BMP-6 EXPOSED OSTEOPROGENITOR CELLS PROMOTE POSTEROLATERAL INTERTRANSVERSE SPINAL FUSION IN THE NEW ZEALAND WHITE RABBIT

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**INTRODUCTION:** The gold standard and most commonly used graft material for posterolateral lumbar arthrodesis is autogenous corticocancellous bone derived from iliac crest. Even with the use of autogenous iliac crest bone graft (ICBG), the nonunion rate after posterolateral fusion has been reported to be as high as 35% with significant morbidity associated with the graft harvest. For these reasons, bone graft expanders and/or substitutes are being actively sought for clinical use.

The bone morphogenetic proteins (BMP) have been shown to stimulate cartilage and bone formation in vivo. Osteoprogenitor (OP) cells are also being studied as a means to enhance bone repair processes (1). It has recently been shown in vitro that exposure of stromal cells to BMP-6 induces cellular differentiation along an osteoblastic lineage (5).

The purpose of this study was to evaluate the osteogenic capacity of BMP-6 exposed osteoprogenitor cells (BMP-6 OP cells) when used as a graft substitute for posterolateral fusion of the lumbar spine in the New Zealand white rabbit.

**METHODS:** Forty-five skeletally mature New Zealand white rabbits were studied using the experimental model described by Boden (4) for single level lumbar intertransverse process fusion. Rabbits were assigned to one of four groups: Group A- decortication alone; Group B- decortication plus carrier (guanidine extracted demineralized bone matrix); Group C- decortication plus autogenous ICBG; Group D- decortication plus BMP-6 OP cells with guanidine extracted demineralized bone matrix (GuaDBM).

The L5-L6 intertransverse area was exposed bilaterally in all animals using two separate paramedian fascial incisions. In Group A the dorsal aspect of the L5-L6 intertransverse area was exposed bilaterally in all animals. The L5-L6 intertransverse fusion bed on each side. In group C, ICBG was harvested as the bone substitute for posterolateral fusion of the lumbar spine in the New Zealand white rabbit.

Animals were sacrificed 6 weeks after the surgical procedure. The entire lumbar spine was harvested and a posteroanterior (PA) radiograph was obtained. All soft tissues were removed from the specimen and the fusion mass was tested by manual palpation (figures 1, 2 and 3) (2, 4).

**RESULTS (Table 1):** Manual palpation of the harvested lumbar spines indicated that the fusion rates of the decortication/GuaDBM group (1/8; 12.5%) was inferior to the decortication/ICBG group (5/9; 55%) and superior to the decortication only group (0/8; 0%). The group of animals which received BMP-6 OP cells/GuaDBM had the highest fusion rate (5/6; 83%).

<table>
<thead>
<tr>
<th>Group</th>
<th># operated</th>
<th># included</th>
<th># fused</th>
<th>% fused</th>
</tr>
</thead>
<tbody>
<tr>
<td>Group A</td>
<td>10</td>
<td>8</td>
<td>0</td>
<td>0%</td>
</tr>
<tr>
<td>Group B</td>
<td>8</td>
<td>8</td>
<td>1</td>
<td>12.5%</td>
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<tr>
<td>Group C</td>
<td>13</td>
<td>9</td>
<td>5</td>
<td>55%</td>
</tr>
<tr>
<td>Group D</td>
<td>14</td>
<td>6</td>
<td>5</td>
<td>83%</td>
</tr>
</tbody>
</table>

Table 1

**DISCUSSION:** Our data demonstrate the osteogenic capacity of autologous BMP-6 exposed OP cells at a density of 10-30 million cells per side of fusion. The preliminary results in this rabbit lumbar intertransverse fusion model suggest that BMP-6 exposed OP cells on a DBM carrier can achieve spinal arthrodesis without the need for supplemental bone graft. The technique of implanted OP cells, therefore, seems to have potential clinical applicability in spinal fusion surgery as a graft substitute/expander and warrants further study. Ongoing work in our laboratory will provide comparative biomechanical testing and volumetric imaging analysis of the fusion specimens evaluated in the current investigation.

**REFERENCES**


**Rhode Island Hospital, Providence, RI.**

**48th Annual Meeting of the Orthopaedic Research Society**

**Poster No: 0800**