Supplementary Online Content


eMethods

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eTable. Calculation of Patient’s Simplified Composite Score for Predicting Tracheotomy Risk.

This supplementary material has been provided by the authors to give readers additional information about their work.
eMethods

Borders of the Airway Divisions

- Nasopharynx
  - Anterior: plane perpendicular to Frankfort horizontal plane passing through posterior aspect of vomer.
  - Inferior: plane parallel to Frankfort horizontal plane passing through anterior nasal spine.
  - Remaining: pharyngeal wall.

- Oropharynx
  - Anterior: plane perpendicular to Frankfort horizontal plane passing through posterior aspect of vomer.
  - Superior: plane parallel to Frankfort horizontal plane passing through anterior nasal spine.
  - Inferior: plane parallel to Frankfort horizontal plane passing through anterior inferior aspect of C2.
  - Remaining: pharyngeal wall.

- Hypopharynx
  - Anterior: plane perpendicular to Frankfort horizontal plane passing through posterior aspect of vomer.
  - Superior: plane parallel to Frankfort horizontal plane passing through anterior inferior aspect of C2.
  - Inferior: plane parallel to Frankfort horizontal plane passing through anterior inferior aspect of C4.
  - Remaining: pharyngeal wall.

Sagittal Midline Measures

- Tongue area (cm²): area contained within an outline along superior surface of tongue to inferior aspect of vallecula to superior aspect of hyoid to posterior aspect of mandible.
- Tongue length (cm): curvilinear distance from anterior aspect of tongue to inferior aspect of vallecula.
  - If inferior aspect of vallecula not clearly defined, point at intersection of plane parallel to Frankfort horizontal plane passing through anterior inferior aspect of C2 and posterior aspect of tongue was used.
- Tongue height (cm): linear distance from superior aspect of tongue to inferior aspect of vallecula.
  - If inferior aspect of vallecula not clearly defined, point at intersection of plane parallel to Frankfort horizontal plane passing through anterior inferior aspect of C2 and posterior aspect of tongue was used.
- Tongue position relative to anterior nasal spine (cm): linear distance from plane perpendicular to Frankfort horizontal plane through anterior aspect of tongue to plane perpendicular to Frankfort horizontal plane through anterior nasal spine.
- Tongue position relative to palate (+ if above, - if below) (cm): linear distance from plane parallel to Frankfort horizontal plane passing through anterior nasal spine to superior aspect of tongue.
- Hyoid posterior distance (cm): shortest (perpendicular) linear distance from central point of hyoid to line connecting anterior aspects of C2 and C3.
- Hyoid cranio-caudal position (cm): shortest (perpendicular) linear distance from central point of hyoid to plane parallel to Frankfort horizontal plane through anterior nasal spine.
- Hyoid anterior distance (cm): linear distance from central point of hyoid to pogonion.
- Nasion to basion distance (cm): linear distance from nasion to basion.

Mandible Measures

- On lateral 3D view
  - Mandibular ramus height (cm): linear distance from condylion superior to gonion.
  - Mandibular body length (cm): linear distance from gonion to pogonion.
  - Mandibular total length (cm): linear distance from condylion superior to pogonion.
  - Gonial angle (degrees): angle created by inferior border of mandibular body and posterior border of ramus.
  - Mandibular ramus width (cm): shortest linear distance from most concave point of inner aspect of mandible to posterior aspect of ramus.
  - Mandibular body width (cm): linear distance from gonion to B point.

- On inferior 3D view
  - Inferior pogonial angle (degrees): angle formed by gonion to pogonion to gonion.

- On anterior 3D view
  - Bigonal distance (cm): linear distance from gonion to gonion.
eResults

Calculation of a Patient’s Simplified Composite Score for Predicting Tracheotomy Risk
1. Measure tongue length, tongue position relative to palate, mandibular total length, gonial angle, inferior pogonial angle, and nasion to basion distance.
2. **Internal normalization:** Divide the length measures (the first 3 in the list above) by nasion to basion distance.
3. **Standardization by reference group values:** Calculate a t-score for each measure, via the formula
   \[ t = \frac{x - m}{s} \]
   where \(x\) is the patient’s measure, \(m\) the group mean for the measure, and \(s\) the group standard deviation. When calculating the t-score, please use the reference table below to determine \(m\) and \(s\) for each measure.
4. **Patient’s simplified composite score:** Add or subtract each t-score, according to the sign appearing in the table below, then divide the sum by 5.
5. **Interpreting the score:** Higher scores indicate greater the tracheotomy risk. A tentative decision threshold is 0. The range of scores observed in our dataset was -1.0 to +1.4, so a score around +1 indicates high risk, and vice versa.
**eTable.** Calculation of Patient’s Simplified Composite Score for Predicting Tracheotomy Risk.

<table>
<thead>
<tr>
<th>Measure</th>
<th>Raw value</th>
<th>Divided by Nasion to Basion Distance</th>
<th>Standardized by Group Values</th>
<th>Sign</th>
<th>Reference Group Mean</th>
<th>Reference Group SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nasion to basion distance</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0.903</td>
<td>0.152</td>
</tr>
<tr>
<td>Tongue length</td>
<td></td>
<td>+</td>
<td></td>
<td></td>
<td>-0.006</td>
<td>0.093</td>
</tr>
<tr>
<td>Tongue position relative to palate</td>
<td></td>
<td>+</td>
<td></td>
<td></td>
<td>0.747</td>
<td>0.146</td>
</tr>
<tr>
<td>Mandibular total length</td>
<td></td>
<td>-</td>
<td></td>
<td></td>
<td>141.5</td>
<td>9.00</td>
</tr>
<tr>
<td>Gonial angle</td>
<td></td>
<td>(do not divide)</td>
<td></td>
<td>+</td>
<td>90.9</td>
<td>15.7</td>
</tr>
</tbody>
</table>

Multiply by signs and add:

Divide by 5 for simplified composite score: