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Radiomic signature from baseline CT Scan to predict initial response to treatment in advanced/unresectable pleural mesothelioma. Preliminary data

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Background

Malignant Pleural Mesothelioma (MPM) is a poor-prognosis disease, mainly correlated to asbestos exposure [1-2]. Due to the recent availability of new therapeutic options, a better prognostic assessment and the predictable response to treatments is increasingly needed. The initial clinical response could represent a parameter useful to identify patients with a better long-term outcome [3-4]. In this study we have hypothesized that a radiomic signature, a quantitative method for image analysis, obtained from CT images of MPM patients, could predict the initial response to the treatment.

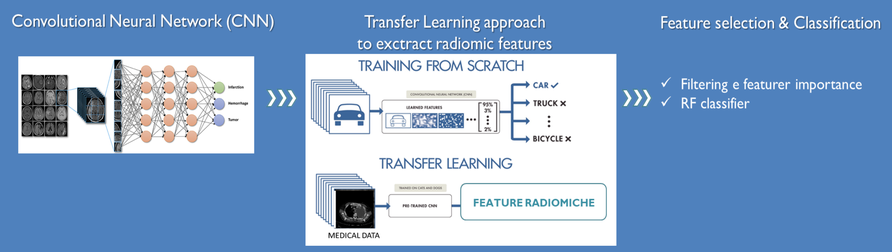

Figure 1 - Scheme of analysis workflow.

Methods and materials

We have proposed a transfer learning approach, used for restricted datasets in medical imaging, trained on baseline CT scans of 28 patients with advanced/unresectable MPM. 8 patients (pts) received standard Platinum-based chemotherapy, while 20 pts received innovative treatments. 22 pts showed an initial partial response, whereas 6 patients showed progressive or stable disease. The initial therapeutical response has been evaluated according to mRECIST criteria [5] by CT Scan at baseline and after 2-3 treatment cycles. We used 3 slices of baseline CT Scan as input to pre-trained convolutional neural network (CNN) to automatically extract radiomic features. For restricted datasets in medical imaging, the transfer learning technique is often used, which basically consists in pre-training the neural network to circumvent the data requirement for training process [6]. Specifically, low-level radiomic features, i.e., related to local structure of the image, are automatically extracted from a pre-trained convolutional neural network (CNN) architecture, AlexNET (Fig. 1). Then, we identified a features subset through a feature stepwise selection procedure was selected. Finally, RF algorithm was trained to discriminate responders (stable or partial response) from non-responders (disease progression). The performance of the prediction classifiers was evaluated on 100 ten-fold cross-validation rounds.

Results

We have combined the optimal features subset extracted from both pre-treatment exams with some clinical features statistically associated with the initial response, such as sex, histotype, BMI, Smoking habits, Pack/year and Disease stage, the models reached discreetly performing results with a median AUC value of 81.33% (IR,77.33%-85.33%). The model has shown a sensitivity and specificity of 77.50% and 100% respectively.

Conclusions

Our results, although deserving to be validated in a larger sample and a longer follow up, are promising; the development of a reliable prognostic tool including a radiomic signature and the early therapeutical response could support clinicians to personalize the treatment choice by identifying patients better candidates for innovative therapies.

Reference

1.van der Bij S, Koffijberg H, Burgers JA, et al. (2012) Prognosis and prognostic factors of patients with mesothelioma: a population-based study. Br J Cancer; 107: 161–164.
2.Shavelle R, Vavra-Musser K, Lee J, et al(2017). Life Expectancy in pleural and peritoneal mesothelioma. Lung Cancer Int; 2782590
3.Terenziani R, Zoppi S, Fumarola C, Alfieri R, Bonelli M. Immunotherapeutic Approaches in Malignant Pleural Mesothelioma. Cancers 2021, 13, 2793.
4.Cantini, L.; Hassan, R.; Sterman, D.H.; Aerts, J. Emerging Treatments for Malignant Pleural Mesothelioma: Where Are We Heading? Front Oncol 2020, 10, 343.
5.Byrne MJ, Nowak AK. (2004). Modified RECIST criteria for assessment of response in malignant pleural mesothelioma. Ann Oncol 15: 257–260.
6.Shin, H. C., Roth, H. R., Gao, M., Lu, L., Xu, Z., Nogues, I., ... & Summers, R. M. (2016). Deep convolutional neural networks for computer-aided detection: CNN architectures, dataset characteristics and transfer learning. IEEE transactions on medical imaging, 35(5), 1285-1298.

Annamaria Catino has no conflicts of interest to declare