



XIX CONGRESSO
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Fourier-Transform Infrared (FT-IR) Spectroscopy of Plasma as a Liquid Biopsy for Monitoring Acute Myeloid Leukemia and Extramedullary Relapse Following Allo-HSCT

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Palazzo degli Affari

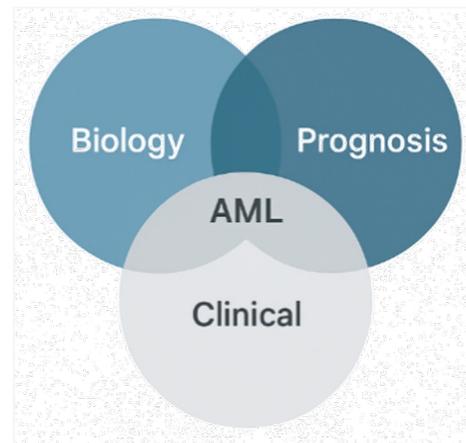


Disclosures of Dr. Alessandro Leoni

| Company name | Research support | Employee | Consultant | Stockholder | Speakers bureau | Advisory board | Other |
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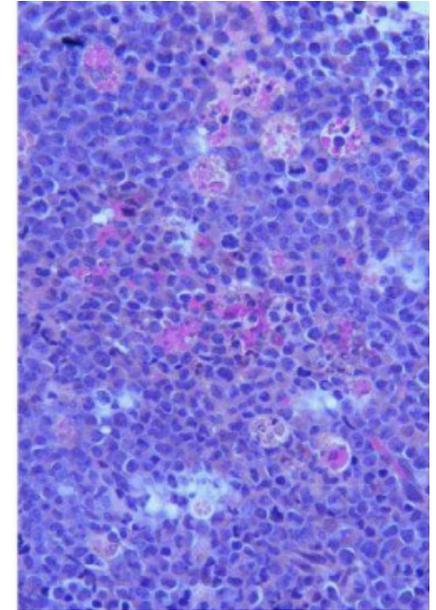
Introduction – Acute Myeloid Leukemia

- ❖ Hematologic malignancy characterized by high biological, clinical, and prognostic heterogeneity
- ❖ Malignant prognosis: hematological relapse rate from 50 to 80% in patients achieves complete response
- ❖ Biological complexity
 - Heterogeneity
 - Interaction with the microenvironment
 - Clonal evolution
 - Genetic and epigenetic alterations



Introduction – Myeloid Sarcoma

- ❖ Extramedullary manifestation of AML characterized by infiltration of leukemic blasts in tissues outside the bone marrow
- ❖ Rare but clinically relevant entity (2.5 - 8% of AML patients)
- ❖ Often underdiagnosed and challenging to recognize
- ❖ Associated with disease relapse and aggressive clinical behavior
- ❖ Clonal selection and immune escape mechanisms



