Palliative Care and Prognostication: Tools for Providing Personalized Care

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What is Palliative Care?

• Relief of suffering

• Branch of medicine devoted to providing chronically or seriously ill patients with relief of symptoms

• Symptoms can include:
  • Pain, nausea, vomiting, shortness of breath, delirium, agitation, constipation, diarrhea, fatigue
  • Emotional and spiritual suffering

• Often a multidisciplinary approach
Palliative Care

- Utilizes medications, therapies, and other specialties
  - Pet therapy
  - Speech, physical or occupational therapy
  - Massage or aromatherapy
  - Behavioral or psychotherapy
  - Religious or spiritual support
Holistic approach to give personalized or individualized care
What is Prognostication?

• The art of using science to estimate the likelihood of an outcome (e.g. death or disability) due to a medical condition

• It includes:
  • Foreseeing (formulation of a timeline or hypothesis)
  • Foretelling (communicating the timeline or hypothesis with the patient, family or health care team)
A 45 year old male was in a MVA and sustained a traumatic brain injury with altered level of consciousness. On arrival to the hospital his GCS is 5. The patient has no response to verbal stimulus and does not open eyes. He has one reactive pupil, the other is fixed and dilated. What other additional information would you need to accurately predict his 6 month mortality rate?

- A. Any history of heart disease including underlying coronary artery disease with CABG or stent placement
- B. Re-evaluation of GCS 6 hours after initial presentation with documentation of change in score
- C. Observation of decorticate or decerebrate posturing or documentation of motor score
- D. There is no way to accurately predict his 6 month mortality rate at the time of initial presentation
“It appears to me a most excellent thing for the physician to cultivate Prognosis; for by foreseeing and foretelling, in the presence of the sick, the present, the past, and the future, and explaining the omissions which patients have been guilty of, he will be the more readily believed to be acquainted with the circumstances of the sick, so that men will have confidence to intrust themselves to such a physician”

Hippocrates

400 BC
The History of Prognostication

- Before the 1970’s, predictions were based on clinical judgement and experience
- 1965 Hockaday et al. published a paper on EEG findings in acute cerebral anoxia from cardiopulmonary arrest
  - 39 patients
  - EEG had an accuracy of 85%
- 1974 Willoughby et al. looked at motor response 1 hour after CPR
  - 48 patients
  - Absent or reflex motor responses only had poorer outcomes
- In the 1970’s “futility discussions” began to emerge for anoxic brain injury induced coma
History of Prognostication

PubMed search – from 1970 through the late 90’s there were less than 25 articles per year published on prognostication. In the early 2000’s it exploded and in 2015 there were 579
Why Does Prognostication Matter?
Decisions, decisions…

- Relationship Between Cancer Patient’s Predictions of Prognosis and Their Treatment Preferences
  - 917 patients with metastatic colon (39%) or lung cancer (61%)
  - Average age 62, 84% white, 62% male
Prognosis and Preferences

• “If you had to make a choice at this time, would you prefer a course of treatment that focuses on extending life as much as possible, even if it means having more pain or discomfort, or would you want a plan of care that focuses on relieving pain and discomfort, even if that means not living as long?”

• Three choices: “extend life”, “relieve pain”, or “don’t know”

• They were also asked “what are the chances you will live for 2 months more” or “6 months more”? 
Prognosis and Preferences

• Patients who thought they had a 90% chance or better at being alive in 6 months were more likely to favor life extending therapy.

• Those patients who wanted life extending therapy were 1.6x more likely to be readmitted to the hospital or have an attempted resuscitation or die.

• NO statistically significant difference in 6 month survival rates between the two groups.
Understanding the Disease

2012 NEJM study showed that out of 1193 patients with metastatic lung and colorectal cancer, 69% of those with lung cancer and 81% of those with colorectal cancer did NOT report understanding that chemotherapy was unlikely to cure their cancer.
More Importantly...

