Title:

Repurposing "old" blood tests to replace costly imaging of Hodgkin lymphoma in low and middle-income settings

Authors:

Jennifer Geel
Tom Kelsey
Artsiom Hramyka
Khumo Myezo
Marc Hendricks
Thandeka Ngcana
Fareed Omar
Yasmin Goga
Beverley Neethling
Vutshilo Netshituni
Anel van Zyl
Elelwani Madzhia
Rema Mathew
Daynia Ballot
Monika Metzger

Introduction:

PET-CT interim assessment is considered standard of care in the risk-adapted management of Hodgkin lymphoma (HL). However, this modality is expensive and often unavailable in the LMIC setting. The objective of this study was to investigate the association between reductions in levels of low-cost, readily available blood tests with changes in PET-CT findings after 2 cycles of ABVD in children and adolescents with HL.

Methods:

Levels of ferritin, lactate dehydrogenase, erythrocyte sedimentation rate, albumin, total white cell count, absolute lymphocyte count, absolute total eosinophil count, HIV status and copper were compared with Deauville scores on PET-CT at interim assessment. Deauville 1-3 denoted rapid early response (RER) while Deauville 4-5 denoted slow early response (SER). Missing values were imputed using the k-nearest neighbour algorithm. The baseline and follow up blood test values were combined into a single difference variable. Data were split into training and testing sets for analysis using Python scikit-learn 0.23.1 with logistic regression, random forests, neural net, naïve Bayes and support vector machine classifiers.

Results:

Random forest analysis gave a test validated accuracy of 76.6% when predicting RER or SER from blood samples. The predictive accuracy of the optimal model applied to the full data set was 85.7% with ROC AUC 82.1%. The differences in ferritin and LDH were the most important predictor variables, together contributing more than half of the discriminative performance; differences in

ESR, albumin, WCC and AEC each contributed 7 – 11%; HIV status and differences in HB and ALC had little value. Other classifiers performed less well than random forests.

Conclusion:

Ferritin and LDH may be used to substitute for PET-CT if unavailable in resource-constrained settings. Caution is necessary… and the decision whether to administer consolidation radiotherapy in SER disease

A combined statistical algorithm combining the most reliable results may offer more robust modelling of which patients may safely forego PET-CT scanning.