids pleural puncture is necessary.

PATIENTS AND METHODS

The indications for this method are as follows: (i) histologically undiagnosed peripheral pulmonary nodules ~15 mm in size that

appear resectable by thoracoscopic wedge resection; (ii) except for the nodules in the apical portion, those on the mediastinal and diaphragmatic surfaces, behind the scapulae, etc. that cannot be reached from the body surface by the shortest way. This technique was performed on 13 lesions in 12 patients from September 2010 to April 2012.

Preoperative CT scans were performed in the lateral position, the same as during the thoracoscopic procedure, using roentgen-opaque markers on the body surface, and a mark was put on the skin at the shortest distance from the lesion. Patients were administered general anaesthesia with a double-lumen tube and placed in the lateral position for surgery. The relevant lung was collapsed and a threaded straight needle was inserted vertically from the skin mark through the chest wall and into the pleural cavity, while observing with a thoracoscope. The thread was withdrawn from the pleural cavity through another surgical port, and a small gauze ball containing the indigo carmine dye (Daiichi Sankyo Co., Ltd., Tokyo, Japan) was tied to the tip. The dye-containing gauze ball was pulled back into the pleural cavity and tugged towards the internal surface of the thoracic wall where it was anchored. When the lung was re-expanded, the dye from the gauze ball stamped the lung surface. The lung was then collapsed again, and the lesion was identified by palpating the area around the stamp on the lung surface with a finger or instruments (Fig. 1).

RESULTS

This technique was performed on 13 lesions in 12 patients. The average tumour diameter was 9.8 mm (range 5–12 mm), and the average distance of the lesion from the visceral pleura was

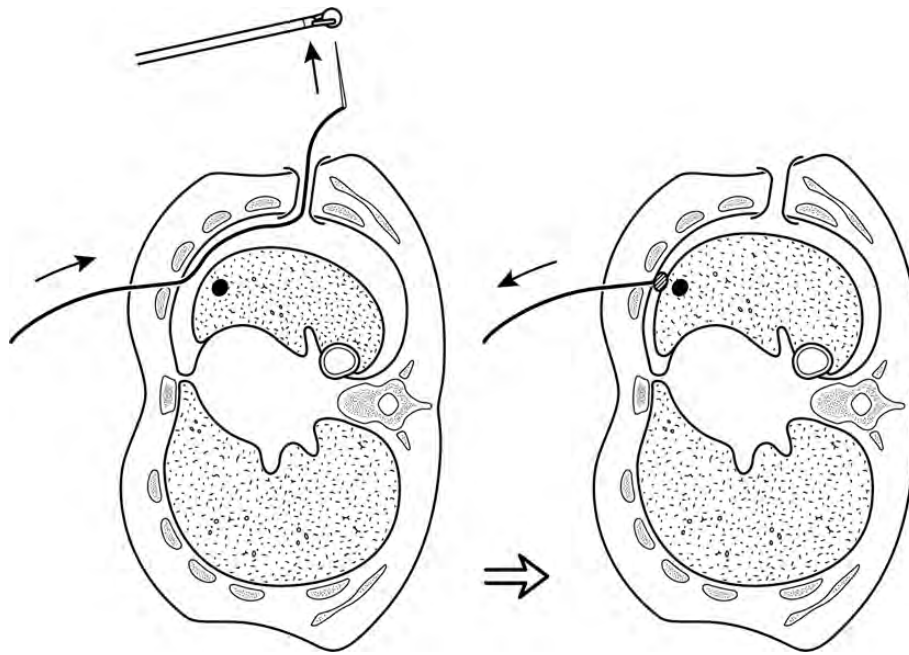


Figure 1: A marking technique that avoids pleural puncture—the intrathoracic stamping method. A thread inserted into the pleural cavity is withdrawn from another surgical port, and a small dye-containing gauze ball is tied to the thread (left). The gauze ball is pulled back into the pleural cavity and tugged towards the internal surface of the thoracic wall. When the lung is re-expanded, the dye from the gauze ball stamps the surface of the lung (right).

5.7 mm (range 0–15 mm). All lesions were identified by thoracoscopy. No complications were observed during the marking procedure.