From Magliano et al., AJH, 2025

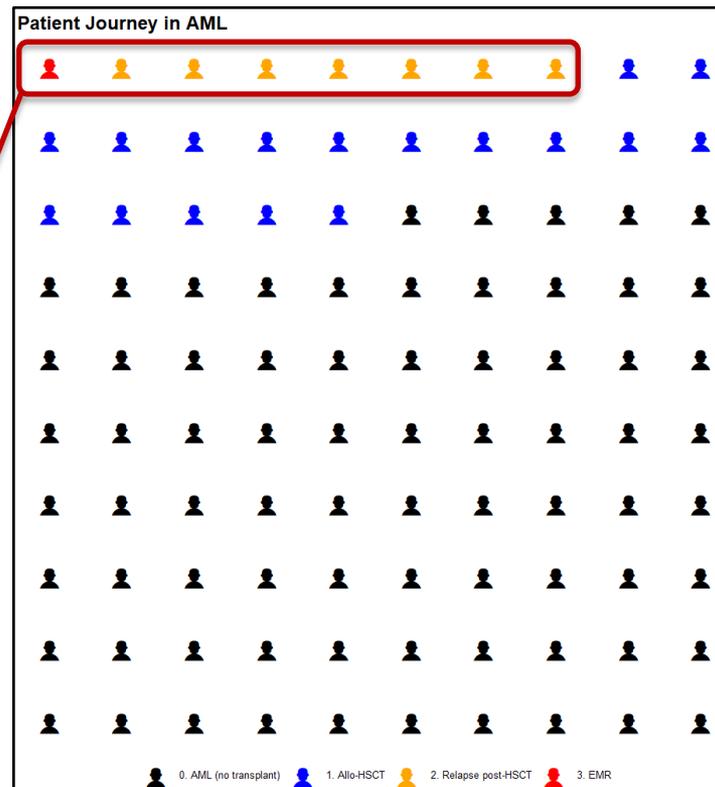
Introduction – Relapse after Allo-HSCT

- ❖ 2,000 - 2,600 new cases of AML per year in Italy
- ❖ 20 - 30% of patients with AML undergo Allo-HSCT*
- ❖ Of transplanted patients, 20 - 40% relapsed*
- ❖ EMR occurs in $\approx 1\%$ of all AML transplanted patients*

Small niche

Out of 100 patients:

- 20 - 30 pts received Allo-HSCT
- Of these, 4 - 12 patients relapse after transplant
- And about ≈ 1 patient develops EMR



* From AIRC

Project and Study Design

Idea to evaluate the potential of **liquid biopsy** approach based on Fourier-Transformation Infrared (FT-IR) technology to identify specific spectral signatures in patients with AML



Settings

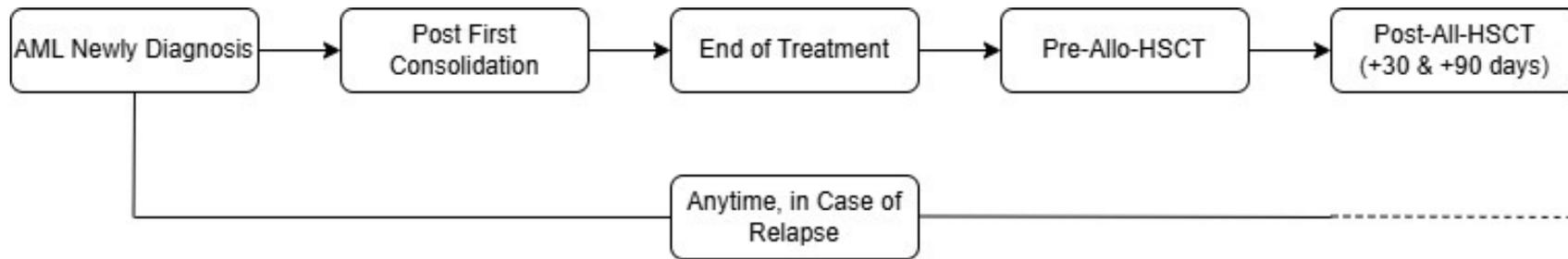
- Monocentric Study – ASST degli Spedali Civili di Brescia

