PROSPECT

PRObiotics to prevent **S**evere **P**neumonia and **E**ndotracheal **C**olonization Trial

APACHE II: A Severity of Disease Classification System
Standard Operating Procedure for Accurate Calculations

BACKGROUND

The APACHE prognostic scoring system was developed in 1981 at the George Washington University Medical Centre. It employs basic physiologic principles to stratify acutely ill adult patients by severity of illness. The basis for the development of this system was the hypothesis that the severity of acute disease, and therefore the risk of death, can be measured by quantifying the extent of the derangement in certain physiologic variables [1].

The APACHE II scoring system, is a simplified version of the original APACHE system, and consists of three sections: twelve acute physiologic variables, age, and chronic health status. The APACHE II score is determined by totalling points from these three sections, resulting in a total score between 0 and 71 points. Patients are assigned points based on the most deranged physiologic variables obtained on these assigned parameters during the patient's **initial 24 hours in an intensive care unit (ICU) setting**. Chronological age and severity of pre-existing chronic disease are also scored as they are thought to impact physiologic reserve and probability of survival during a period of acute illness [1].

One data point of the acute physiologic variables, the Glasgow Coma Score (GCS), has a large impact on the overall APACHE II score. The GCS demonstrates significant variability in its determination, affecting the overall APACHE II. It has the potential to contribute 17% of the theoretical maximum acute physiological score, which is more than any other variable in the APACHE II assessment [2]. Patients in the ICU receive large amounts of sedation and / or paralytic agents that can impair the accurate assessment of the GCS. For this reason, it is very important to collect GCS scores in the most accurate and consistent manner. Based on a prospective cohort study of 9848 patients from twenty-two general adult intensive care units, it is recommended that GCS be assessed directly (i.e. use the GCS score **prior to sedation**). This is more consistent compared to assuming GCS is normal in patients [2].

There are other data points that also have an impact when calculating an accurate APACHE II score. Assessment of pre-existing chronic disease, as well as assessing for acute renal failure, has an impact on the final total APACHE II score. The literature has suggested that adherence to consistent guidelines when collecting this data decreases variability in final scores [1,2]. The following guidelines have been provided to you for your use in calculating APACHE II scores.

Worksheet Completion: *(Please refer to page 7 for a copy of the APACHE II worksheet)*

- Determine your 24-hour APACHE II assessment window. This time window is the patient's first 24 hours since being admitted to the ICU.
- Follow the guidelines provided as you complete the APACHE II assessment.
- Proceed through the worksheet, completing each data point for physiologic variables, age points, and chronic health points. Check or fill in the circle that corresponds with the range for the value you have selected.
- To calculate the Total APACHE score, sum the 3 following domains:

    A. PHYSIOLOGIC VARIABLES (APS) (total of **12** variables)
    There will be 11 variables if there is no ABG available as the **oxygenation** and **Arterial pH variable** are not summated, however, you will be using the Serum HCO$_3$ variable
    B. AGE POINTS
    C. CHRONIC HEALTH POINTS

A) PHYSIOLOGIC VARIABLES

- All APACHE II data collected must be from the first 24 hours following ICU admission. The GCS assessment should be taken prior to the patient receiving sedation. This may be outside of the 24 hour assessment period but will provide a more accurate score of neurological function.
- When recording variables for the Acute Physiology Score, if a physiologic measurement is not obtained during the 24 hour time frame, assign a zero ("0") point score.
- For all acute physiologic measurements: choose the *worst, most abnormal value* recorded during the full 24 hour assessment period. These values may be low or high, but will always be the most deranged value with the highest point score (furthest away from the column headed 0-Normal). Remember that this data is not compared to local laboratory values but rather the APACHE II scoring system.
- Do not include values from the Operating Room.
- Do not include values you assess as being transient (eg. a 1 time spike or drop in blood pressure).

The 12 Physiological Variables are:

1. Temperature

- Record rectal or core temperature in degrees Celsius (°C).
- Add 0.5°C if oral
- Add 1.0°C if axillary

2. Mean Arterial Pressure (MAP)

- Record in mmHg
- Use the following formula to calculate the MAP: SBP +[DBP×2]÷3

3. Heart Rate

- Do not score for bradycardia if a pacemaker is present.
- Record the documented ventricular rate.

4. Respiratory Rate

- Record the most deranged ventilated or non-ventilated rate.

