Use of the POSTHORAX vest in patients who underwent heart surgery during cardiac rehabilitation and its impact on functional recovery and respiration function.

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1. Introduction

• **Median sternotomy** remains the best surgical approach for cardiac surgery. It can be complicated by the appearance of skin **infections** and mediastinitis, dehiscence, and instability of bone surfaces.

• **Sternal vests** are devices created in order to prevent sternal dehiscence and instability; their use may result in the limitation of thoracic excursion that might worsen temporary restrictive lung disease in patients undergoing cardiac surgery.
A sternal stabiliser must:

- be **active** on the sternotomy without compromising the ventilatory function
- be **easy** to use
- reduce **pain** and **discomfort** without restrictions of physical activity
- improve patients’ **quality of life**.
Sternal instability leads to an infection of the sternal wound!

After 1009 patients and 90 post operative days, in the non-Posthorax group, we had 29 deep sternal wound infections, 10 superficial wound infections and 3 dehiscences. In the Posthorax group we observed only 2 superficial wound infections. 25% of complications occurred after hospital discharge.

2. Aim of the study

The objective of this study is to evaluate the impact of the use of the PosThorax® vest on functional recovery and respiratory function during the cardiac rehabilitation programme following heart surgery.
All the patients admitted to our Department of Rehabilitation from Cardiac Surgery Centres, on day five to seven after cardiac surgery via median sternotomy, were the subject of the present study.
**INCLUSION** criteria:

- All subjects aged \( \leq 80 \) years who underwent cardiac surgery via medial sternotomy
- Mobilised
- Able to ambulate
- Able to undergo the usual physiotherapy programme
- And perform exercises on the exercise bike

**EXCLUSION** criteria:

- > 80 years of age, medical history of clinically significant bronchopulmonary disease and/or use of bronchodilator therapy
- FE < 30%
- Recent myocardial infarction (<30 days), aortic replacement surgery because of thoracic aortic aneurysm
- Sternal wound complications which would require the elective use of the corset from the early days after surgery.
4. Methods

Randomisation

Patients are randomly assigned to two groups:

• Group 1: 40 patients will be encouraged to wear the PosThorax® vest continuously (24 hours/day);

• Group 2: 40 patients will not use the vest.
Patients enrolled from the outset of the study: 56
Patients currently completed: 33

