The utility of metabolic parameters on baseline F-18 FDG PET/CT in predicting survival in paediatric lymphoma

A Preliminary Review

Authors

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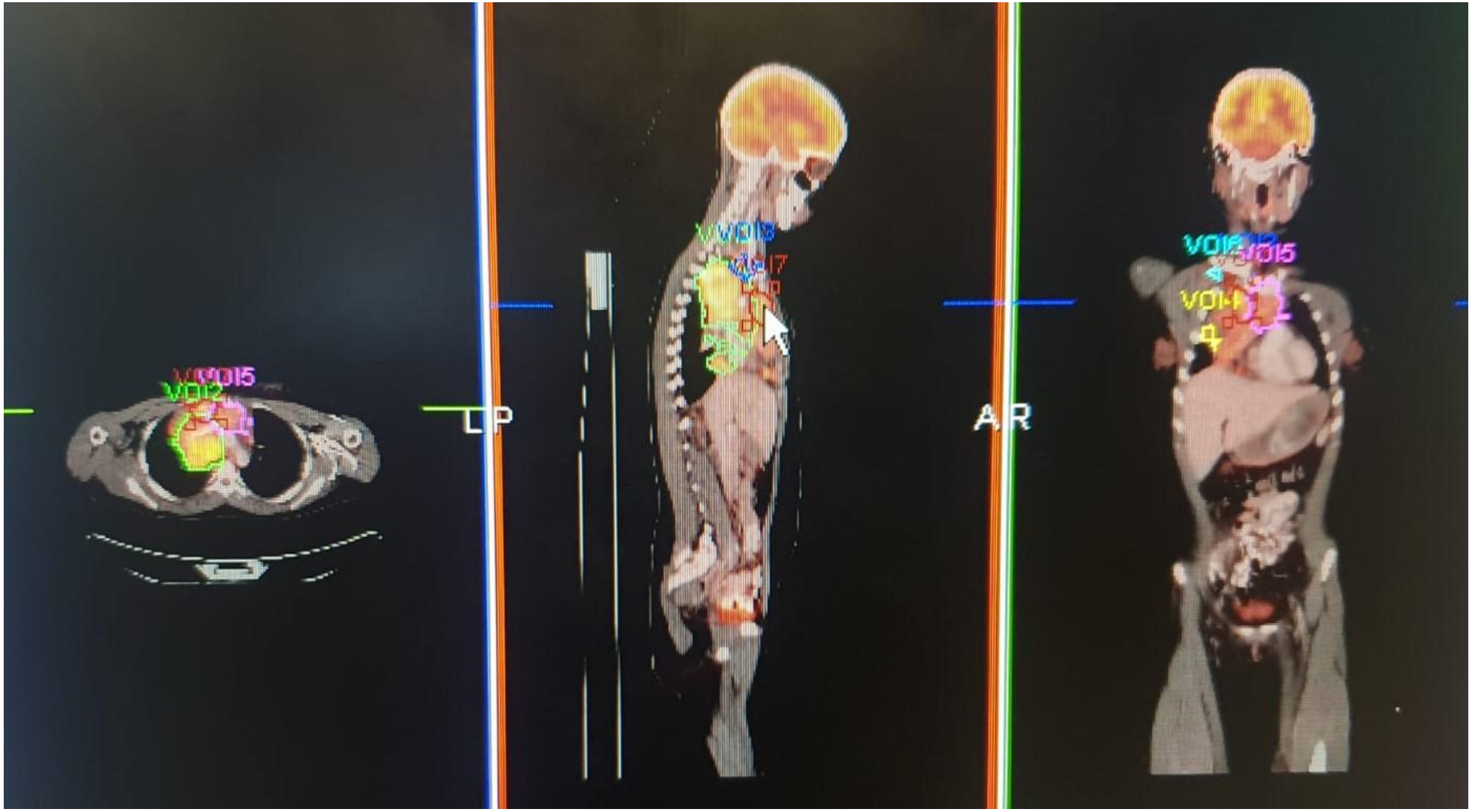
Background and aim

- Lymphoma is the third most common paediatric cancer.
- Early detection of high-risk patients is necessary in order to anticipate those who will benefit from more intensive therapy and follow-up.
- Current literature shows that residual tumor avidity on PET following chemotherapy corresponds with lower overall survival (OS) and progression-free survival (PFS).
- However, the value of various metabolic parameters on baseline F-18 FDG PET as predictors of OS and PFS have not been adequately investigated.
- The aim of this study is to evaluate the prognostic value of WB-MTV (whole-body metabolic tumor volume), TLG (total lesion glycolysis) and SUV_{max} (maximum standardized uptake value) on baseline F-18 FDG PET/CT in predicting OS and PFS in paediatric lymphoma.
- A secondary objective is to determine whether various biochemical and imaging risk indicators are predictive of OS and PFS.

