Isolated human pulmonary artery structure and function pre- and post-cardiopulmonary bypass surgery

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Abstract

Background: Pulmonary dysfunction is a known complication after cardiac surgery using cardiopulmonary bypass, ranging from sub-clinical functional changes to prolonged postoperative ventilation, acute lung injury and acute respiratory distress syndrome. Whether human pulmonary arterial function is compromised is unknown. The aim of the present study was to compare the structure and function of isolated and cannulated human pulmonary arteries obtained from lung biopsies after the chest was opened (pre-cardiopulmonary bypass) to those obtained at the end of cardiopulmonary bypass (post-cardiopulmonary bypass) from patients undergoing coronary artery bypass graft surgery.

Methods and Results: Pre- and post-cardiopulmonary bypass lung biopsies were received from 12 patients undergoing elective surgery. Intralobular small arteries were dissected, cannulated, pressurized and imaged using confocal microscopy. Functionally, the thromboxane mimetic U46619 produced concentration-dependent vasoconstriction in 100% and 75% of pre- and post-cardiopulmonary bypass arteries, respectively. The endothelium-dependent agonist bradykinin stimulated vasodilation in 45% and 33% of arteries pre- and post-cardiopulmonary bypass respectively. Structurally, in most arteries smooth muscle cells aligned circumferentially; live cell viability revealed that whilst 100% of smooth muscle and 90% of endothelial cells from pre-cardiopulmonary bypass biopsies had intact membranes and were considered viable, only 60% and 58% respectively were viable from post-cardiopulmonary bypass biopsies.

Conclusions: We successfully investigated isolated pulmonary artery structure and function in fresh lung biopsies from patients undergoing heart surgery. Pulmonary artery contractile tone and endothelium dependent dilation were significantly reduced in post-cardiopulmonary bypass biopsies. The decreased functional responses were associated with reduced cell viability. (Up to 250 words)

Keywords— cardiopulmonary bypass, lung, bradykinin, thromboxane, vasodilation, vasoconstriction

Biography:

Emad AlJaaly is a heart surgeon trained in the UK. He has completed his PhD in 2019 at Imperial college London. He is a researcher and has published various papers including two randomised trials. His personal journey to become a heart surgeon spanned across several countries, each with its own linguistic, cultural and logistic challenges. This gave him the opportunity to develop especial leadership skills to progress in several healthcare systems.

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