DISCUSSION

A safe and easy marking technique is sought for the localization of peripheral pulmonary lesions. Our marking technique is safe, avoids pleural puncture, is easy to implement and does not require any special equipment, skills or investments.

Complications resulting from visceral pleural puncture have proven to be problematic with the CT-guided hook-wire technique [9]. Similar complications have been reported for other techniques that insert pigment [4, 5] or contrast media [7]. Systemic air embolism with cardiac and/or neurological symptoms has particularly been reported, including one death from myocardial infarction following an air embolism [10]. The advantages of techniques that insert contrast media such as barium sulphate into the bronchi near the lesion using a bronchoscope include the relatively low incidence of complications; however, they need special equipment and skills [6]. Furthermore, frequent CT scanning or intraoperative fluoroscopy is required for these techniques, and the level of radiation exposure for patients and practitioners is problematic. Compared with previous techniques, ours requires little exposure to radiation. No ideal technique is available because of some minor or major complications shown by other methods of localization [9].

In our experience, the stamped marking was within 1 cm from the lesion in all cases. We believe that surgical positions, needle insertion angles and respiratory movements affected accuracy, and further study is necessary.

When preoperative marking is not conducted, lesion identification is performed on the basis of imaging findings; however, in some cases, intraoperative localization takes a long time. We

believe that if visual inspection and palpation are performed focusing on the marked area, our technique reduces localization time during thoracoscopic surgery.

When, in surgical procedures, targeting lesions are difficult to palpate due to their distance from the pleura, it is not easy to identify their location using our technique only. In addition, similar to the hook-wire technique, our technique is unsuitable for lesions that cannot be reached from the body surface by the shortest way. In such cases, designed segmental resection should be performed.

In summary, we designed a new, safe and easy marking technique—the intrathoracic stamping method—that avoids pleural puncture. We believe that our technique is not only useful for lesion localization during thoracoscopic surgery, but also reduces the time needed to identify the location of the lesion.

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Conflict of interest: none declared.

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eComment. Criticism on a new marking technique for lung nodules identification

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We have read with interest the paper by Kawada and colleagues focusing on the preoperative marking of small lung nodules resectable by thoracoscopic wedge resection [1]. As the authors underline, various marking procedures for localization have been already described. However, each one of these techniques is affected by different disadvantages [2]. When a preoperative marker is needed, we usually use the percutaneous CT-guided hook-wire placement method. We are conscious that this procedure is affected by possible complications such as pneumothorax, haemothorax, air embolism, and the disadvantages of an additional radiation exposure. In our experience with hook-wire placement, we only observed pneumothorax, usually low entity. However, chest tube placement is always required to avoid tension pneumothorax during mechanical ventilation at the subsequent surgical operation. Therefore, we think that the first advantage of the intrathoracic stamping method proposed by Kawada and colleagues is avoidance of the risks associated with visceral pleural puncture. The second possible advantage we identify in this method is that the use of an opaque marker lying on the skin, instead of a percutaneous hook-wire, reduces the possibility of accidental marker removal before surgery, and allows placement one or two days before operation. Lastly, although we do not have experience with the stamping method, we think that, in the event of adhesions, thoracoscopic pleural debridement could be performed

more easily without a hook-wire inside the chest cavity. We identified as a possible disadvantage, the need to place the patient in the same position during CT scan and surgery, with the risk of dye spreading inside the pleural cavity, hence losing marking precision. In conclusion, we congratulate the authors who have described this new method. More data should be useful to definitively confirm its utility and safety.

Conflict of interest: none declared

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eReply. Re: Criticism on a new marking technique for lung nodules identification

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We thank Baisi *et al.* for their favourable eComment on our article [1, 2]. We think that the first advantage of the intrathoracic stamping method is the avoidance of a pleural puncture or placement of the chest tube before operation. It is possible that an opaque marker lying on the skin is placed several days before operation, as they mentioned. In the case of dye spreading inside the pleural cavity, hence losing marking precision, we make the marking on the stamp of the visceral pleura using a needle with an attached thread. The greatest disadvantage is the position gap between the tumour and the marking because of surgical positions, needle insertion angles, and respiratory movements. In our experience, the stamped marking is within 1 cm of the lesion in all cases and so further study is necessary.

Conflict of interest: none declared

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