Machine Learning to Implement the Validity of Whole Body MRI in the Detection of Lymph Node Metastasis in Patients with Locally Advance Cervical Cancer Treated with Neoadjuvant Chemotherapy

Introduction/Background Concurrent cisplatin-based chemotherapy plus brachytherapy is standard treatment for locally advanced cervical cancer (LACC). Platinum-based neoadjuvant chemotherapy (NACT) followed by radical hysterectomy is an alternative approach reserved for patients with stage IB2-IIA disease. Therefore the correct pre-treatment staging is essential to the proper management of this disease. Pelvic magnetic resonance imaging (MRI) is the gold standard examination but studies about MRI accuracy in the detection of lymph node metastasis in LACC patients show conflicting data. Machine learning (ML) is emerging as a promising tool for unraveling complex non-linear relationships between patient attributes that cannot be solved by traditional statistical methods. Here we investigated whether ML might improve the accuracy of MRI in the detection of lymph node metastasis in LACC patients.

Methodology We analyzed retrospectively LACC patients who underwent NACT and radical hysterectomy from 2014 to 2020. Demographic, clinical and MRI characteristics before and after NACT were collected, as well as information about post-surgery histopathology. Random features elimination wrapper was used to determine an attribute core set. A ML algorithm, namely Extreme Gradient Boosting (XGBoost) was trained and validated with 10-fold cross-validation. The performances of the algorithm were assessed.

Results Our analysis included n.92 patients. FIGO stage was IB2 in n.4/92 (4.3%), IB3 in n.42/92 (45%), IIA1 in n.1/92 (1.1%), IIA2 in n.16/92 (17.4%) and IIB in n.29/92 (31.5%). Despite detected neither at pre-treatment and post-treatment MRI in any patients, lymph node metastasis occurred in n.16/92 (17%) patients. The attribute core set used to train ML algorithms included grading, histotypes, age, parity, largest diameter of lesion at either pre and post-treatment MRI, presence/absence of fornix infiltration at pre-treatment MRI and FIGO stage (Figure 1-Panel A). XGBoost showed a good performance (accuracy 89%, precision 83%, recall 78%, AUROC 0.79, Figure 2-Panel B).

Conclusion We developed an accurate model to predict lymph node metastasis in LACC patients in NACT, based on a ML algorithm requiring few easy-to-collect attributes.