Spinal Cord Injury

A Comparison on Animal Models

K Stoner & N Grosland
Weight Drop Injury

• Not all energy transmitted to cord
  • Weight-height combination (Dohrmann 1976)
Weight Drop Injury

- Not all energy transmitted to cord
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  - Affects of device mass, materials, support
Weight Drop Injury

• Not all energy transmitted to cord
  • Weight-height combination (Dohrmann 1976)
  • Affects of device mass, materials, support
  • Cord deformation

Less Stiff > Deform
More Stiff

Impulse vs slow impact?
Duration of load?
Requirement for Model

• Correlate Load/Impulse/Pressure
  • Lesion volume
  • Spinal electropotential
  • Behavior of animal

• Possible with weight drop HOWEVER uncontrolled
Compression-Injury

- Balloon catheter device
  - Inflated epidurally or subdurally

Baydin 2007
Compression-Injury

• Pressure and volume of balloon tightly controlled
  • Impulse or slow inflation

Rats rapid subdural injury: 5 normal gait, 0 no movement
Martin 1992
Compression-Injury

- Pressure and volume of balloon tightly controlled
  - Impulse or slow inflation
- SEPs monitored before and after

Rabbit, epidural, slow inflation 40-60psi 15 min
Baydin 2007
Compression-Injury

• Pressure and volume of balloon tightly controlled
  • Impulse or slow inflation
• SEPs monitored before and after
• Deformation of cord – imaging with contrast agent

Martin 1992
Compression-Injury

• Large Animal Models Successful
  • Rabbit – Baydin 2007
  • Dog - Tarlov 1953
  • Rhesus Monkey – Tator 1973

Rhesus Monkey
slow inflation 400
mmHg 5min:
0 complete
paraplegia, 4 normal
Tator 1973
Compression-Injury

- Rat treadmill training possible

Rapid inflation
20ul 5 min: 0
no movement,
12 normal
Multon 2003
## Cost Comparison

<table>
<thead>
<tr>
<th>Drop Weight</th>
<th>Potentiometer</th>
<th>Compression Catheter</th>
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<tbody>
<tr>
<td>NI 9237 Module</td>
<td>NI 9201 Module</td>
<td>Ana-Box</td>
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<td>NI Chassis</td>
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<td>NE 1010 Syringe Pump</td>
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<td>LabView Software</td>
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<td>Pressure Sensor</td>
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<td>Laptop</td>
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<td>Machining</td>
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*If High Speed camera add ~$15,000 to buy*
Overall

**Weight Drop**
- Used mostly in small animals
- Load-injury response hard to control
- Data collection complicated
- Surgery difficult
- Expensive

**Compression**
- Used in small and large animals
- Pressure well controlled
- Data collection simple
- Surgery easy
- Inexpensive
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