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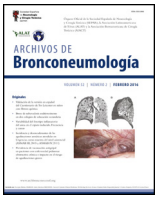

Original Article

Arterial Stump Thrombosis after Lung Resection Surgery: Clinical Presentation, Treatment and Progress☆

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ABSTRACT

Objective: To determine the prevalence of arterial stump thrombosis (AST) after pulmonary resection surgery for lung cancer and to describe subsequent radiological follow-up and treatment.
Material and methods: Observational, descriptive study of AST detected by computerized tomography angiography (CT) using intravenous contrast. Clinical and radiological variables were compared and a survival analysis using Kaplan–Meier curves was performed after dividing patients into 3 groups: patients with AST, patients with pulmonary embolism (PE), and patients without AST or PE.
Results: Nine cases of AST were detected after a total of 473 surgeries (1.9%), 6 of them in right-sided surgeries (67% of AST cases). Median time to detection after surgery was 11.3 months (interquartile range 2.7–42.2 months), and range 67.5 months (1.4–69.0 months). Statistically significant differences were found only in the number of CTs performed in AST patients compared to those without AST or PE, and in tumor recurrence in PE patients compared to the other 2 groups. No differences were found in baseline or oncological characteristics, nor in the survival analysis.
Conclusions: In this series, AST prevalence was low and tended to occur in right-sided surgeries. Detection over time was variable, and unrelated to risk factors previous to surgery, histopathology, and tumor stage or recurrence. AST had no impact on patient survival.

Trombosis en el muñón arterial de cirugías de resección pulmonar: análisis de su presentación clínica, tratamiento y evolución

Palabras clave:
Trombosis
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RESUMEN

Objetivo: Determinar la prevalencia de trombosis de muñón arterial (TMA) en cirugías de resección pulmonar por carcinoma broncogénico, y describir su evolución radiológica y tratamiento.
Material y métodos: Estudio observacional y retrospectivo de casos de TMA detectados mediante angiotomografías con contraste intravenoso (TAC). La comparación de variables clínicas, radiológicas, y el análisis de supervivencia mediante curvas de Kaplan-Meier, se realizó planteando 3 grupos: pacientes con TMA, pacientes con tromboembolismo pulmonar (TEP) y pacientes sin TMA ni TEP.
Resultados: Se detectaron 9 TMA en 473 cirugías (1,9%), 6 de ellas en el lado derecho (67% de las TMA), con una mediana de tiempo de detección desde la cirugía de 11,3 meses (rango intercuartílico

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2,7-42,2 meses). Salvo el número de TAC en pacientes con TMA comparados con el grupo sin TEP ni TMA, y la recidiva tumoral en pacientes con TEP en comparación con los restantes 2 grupos, no se encontraron diferencias estadísticamente significativas en las características basales ni en las oncológicas. Igualmente no se encontraron diferencias en el análisis de supervivencia.

Conclusiones: En nuestra serie, la TMA fue una patología infrecuente que tendió a localizarse en las cirugías del lado derecho, y cuya detección a lo largo del tiempo fue variable. No se asoció a factores de riesgo previos a la cirugía ni tuvo predisposición en relación con la estirpe histológica, estadificación oncológica o recidiva tumoral.

Introduction

Arterial stump thrombosis (AST) in pulmonary resection surgery has been described, but this condition, particularly the prognostic implications and the correct therapeutic approach, has not been studied in depth. Since the first 2 cases of AST in pneumonectomies were described in 1966,[1] only 2 studies,[2,3] small series and isolated case reports have been published in the literature, all retrospective. Although in the past little importance has been given to this finding, in recent years, the generalized use of imaging techniques in follow-up, and the improved resolution of these procedures have led to a growing number of reports of cases with associated complications.[4–11]

The main objectives of our study were to determine the prevalence of AST in oncological lung resection surgery, to identify risk factors present before the intervention and those caused by the procedure itself, and to describe subsequent progress in terms of radiological follow-up and treatment. The secondary objective was to determine clinical, oncological and prognostic differences between patients with AST, patients who did not have any type of thrombosis, and those who had pulmonary thromboembolism (PTE).

Materials and Methods

Design

Observational retrospective study of a historical cohort of patients undergoing pulmonary resection for lung cancer. Following the indications of the local Ethics Committee, the observational, retrospective design of this study precluded the need for informed consent. The report was drafted in accordance with the STROBE statement guidelines.[12]

Study Setting and Population

The Hospital Universitario 12 de Octubre is a tertiary-level university teaching hospital with a reference population of approximately 500 000 inhabitants. Patients were considered eligible if they had undergone lung resection surgery between January 2006 and June 2012, and included if they met the following criteria: (a) a clinical diagnosis of lung cancer before surgery; (b) treated with open thoracotomy and anatomical resection (lobectomy or pneumonectomy); (c) follow-up for at least 3 years; and (d) availability of computed tomography angiogram (CTA) with intravenous contrast medium during post-surgical follow-up. Patients who died in the 2 weeks following surgery and patients with sublobar resections were excluded. Follow-up concluded on May 25, 2015, and data collection was performed between June and August 2015.

The cohort was generated from records of thoracic surgery interventions performed during the study period, while follow-up data and other clinical and survival variables were obtained from a review of all clinical reports available in the paper and digital files of our hospital and other centers in the Community of Madrid, using the HORUS program, including emergency room visits, hospital admissions, and outpatient clinic consultations. Radiological variables were collected from an examination of the imaging studies and reports of all procedures performed in these patients retrieved from the digital database of our hospital. In accordance with SEPAR guidelines on the prophylaxis of venous thromboembolic disease (VTED),[13] all surgeries were categorized as high risk, with the use of physical measures (compression methods) during admission and administration of low molecular weight heparin 2–6 h before surgery. With regard to clinical follow-up, patients were seen at 2 weeks, 3 months, 6 months and 12 months after surgery. Subsequent visits were annual. Follow-up imaging studies were performed using CTA with intravenous contrast in the visits conducted 3 and 12 months and then every year.

Variables Analyzed

Outcome variables: The primary variable was clot on the arterial stump observed on radiological studies, defined as the formation of a clot located and adhered to the arterial suture in lung resection surgeries, manifesting as a visible filling defect in the artery lumen. The outcome variable for the survival analysis was all-cause death.

Other clinical, surgical, oncological and radiological variables were collected.

Clinical variables: VTED, whether deep vein thrombosis (DVT) or PTE, the latter defined as a clot that has broken free (embolism) from another part of the venous system and lodged in the pulmonary arteries[14]; arterial hypertension (systolic/diastolic >140/90 mmHg or antihypertensive treatment); diabetes mellitus (fasting blood sugar >125 mg/dl on 2 or more determinations or glucose-lowering treatment); atrial fibrillation (diagnosed by electrocardiogram and/or antiarrhythmic treatment); obesity (body mass index $\geq$30 kg/m^2) and chronic airflow obstruction (maximum forced expiratory volume in 1 second [FEV_1]<80%) (all variables: yes/no).

Surgical and radiological variables: type of intervention (right or left upper or lower lobectomy, middle lobectomy, bilobectomy and right or left pneumonectomy); if arterial reconstruction was required; number of CTAs with intravenous contrast; post-surgical pulmonary hypertension diagnosed by transthoracic echocardiography.

Oncological variables: histological strain and oncological staging according to international classifications[15,16] with pathology report of surgical specimen; tumor relapse and death.

PTE variables: the following data were collected from patients with documented AST: antiplatelet treatment; radiological resolution and hypercoagulability disorder (yes/no); duration of antiplatelet treatment in days, and time between surgery and appearance and resolution of clot in months, if applicable.