• Patients WANT to know
  • “Knowing is Better” study
  • Average age 78
  • 65% patients wanted to discuss prognosis if their doctor felt they had < 5 years to live
  • 75% patients wanted to discuss prognosis if their doctor felt they had < 1 year to live
  • Why: to prepare, to make the most of the life they have left, to make medical decisions
  • Why not: emotional difficulty, uncertainty of prognosis, information would not be useful
Why don’t we talk about it?..

• Don’t want to “take away hope”
• Lowered patient ratings of physician satisfaction (true, in one study)
• Want to avoid the “self fulfilling prophecy” in predicting mortality and morbidity
Everyone wants to be loved...

and Press Ganey scores go down.
Maybe that’s not the reason...
Why don’t we prognosticate?..

Fear
Of
Inaccuracy
Let’s take a step back

Knowledge is having the right answer.
Intelligence is asking the right question.
What Do We Know About Prognostication?

- Prognostication of Survival in Patients With Advanced Cancer: Predicting the Unpredictable?
- David Hui, MD from Palliative Care Dept. at MD Anderson
- 4 Principles of predicting survival
  - Prognostication is a *process* rather than an event
  - Prognostic factors may *evolve* throughout the disease course
  - Prognostic *accuracy varies* depending on your definition of accuracy, the patient population, and the time frame
  - Exact timing of death *is not predictable*
It’s a Process
Patient’s prognosis may change based on:
treatment response
complications
non related factors - other diseases or social issues/compliance
Location, Location, Location!

Prognosis Evolves...

- Where you are on the map matters...
- Prognostic factors vary by the stage of disease
- Early cancer stages, prognosis is driven by tumor stage, histology, etc
- Late cancer stage, prognosis is usually based on patient related factors such as PPS, cachexia, mental status
Three Approaches of Prognostication

• Temporal question – How long will this patient live?

• Surprise question – Would I be surprised if they died (in a designated amount of time)?

• Probabilistic question – What is the probability of survival (in a specific time frame)? [0-100%, 10% increments]
How long do I have, doc?
Temporal Question

• Approximately 20-30% rate of accuracy to within 33% of actual survival
• Usually overly optimistic
• Less accurate predictions usually made in:
  • Female patients
  • Certain subspecialties
  • **Longer** duration of doctor-patient relationship
  • Lack of clinical experience
  • Younger patient age
Surprise Question

• More accurate... 76-88% accuracy rate

• Moss et al in 2010:
  • 4 oncologists
  • 853 patients
  • Would you be surprised if this patient died within the year?
  • PPV was 41%, NPV 97%, making it helpful in identifying patients who will live greater than 1 year, but less helpful in identifying patients who would die within the year

• Found to be valid in other cultures as well (Italy & Japan)
Probabilistic Question

- Asks the provider to state the probability (in a percentage) of survival in a specific time
- Any number between 40-60% is considered ambivalent and not accurate
- Is it more accurate?..
  - Maybe, but it depends on who you ask
Hui et al

- Compared nurses’ and doctors’ predictions for estimation of survival from time of admission to specific time frames
- 151 patients with cancer admitted to a palliative care unit
- Median survival 12 days

<table>
<thead>
<tr>
<th>Time Frame</th>
<th>Accuracy rate MDs</th>
<th>Accuracy Rate RNs</th>
</tr>
</thead>
<tbody>
<tr>
<td>24 hours</td>
<td>71%</td>
<td>91%</td>
</tr>
<tr>
<td>48 hours</td>
<td>66%</td>
<td>86%</td>
</tr>
<tr>
<td>1 week</td>
<td>58%</td>
<td>61%</td>
</tr>
<tr>
<td>2 weeks</td>
<td>56%</td>
<td>53%</td>
</tr>
<tr>
<td>1 month</td>
<td>67%</td>
<td>60%</td>
</tr>
<tr>
<td>3 months</td>
<td>86%</td>
<td>79%</td>
</tr>
<tr>
<td>6 months</td>
<td>96%</td>
<td>88%</td>
</tr>
</tbody>
</table>
What does all this mean?

- HOW we ask the question matters!!
- WHO we ask matters too!
That’s nice Kat, but it’s all kind of vague...
Phase Angle

• What is phase angle?
  • It’s a calculation
  • Marker of cellular function based on bioelectrical impedance
  • Phase angle = arc-tangent (reactance/resistance) x 180 degrees/Pi

• Phase angle depends on cell membrane integrity and on body cell mass.