Population

- ≥ 18 years patients
- Healthy Controls
- AML patients
- Different timepoints

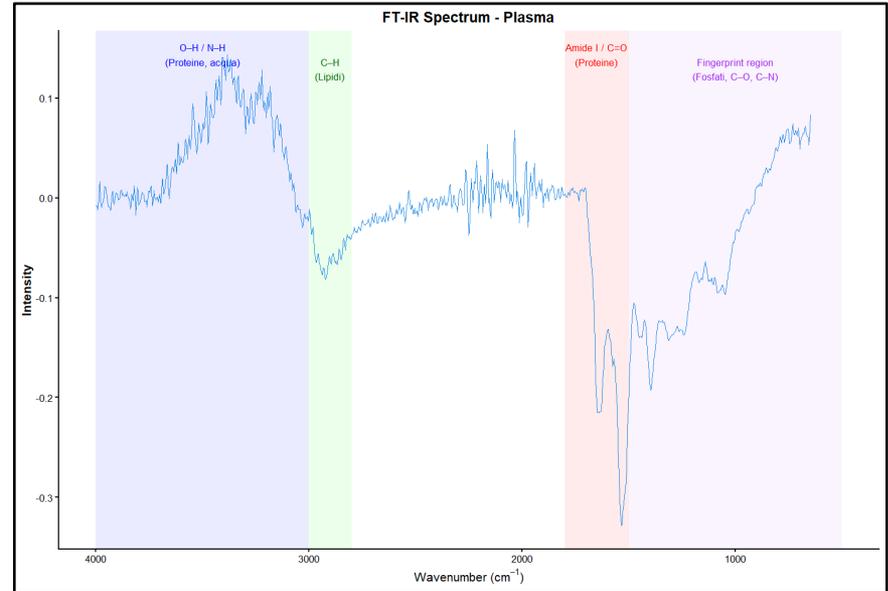
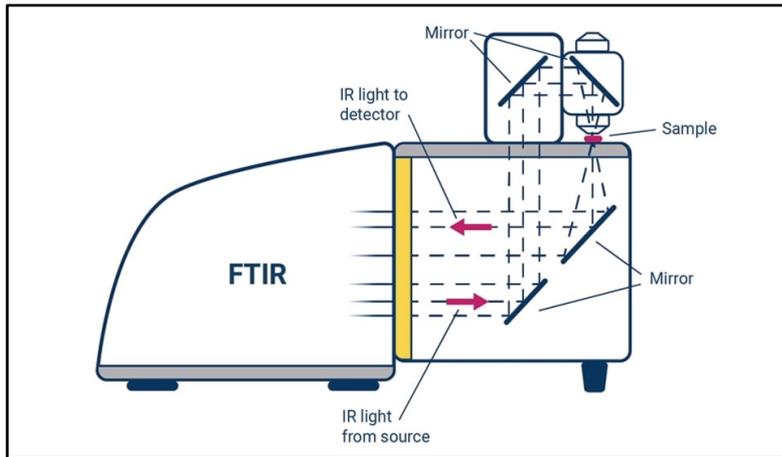
Sample

- Plasma (up to now)



FT-IR Technology

FT-IR is a spectroscopic technique that analyzes the absorption of infrared radiation by molecules. Each region of the spectrum provides information on their structure, composition, and electronic configuration, thus allowing a “molecular spectrum” characteristic of the sample to be obtained.



