“Circular clamp” excision: A new technique for lung metastasectomy

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Lung metastasectomy is an accepted procedure in selected patients and demonstrates good survival, depending on the primary tumor histology, disease-free interval, and number and location of the metastases.¹

The aim of metastasectomy is radical tumor resection, saving as much healthy lung tissue as possible: Wedge resection, segmentectomy, and nodule excision are the most common surgical techniques for this procedure.²

Pulmonary nodule excision, the most parenchyma-sparing procedure, is indicated for small and central nodules not suitable for wedge resections because of their central location and theoretically requiring an anatomic segmentectomy or lobectomy. Lung nodule excision is usually performed by exposing the nodule with a pair of lung forceps, trying to further improve nodule exposure by a tampon mounted on another forceps and pushing behind the nodule.

This procedure can be difficult because the nodule is slippery and deeply embedded within the parenchyma, and lung tissue incision results in profuse bleeding even at a high coagulation level using an electric scalpel or laser devices. In addition, there is a risk of tumor cell seeding in case of accidental nodule opening or incision.

We have devised a new technique of lung nodule excision using custom-built forceps (Figure 1) designed to block and expose the nodule, and to clamp the lung tissue containing the nodule, thereby avoiding bleeding during the incision and allowing accurate suturing after the excision.

CLINICAL SUMMARY

Surgical Technique

After gently palpating the whole deflated lung parenchyma and locating the nodules to be resected, the forceps are placed on the parenchyma so that the target nodule is in the center of the empty upper ring (Figure 2, A).

FIGURE 1. Small, medium, and large prototypes of the newly designed circular clamp.

The forceps are gently closed: This maneuver blocks the nodule exactly in the center of the upper empty ring while the gradual pressure of the lower closed ring exposes the nodule. The pulmonary vessels of the district involved are clamped by the 2 coaxial parallel rings.

A circular incision is performed with an electric knife at a high coagulative level, leaving the nodule exactly in the center of the resection circle (Figure 2, B). In any case, the shielding of the 2 rings prevents accidental fulguration of other tissues.

After the healthy lung tissue surrounding the nodule is completely excised, the lesion is then resected (Figure 2, C). The lung parenchyma is then sutured by a single running suture using a 3-0 polypropylene stitch (Figure 2, D). When the suture is complete, the forceps are removed and aerostasis and hemostasis are tested as usual.

A careful nodule excision technique consisting of cutting out a uniform layer of normal lung tissue around the nodule by making a cone-shaped excision with the larger base on the pleural surface³ may avoid parenchyma perforation; if perforation occurs, a standard tractotomy may be required.⁴

Forceps Description

Similar to ordinary surgical forceps, this custom-built circular clamp works as a first-class lever with double-arched branches. This design ensures there is a space between the distal part of the branches where the healthy lung tissue

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FIGURE 2. A, Nodule targeting and pulmonary clamping. B, Pulmonary incision. C, Completed nodule excision. D, Parenchyma suturing.

compressed by the distal rings may be allocated without being damaged when the forceps are completely closed. The distal part of the forceps is made of 2 parallel coaxial concentric rings, the upper one empty (a pure ring) and the lower one closed (a plate disc).

On closing the forceps, the closed lower ring pushes the nodule exactly into the center of the upper empty ring. As the forceps close, the rings work as a circumferential clamp, clamping all the vessels close to the nodule.

DISCUSSION

This new surgical device makes lung nodule excision safer and easier. The forceps 1) block the nodule exactly in the center of the upper empty ring; 2) further expose the nodule by the gradual pressure of the lower closed ring; and 3)

clamp the pulmonary vessels involved by the clamping action of the 2 coaxial parallel rings. Some ringed forceps designed to block pulmonary peripheral nodules have been described, namely, during thoracoscopic standard wedge resection.⁵ Our custom-built device was designed for centrally located lesions because the double-arched branches allow the distal rings to be positioned in the deepest part of the lobe, avoiding detrimental parenchymal compression caused by the classic right branches. In addition, the forceps are designed for lung tumorectomy by electric knife because of the clamping action on the vessels close to the nodule.

The proposed device may also be used for hamarto-chondroma and undiagnosed nodule excision (intraoperative lung biopsy) without tumor opening and neoplastic cell seeding.

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