• Membrane integrity and cell mass may be compromised by inflammation, tumor by products, etc

• Healthy patients’ phase angle is usually between 5-7
How is Phase Angle Measured?
Phase Angle in Cancer Prognostication

- 222 patients
- Prospective analysis, single institutional study
- Average age 55
- 59% female
- Karnofsky score average 55
- Median overall survival 106 days
Phase Angle in Cancer Prognostication

- They calculated phase angle as well as information for other validated tools (Palliative Prognostic Score – PaP and the Palliative Prognostic Index – PPI)
- Looked at hand grip strength and maximum inspiratory pressure as well
- Survival time from time of PCU admission was collected from EMR
Phase Angle Use in Prognostication

- Both unadjusted phase angle and standardized phase angle were significantly associated with overall survival
  - Lower phase angle was associated with shorter survival
- Hand grip strength and maximum inspiratory pressure only trended toward significance
- Confirmed what we already knew:
  - Lower KPS and PPS had poorer survival
  - Lower albumin and higher PaP scores
### Phase Angle Use in Prognostication

<table>
<thead>
<tr>
<th>Unadjusted Phase Angle</th>
<th>Median Survival &lt; 3 mo</th>
<th>Median Survival 3-6 mo</th>
<th>Median Survival &gt;6 mo</th>
</tr>
</thead>
<tbody>
<tr>
<td>2-3</td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4-5</td>
<td></td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>&gt;6</td>
<td></td>
<td></td>
<td>X</td>
</tr>
</tbody>
</table>

NEEDS FURTHER VALIDATION!
Traumatic Brain Injury
Traumatic Brain Injury

• 2008 Predicting Outcome after Traumatic Brain Injury: Development and International Validation of Prognostic Scores Based on Admission Characteristics

• Goal: Use prospectively collected data from 11 studies to create a prognostic model
  • Data from admission could be used to predict morbidity and mortality at 6 months

• Why?.. to support early clinical decision making
Traumatic Brain Injury

• IMPACT tool was born
  • IMPACT = International Mission for Prognosis and Analysis of Clinical Trials in TBI

• Utilized data from the MRC CRASH trials to validate the data
  • MRC CRASH = Medical Research Council Corticosteroid Randomization after Significant Head Injury
Traumatic Brain Injury

**IMPACT**
- 8509 patients aged >14 y.o.
- 11 studies from 1984 – 1997
- Moderate – severe TBI (GCS <12)
- Endpoint was 6 month GOC (Glasgow Outcome Scale)

**MRC CRASH**
- >10,000 patients in an international, double blind, placebo controlled trial
- Effects of early administration of 48 hour infusion of methylprednisone on outcomes of TBI
- HIGHER morbidity and mortality in patients in the steroid group
- IMPACT data was validated using 6,681 patients from MRC CRASH with GCS <12 with 6 mo GOS available
Glasgow Outcome Scale

<table>
<thead>
<tr>
<th>GOS score</th>
<th>Functional status</th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td>Resumption of normal life; there may be minor neurologic and/or psychological deficits</td>
</tr>
<tr>
<td>4</td>
<td>Able to work in a sheltered environment and travel by public transportation</td>
</tr>
<tr>
<td>3</td>
<td>Dependent for daily support by reason of mental or physical disability or both</td>
</tr>
<tr>
<td>2</td>
<td>Unresponsive for weeks or months or until death</td>
</tr>
<tr>
<td>1</td>
<td>Death</td>
</tr>
</tbody>
</table>

GOS: Glasgow outcome score
IMPACT – 3 Prognostic Models

- Core Model
  - Age
  - Motor Score from GCS
  - Pupillary reactivity

- Extended Model
  - Core information plus...
  - Secondary insults – hypoxia and hypotension
  - CT characteristics - SAH and epidural hematoma

