INVESTIGATION OF VESSEL STRUCTURE IN THE VICINITY OF LUNG TUMOURS

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Lung cancer is considered a major cause of cancer death. We are currently developing methods for detection of vessels in lung CT images. The aim of this study was to investigate the number of vessels in areas of unilateral lung tumours and compare with the equivalent contralateral lung with no tumour. Lung CT images were downloaded from the Cancer Imaging Archive wiki.cancerimagingarchive.net/display/Public/LungCT-Diagnosis.2 Software was written in MATLAB (The MathWorks Inc., USA) in order to display and analyse the DICOM images. Windowing was performed manually in order to clearly display the tumours as well as surrounding vessel like structures. As well as vessel like structures directly attached to the tumour were counted and compared with the corresponding region in the contralateral lung with no evidence of tumour; small vessel like structure and branches were not included. The area of the tumour was manually delineated and calculated in terms of pixels. For each set of CT images, one image was used where the tumour size was greatest. In all eight cases the number of clear vessel like structures in the immediate vicinity of the tumour was greater than that in the corresponding area on the contralateral side, mean (standard deviation) of the difference 5 (1.6), there was a significant difference p < 0.001 (one sample t test). In addition vessel like structures often appeared brighter on the side of the tumour. The results of this pilot study suggest that the number of clear bright vessel like structures in the immediate vicinity of a lung tumour may be higher than in the corresponding area on the contralateral side. We feel this research merits further study in order to investigate if this approach may help enable early detection of lung tumours.

REFERENCES

Plasma syndecan-1 level as a predictive marker of vasoplegic syndrome associated with surgery requiring cardiopulmonary bypass and possible involvement of oxidative stress

Background Vasoplegic syndrome (severe refractory hypotension) is associated with oxidative stress leading to endothelial dysfunction and complications 10 to 40% of surgery requiring cardiopulmonary bypass (CPB). Whilst operative mortality is low, recovery is often prolonged in patients developing vasoplegia. There are, as yet, no validated biomarkers for vasoplegia that could be used to identify ‘at risk’ patients. We hypothesised that plasma levels of the endothelial surface layer (glycocalyx) protein, syndecan-1, shed during CPB, will be higher in patients who develop vasoplegia and that leukocyte responses to oxidative stress will be altered.

Methods Patients (n = 48) undergoing cardiac surgery requiring CPB were, prospectively, enrolled; blood collected and indices of outcome recorded. A surrogate index of vasoplegia was adopted: requirement for infusion of vasoconstrictor agents for longer than 48 h. An enzyme-linked immunosorbent assay was used to measure plasma levels of syndecan-1 at four time-points: after induction of anaesthesia but before CPB (T1); within 30 min of CPB ending (T2); 2 h (T3) and 24 h (T4) post-CPB. Real time qPCR was used to determine, in patient leukocytes (n = 20), relative expression (to house-keeping gene18S) of mRNA for markers of oxidative stress; NQO1 and SOD2, cytoplasmic and mitochondrial enzymes, respectively; and for comparison, TNFα.

Results Syndecan-1 levels at T2 were significantly higher in vasoplegic patients (110.7 ng/mL, IQR 65.46–153.2) than non-vasoplegic patients (53.8 ng/mL, IQR 40.67–102.2; p < 0.001). ROC curve analysis showed syndecan-1 had significant (p = 0.009) predictive power for onset of vasoplegia, with an area under the curve of 0.766 (95% CI: 0.6019–0.9301); and a cut-off of 63.33 ng/mL (83.33% sensitivity, 69.23% specificity). Syndecan-1 levels were higher in patients whose intensive care unit length of stay (LOS) and hospital LOS were above corresponding medians for the cohort (p = 0.0061 and p = 0.0148, respectively). NQO1 relative expression was significantly higher (p = 0.022) in vasoplegic patients (3.779 ± 1.036) than non-vasoplegic patients (1.3 ± 0.302); whereas, neither SOD2 nor TNFα expression were significantly altered.

Conclusion Plasma syndecan-1 measured immediately post-CPB had good predictive power for patients at risk of vasoplegia. Greater relative expression of leukocyte NQO1 in vasoplegic patients indicates activation of antioxidant defence mechanisms in response to oxidative stress, which could contribute to syndecan-1 shedding.

Introduction Respiratory infection is a common cause of severe sepsis. Current therapeutic guidelines emphasise the importance of early initiation of antibiotic therapy, but make no