<table>
<thead>
<tr>
<th>Causes of exit from the study</th>
<th>Group 1</th>
<th>Group 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intolerance to the vest</td>
<td>4</td>
<td>-</td>
</tr>
<tr>
<td>Sternal wound complications</td>
<td>0</td>
<td>2</td>
</tr>
<tr>
<td>Other complications</td>
<td>5</td>
<td>4</td>
</tr>
<tr>
<td>Inability to perform plethysmograph and/or DLCO</td>
<td>4</td>
<td>4</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>Group 1</th>
<th>Group 2</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>No. of subjects</td>
<td>17</td>
<td>16</td>
<td></td>
</tr>
<tr>
<td>M/F</td>
<td>14/3</td>
<td>11/5</td>
<td>NS</td>
</tr>
<tr>
<td>age</td>
<td>65 ± 11</td>
<td>66 ± 8</td>
<td>NS</td>
</tr>
<tr>
<td>BMI</td>
<td>27 ± 3</td>
<td>23 ± 7</td>
<td>NS</td>
</tr>
<tr>
<td></td>
<td>Group 1</td>
<td>Group 2</td>
<td>pΔGr1-Gr2</td>
</tr>
<tr>
<td>----------------</td>
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<td>--------------</td>
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</tr>
<tr>
<td></td>
<td>I</td>
<td>II</td>
<td>ΔII-I</td>
</tr>
<tr>
<td>Hb (g/dL)</td>
<td>10.5 ± 1.5</td>
<td>10.7 ± 0.9</td>
<td>0.4 ± 0.9</td>
</tr>
<tr>
<td>TLC</td>
<td>4.8 ± 0.8</td>
<td>5.4 ± 1.2</td>
<td>0.5 ± 0.6</td>
</tr>
<tr>
<td>TLC %</td>
<td>79 ± 13</td>
<td>88 ± 14</td>
<td>8 ± 10</td>
</tr>
<tr>
<td>FEV1</td>
<td>1.8 ± 0.5</td>
<td>2.0 ± 0.7</td>
<td>0.2 ± 0.4</td>
</tr>
<tr>
<td>FEV1 %</td>
<td>66 ± 16</td>
<td>74 ± 20</td>
<td>9 ± 11</td>
</tr>
<tr>
<td>FEV1/FVC</td>
<td>82 ± 9</td>
<td>80 ± 6</td>
<td>-2 ± 9</td>
</tr>
<tr>
<td>DLCO</td>
<td>4.2 ± 0.8</td>
<td>4.6 ± 1.1</td>
<td>0.5 ± 0.6</td>
</tr>
<tr>
<td>DLCO %</td>
<td>51 ± 8</td>
<td>57 ± 11</td>
<td>6 ± 6</td>
</tr>
<tr>
<td>KCO</td>
<td>1.0 ± 0.1</td>
<td>1.1 ± 0.2</td>
<td>0.0 ± 0.1</td>
</tr>
<tr>
<td>KCO %</td>
<td>78 ± 11</td>
<td>78 ± 14</td>
<td>1 ± 8</td>
</tr>
<tr>
<td>6MWT</td>
<td>290 ± 100</td>
<td>426 ± 69</td>
<td>134 ± 59</td>
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<tr>
<td>6MWT %</td>
<td>56 ± 19</td>
<td>83 ± 15</td>
<td>27 ± 13</td>
</tr>
</tbody>
</table>
Results of cardiopulmonary exercise testing

% VO2 max predicted

Workload

Group 1

Group 2

Group 1

Group 2
There is no significant difference in the increase of TLC% after training between the two groups.

* p < 0.05 vs baseline

§ p < 0.05 vs analogue Group 1
There is no significant difference in the increase of DLCO% after training between the two groups.

* * p < 0.05 vs baseline
There is no significant difference in the increase of KCO% after training between the two groups.
Results of 6 Minute Walking Test

There is no significant difference in the increase of 6MWT% after training between the two groups.

* p < 0.05 vs baseline

Δ²⁻¹ Group 1
Δ²⁻¹ Group 2

Group 1
Group 2
EuroQoL 5D-3L results

To help people say how good or bad a health state is, we have drawn a scale (rather like a thermometer) on which the best state you can imagine is marked 100 and the worst state you can imagine is marked 0.

We would like you to indicate on this scale how good or bad your own health is today, in your opinion. Please do this by drawing a line from the box below to whichever point on the scale indicates how good or bad your health state is today.

Your own health state today

p = 0.007

p = 0.004
vest group  1 no problems, 2 some problems, 3 extreme problems.

**EURO QoL 5D 3 L**

- **MOVEMENT CAPACITY**: p = 0.004
- **PERSONAL CARE**: p < 0.0001
- **USUAL ACTIVITIES**: p < 0.0001
- **PAIN/DISCOMFORT**: p < 0.0001
- **ANXIETY/DEPRESSION**: p < 0.0001
6. Conclusion

• The study demonstrates the full effect of a rehabilitation cycle on the recovery of respiratory function and submaximal functional capacity.

• The absence of differences in the improvement of various ventilatory parameters and the distance walked in the 6MWT between the two groups shows that the use of the POSTHORAX© vest does not have a negative impact on the recovery of these parameters.

• These results suggest that devices such as Posthorax© should be more extensively used after sternotomy in cardiac surgery.
FONDAZIONE SALVATORE MAUGERI
CLINICA DEL LAVORO E DELLA RIABILITAZIONE
DPR. 391 DEL 5-6-1963
I.R.C.C.S.

Grazie