- Lab Model
  - Glucose and hemoglobin values
IMPACT Tool

http://www.tbi-impact.org

**Prediction models for 6 month outcome after TBI**

<table>
<thead>
<tr>
<th>Admission Characteristics</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Core</td>
<td></td>
</tr>
<tr>
<td>Age (14-99 years)</td>
<td></td>
</tr>
<tr>
<td>Motor Score</td>
<td>[Select] ▼</td>
</tr>
<tr>
<td>Pupils</td>
<td>[Select] ▼</td>
</tr>
<tr>
<td>Core+CT</td>
<td></td>
</tr>
<tr>
<td>Hypoxia</td>
<td>[Select] ▼</td>
</tr>
<tr>
<td>Hypotension</td>
<td>[Select] ▼</td>
</tr>
<tr>
<td>CT Classification</td>
<td>[Select] ▼</td>
</tr>
<tr>
<td>tSAH on CT</td>
<td>[Select] ▼</td>
</tr>
<tr>
<td>Epidural mass on CT</td>
<td>[Select] ▼</td>
</tr>
<tr>
<td>Core+CT+Lab</td>
<td></td>
</tr>
<tr>
<td>Glucose (3-20 mmol/L)</td>
<td>mmol/L ▼</td>
</tr>
<tr>
<td>Hb (6-17 g/dL)</td>
<td>g/dL ▼</td>
</tr>
</tbody>
</table>

**Calculate**  **Reset**

This model predicts outcome in the following patients:

Adults with head injury, Glasgow Coma Scale 12 or less.
What do you need for calculating IMPACT?

**Marshall CT classification of TBI**

<table>
<thead>
<tr>
<th>Category</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Diffuse injury I (no visible pathology)</td>
<td>No visible intra-cranial pathology seen on CT scan</td>
</tr>
<tr>
<td>Diffuse injury II</td>
<td>Cisterns are present with midline shift &lt; 5 mm and/or lesion densities present</td>
</tr>
<tr>
<td>Diffuse injury III</td>
<td>No high- or mixed-density lesion &gt; 25 ml, may include bone fragments and foreign bodies</td>
</tr>
<tr>
<td>Diffuse injury IV</td>
<td>Cisterns compressed or absent with mid-line shift 0-5 mm No high- or mixed-density lesion &gt; 25 ml</td>
</tr>
<tr>
<td>Evacuated mass lesion</td>
<td>Any lesion surgically evacuated</td>
</tr>
<tr>
<td>Non-evacuated mass lesion</td>
<td>High- or mixed-density lesion &gt; 25 ml, not surgically evacuated</td>
</tr>
</tbody>
</table>

**Table 1. Glasgow Coma Score**

<table>
<thead>
<tr>
<th>Eye Opening (E)</th>
<th>Verbal Response (V)</th>
<th>Motor Response (M)</th>
</tr>
</thead>
<tbody>
<tr>
<td>4=open spontaneously</td>
<td>5=normal conversation</td>
<td>6=normal</td>
</tr>
<tr>
<td>3=open to voice</td>
<td>4=disoriented</td>
<td>5=localizes pain</td>
</tr>
<tr>
<td>2=open to pain</td>
<td>3=words, incoherent</td>
<td>4=withdraws from pain</td>
</tr>
<tr>
<td>1=none</td>
<td>2=incomprehensible sounds</td>
<td>3=decorticate posturing</td>
</tr>
<tr>
<td>1=none</td>
<td>1=none</td>
<td>2=decrebrate</td>
</tr>
</tbody>
</table>