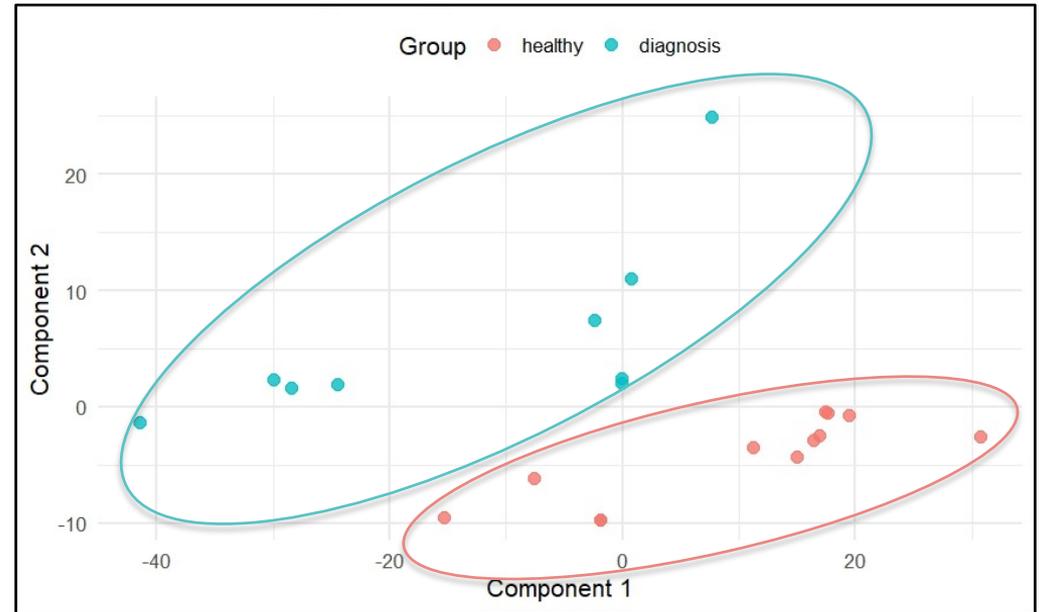
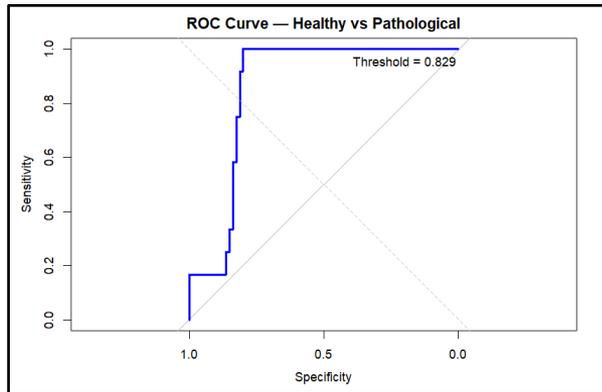
Results 1 – Healthy vs Pathological Subjects at Diagnosis

High discriminating power

AUC = 0.866

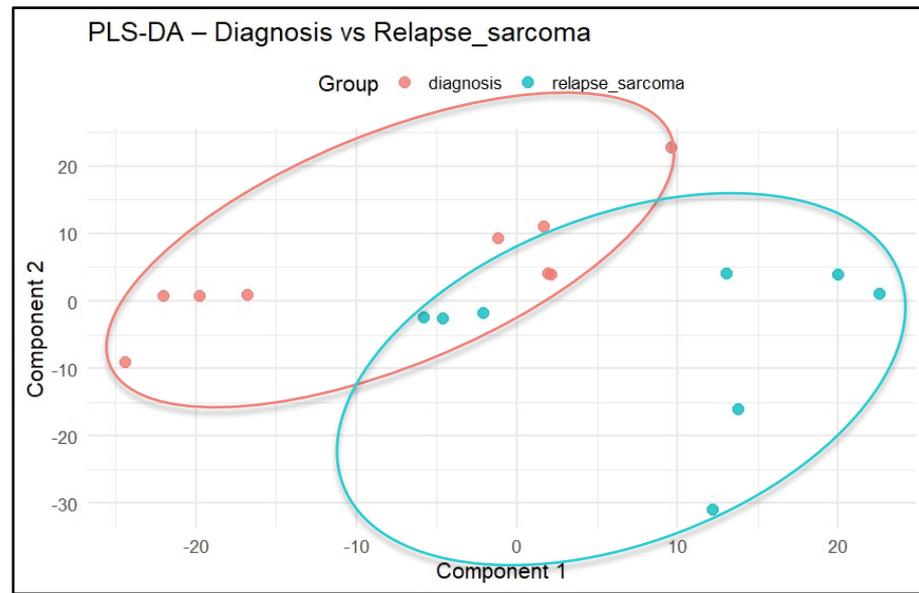
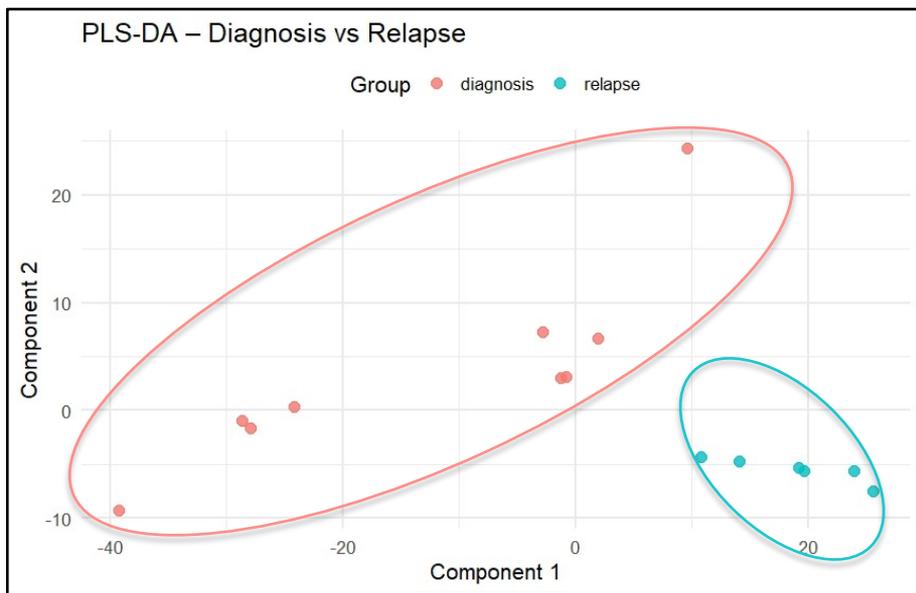
Accuracy = 0.826