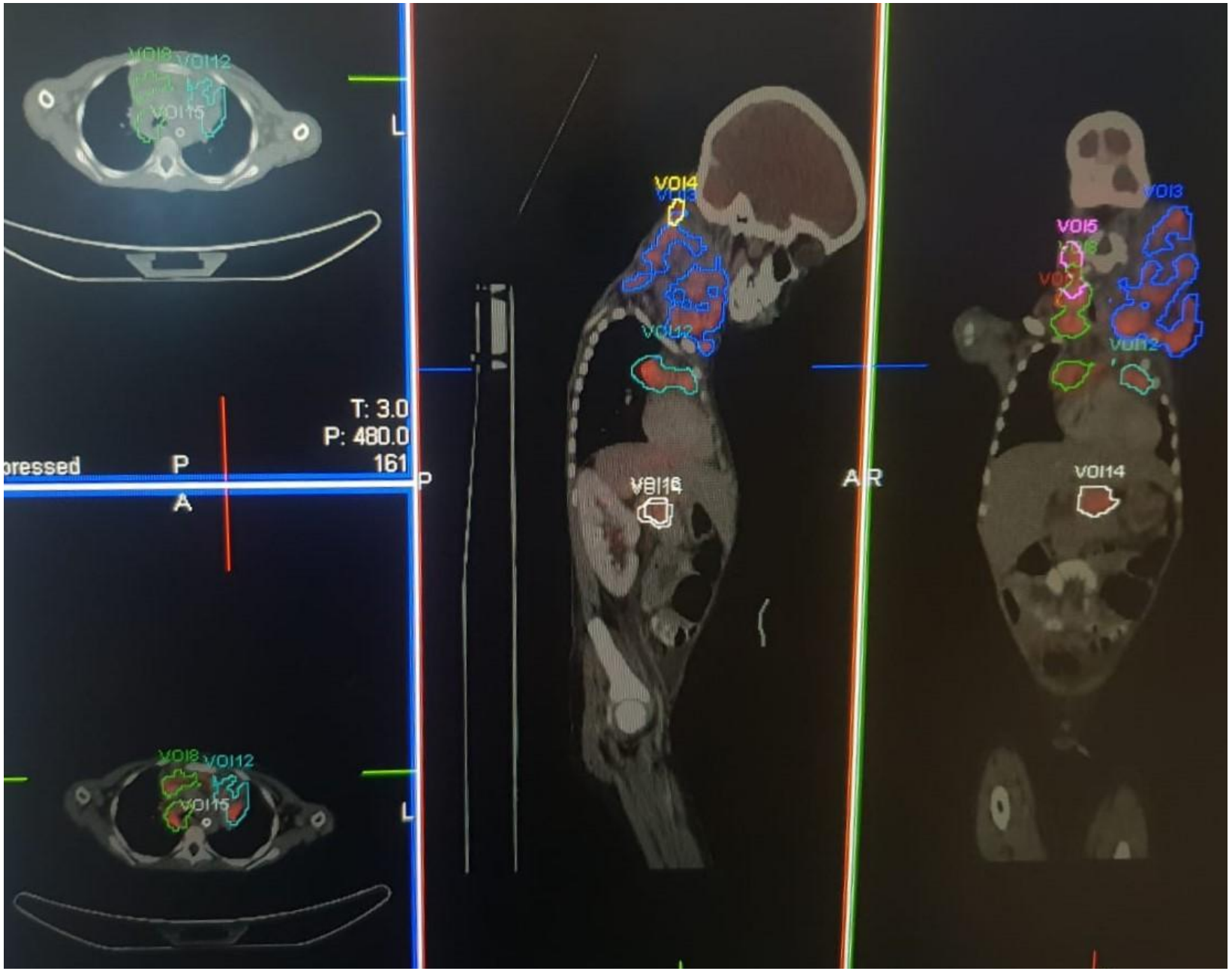
Materials and methods

- A total of 21 male and 7 female paediatric patients (mean age 11.2 years; range: 4-20 years) with histologically-proven lymphoma who were referred to the department of Nuclear Medicine between January 2013 and December 2018 were included in this analysis. 24 patients had Hodgkin Lymphoma (HL) and 4 patients Non-Hodgkin Lymphoma (NHL).
- Baseline F-18 FDG PET/CT images were retrospectively reviewed and WB-MTV, TLG and SUVmax values were recorded, as well the presence of bone marrow, splenic, liver or lung involvement and the presence or absence of effusions or bulky disease. Follow-up records were reviewed, including baseline biochemistry (Hb, LDH, albumin, ESR).
- All patients received therapy in accordance with standard regimes. Patients who had received any therapeutic intervention prior to baseline imaging, who did not complete therapy or who were lost to follow up were excluded.

