Original article

Three Dimensional Computed Tomography for Preoperative Assessment of the Pulmonary Artery in Patients Undergoing Endoscopic Lobectomy or Segmentectomy[☆]

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ABSTRACT

Background: The interest for endoscopic pulmonary anatomic resections has grown exponentially during the last decade. During thoracoscopic procedures surgeons cannot rely on digital handling and operative field is viewed on a two-dimensional video monitor, thus frequently encountering anatomical difficulties. The hypothesis is that foreknowledge of the anatomy of each patient would greatly contribute to the safety and accuracy of the operation.

The aim of the study was to evaluate the effectiveness of three-dimensional multidetector computed tomography (3D-MDCT) software to identify the pulmonary artery branching pattern during the preoperative study of endoscopic lobectomies and segmentectomies.

Methods: Descriptive prospective study of 25 consecutive patients scheduled from November 2015 to July 2016 in a tertiary referral academic hospital for VATS lobectomy or segmentectomy and evaluated about branching pattern of the pulmonary artery with preoperative 16-row 3D-MDCT angiography. Intraoperative findings of the pulmonary branching pattern were compared with the preoperative 3D-MDCT angiography images.

Results: According to the intraoperative findings, 67 out of 68 (98%) of pulmonary artery branches were well defined in the 3D-MDCT angiography images. There was a unique 2 mm undetected branch. No conversion to open thoracotomy was needed because of intraoperative bleeding.

Conclusion: 3D-MDCT angiography imaging is useful for preoperative identification of the pulmonary artery branching pattern.

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Rentabilidad de la reconstrucción volumétrica de la arteria pulmonar para la planificación de lobectomías y segmentectomías endoscópicas

R E S U M E N

Palabras clave:
Tomografía computarizada
Videotoracoscopia
Lobectomía
Segmentectomía
Arteria pulmonar

Introducción: El número de resecciones pulmonares mayores endoscópicas ha presentado un incremento exponencial durante la última década. La realización de la videotoracoscopia (VTC) puede ocasionar dificultades para la correcta interpretación de la anatomía torácica debido a la ausencia de exploración manual y de la visión en profundidad en el caso de trabajar con monitores bidimensionales. En consecuencia, el hecho de conocer con exactitud la anatomía de cada paciente contribuiría enormemente a la realización de una cirugía segura y precisa. El objetivo del estudio es analizar la eficacia de las reconstrucciones volumétricas realizadas mediante angiotomografía computarizada multidetector para identificar el patrón de ramificación de la arteria pulmonar en el preoperatorio de lobectomías y segmentectomías endoscópicas.

Métodos: Estudio descriptivo prospectivo de 25 pacientes seleccionados de noviembre de 2015 a julio de 2016 para realización de lobectomía/segmentectomía VTC en un hospital de tercer nivel. En todos los casos se realizó una reconstrucción volumétrica de la arteria pulmonar mediante angiotomografía computarizada multidetector de 16 coronas. Se analizaron comparativamente el número de ramas arteriales identificadas mediante reconstrucción volumétrica y las observadas durante la resección pulmonar.

Resultados: En total 67 de las 68 (98%) ramas de la arteria pulmonar fueron correctamente identificadas mediante la reconstrucción volumétrica preoperatoria. La única rama no objetivada mediante la reconstrucción volumétrica presentaba un diámetro menor a 2 mm. No fue precisa ninguna conversión a toracotomía abierta debido a accidente vascular.

Conclusiones: La reconstrucción volumétrica es útil como herramienta diagnóstica preoperatoria para la correcta identificación del patrón de ramificación de la arteria pulmonar.

Introduction

Video-assisted thoracoscopic (VATS) lobectomies and segmentectomies have been established as surgical techniques of choice for the treatment of lung cancer, pulmonary metastases and benign lung diseases.[1–3] The efficacy of the endoscopic approach has been described on numerous occasions in the medical literature, providing the following advantages: lower morbidity, better postoperative respiratory function, and oncological results similar to those obtained by thoracotomy.[4–9] The branching pattern of the pulmonary vessels presents great interindividual variability, a characteristic requiring detailed knowledge of the locoregional anatomy. The need to know the anatomy of the patient is accentuated in endoscopic surgery because it lacks manual exploration and depth perception when working with two-dimensional monitors. Computed tomography angiography provides volumetric reconstructions (3D-CTA) easily and quickly, while providing very practical visual information.[10–14] The hypothesis of this study is that the preoperative identification of the pulmonary artery branching pattern would effectively contribute to the prevention of vascular accidents. The aim of the study is to analyze the efficacy of 3D-CTA for the preoperative planning of VATS lobectomies and segmentectomies.

Methods

The following is a descriptive, prospective study of 25 patients selected for lobectomy or VATS segmentectomy from November 2015 to July 2016 at the only third-level hospital in the corresponding geographical area. The inclusion criteria for VATS lobectomy or segmentectomy included adult patients with stage I lung cancer, central lung metastases and benign lung disease (lobar emphysema). In lung cancer, mediastinal staging guidelines of the European Thoracic Surgery Society were applied.[15] In all cases of lung cancer, systematic lymphadenectomy was carried out after lung resection according to the recommendations established by the European guidelines: *en bloque* resection of mediastinal lymphadenopathies together with adjacent tissue/fat of at least 3 lymph node regions (among which the subcarinal region was always included), accompanied by the resection of hilar and intrapulmonary lymphadenopathies.[16] The exclusion criteria of the study were lung cancer stages II and III, body mass index >30, peripheral pulmonary metastases (defined as metastases in the external third of the lung parenchyma), previous thoracic surgery, previous thoracic radiotherapy and known history of tuberculosis. Informed consent was obtained from all patients, and the Declaration of Helsinki guidelines for data