Characteristic spectral signature



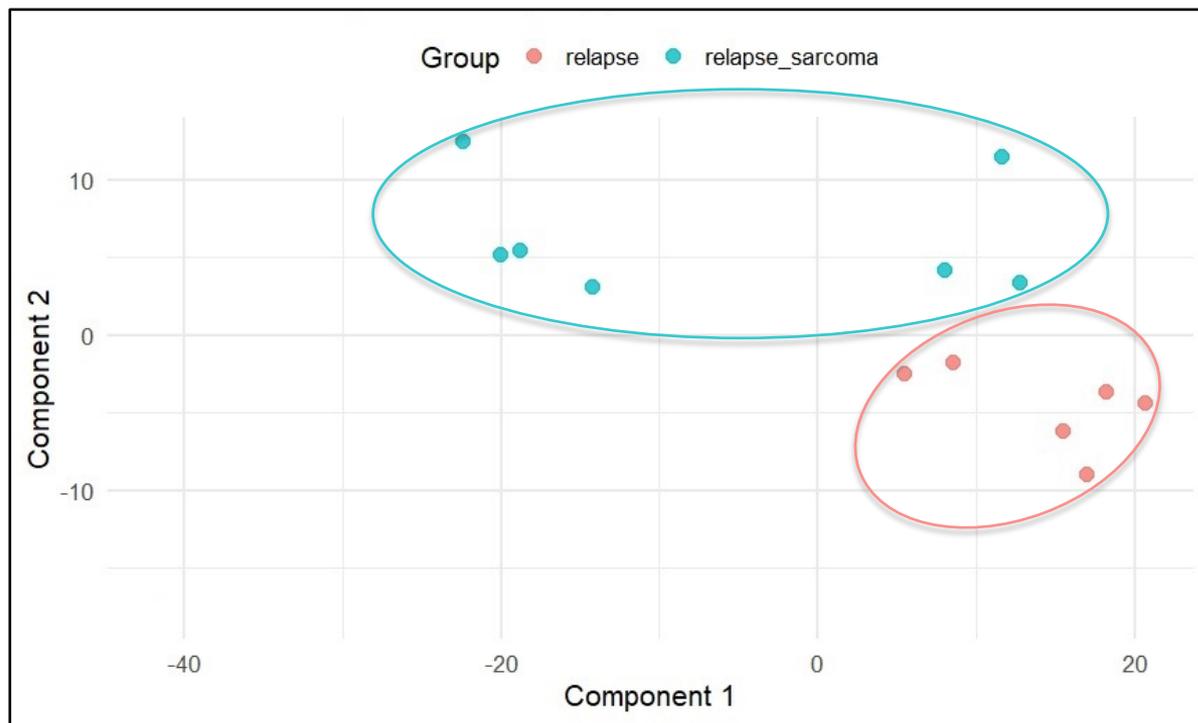
Results 2 – Diagnosis vs Relapse

Excellent discrimination between diagnosis and both medullary and extramedullary relapse