Measuring WB-MTV (Whole-Body Metabolic Tumor Volume), TLG (Total Lesion Glycolysis) and SUVmax (Maximum standardized uptake value)

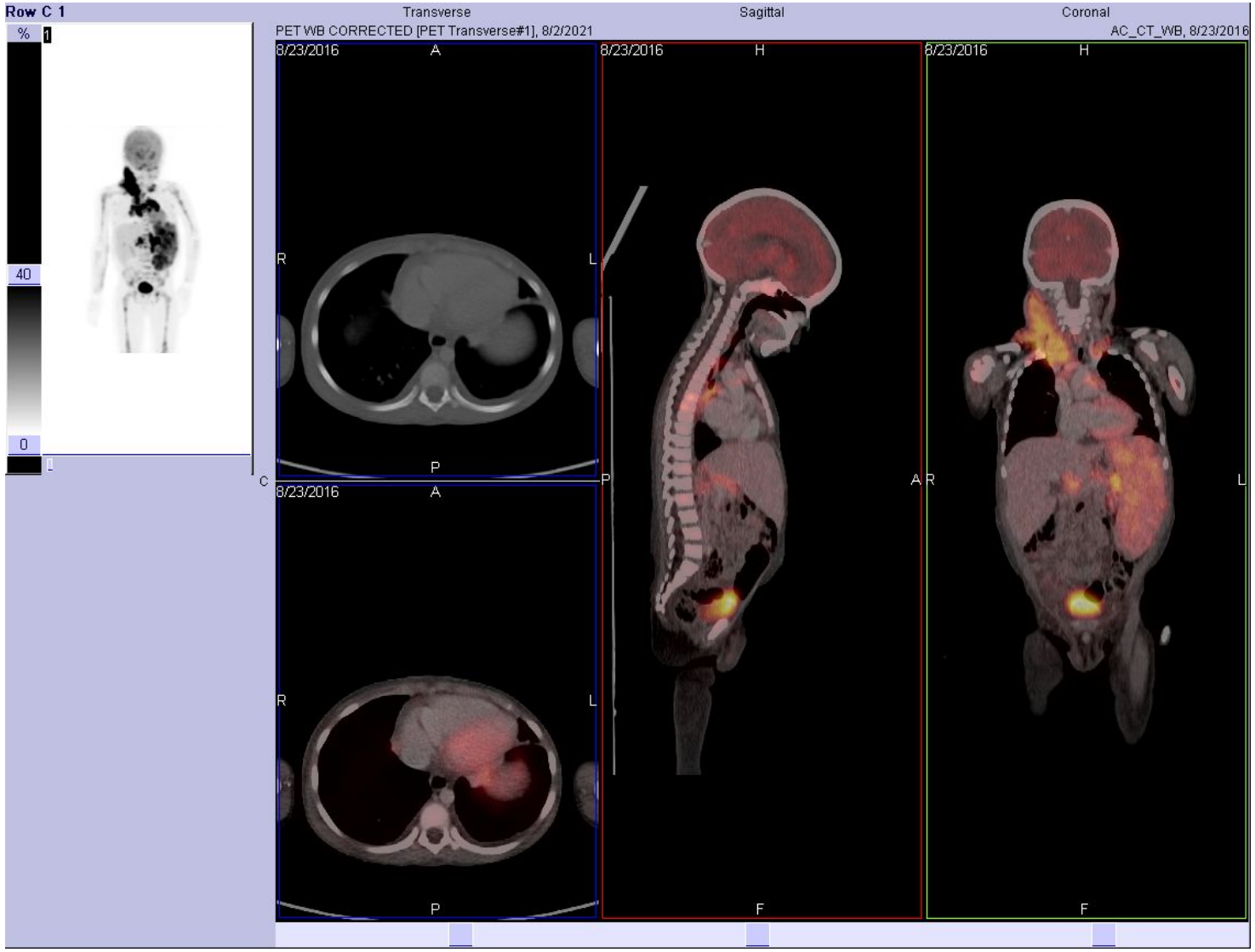


MIP (Maximum Intensity Projection) *(left)* Fused PET/CT *(right)*

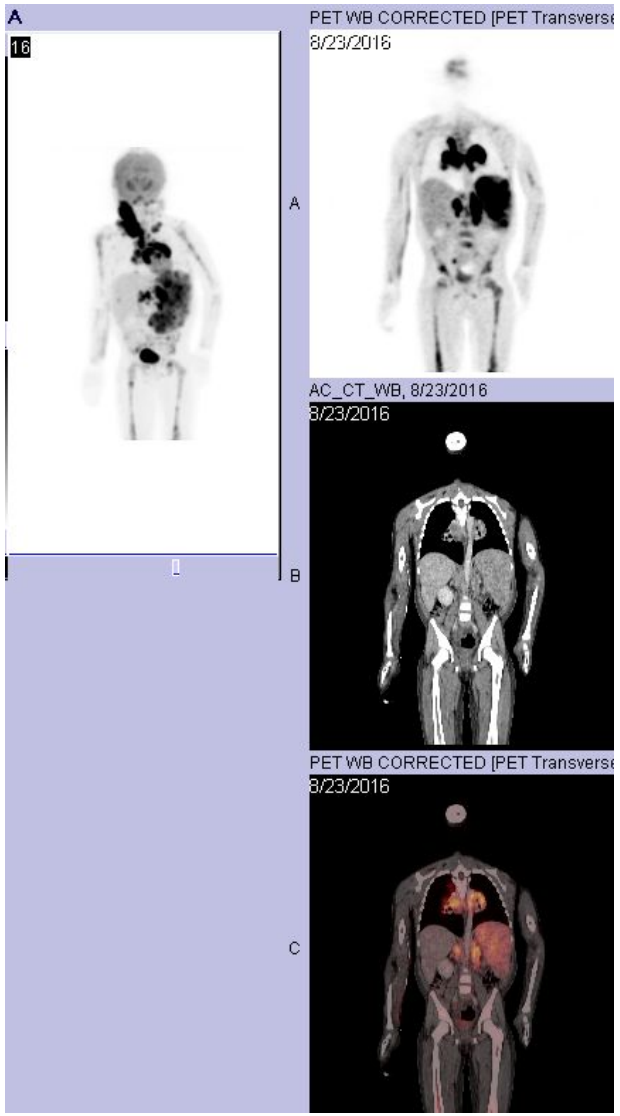


Results

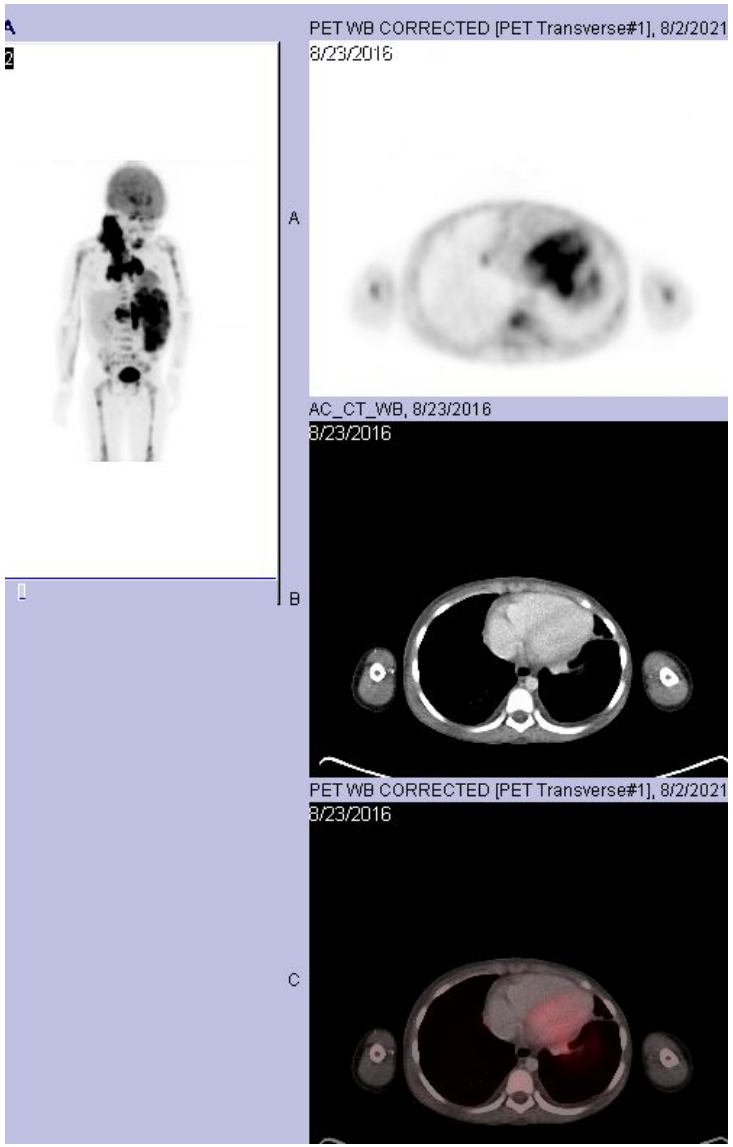
- Mean follow-up period was 42.5 months (median 39.5 months; range: 7 – 95 months). Significant negative correlation was observed between baseline WB-MTV and PFS *(r = -0.455, p=0.017)*.
- The presence of bone marrow involvement on baseline PET (N=10) was associated with shorter mean PFS (25.90 months) compared with those with no bone marrow involvement (N=17; 42.06 months). Likewise, the presence of pleural or pericardial effusion (N=6) was associated with a mean PFS of 17.33 months versus 41.43 months in those with no effusions (N=21).