5. Oxygenation

- If the patient has an $FiO_2 < 0.5$ AND ≥ 0.5 within this same 24-hour period, use the $AaDO_2$ or PaO_2/FiO_2 value which scores highest in this category.
- The formula to calculate $AaDO_2$ at sea level is: $[FiO_2 \times 713]-[PaCO_2 \div 0.8]-PaO_2$
- Please refer to your hospital laboratory for local barometric pressures because this impacts the value that should be used for accurate calculations. If you are at sea level (an altitude less than 1000 feet) use a barometric pressure of 760 mmHg minus the pressure of water (47 mmHg) for a total pressure of 713 mmHg.
- Remember only 1 value should be accounted for in this oxygenation variable, Do not score for both PaO_2 and $AaDO_2$

6. Arterial pH

7. Serum Sodium (mmol/L)

8. Serum Potassium (mmol/L)

9. Serum Creatinine (mg/100mL or µmol/L)
- Patients score double points for ACUTE renal failure.

10. Hematocrit (%)

11. White Blood Cell Count (total mm3 in 1000s)

12. Glasgow Coma Scale (GCS)

- Calculate the GCS by assessing each of the three components: eye opening, motor response, and verbal response.
- Choose the most accurate, lowest cumulative score available in the 24 hour assessment period.
- If a patient has received sedation or paralytic agents, it is preferable to record the GCS prior to receiving the medications even if outside the 24 hour assessment period.
- If you are unable to obtain a reliable, pre-sedation GCS the neurological status should be scored as normal (GCS = 15).
- Patients who receive large amounts of sedation may have their GCS recorded as "3" (i.e. no response for eye opening, motor, or verbal). Unless there is a documented cause for the decreased level of

consciousness (in addition to sedation) this should not be considered an accurate GCS.
- For intubated patients use your best clinical judgment when scoring "verbal response".
- For post-operative patients wait 6 hours to record the GCS if a patient has been admitted to the ICU from surgery

Enter the total score of the GCS based on the following definition:

Eye Opening Response	Motor Response	Verbal Response
Spontaneous = 4	Obeys Commands = 6	*If not intubated:*
To Voice = 3	Localizes to Pain = 5	Oriented = 5
To Pain = 2	Flexion / Withdrawal = 4	Confused = 4
None = 1	Abnormal Flexion = 3	Inappropriate = 3
	Extension = 2	Incomprehensible = 2
	No Response = 1	No Response = 1
		If intubated:
		Appears to be able to converse = 5
		Ability to converse questionable = 3
		Unresponsive = 1
□+	□+	□ = □ - 15=□

13. **Serum HCO$_3$ (venous mmol/L) - not preferred, use if no ABG's**

B) AGE POINTS

Appropriately assign Age Points as follows. Remember to carefully calculate the patient's age.

Age (years)	Points
< 44	0
45-54	2
55-64	3
65-74	5
> 75	6

C) CHRONIC HEALTH POINTS

- Appropriately assign Chronic Health Points using the definitions listed below. If a patient has evidence of one or more of the following criteria **(1-5),** points will be scored as follows:

  a) Non-operative or emergency postoperative patients = **5 points**
  b) Elective postoperative patients = **2 points**
  c) If the patient has no chronic health states **= 0 points**

- "*Emergency postoperative patient*" will be defined as a patient who has received surgery required immediately to correct a life-threatening condition.
- A total of either "0", "2", or "5" points can be scored for this section. Points are not calculated based on the number of chronic health conditions.

- The patient's complete medical history / hospital chart should be reviewed for assessment of this category.
- Organ insufficiency or immunocompromised state must have been evident <u>prior</u> to this hospital admission and conform to the following definitions:

1) LIVER

Biopsy proven cirrhosis and documented portal hypertension, episodes of past upper GI bleeding attributed to portal hypertension or prior episodes of hepatic failure/encephalopathy/coma.

2) CARDIOVASCULAR

New York Heart Class IV. Dyspnea at rest (patients who should be at complete rest, confined to bed or chair; any physical activity brings on discomfort and symptoms occur at rest).

3) RESPIRATORY

Chronic restrictive obstructive vascular disease resulting in severe exercise restriction, i.e. unable to climb stairs or perform household duties or documented chronic hypoxia, hypercapnia, secondary polycythemia, severe pulmonary hypertension (>40mmHg) or respiratory dependency.

4) RENAL

Receiving chronic dialysis.

5) IMMUNOCOMPROMISED

The patient has received therapy that suppresses resistance to infection, (e.g. immuno-suppression, chemotherapy, radiation, long term or recent high dose steroids) or has a disease that is sufficiently advanced to suppress resistance to infection, (e.g. leukemia, lymphoma, multiple myeloma, AIDS).

The definition for long term high dose steroids is:
a) Greater than 0.3 mcg/kg/day of Prednisone or its equivalent daily for 6 months.
b) Use of active radio- or chemotherapy in the previous year.

REFERENCES AND RESOURCES

1. Knaus WA, Draper EA, Wagner DP, Zimmerman JE. APACHE II: A severity of disease classification system. Crit Care Med 1985; 13(10):818-829

2. Livingston BM, Mackenzie SJ, MacKirdy FN, Howie JC. Should the presedation Glasgow Coma Scale value be used when calculating Acute Physiology and Chronic Health Evaluation scores for sedated patients? Crit Care Med 2000; 28(2):389-394

3. Medical Information Eli Lilly Canada Inc. Use of APACHE II in the PROWESS Trial.

4. Computer assisted APACHE tool: http://www.sfar.org/scores2/apache22.html.