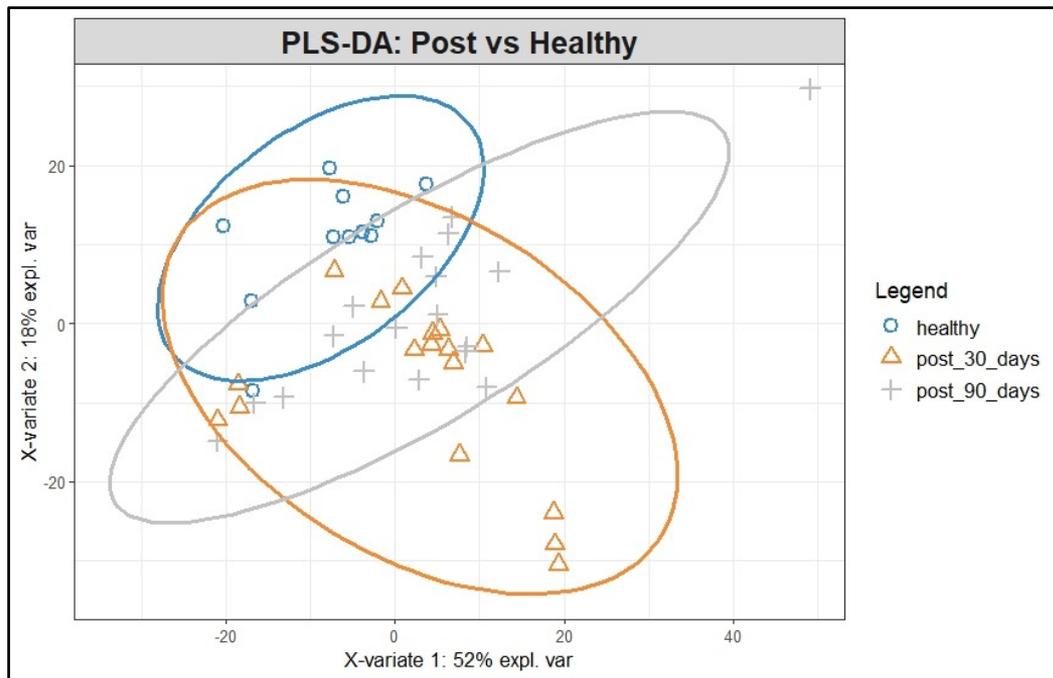
Results 3 – BM Relapse vs Extramedullary Relapse

- Excellent discrimination between medullary and extramedullary relapse
- Distinct biochemical profiles associated with different relapse presentations



Results 4 – Post Allo-HSCT Analysis

- Progressive normalization of the FT-IR spectral profile
- Approximately 95% of samples had reached a “normal” state at 90 days post Allo-HSCT, with partial and gradual metabolic recovery



Discussion and Conclusions

- FT-IR technology allows us to distinguish between healthy and pathological subjects, between diagnosis and relapse, and, incredibly, between types of relapse
- Accurately reflects clinical and metabolic status
- First evidence of the usefulness of FT-IR as a liquid biopsy in AML
- Potential role in disease monitoring
- Potential identification of new biomarkers
- Several clinical implications (early prediction of relapse?)



Future perspectives

- Functional, sensitive and non-invasive approach that could potentially complement current diagnostic methods
- Extracellular Vesicles as an alternative source to plasma
- Evaluation of pre-relapse timepoints to assess their predictive potential
- Further studies are needed for integration into precision medicine, and, above all, there is a need to expand the cohort



comparison with current methods used in diagnostics (and elsewhere) for monitoring the disease



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