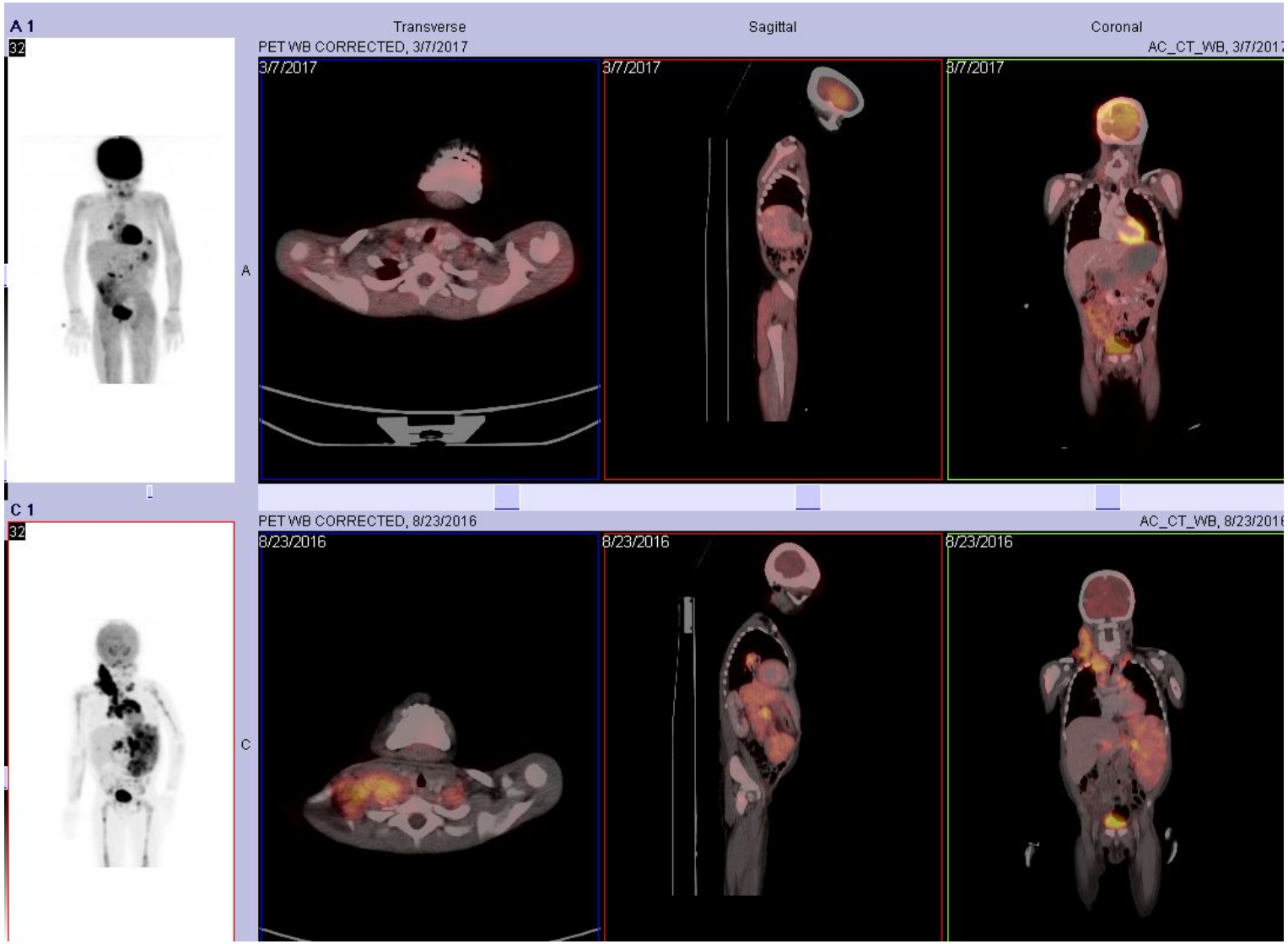
Patient A: A 6-year-old male with Hodgkin's Lymphoma. Baseline images (Maximum Intensity Projection, MIP; axial, coronal and sagittal fused PET/CT) demonstrated splenic and bone marrow involvement as well as a pericardial effusion and small bilateral pleural effusions. Whole-body MTV – 901.83cm^3 (TLG- 3655.06; SUVmax 10.78).