Adapted from ACS ATLS⁶
# Prediction models for 6 month outcome after TBI

<table>
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<th>Value</th>
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<tbody>
<tr>
<td>Core</td>
<td></td>
</tr>
<tr>
<td>Age (14-99 years)</td>
<td>45</td>
</tr>
<tr>
<td>Motor Score</td>
<td>Abnormal Flexion</td>
</tr>
<tr>
<td>Pupils</td>
<td>One</td>
</tr>
<tr>
<td>Core+CT</td>
<td></td>
</tr>
<tr>
<td>Hypoxia</td>
<td>Yes</td>
</tr>
<tr>
<td>Hypotension</td>
<td>Yes</td>
</tr>
<tr>
<td>CT Classification</td>
<td>Diffuse Injury III</td>
</tr>
<tr>
<td>iSAH on CT</td>
<td>Yes</td>
</tr>
<tr>
<td>Epidural mass on CT</td>
<td>No</td>
</tr>
<tr>
<td>Core+CT+Lab</td>
<td></td>
</tr>
<tr>
<td>Glucose (54-360 mg/dL)</td>
<td>85</td>
</tr>
<tr>
<td>Hb (6.9-17 g/dL)</td>
<td>14</td>
</tr>
</tbody>
</table>

**This model predicts outcome in the following patients:**

Adults with head injury, Glasgow Coma Scale 12 or less.

**Prognostic Results:**

- Predicted probability of 6 month mortality: **Core model: 44%**
- Predicted probability of 6 month unfavourable outcome: **Core model: 71%**
- Predicted probability of 6 month mortality: **Core+CT model: 74%**
- Predicted probability of 6 month unfavourable outcome: **Core+CT model: 89%**
- Predicted probability of 6 month mortality: **Core+CT+Lab model: 48%**
- Predicted probability of 6 month unfavourable outcome: **Core+CT+Lab model: 78%**
Validating the IMPACT Tool

- Core tool and variant of extended model were externally validated using MRC CRASH data
  - no labs, hypoxia, hypotension, or epidural hemorrhage data recorded in CRASH
- Prediction of mortality (GOS 1) vs survival (GOS 2-5)
- Unfavorable outcomes were GOS 1-3, favorable GOS 4-5
- Patients in both groups were comparable in age, motor scores, and 6 month mortality and unfavorable outcomes
What mattered most?

- Three factors at time of admission
  - Age
  - Motor score from GCS
  - Pupillary reactivity
- All predictors had statistically significant associations with 6 month GOS
  - Hypoxia, hypotension
  - CT showing mass effect, signs of raised ICP (CT class III or IV), or SAH
  - Higher glucose or low hemoglobin
- Epidural hemorrhage was a favorable sign
What about clinical acumen?

- Prognostication of Mortality and Long term Functional Outcomes Following Traumatic Brain Injury: Can We Do Better?
- We surveyed clinical providers of 86 patients with moderate-severe TBI at admission, day 3, and day 7 post-injury for a patient's predicted functional outcome at six months and mortality.
- They then calculated a prognostic score using the IMPACT tool and compared.
- Overall, clinicians of varying backgrounds showed an accurate prediction of survival (87.2-97.4%) but struggled in prognosticating poor functional outcomes (24.3-36.6%). These values did not statistically improve over 7 days. Stratified CRASH (87.2%) and IMPACT (84.9%) accuracy rates were statistically better than clinical judgment alone in predicting functional outcomes (p<0.0001).
A 45 year old male was in a MVA and sustained a traumatic brain injury with altered level of consciousness. On arrival to the hospital his GCS is 5. The patient has no response to verbal stimulus and does not open eyes. He has one reactive pupil, the other is fixed and dilated. What other additional information would you need to accurately predict his 6 month mortality rate?

• A. Any history of heart disease including underlying coronary artery disease with CABG or stent placement

• B. Re-evaluation of GCS 6 hours after initial presentation with documentation of change in score

• C. Observation of decorticate or decerebrate posturing or documentation of motor score

• D. There is no way to accurately predict his 6 month mortality rate at the time of initial presentation
Answer

• Answer C is correct.
  • Motor score is one of the basic components of the IMPACT tool that will help predict 6 month mortality on initial presentation.

• Answers A and B are incorrect as underlying heart disease or change in GCS have not been validated as predictors of mortality in TBI

• Answer D is incorrect as mortality can be accurately predicted in TBI at the time of initial presentation.
What did we learn? (aka goals/objectives)

• Palliative care focuses on relief of suffering
• Prognostic models are AVAILABLE
• Use all your tools in the tool box
• Models/tools may help provide realistic information to family members and clarify goals of care
Questions...

- DrKatherineDietrich@gmail.com