Oligometastases: A New Paradigm for the Radiation Oncologist.

Searching new predictive factors

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The term "oligometastases" was first described by Hellman and Weichselbaum in 1995 as “…a less advanced state of metastatic disease amenable to and potentially curable with local therapy”

Hellman S, Weichselbaum RR: JCO, 1995

The term “oligometastases” is usually used for five or fewer metastatic lesions

Milano MT et al. JROBP, 2012

Often, this clinical situation has a slow rate of progression, justifying focal treatments

Alongi F et al. The Oncologist, 2011

Courtesy of Prof. F. Alongi
Effects of Stereotactic Ablative Radiation Therapy (SABR) on tumor tissue

Zeng et al. Lancet Oncology, 2014
SABR for oligometastases: which patient?

Selection of patient for SABR remains an investigational issue

Number of metastases and Organ involvement?

Synchronous or metachronous?

Gene Profiles?

TUMOR Metabolic Parameters?
Characteristic metabolic changes enable cells to meet the large biosynthetic demands associated with cell growth and division.

Changes in rate-limiting glycolytic enzymes redirect metabolism to support growth and proliferation.

Metabolic reprogramming in cancer is largely due to oncogenic activation of signal transduction pathways and transcription factors.

Harrison et al. Clin Cancer Res 2011
Israël M et al. Molecular Cancer 2011
Radiopharmaceuticals uptake by cancer cells
Fluorodesossiglucose Parameters

✓ **SUV-max** as measured by the highest 18-FDG uptake within the Region of Interest (ROI)

✓ **SUV-mean** as measured by the mean 18-FDG uptake value within the ROI

✓ **Metabolic Tumor Volume (MTV)** defined as total tumor volume with a SUV of 2.5 or greater

✓ **Total Lesion Glycolysis (TLG)** represented the metabolic rate of the tumor, calculated by multiplying SUV-mean by MTV

SUV: Standardized Uptake Value
Lung oligometastases and Fluorodesossiglucose Parameters

Metastases-Response to SABR seems to be related to values of SUV max and SUV mean

Table 3. Correlations between Pre-SABR Metabolic Parameters with Local Failure, Distant Metastatic Progression, and Lung Metastasis Response

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Local Failure (In-Field)</th>
<th>Distant Metastatic Progression</th>
<th>Lung Metastasis Complete Response (6 mo after SABR)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>OR</td>
<td>95% CI</td>
<td>p Value</td>
</tr>
<tr>
<td>SUV&lt;sub&gt;max&lt;/sub&gt; (for values ≥ 5)</td>
<td>2.93</td>
<td>0.52-5.11</td>
<td>0.219</td>
</tr>
<tr>
<td>SUV&lt;sub&gt;mean&lt;/sub&gt; (for values ≥ 5)</td>
<td>1.06</td>
<td>0.22-5.16</td>
<td>0.936</td>
</tr>
<tr>
<td>MTV</td>
<td>1.01</td>
<td>0.89-1.14</td>
<td>0.855</td>
</tr>
<tr>
<td>TLG</td>
<td>1.01</td>
<td>0.97-1.02</td>
<td>0.897</td>
</tr>
</tbody>
</table>

Note: Boldface indicates statistically significant p values.
SABR, stereotactic ablative radiotherapy; CI, confidence interval; SUV<sub>max</sub>, maximum standardized fludeoxyglucose F 18 uptake value; SUV<sub>mean</sub>, mean standardized fludeoxyglucose F 18 uptake value; MTV, metabolic tumor volume, defined as total volume with a standardized uptake value of 2.5 or greater; TLG, total lesion glycolysis.
Liver oligometastases and Fluorodesossiglucose Parameters

<table>
<thead>
<tr>
<th>Parameter</th>
<th>OR</th>
<th>IC 95% inf</th>
<th>IC 95% sup</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>SUV max [&gt;10 vs &lt;=10]</td>
<td>5.029</td>
<td>1.264</td>
<td>20.002</td>
<td>0.022</td>
</tr>
<tr>
<td>SUV mean [&gt;5 vs &lt;=5]</td>
<td>4.749</td>
<td>1.106</td>
<td>20.388</td>
<td>0.040</td>
</tr>
</tbody>
</table>

SABR Efficacy seems related to values of SUV-max and SUV-mean

FDG-PET/CT pre-SABR

FDG-PET/CT after SABR

Unpublished data
Nodes and bone oligometastases in post operative prostate cancer

How treatments modify the pattern of relapse in post operative prostate cancer?

**PATTERN OF RELAPSE:**
- WHITE: HT AFTER RP
- BLUE: RP (+/- SABR)
- RED: SBRT POST RT

New tracer as 68-Gallium-PSMA is under investigation as an useful tool for early detection of relapse in post operative prostate cancer

HT: Hormone Therapy; RP: Radical Prostatectomy; SABR: Stereotactic Ablative Radiotherapy; RT: Radical Radiotherapy

Unpublished data
CONCLUSION

Radiomic (quantitative features from medical images) could be used as predicting of oncologic outcomes

Radiopharmaceutical (Fluorodesossiglucose) uptake by cancer cells used as a guide to personalize treatment strategy in oligometastatic patients

In case of High Risk metabolic features local treatment could be integrated early with sistemic drugs

Understanding the relation between metabolism and epigenetics in cancer cells may open new anti-cancer strategies