Traumatic Brain Injury

Hope on the Horizon

Today’s Speakers

• Kevin Fleming, President Paradigm Management Services
• Dr. Ross Zafonte, Chairman Physical Medicine Harvard Medical School
• Dr. Nathan Cope, CMO Paradigm Management Services
Paradigm’s seminar series agenda was influenced by feedback from our last session.

- Return to Work: Managing the Impossible
- Managing Traumatic Brain Injuries
- Controlling Medically Volatile Cases
- Projecting Large Dollar Claim Expenses
- Chronic Cases Causing Chronic Pain
- Four Ways to Protect Claims From Medical Cost Inflation
Guest Speaker: Dr Ross Zafonte

Dr. Ross Zafonte joins us from Spaulding and the Harvard Medical School where he is the Earl P. And Ida S. Charlton Professor and Chair of the Department of Physical Medicine and Rehabilitation.
High visibility Traumatic Brain Injuries (TBI) capture headlines, but behind the scenes millions more occur.

- In the US each year:
  - 5 MM head injuries
  - 2 MM permanent
  - 235,000 hospitalizations
  - 50,000 die

- 320,000 US troops are reported to have incurred TBIs in Iraq

- TBIs are the 2nd most costly injury type for Workers’ Comp

- Key causes are falls and motor vehicle accidents
Head injury involves both primary and secondary lesions.

Primary lesions:
- Skull fracture
- Brain contusion
- DAI

Secondary lesions:
- Intracranial hemorrhages
- Brain edema
- Increase of ICP (ISCHEMIA)
- Infections
- Delayed lesions
- Sequelae
Brain Injury

The location of the injury is of great importance.
Intracranial pressure is a key issue.
Brain Injury

Those who talk and ---.
After the moment of impact how long would you expect it to take for the vast majority (95%) of the damage to the brain to occur for a serious brain injury?

A. Immediately upon impact

B. Within minutes of the impact

C. Within a period of hours

D. Progressively over a period of days

E. Continuously for days, months, and years after the injury
Brain Injury

It is important to consider the sequence of molecular events.

Sequence of Molecular Events

- **0 min**: Ion channel changes
- **1 min**: Activation of voltage-dependent channels
- **10 min**: Glutamate release
- **1.5 hours**: AMPA receptors activation
- **3 hours**: GABA receptors activation
- **6 hours**: NO• generation
- **15 hours**: Inflammation
- **5 days**: Matrix proteases expression
- **15 days**: Free radicals generation
- **15 days**: Growth factors expression

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Brain Injury

Brain trauma is a process not an event.
The dopamine tissue levels in the frontal cortex decrease as the injury progresses.

Dopamine Tissue Levels in the Ipsilateral Frontal Cortex

- **1 Day**: Average dopamine level is close to 350.
- **7 Day**: Average dopamine level decreases to approximately 250.
- **14 Day**: Average dopamine level further decreases to around 150.
- **28 Day**: Average dopamine level stabilizes at a lower level, close to 110.

This graph illustrates the decline in dopamine levels over time post-injury.
Brain Injury

Studies using fMRI scans reveal brain injury differences.

adapted from McAllister et al
Does rehabilitation work? Studies point to “yes.”

In 2006 L Turner-Stokes, S Paul, and H Williams published a study of 297 persons following severe TBI in the Journal of Neural Psychiatry that showed:

- High dependency patients experienced the greatest average reduction in weekly cost of care -- the higher the dependency the more costs saved
- It took 138% more time to offset costs for low dependency patients than it did for high dependency patients:
  - Time taken to offset cost was 16.3 months in high dependency group
  - Time taken to offset costs was 38.8 months in lower dependency group
Therapy and its intensity are critical components of recovery.

