Health Service Cost associated with Percutaneous Vertebroplasty in patients with spinal metastases

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Purpose

Vertebroplasty was first described by Galibert in 1987 as a treatment for painful vertebral angioma. Since then, its use has expanded to include treatment for osteoporotic wedge fractures, spinal metastases and spinal trauma. A recent open label randomised trial (VERTOS II) concluded that vertebroplasty for acute osteoporotic fractures had an acceptable cost of €22,685 per quality-adjusted life year (QALY) gained when compared to conservative management. Little information is available regarding the cost of vertebroplasty in the setting of malignancy - in a group of patients who may have a limited life expectancy and severe intractable pain.

The aim of this study was to ascertain prospectively the health service cost of vertebroplasty on a cohort of consecutive patients with spinal metastases.
Methods and Materials

Vertebroplasty for spinal metastases has been performed at our institution by the senior author since 2001. The procedure is performed under conscious sedation and local anaesthetic in the Interventional Suite with fluoroscopic guidance. Data was collected prospectively on standard forms in a consecutive series of patients undergoing vertebroplasty for spinal metastases between August to December 2011. Quality of life questionnaires (EQ-5D) were filled out pre-, six weeks and at six months post-vertebroplasty.

Measurement of costs:

Operative costs

Theatre running costs was based on the Department of Health published national schedule of reference cost. This was combined with variable operative costs. To obtain the most accurate data, operative costs relating to percutaneous vertebroplasty (equipment and consumables) were identified and measured prospectively. A structured questionnaire was completed during a sample of operations. For items of equipments, an estimation of their lifespan was obtained, as well as any maintenance cost and approximation of the number of times used. From this, an annual equivalent cost is estimated and divided by the annual use to obtain a cost per hour per patient. The staffing element of the theatre costs was based on the team - reflecting the grade of radiologist and assistant, as well as the number and grade of radiographic and nursing staff. Where complications were identified, cost of each event would have been compiled and attached as a "complication cost".

Other healthcare costs

The cost of an inpatient day (including staffing, capital charges and overheads) on a general medical ward was also based on the Department of Health figures. For each patient, this cost was multiplied by the total inpatient stay. Drugs were costed according to the manufacturers' price list.

The cost of imaging pre-vertebroplasty was not included in this exercise as they were performed as part of the patients' routine follow up.
Mean cost for percutaneous vertebroplasty was calculated using individual patient data refined with the additional more detailed information from the procedure cost questionnaire. The cost data was analysed by intention to treat.

**Health Status:**

The EQ-5Q questionnaire was used for the economic evaluation to permit the calculation of QALYs. Data was collected pre- and 6 weeks post-vertebroplasty for 10 patients. Data was also collected after at least 6 months to assess long term change, if any.
Results

Of the eleven consecutive patients who underwent vertebroplasty over the four period, eight were performed as planned outpatient procedures and three were referred with intractable pain whilst in hospital.

Five required overnight stay in a general ward because of social circumstance or distance from home, while one stayed in hospital for two days as his procedure was cancelled and rescheduled. Two of the inpatients were able to be discharged from hospital one and two day post-vertebroplasty, while the third patient died two weeks post vertebroplasty from his primary malignancy.

The median time of the procedure was 60 minutes (range 40-80 minutes) with a median time of 60 minutes (range 10-230 minutes) spent in recovery pre- and post- procedure. All procedures were performed with conscious sedation and local anaesthetic in the radiology intervention suite. Staffing involved one Consultant radiologist, four nurses (two in recovery, two in the intervention suite) and two radiographers.

Health Service costs:

Personnel and equipment costs are illustrated on Tables 1 and 2. Based on these figures, the average cost of vertebroplasty per patient - including consumables, capital equipment, hotel/clinic costs and staffing - is £2213.25 (range £1,581.72- £6,076.72, 95% C.I £729.95).

Mean EQ-5D utility scores increased from 0.4392 pre-treatment to 0.5398 post-treatment (p=0.225, 2 tailed paired student t-test). Four patients did not improve their utility scores. In two, pain was secondary to concomitant benign bone disease rather than metastasis: a subsequent insufficiency pubic fracture from previous radiotherapy in one and degenerative change at the facet joint in the other. When these two patients were excluded, the utility scores increased from 0.421 pre-treatment to 0.5979 post-treatment (p=0.047).

The visual analogue scale (VAS) of perceived health improved from a mean of 46.5 to 59.5 (p=0.156). This effect was sustained at 6 months (n=8, mean VAS 66.7). When the two patients with benign disease were excluded, the mean VAS rose from 41.88 to 63.75 (p=0.00537).
Based on a consecutive series of 128 patients undergoing vertebroplasty for spinal metastasis in our unit, the median survival for patients with myeloma was 20 months (range 2-91 months) while that for patients with metastases was 8 months (range 1 week to 107 months)\(^8\).

The cost per QALY was calculated at £23,545.21 for patients with myeloma and £58,706.90 for patients with metastatic disease.

**Table 1: Staff costs per hour**

<table>
<thead>
<tr>
<th>Staff Type</th>
<th>Hourly Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Consultant Radiologist (n=1)</td>
<td>£67.30</td>
</tr>
<tr>
<td>Registrar (n=1 - for half the cases)</td>
<td>£18.30</td>
</tr>
<tr>
<td>Radiographers (n=2)</td>
<td>£30.80</td>
</tr>
<tr>
<td>Nurses (n=4)</td>
<td>£61.50</td>
</tr>
</tbody>
</table>

*Based on published salaries: consultant, registrar (5\(^{th}\) year), nurse (Band 6), radiographer (Band 6).

**Table 2: Hotel and Equipment costs**

<table>
<thead>
<tr>
<th>Service</th>
<th>Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre-vertebroplasty clinic appointment</td>
<td>£161</td>
</tr>
<tr>
<td>Post vertebroplasty clinic appointment</td>
<td>£157</td>
</tr>
<tr>
<td>Overnight hospital stay</td>
<td>£371</td>
</tr>
<tr>
<td>Day case hospital stay</td>
<td>£171</td>
</tr>
<tr>
<td>Interventional Fluoroscopy Unit (cost per hour)</td>
<td>45.20</td>
</tr>
<tr>
<td>Consumables and Drugs (per patient)</td>
<td></td>
</tr>
<tr>
<td>Vertebroplasty kit</td>
<td>£744.00</td>
</tr>
<tr>
<td>Theatre pack, gloves, gowns, needles, syringes</td>
<td>£139.46</td>
</tr>
<tr>
<td>Lignocaine, Midazolam, Cefuroxime, Fentanyl</td>
<td></td>
</tr>
</tbody>
</table>
• %Based on Department of Health published national schedule of reference cost.
• #Based on a 10 year machine life span, capital cost £500,000 maintenance cost £44,000 per annum.
**Fig. 1:** Trocar inserted into the pedical under fluoroscopic guidance.

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**Fig. 2:** Cement injection.

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**Fig. 3:** Two levels treated.

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Fig. 4: Lateral view.

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Conclusion

Health service cost for percutaneous vertebroplasty in patients with spinal metastases is significantly lower than previously estimated and is in keeping with that of other palliative radiological procedures.
References


