Compressive orthotic bracing in the treatment of Pectus Carinatum

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Disclosure

• I have no relevant financial relationships with the manufacturer of any commercial product or providers of commercial services discussed in this CME activity.
• I do not intend to discuss an unapproved or investigative use of a commercial product or device in my presentation.
• This review was approved by the IRB at both Kaiser Permanente Health System and David Grant Medical Center.
Background

- Pectus Carinatum = protrusion of the sternum due to overgrowth of costal cartilages
- Classic treatment surgical with cartilage resection and sternal osteotomies
- Nonoperative treatment with bracing proposed 1990’s by Haje

Background

- Few case cohorts of successful bracing from Calgary and Cincinnati
- Mostly subjective data of cosmetic improvement
**Study Questions**

- Is orthotic bracing a successful treatment for pectus carinatum when objectively evaluated by Computed Tomography (CT)?
- Can predictive radiographic markers be obtained from pre-treatment CT?

**Methods / Study Group**

- 63 Patients with PC over 8 years
- 11 Females (17%); 52 Males (83%)
- Mean age 13.3 ± 2.5
- All patients were offered bracing
- Pre-treatment CT’s obtained
- Follow up is 4-60 months, median 25 months
Treatment Protocol

- Custom fitted clamshell orthoses with extra padding over area of maximal protrusion
- 23 hr daily wear for 3-6 months
- 16 hr daily wear for 3-6 months
- Nightly wear until vertical growth ceased
Results of Treatment

- 17 patients (27%) chose observation
- 46 patients began the protocol, 10 excluded (6 in maintenance phase, 4 lost to follow up)
- 28/36 (78% compliance) completed therapy
  - 24/28 (86% success) with good or excellent cosmetic result by survey and exam
- 8 requested surgery
  - 4 failed due to noncompliance
  - 4 compliant and failed bracing

Pretreatment CT Characteristics

<table>
<thead>
<tr>
<th>Group</th>
<th>N</th>
<th>Age</th>
<th>Haller Index</th>
<th>ASR</th>
<th>Asymmetry Index</th>
</tr>
</thead>
<tbody>
<tr>
<td>Successful Bracing</td>
<td>19</td>
<td>13.1</td>
<td>2.05</td>
<td>14.8</td>
<td>1.06</td>
</tr>
<tr>
<td>Observation</td>
<td>11</td>
<td>12.5</td>
<td>2.05</td>
<td>9.2*</td>
<td>1.05</td>
</tr>
<tr>
<td>Failed (Noncompliant)</td>
<td>8</td>
<td>14.4</td>
<td>1.84*</td>
<td>11.7</td>
<td>1.04</td>
</tr>
<tr>
<td>Failed (Compliant)</td>
<td>4</td>
<td>15</td>
<td>2.85*</td>
<td>27.3*</td>
<td>1.23**</td>
</tr>
</tbody>
</table>

* p < 0.05 when compared to successful bracing group
** p < 0.01 when compared to successful bracing group

Table 1: Radiographic indices on pre-treatment chest CT scan, retrospectively grouped by outcome. Data expressed in means, p value calculated by one-tailed Student T-test.
Post-Treatment CT Characteristics with Successful Bracing

<table>
<thead>
<tr>
<th></th>
<th>N</th>
<th>Age</th>
<th>Haller Index</th>
<th>ASR</th>
<th>Asymmetry Index</th>
</tr>
</thead>
<tbody>
<tr>
<td>Before</td>
<td>10</td>
<td>13.0</td>
<td>2.00</td>
<td>11.99</td>
<td>1.04</td>
</tr>
<tr>
<td>After</td>
<td>10</td>
<td>14.6</td>
<td>2.08</td>
<td>5.53**</td>
<td>1.03</td>
</tr>
</tbody>
</table>

** p < 0.01 when compared to pre-treatment value

Table 2: Results of bracing on radiographic markers. Data expressed in means, p value calculated by one-tailed Student T-test.

Summary

- Compressive orthotic bracing is a successful method of treatment for PC
- Sternal rotation can be significantly improved with appropriate bracing
- Asymmetry of chest diameter is related to concomitant excavatum-type deformity and is less likely to respond to bracing.
Summary – Practice Guidelines

• Symmetric PC is treated with bracing with no additional studies needed
• Asymmetric PC → limited chest CT
• If asymmetry index >1.15 and ASR >20, then primary surgical repair is indicated, with possible postoperative bracing.
• Otherwise, bracing is initiated per protocol.

References