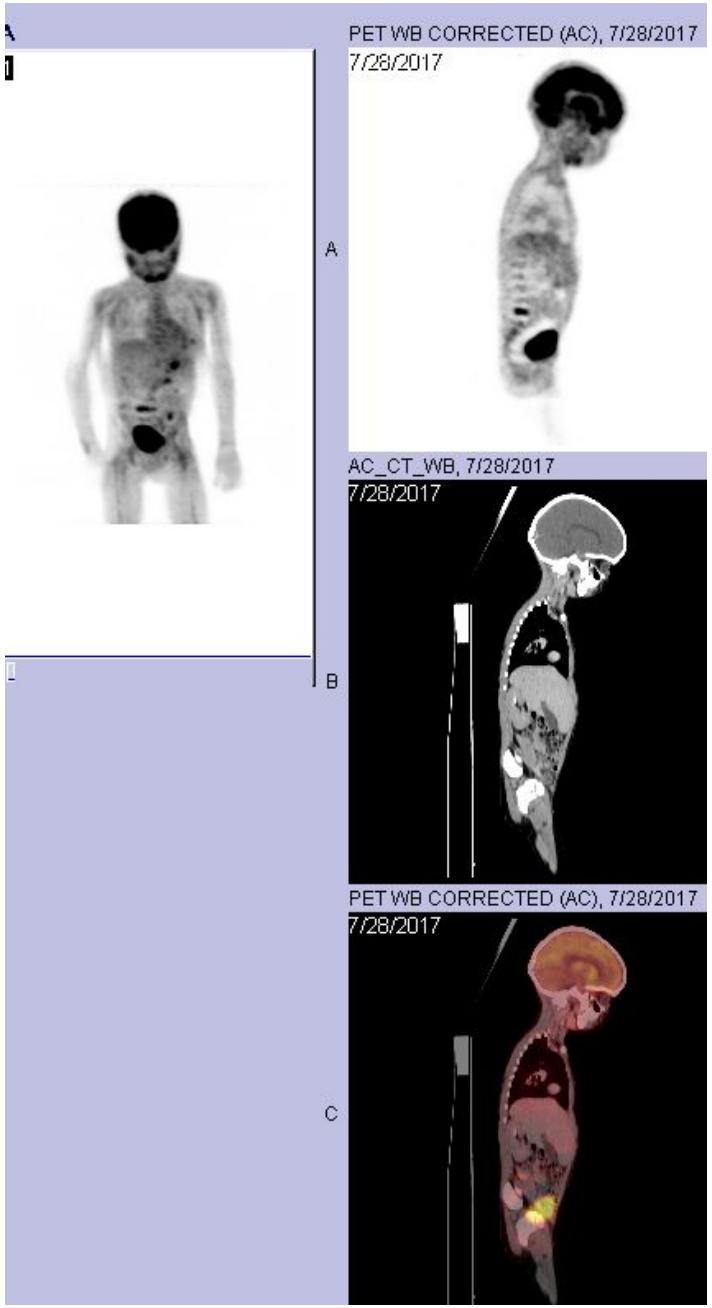
Coronal PET, CT and fused images highlighting
bone marrow involvement.



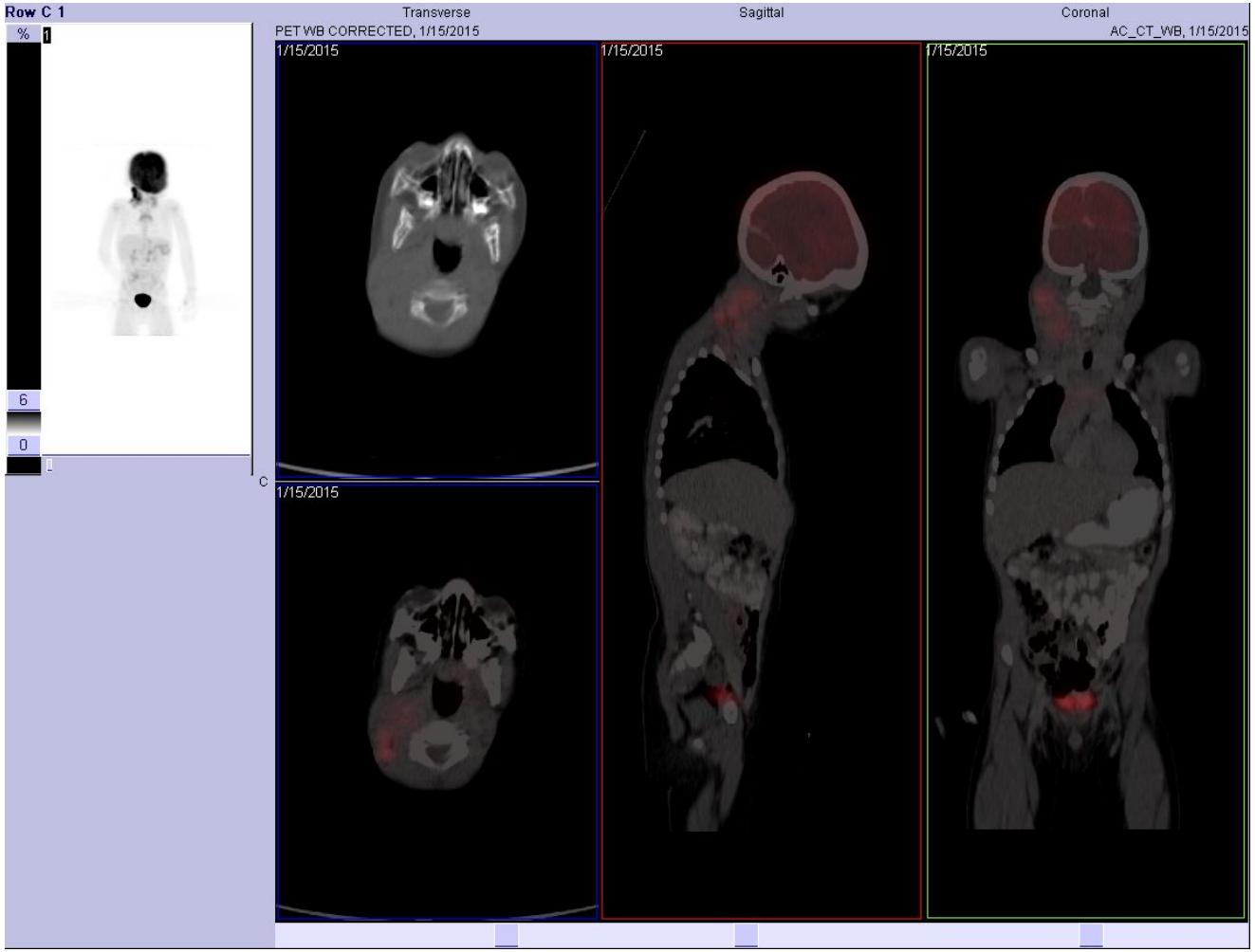
Axial PET, CT and fused images demonstrating a small pericardial effusion and bilateral small pleural effusions.



