Background
Controlled hypotension (CH) is one means to limit or avoid the need for allogeneic blood transfusions.1-2 Despite the availability of several different agents to provide CH including sodium nitroprusside, nitroglycerin, nicardipine, and esmolol, none are without significant adverse effects.2-3 Clevidipine is a short-acting, intravenous calcium channel antagonist with a half-life of 1-3 minutes due to rapid metabolism by non-specific blood and tissue esterases. To date, there are no prospective evaluations with clevidipine in the pediatric population.2,3 We prospectively evaluated the dosing requirements, efficacy, and safety of clevidipine for CH during spinal surgery in the pediatric population.

Protocol
• Prospective open label observational clinical study
• Inclusion criteria
  ➢ Patients undergoing posterior spinal fusion
• Exclusion criteria
  ➢ Allergy to dihydropyridine calcium channel antagonists
  ➢ Allergy to soy or eggs or disorders of lipid metabolism (clevidipine is in a lipid base)
  ➢ Non-neuroromuscular causes of scoliosis
• No change in our standard anesthetic care
  ➢ Premedication: Intravenous or oral midazolam
  ➢ Anesthetic induction: inhalational or intravenous induction based on the preference of the patient
  ➢ Intraoperative anesthetic management: facilitation of endotracheal intubation with a dose of rocuronium followed by desflurane titrated to maintain the bispectral index at 40-60, fentanyl 2-4 µg/kg followed by a remifentanil infusion to maintain the mean arterial pressure at 55-65 mmHg
  ➢ Intraoperative monitoring: standard ASA monitors plus an intravenous cannula and two peripheral intravenous cannulae
  ➢ Tranexamic acid as an anti-fibrinolytic agent
  ➢ Motor and somatosensory evoked potentials were monitored intraoperatively
• When the MAP was more than 65 mmHg despite remifentanil at 0.3 µg/kg/min, clevidipine was added to maintain the MAP in range of 55 to 65 mmHg. The infusion was initiated at 0.5-1 µg/kg/min and titrated up in increments of 0.5-1 µg/kg/min every 2-3 minutes.

Table 1. Patient Characteristics
Of the 9 patients (6 males and 3 females) enrolled in the study to date, two did not require a clevidipine infusion to maintain the desired MAP range, leaving 7 patients for analysis.

<table>
<thead>
<tr>
<th>Measurements</th>
<th>Range (average ± SD)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td>9-19 years (14.6 ± 3.1 years)</td>
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<tr>
<td>Weight</td>
<td>18.9-70.4 kg (45.6 ± 14.4 kg)</td>
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Table 2: Intraoperative Variables

<table>
<thead>
<tr>
<th>Measurements</th>
<th>Range (average ± SD)</th>
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<tbody>
<tr>
<td>Duration of the clevidipine administration</td>
<td>5-389 minutes (204 ± 112 minutes)</td>
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<tr>
<td>Maintenance infusion rate</td>
<td>0.5-5 µg/kg/min (2.6 ± 1.1 µg/kg/min)</td>
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<tr>
<td>Time to achieve the target MAP</td>
<td>Four of 7 patients (57.1%) achieved the target MAP within 5 minutes</td>
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<tr>
<td>HR increase from a baseline</td>
<td>75 ± 16 to 84 ± 13 bpm (p&lt;0.028)</td>
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<td>No patient had a HR increase ≥ 20 beats/min.</td>
<td>No case required the administration of a β-adrenergic antagonist to control HR.</td>
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<tr>
<td>Duration of surgical procedure</td>
<td>175-445 minutes (305 ± 82 minutes)</td>
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<tr>
<td>Estimated blood loss</td>
<td>100-1300 mL (524 ± 401 mL)</td>
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<tr>
<td>Total intravenous fluids infusion</td>
<td>650-3475 mL (1925 ± 781 mL)</td>
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</tbody>
</table>

• When the clevidipine infusion was discontinued, MAP returned to ≥ 65 mmHg within 10 minutes in 5 of the 7 patients (71.4%).
• In one patient, the clevidipine infusion was discontinued temporarily due to a MAP < 50 mmHg. The MAP returned to ≥ 65 mmHg in 6 minutes without other treatment.

Conclusion
Clevidipine maintained the MAP at 55 to 65 mmHg and provided effective CH during a desflurane and remifentanil based anesthetic. Mild reflex tachycardia which did not require therapy was noted. One episode of a low MAP occurred which responded quickly to termination of the clevidipine infusion.

References