

Clinical Correlation of Early Atelectasis after Bilateral Internal Thoracic Artery Harvest for Coronary Artery Bypass Grafting



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Background	Atelectasis is a significant complication after cardiac surgery. The current study was designed to assess the significance of atelectasis after bilateral internal thoracic artery (BITA) harvest.
Methods	The ICU admission chest x-ray of 565 patients undergoing BITA was reviewed. Linear regression modelling was used to assess the relationship between atelectasis and oxygenation as well as patient variables to length of ventilation and length of stay in the Intensive Care Unit (ICU).
Results	Eighty-nine patients (15.8%) had Grade 2/3 atelectasis which was significantly more common on the left as compared to the right (left 0.149 95% CI [0.119-0.178], right 0.027 95% CI [0.013-0.040], $p < 0.001$). Grade 2/3 atelectasis on the right was associated with a significant drop in the pO_2 ($p = 0.001$) and the per cent O_2 -fractional O_2 (PF) ratio ($p = 0.002$). Factors associated with increased ventilation time included presence of Grade 2/3 atelectasis ($p = 0.001$) and peripheral vascular disease (PVD) ($p < 0.001$), both of which were predictors of prolonged ICU length of stay ($p = 0.002$ and $p < 0.001$ respectively).
Conclusions	Early atelectasis is related to impaired oxygenation, prolonged ventilation and prolonged ICU stay. Future research should focus on strategies to minimise atelectasis and to determine if these changes translate into better patient outcomes.
Keywords	Anaesthesia • Lung-other • Perioperative issues and risk analysis • Cardiac-other • Coronary disease • Extracorporeal circulation

Introduction

Respiratory insufficiency remains a significant complication after coronary bypass graft (CABG) surgery. The aetiology of respiratory dysfunction is multifactorial however postoperative atelectasis is recognised as a common contributor

resulting in decreased lung compliance, increased pulmonary vascular resistance, impaired oxygenation [1] and an increased risk of postoperative pneumonia [1].

The incidence of atelectasis after heart surgery has been previously reported, however this data reflects older surgical strategies for CABG that may not be currently relevant, such

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as the use of systemic hypothermia, older generation oxygenators and limited use of the internal thoracic artery as a conduit. This latter aspect may particularly influence lung function due to the potential contribution of injury to the phrenic nerve from dissection and pleural breach.

The aim of our study was to determine perioperative characteristics that predict atelectasis in patients who have undergone CABG and to determine the clinical outcomes related to the presence and/or severity of postoperative atelectasis. We hypothesised that atelectasis is more common with pleural breach and topical myocardial cooling with cold slush and that the degree of atelectasis on the initial x-ray on admission to the ICU is a predictor of respiratory dysfunction as determined by measures of oxygenation and length of ventilation.

Materials and Methods

Ethics

Our tertiary care cardiac centre has approval from its institutional research ethics board to anonymously publish data that are prospectively collected before and after coronary artery bypass grafting. As such, individual patient consent was waived.

We retrospectively analysed prospectively collected data from the Peri-Operative Database Unit to identify patients undergoing CABG with bilateral internal thoracic artery (BITA) harvest. Between May 2, 2006 and October 23, 2012, 9166 patients underwent CABG of which 2393 cases were performed with the BITA approach. Patients were excluded if they had undergone other procedures such as valve replacement or arrhythmia surgery. A final cohort of 565 cases was selected. The database captures detailed information on preoperative, peri-procedural and postoperative variables for all patients undergoing cardiac surgery and it is maintained by a team of full-time data abstractors who are responsible for data collection and an ongoing audit process. Follow-up until death or discharge was 100% for all patients included in the study.

Peripheral vascular disease (PVD) was defined as the presence of claudication with confirmation of lower limb vascular stenosis on Doppler, a history of peripheral vascular intervention, a history of abdominal aortic aneurysm or documented renal or subclavian stenosis.

Blood gases were sampled within one hour of arrival in the ICU and the FiO_2 at the time of sampling was recorded. The PF ratio was calculated as the ratio of the pO_2 and the FiO_2 .

Chest Radiography

Posteroanterior and lateral chest radiographs were obtained preoperatively and prior to discharge from hospital. Supine anteroposterior (AP) radiographs were obtained within six hours of arrival in the ICU. Radiographs were interpreted by one of four cardiothoracic radiologists with seven to 20 years of experience (SA, AAJ, AO, CD). All were blinded to patient characteristics. To verify the reproducibility of the atelectasis

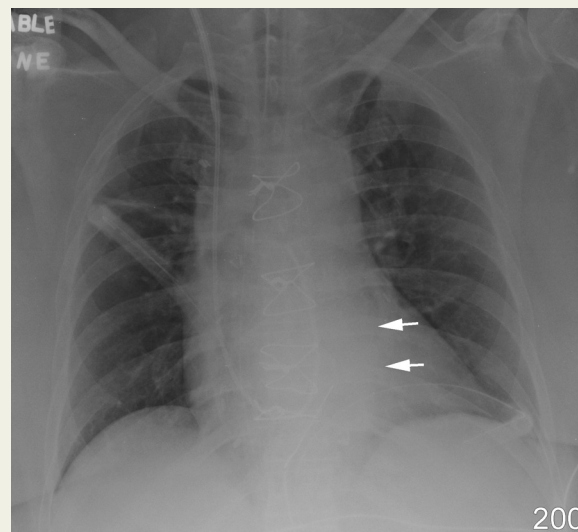


Figure 1 Post-operative chest radiograph in a 63-year-old woman depicts grade 1 atelectasis in the left lower lung zone (arrows).

scoring system, inter-observer reliability between two radiologists (SA, AAJ) was tested in 100 patients.

Atelectasis was graded using a modified rating scale based on that described by Wilcox et al. [2]: grade 0, no atelectasis, grade 1, plate-like atelectasis or a basal opacity occupying or obscuring one third or less of the width of the ipsilateral hemidiaphragm (Figure 1), grade 2, basal opacity occupying or obscuring between one and two-thirds of the width of the hemidiaphragm (Figure 2) and grade 3, basal opacity occupying or obscuring over two-thirds of the hemidiaphragm or complete lobar collapse (Figure 3). In evaluating atelectasis,

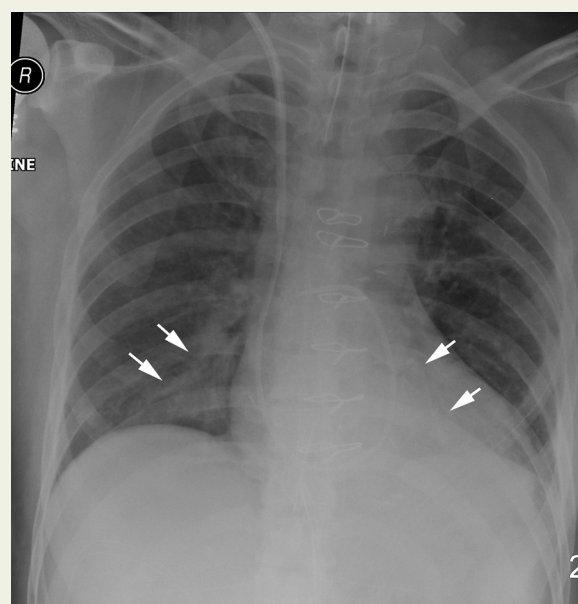


Figure 2 Supine AP chest radiograph in a 55-year-old man demonstrates grade 2 bibasilar atelectasis (arrows).

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