**Therapy**
- Time
- Schedule
- Black box- type of therapy
- Dosing
- Termination of therapy
- Augmentation with medications

**Intensity**
- Zhu 2001 single blind RCT (n=36)
- Shiell 2001 2 center RCT (n=51)
- Slade 2002 single blind RCT (n=131)
- Cifu 2003 Multicenter nonrandomized trial (n=491)
  - Evidence that more “intensive therapy associated with earlier functional gains”
  - Noisy data- timing/severity
There are numerous problems associated with brain injury...

**Awareness in Vegetative State**

Brain Injury Patient
- Playing a Sport
- Walking in a Familiar Space

Healthy Volunteer
- Playing a Sport
- Walking in a Familiar Space

**Neuroendocrine Issues**

Hypothalamus

Pituitary Gland
Avoiding known problems is a key aim of medical management.

Spasticity

Heterotopic ossification

Agitation

Memory

Technology
One of the best safeguards against complications is having skilled experts at the helm of a systematic program of medical management.

- Provide oversight
- Clarify diagnoses
- Consult and collaborate with attending doctors
- Set expectations
- Provide continuity
- Validate care needs
Armed with the right data, the impact is greatly enhanced.

**Schematic of Paradigm Data Tables:**

<table>
<thead>
<tr>
<th>Injury Severity, Secondary Injuries</th>
<th>Concurrent Medical Problems</th>
<th>Functional Status</th>
<th>Psychosocial Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>Location and History of Treatment</td>
<td>Procedures and Medications</td>
<td>Attending Physician Input</td>
<td>Problems and Risks Identified</td>
</tr>
<tr>
<td>Comparison with Paradigm Database</td>
<td>Long-range Plan and Outcome</td>
<td>Total Tracking Data on Recovery, Complications and Cost</td>
<td>Comprehensive Outcome Assessment</td>
</tr>
</tbody>
</table>
Role of Outcome Planning & Management

Planning for an optimal outcome early in the injury lifecycle provides a blueprint for success.

- Sets optimal outcome as key goal
- Calibrates expectations
- Plans steps for achievement
- Comprehensive in scope
- Provides tracking and measurement accountability
On average, how expensive would you expect a severe brain injury without complications to be during the first 18 – 24 months?

A. Less than $100,000
B. $100,001 - $300,000
C. $300,001 - $600,000
D. $600,001 - $800,000
E. More than $800,000
From a financial point of view, the acute period of TBI injuries can be highly expensive.

TBI Medical and Financial Volatility

- Medical expenses are high, and escalate enormously when complications emerge.

**Level 3**
- Average Cost: $144,279

**Level 4**
- Average Cost: $344,996

**Level 5**
- Average Cost: $692,217

**Level 6**
- Average Cost: $926,889

Source: Paradigm mean values for medical costs years 2002-2008 adjusted for inflation (methodology likely understates risk exposure)
* Complexity is a Paradigm Management Services proprietary scale assigned after a multivariate analysis containing more than 30 variables. Level 1: Minimal treatment, 2: Routine treatment, 3: Low-intensity treatment, 4: High-intensity treatment, 5: Severe, 6: Extremely severe.
The Challenge

However, the ongoing costs associated with TBI injuries can be equally volatile and expensive...even for cases that during the acute period look fairly inexpensive and stable.

Five Traumatic Brain Injury Claims

* Selected sample of five acquired brain injury claims with traditional medical management (i.e., not Paradigm cases); numbers adjusted for inflation
Reducing Volatility

Research shows that the best likelihood for reducing ongoing volatility is to return the injured person to meaningful work...Paradigm has a much better track record than the industry as a whole in this regard.

1. Based on an independent comparison by Milliman, the nation’s leading actuarial and consulting firm, of Paradigm cases to their proprietary database of similar Workers’ Compensation claims; Release to Return to Work is determined by the attending physician (not Paradigm)
We hope you will join us for future webinars, and leave knowing the following.

- Brain injuries are fragile and volatile
- Systematic Care Management is critical
- Better outcomes are possible
- Paradigm can help!
Questions