

Intraspinal Monitoring Following Spinal Cord Injury – An Experience

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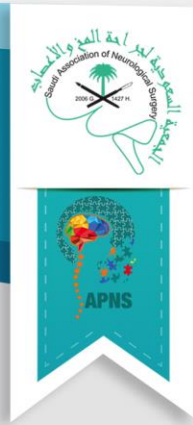
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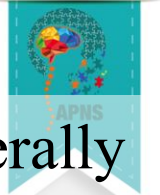
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Disclosure information

- No disclosures

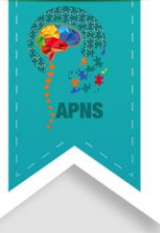


Introduction



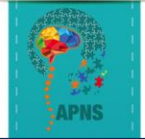
- Spinal cord injury is debilitating condition that is generally known to be irreversible
- Surgical decompression within 24 hours of SCI is the accepted management
- Recent literature: detection of changes in spinal physiological parameters, such as intraspinal pressure & spinal cord perfusion pressure
- We investigate the changes in physiological parameters using an animal model and correlate them with imaging and histology

Normal Spinal Parameters



- $ISP = 0-15 \text{ mmHg}$
- $SCPP = 90-100 \text{ mmHg}$
- $SCPP_{opt} = \text{individualized. } \sim 90 \text{ mmHg?}$
- $sPRx \leq 0$ intact pressure reactivity
- $sRAP = -1 \leq sRAP \leq +1$ Values closer to 0 + low ISP = good compensatory reserve
- Microdialysis: Glucose $> 4.5 \text{ mM}$

Literature Review



Chen et al. 2017	Khaing et al. 2017	Phang et al. 2016
<p>Calculation of continuous optimal spinal cord perfusion pressure (cSCPP_{opt}) and metabolic profile correlation after TSCI.</p> <ul style="list-style-type: none"> • ↓ cSCPP_{opt} variance + ↑ glucose = possibility of better outcome 	<p>Time-related and structural ISP changes after TSCI in rats. Dural and pial contribution to ISP.</p> <ul style="list-style-type: none"> • ISP ↑ 3X within 30 minutes, up to 7 days. 	<p>Evaluation of ISP measurement in 42 patients, with technical nuances, complications, follow-up, and safety.</p>
Czosnyka et al. 2016	Varsos et al. 2016	Phang et al. 2015
<p>ISP waveform analysis. 3 peaks: percussion, tidal, and diastolic. Presence of mean pulse amplitude, mean respiratory amplitude, and mean magnitude of slow waves. Possibility of interpretation same as ICP.</p>		<p>3 intradural compartments with different ISP following SCI. Injury site intraparenchymal ISP = subdural ISP.</p>

Literature Review

Imaging

Conventional MR: signal changes indicating edema, hemorrhage, or interstitial fibrosis

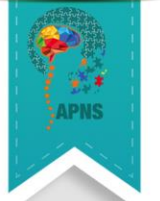
Newer techniques: DTI with lower FA and higher MD, correlated with clinical grade (D'souza et al. 2017)

MRS in SCI rat model (Zheng et al. 2016)

Electron microscopy

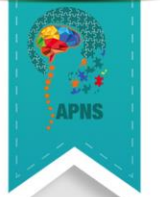
Temporal evolution of axonal autophagy after SCI in a rat-model. Max. mean fiber diameter was at 24hrs (Ribas et al. 2015)

Objectives



- Document normal ISP and SCPP of rats
- Document variance of ISP and SCPP when SCI is present
- Compare difference of ISP and SCPP between decompressed and nondecompressed groups of SCI
- Document time-related radiological findings following SCI
- Document time-related histological findings using EM following SCI

Materials and Methods



- **Animal subjects:**

21 female Long Evans rats, into 3 groups: SCI w/ decompression, SCI w/o decompression, and control

- **Induction:**

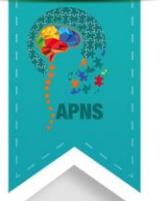
Isoflurane (5% induction, 2.5% maintenance). Continuous MAP recordings for 24 hours using Millar Mikro-Tip catheter

- **SCI:**

Area of T7-T8. 14 rats. 3rd generation spinal cord contusion device

7 rats decompressed by laminectomy and duroplasty within 6 hours of injury

Materials and Methods



- **Pressure recordings:**

Codman microsensor ICP catheter. Control group ISP for 3 hours. SCI group at: time of injury, 15 minutes, 30 minutes, 1 hour, 3 hours, 6 hours, 12 hours, 24 hours, and 48 hours after injury

- **Imaging:**

Experimental 3.0 T MRI in 4 rats (2 w/ and 2 w/o decompression) at: time of injury, 6 hours, 24 hours, and 7 days after injury

- **Euthanasia:**

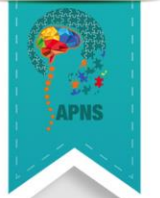
Administration of CO₂

- **Electron microscopy:**

Imaging under electron microscope. 2 control group rats. 4 SCI rats after 48h, rest of SCI rats after 7 days



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Thank you