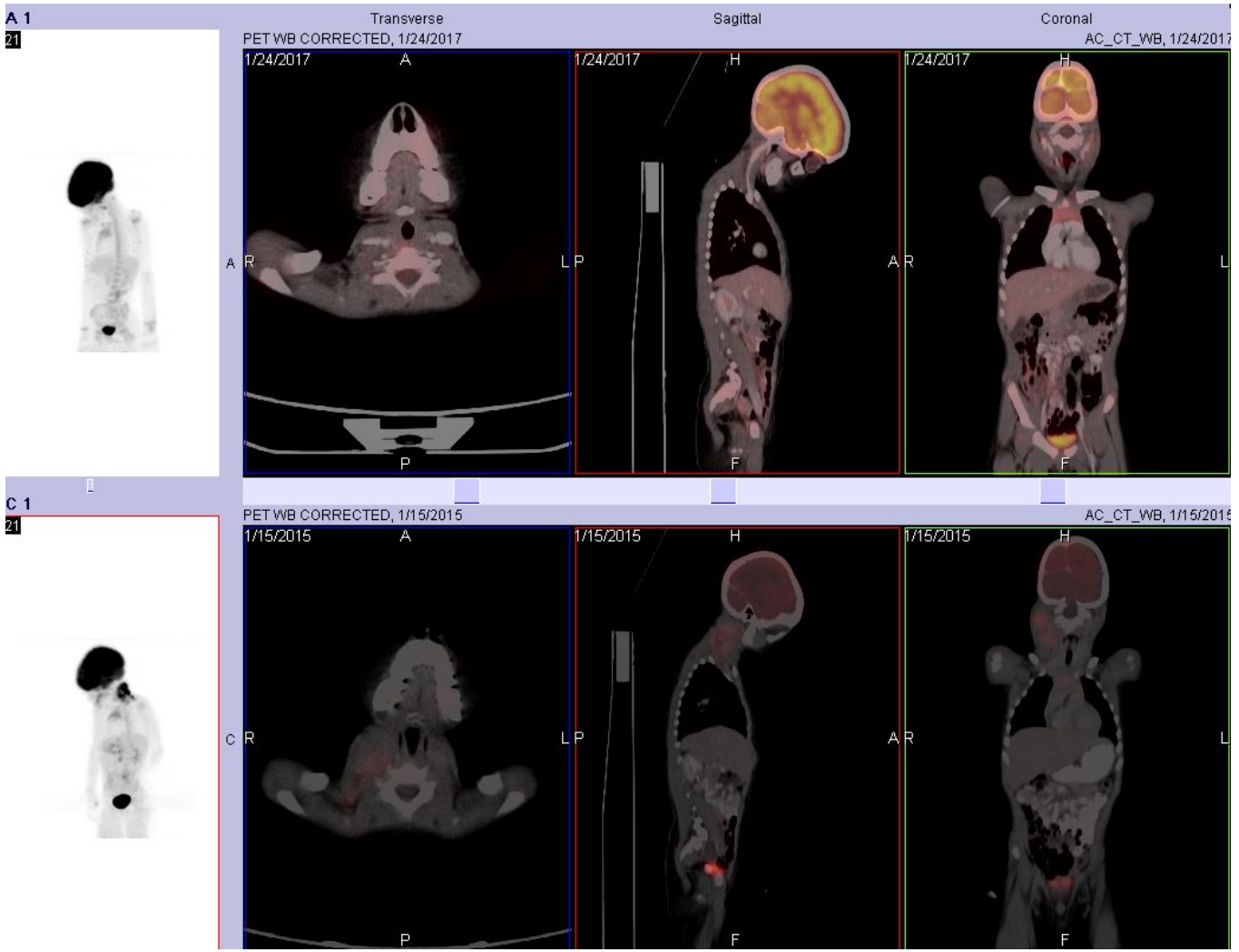
After 6 cycles of ABVD chemotherapy, a partial metabolic response was noted with residual nodal, splenic and marrow involvement on the end of treatment PET/CT.



An additional 4 cycles of chemotherapy (DHAP) was subsequently administered.
However, progression was noted on follow-up PET/CT imaging with a new lesion in the body of L5.
Progression-free survival was 11.2 months; overall survival is 59.3 months.



Patient B: A 4-year-old male with Hodgkin's Lymphoma. Baseline images (MIP; axial, coronal and sagittal fused PET/CT and axial CT) demonstrate metabolically active right cervical lymphadenopathy with no bone marrow or splenic involvement and no effusions. Whole-body MTV - 35.73 cm^3 (TLG- 147.57; SUVmax- 10.21).



After 6 cycles of chemotherapy (ABVD), a complete metabolic response was noted. No progression was seen on a follow-up scan approximately 18 months after the end of treatment PET, and the patient has not progressed to date. Progression-free and overall survival of 78.7 months.

Conclusion

- WB-MTV on baseline F-18 FDG PET/CT demonstrates significant negative correlation with PFS in paediatric lymphoma.
- In addition, the presence of bone marrow involvement or effusion(s) on baseline imaging are associated with shorter mean PFS.
- Further evaluation of a larger sample size is necessary in order to confirm these preliminary findings.

References

1. Zhou Y, Hong Z, Zhou M, Sang S, Zhang B, Li J, et al. Prognostic value of baseline 18F-FDG PET/CT metabolic parameters in paediatric lymphoma. J Med Imaging Radiat Oncol. 2020; 64(1):87-95.

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