Integration of the continuous 31-gene expression profile score and clinicopathologic features to predict sentinel lymph node status in patients with cutaneous melanoma: Use of artificial intelligence to attain near perfect prediction

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CLINICAL NEED
Which cutaneous melanoma patients should have a sentinel lymph node biopsy (SLNB)?

- Sentinel lymph node biopsy (SLNB) identifies early lymphatic metastasis
- SLNB is recommended for cutaneous melanoma patients with ≥5% risk of a positive SLNB.
- Most eligible patients will have a negative SLNB.

31-GENE EXPRESSION PROFILE

Stratifies metastatic risk

The 31-gene expression profile (31-GEP) test stratifies risk of cutaneous melanoma metastasis.1,15

OBJECTIVE

Use artificial intelligence to incorporate molecular (31-GEP), histologic, and clinical findings to improve precision of SLN positivity prediction.

METHODS AND RESULTS

31-GEP development

A neural network algorithm incorporating the 31-GEP and clinicopathologic features was developed (n=1398)16 and validated on an independent cohort (n=1674).

Variable selection and importance

<table>
<thead>
<tr>
<th>Variable</th>
<th>Variable importance assessment function</th>
<th>Log-likelihood value***</th>
</tr>
</thead>
<tbody>
<tr>
<td>31-GEP score</td>
<td>100</td>
<td>Q2 = 91.3; P&lt;.001</td>
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<tr>
<td>Breslow thickness</td>
<td>56</td>
<td>G2 = 53.5; P&lt;.001</td>
</tr>
<tr>
<td>Mitotic rate</td>
<td>25</td>
<td>G2 = 20.7; P&lt;.001</td>
</tr>
<tr>
<td>Ulceration</td>
<td>83</td>
<td>G2 = 19.1; P&lt;.001</td>
</tr>
<tr>
<td>Age</td>
<td>0</td>
<td>G2 = 10.5; P&lt;.001</td>
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*All variables are continuous, except ulceration which is categorical. **Scale of 0-100 with 100 having the highest importance. ***Highest G2 value (31-GEP) corresponds to the best explanatory variable. Additional variables that were considered but were too sparse or did not improve algorithm fit were regression, age, tumor infiltrating lymphocytes, microsatellites, lymphovascular invasion, melanocytic features, atypical melanocytes, and clinical subtype.

REFERENCES, FUNDING, & DISCLOSURES


Primary Findings

• 31-GEP score was the most important variable in predicting SLN positivity (variable importance assessment and log-likelihood)
• With a slope of 0.999, the i31-GEP provides a near perfect prediction of SLN positivity rate compared to observed rates
• Of patients originally classified with 5-10% SLN positivity risk (eligible T1a and T1b), i31-GEP reclassified 63% of patients whose true risk was <5% or >10%
• The i31-GEP had a high NPV (98%) in patients with T1-T4 tumors